Sustainability of cropping systems for durum wheat production chain

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Barilla
The Italian Food Company. Since 1877.

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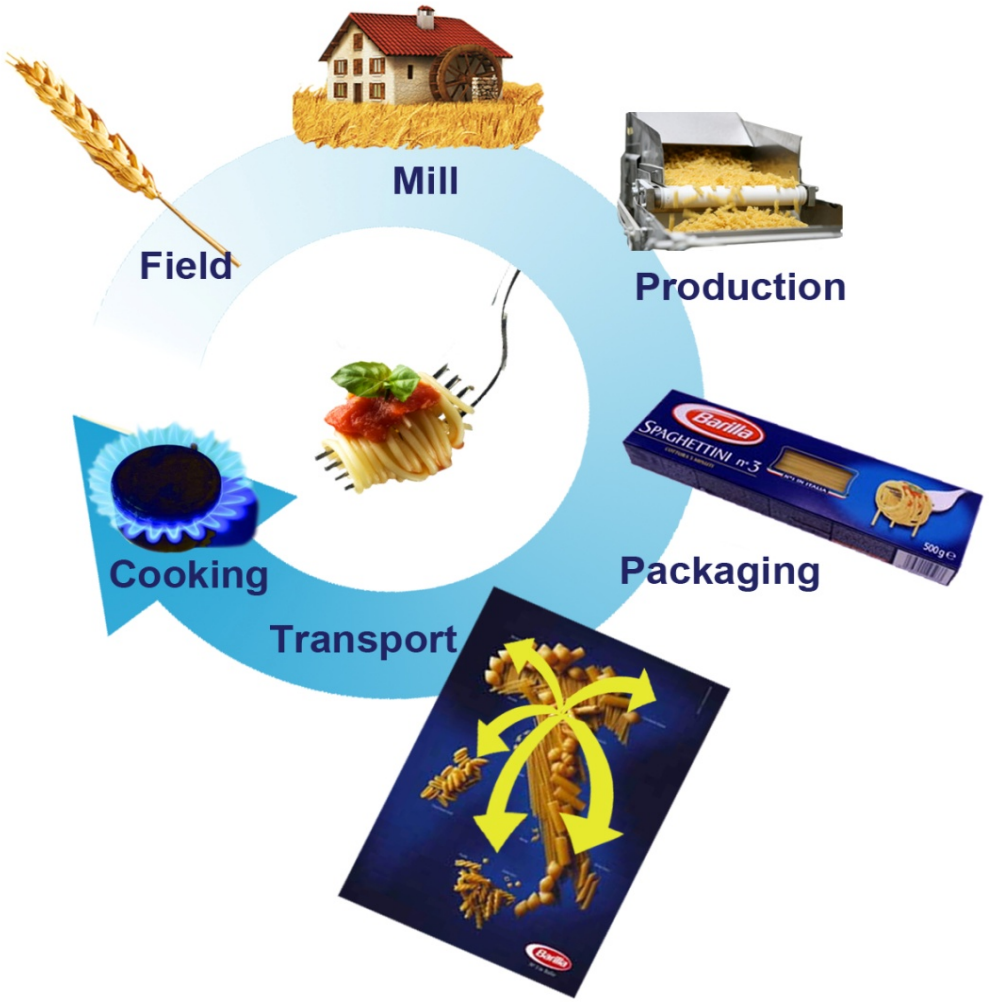
1 – Context

LIFE CYCLE ASSESSMENT APPROACH

The Life Cycle Assessment (LCA) is an environmental impacts analysis methodology of consecutive and inter-linked stages of a product system, starting from raw material acquisition or generation through natural resources to final disposal.



1 – Context

FOOTPRINT INDICATORS

Carbon Footprint represents the total amount of greenhouse gas (GHG) emitted either directly or indirectly by human activity throughout overall life-cycle. It is expressed in equivalent tons of CO_2

BSI

PAS 2050:2008

ISO International Organization for Standardization

ISO 14064:2006

Water Footprint measures water consumption in terms of Volume employed (evaporated) and/or polluted per unit of time throughout overall life-cycle.

