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Grassland and forages in high output dairy farming systems

Forage production and use in the dairy farming systems of Northern Italy

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Dairy farming systems and cheeses

- Italian production of milk is about 11 million tons (year 2014)
- More than 80% of the milk is produced in Northern Italy
- **Grana Padano** and **Parmigiano-Reggiano**, the two main Italian PDO cheeses, use more than 40% of the milk produced in Northern Italy.

Areas of origin

Characteristics of the two dairy systems

Main difference:

silage fodders are banned in the Parmigiano-Reggiano system, to prevent *Clostridia* contamination and potential swelling defects

(P-R is a preservative-free cheese).

Regulations for Parmigiano-Reggiano production set the minimum level of dry matter intake from hay at 50% of dairy cows' rations.

Characteristics of the two dairy systems

- Both are **high output dairy farming systems** → **30.7** kg milk cow^{-1} day^{-1} in Grana Padano, **23.7** kg milk cow^{-1} day^{-1} in Parmigiano-Reggiano,

- and **integrated crop-livestock systems** → the recycling of livestock manure as a fertiliser, even within the limits imposed by the Nitrates Directive, is the basic means of fertilising crops.

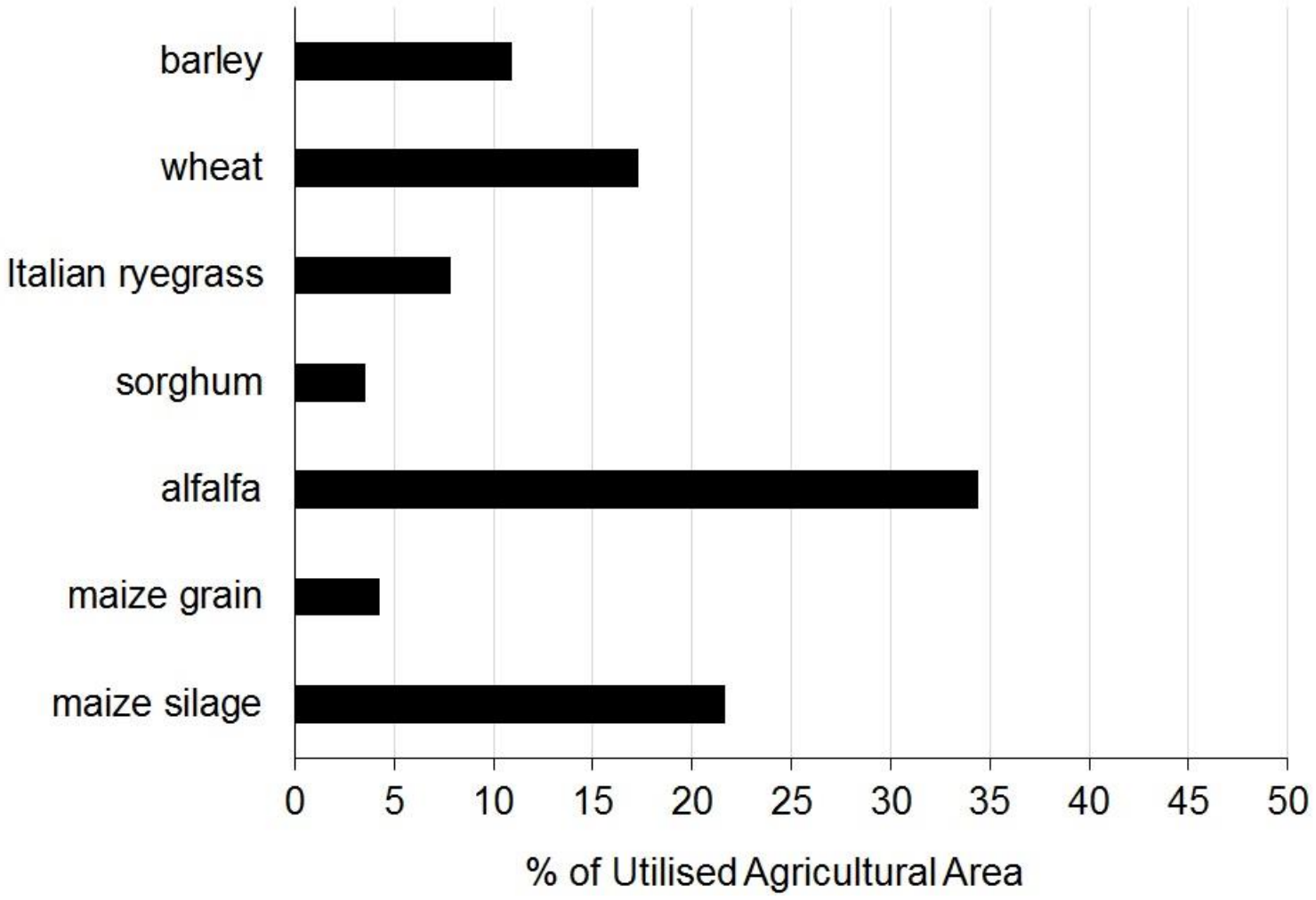
Origin of the data

The data presented are from representative dairy farms belonging to the two production areas, monitored by CRPA in two LIFE projects:

- **AQUA**, *Achieving good water quality status in intensive animal production areas*

- **Climate ChangE-R**, *Reduction of greenhouse gases from agricultural systems of Emilia-Romagna*

Grana Padano forage system



Area of crops in farms producing milk for Grana Padano cheese (average values for representaive dairy farms monitored by CRPA).

The Grana Padano forage system

Maize silage is the mainstay forage for the production of either fresh milk or milk for GP cheese.

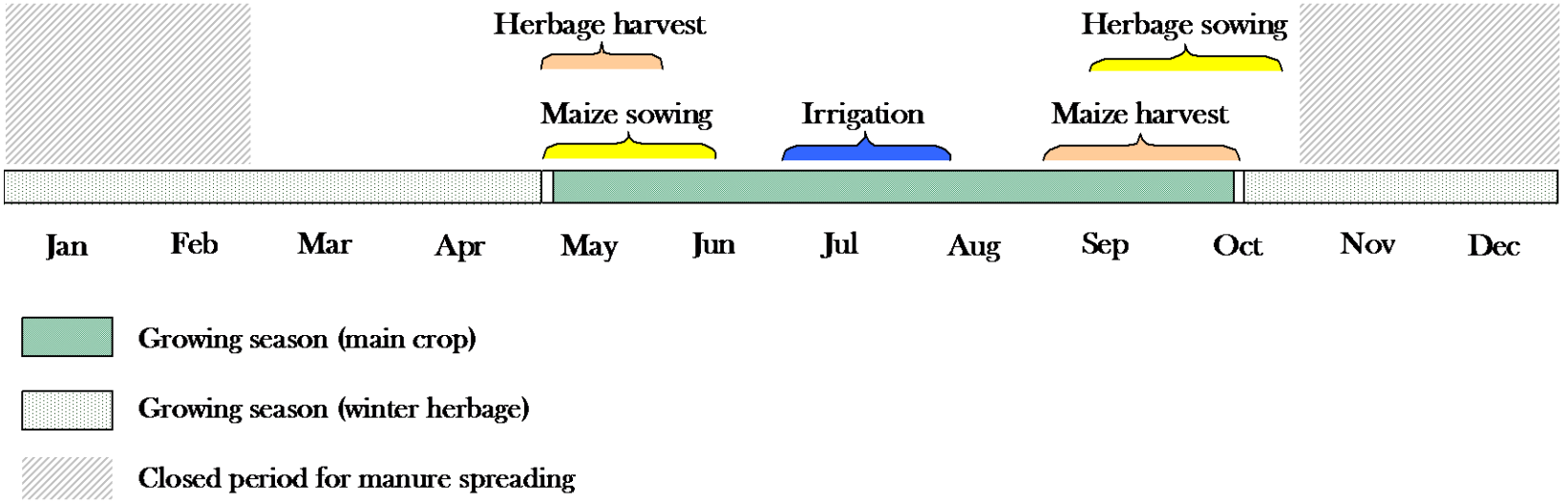
	Irrigation	FAO class	Average
Yield (Mg DM ha^{-1})	Yes	400-500	22.1
		600-700	22.9
	No	400-500	18.9
		600-700	20.0
N uptake (kg ha^{-1})	Yes	400-500	254
		600-700	266
	No	400-500	217
		600-700	243

Average yield and N uptake for the main types of maize in the Italian northern plain (unpublished data from Pioneer Hi-Bred Italia, modified by Agroselviter University of Turin).