Water Footprint NETWORK

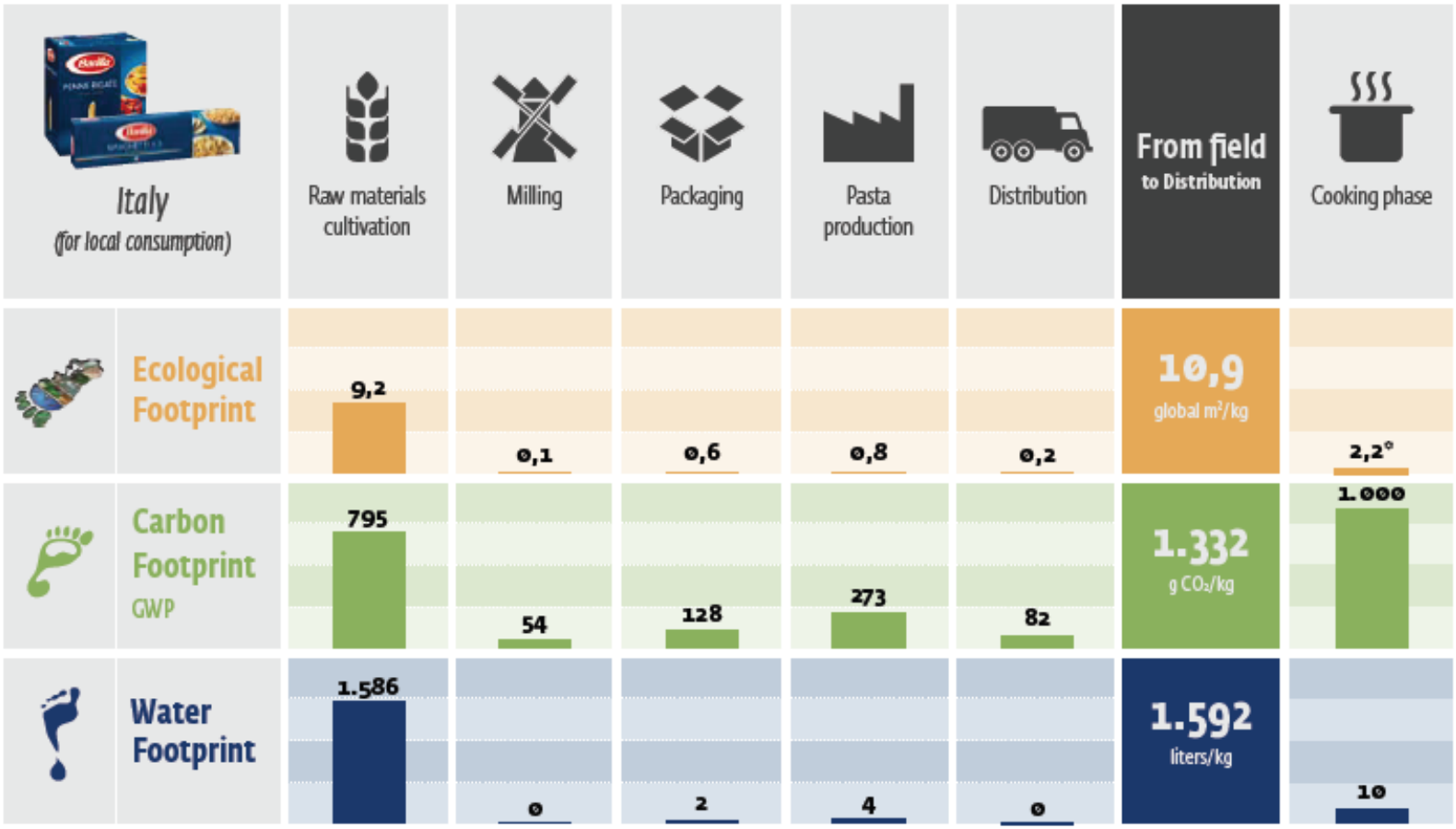
Ecological Footprint is a measure of the number of land or Maritime plots necessary to regenerate the resources consumed and absorb the waste produced by human settlements or a single human activity, employing measures of dominant resource and technology management.

Global Footprint Network
Advancing the Science of Sustainability

1 – Context

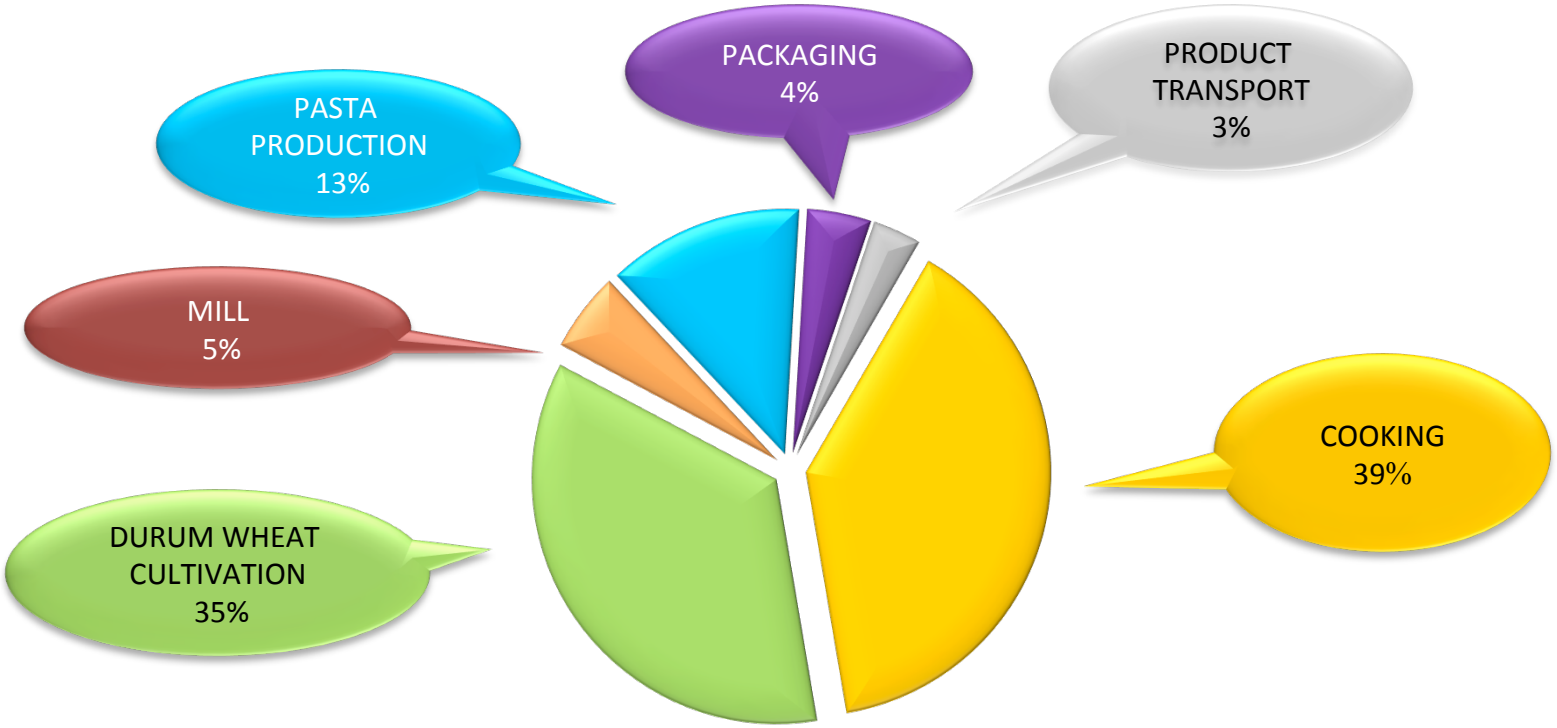
DURUM WHEAT - PASTA LCA

2009 Published the first **Environmental Product Declaration** (for pasta produced in Italy)



1 – Context

FROM RESULTS TO PROGRAM

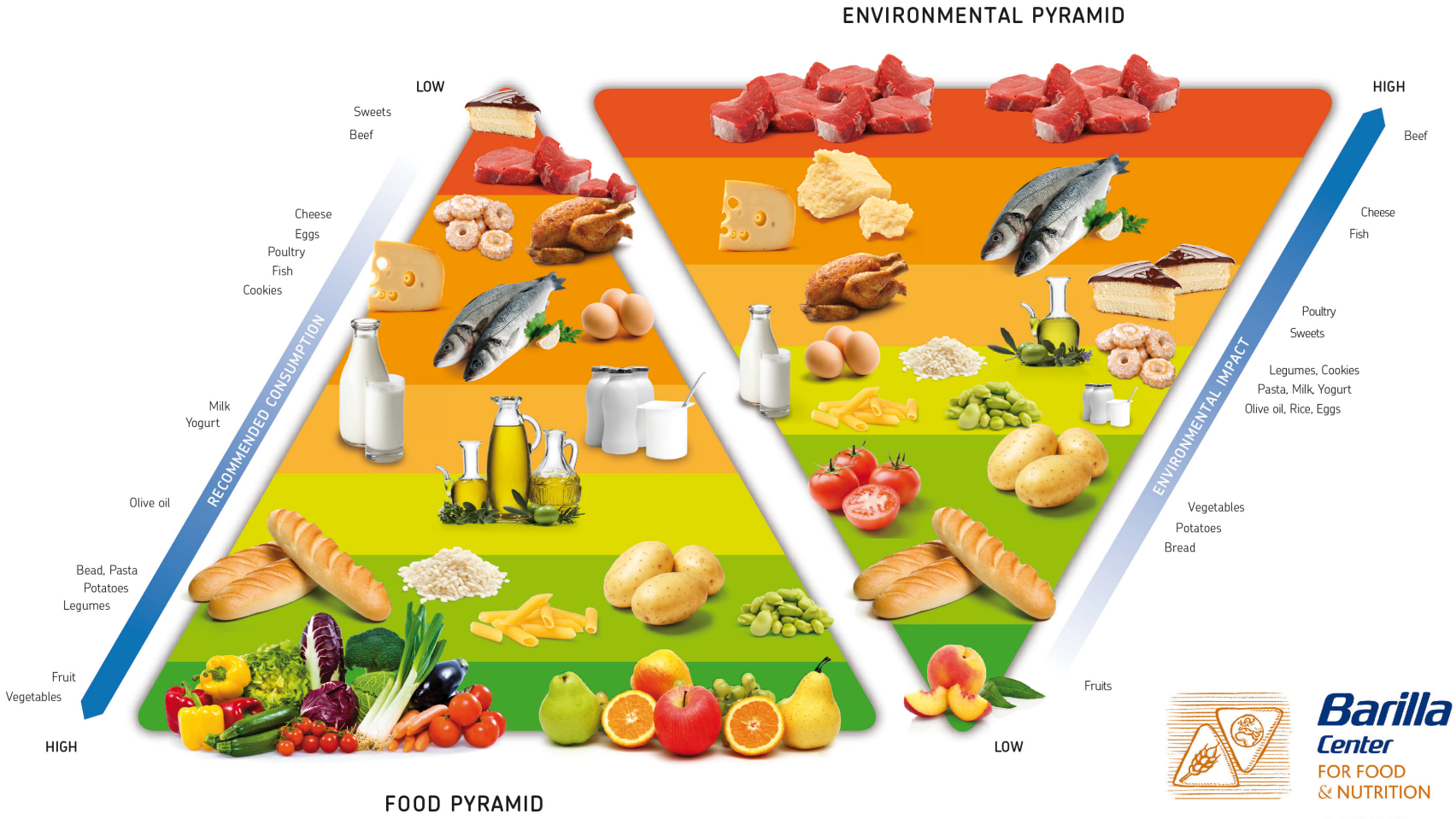


The pasta LCA shows that:

- Pasta has medium-low environmental impacts
- Environmental impacts are mainly due to pasta cooking and durum wheat cultivation;
- the choice of the cropping system influences tillage operations, fertilizers consumption and yields;
- the most important environmental impacts of farming activities are the fertilizers use and the tillage operations (e.g. diesel consumption).

The BCFN Double Pyramid

THE DOUBLE FOOD AND ENVIRONMENTAL PYRAMID MODEL, PROPOSED BY BCFN IN 2010



Barilla Center FOR FOOD & NUTRITION

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2 – Sustainable Durum wheat cultivation

FROM THEORY TO PRACTICE

BARILLA decided to undertake the analysis of different cropping systems through a multidisciplinary approach: economic, productive, agronomic and environmental

AIM OF THE PROJECT

1) To identify sustainable alternative cropping systems for the cultivation of durum wheat;

2) To analyze and evaluate the characteristics of cropping systems identified;

3) To propose possible in-field experimentations to validate the proposed solutions and to integrate the Barilla's cultivation disciplinary;

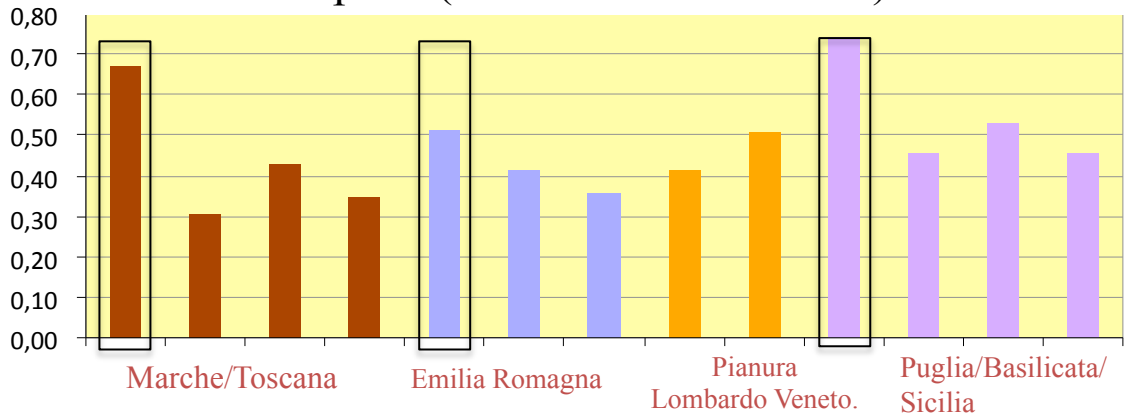
2 – Sustainable Durum wheat cultivation

INDICATORS USED

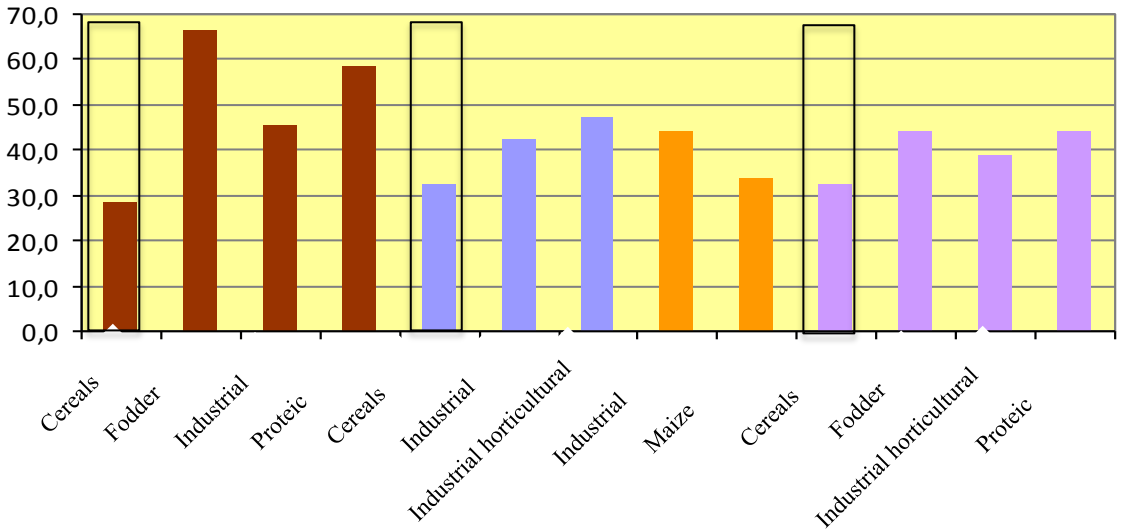
ENVIRONMENT	**CARBON FOOTPRINT**: total amount of greenhouse gases (GHG) generated by the processes included in the system. It is measured in terms of mass of CO_2 equivalent
	WATER FOOTPRINT: water consumption of a system including direct consumption, evapotranspiration amount, polluted water. It is measured in volume of water
	ECOLOGICAL FOOTPRINT: amount of biologically productive land and water is required to produce all the resources consumed and to absorb the waste generated by a system. It is measured in global hectares (gha).
AGRONOMIC	**NUtE (Nitrogen Utilization Efficiency)**: it is measured in terms of kg or product per kg of nitrogen and it is affected by previous crop, type and rate of fertilizers, crop residues, variety and meteorological conditions.
ECONOMICS	**NET INCOME:** difference between the direct costs of cultivation and the gross marketable products
PRODUCT SAFETY	**DON INDEX**: expression of the cultivation safety aspects related to the possibility of reducing pathology occurrence due to the deoxynivalenol mycotoxin (DON).

2 – Sustainable Durum wheat cultivation

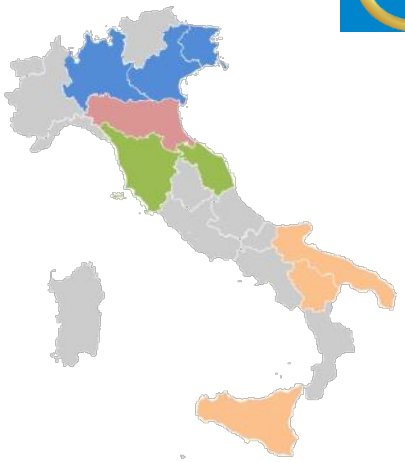
Carbon Footprint (t Co2 / t durum wheat)



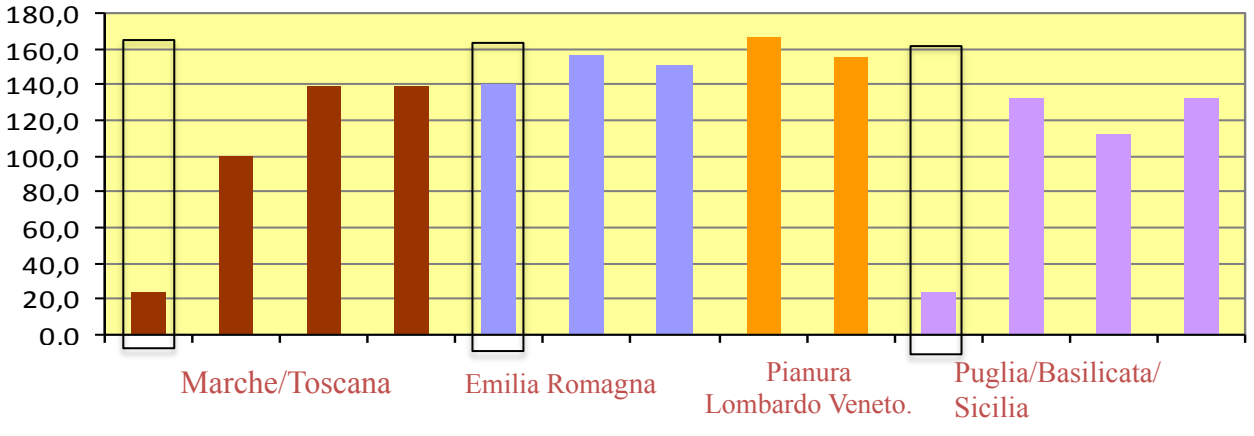
Nitrogen Indicator (kg durum wheat / kg N)



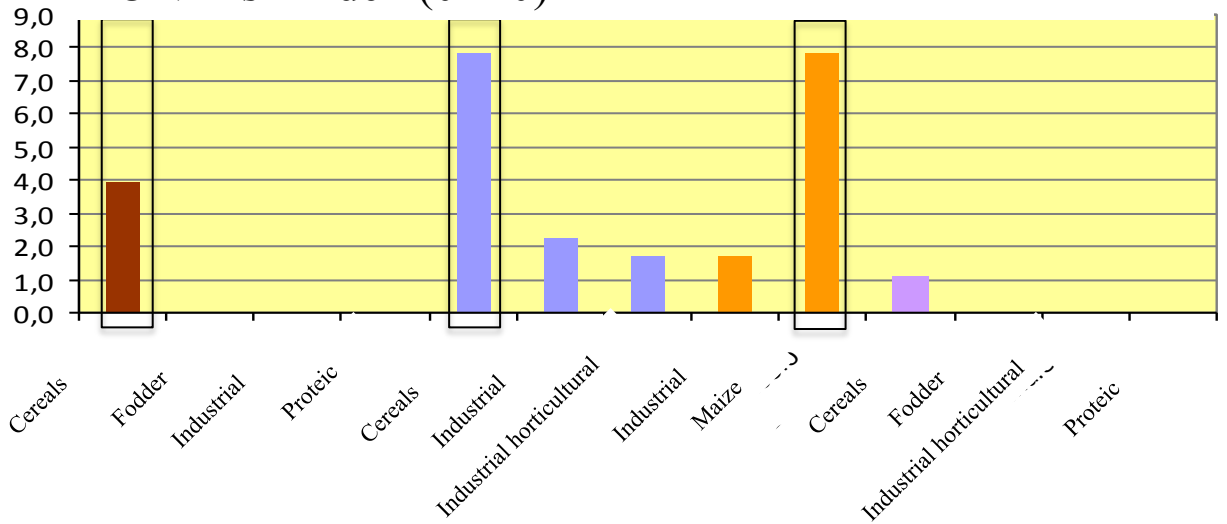
Durum wheat cultivation



Net Income (€ / t durum wheat)

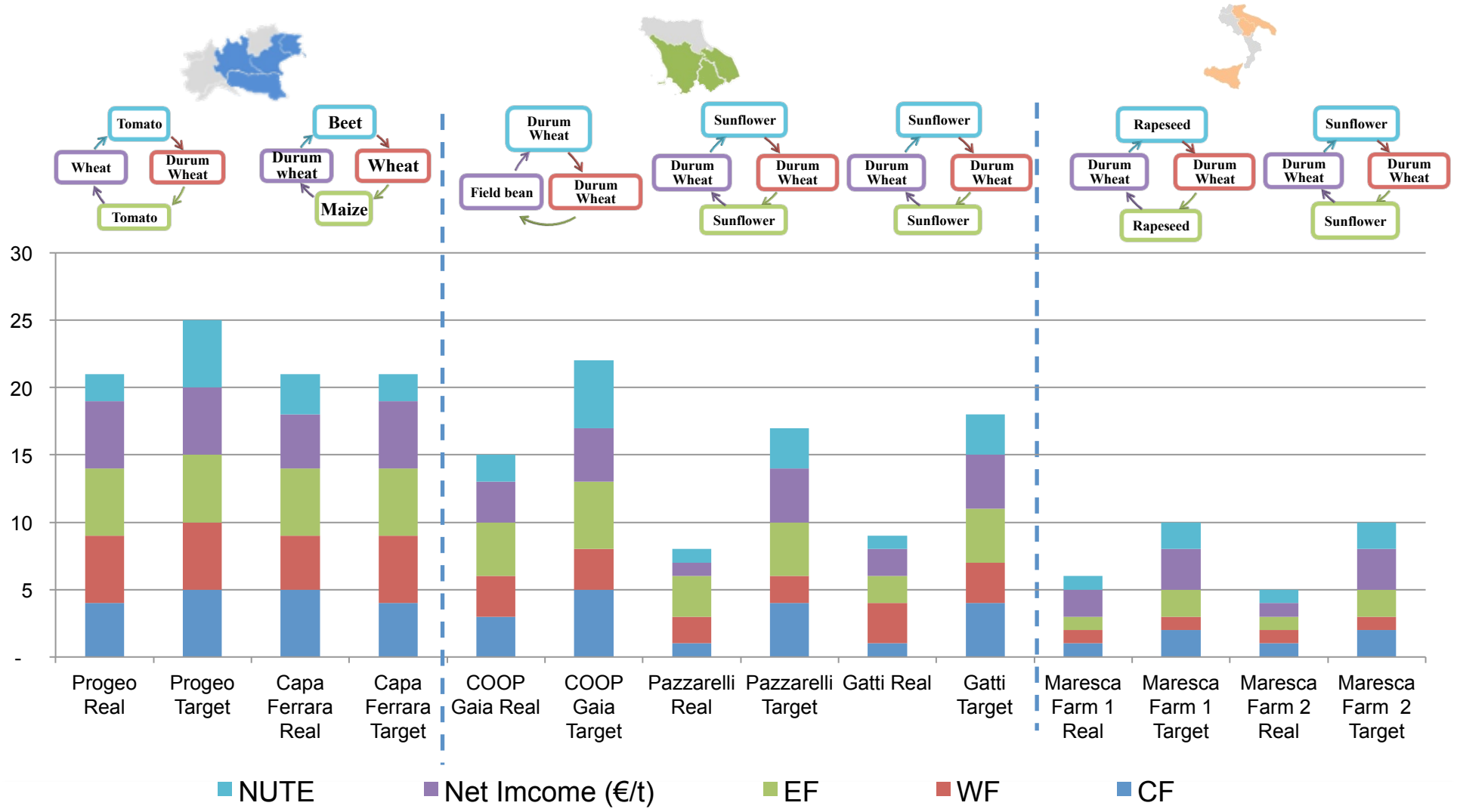


DON Risk Index (0 -10)



2 – Sustainable Durum wheat cultivation

OVERALL RESULTS REAL AND THEORICAL SCENARIOS



2 – Sustainable Durum wheat cultivation

ENVIRONMENTAL RESULTS OVERVIEW

The **Carbon Footprint** of Durum Wheat calculated through target model is lower than the same indicator calculated for the real scenarios. The comparison of CF for the target and real models shows a difference in the order of 20-30%.

No significant differences for the indicator **Water Footprint** calculated through the target and real models. The indicator depends mainly on the green water (rainwater evapotranspirated during the crop growth).

The **Ecological Footprint** comparison show a difference of about 10-15% between the target and real models shows; the differences depend on the yield of durum wheat considered for the models development.

2 – Sustainable Durum wheat cultivation

ECONOMIC RESULTS OVERVIEW

•The **Net income** results similar between real and target in the farms situated in the Northern Italy.

•In Central and Southern Italy there are huge differences between the real value of net income and the target value achievable with more accurate agricultural practices (from 16 to 112%)

•The differences are due both to higher yields and to the lower use of technical tools (seeds, diesel, fertilizers, pesticides) in the target scenario.

NET INCOME: difference between the direct costs of cultivation (agricultural activities, fertilizer consumption) and the gross marketable products.

2 – Sustainable Durum wheat cultivation

AGRONOMIC RESULTS OVERVIEW

DON
there is consistency between observed and predicted data.

Nitrogen Utilization Efficency

- the nitrogen utilization efficiency in Italy is not high.
- in target scenario, the use of nitrogen depends from Granoduro.net with the balance method taking into account the actual needs of the system environment and crop cultivation.
- lower efficiency of real scenario can be caused by:
  - pre-sowing nitrogen distribution;
  - distribution of nitrogen according to static rules and not taking into account the preceding crop and soil analysis.

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3 – Conclusions

- Monoculture or cereal cropping system are the less sustainable both for environmental and economic parameters;

- A comparison of the real and target scenario shows that it is possible to further improve crop sustainability;

- cultivation system and efficiency in crop management (i.e. trough DSS) are main tool for crop sustainability improvement;

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4 – Next steps

THE HANDBOOK FOR SUSTAINABLE CULTIVATION OF DURUM WHEAT (1/2)

With the indications emerging from this study and verified in field, a *Handbook* has been published. Here the main issues:

1. **Crop rotation**
2. **Till the soil with respect**
3. **Use the most suitable variety**
4. **Use only certified and treated seeds**
5. **Sow at the right moment**
6. **Use the right amount of seed**
7. **Control weed species promptly**
8. **Dose nitrogen in relation to plant needs**
9. **Protect the plant from disease**
10. **Extend sustainability to the farm system**

4 – Next steps

THE HANDBOOK FOR SUSTAINABLE CULTIVATION OF DURUM WHEAT (2/2)

In order to further test the results of the study some farmers this years, have sown part of their durum wheat *(see table below)* according to the indications contained in the *Handbook* and part as they would usually do.

Azienda agricola	Comune	Provincia	Superficie sperimentazione (ha)	Precessione colturale
1	Parma	PR	23	Pomodoro/Bietola
2	Parma	PR	13	Pomodoro
3	parma	PR	28,5	Pomodoro
4	Mirabello	FE	3	Mais
5	Chieuti	FG	10	Pomodoro/Colza
6	Fermo	FM	5	Girasole
7	Macerata	MC	5	Cece da granella
8	Castelfidardo	AN	1,5	Girasole da granella
9	Fano	PU	1,5	Favino granella secca
10	Spinetoli	AP	1,5	Frumento duro
11	Sant'Elpidio al mare	FM	1,5	Frumento duro
12	Senigallia	AN	5	Favino granella secca
13	Medicina	BO	4	Barbabietola da zucchero
14	Fauglia	PI	2,5	Girasole da granella
15	Montecosaro	MC	3,6	Girasole da granella
16	Recanati	MC	3	Girasole da granella

Thank you

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