Grana Padano forage system

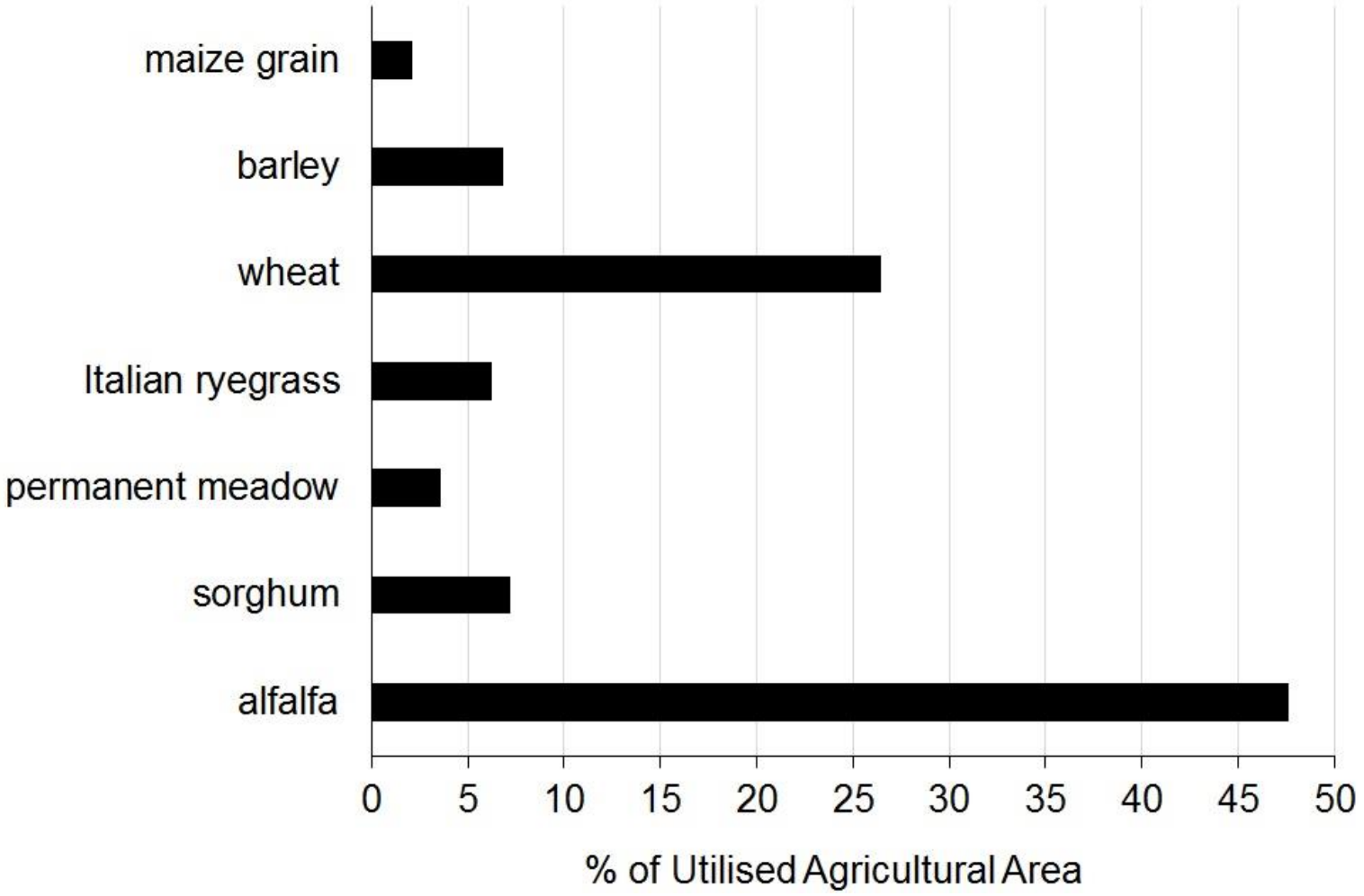
A two-crops-per-year cropping system:

maize for silage in combination with Italian ryegrass or winter cereals for silage production.



Yield: 23-27 t DM ha^{-1}. Uptake: 290-340 kg N ha^{-1}

Parmigiano-Reggiano forage system



Area of crops in farms producing milk for Parmigiano-Reggiano cheese (average values for representaive dairy farms monitored by CRPA).

Parmigiano-Reggiano forage system

Four or more cuttings of alfalfa (up to 6 or 7 under irrigation) can be harvested each year.

	1st year	2nd year	3rd year	4th year
Plains (Mg DM ha^{-1})				
Irrigated	10-11	16-18	13-14	10-12
Not irrigated	7-9	13-15	11-13	9-11
Hills (Mg DM ha^{-1})				
Not irrigated	3-5	8-10	6-8	3-5

Average yield of alfalfa in the Italian northern plains and hills.

Parmigiano-Reggiano forage system

Permanent meadows are still found in the less-intensive farms.

Without irrigation in the hills and with surface irrigation in the plain.

Parmigiano-Reggiano forage system

The presence of meadows increases the environmental sustainability of the dairy system:

- depleting nitrates in the soil,
- holding a high number of plant and animal species,
- accumulating organic matter (carbon sink).

Characteristics of the rations

- Grana Padano system →
  maize silage (23 kg cow^{-1} day^{-1}), alfalfa (6.8), concentrate (9.5) and other silage
- Parmigiano Reggiano system →
  alfalfa hay (11.4 kg cow^{-1} day^{-1}), concentrate (11), and grasses hay
- In both systems the average dry matter intake for lactating cows is around 23 kg DM cow^{-1} day^{-1}

Quality of the forages

	Maize silage	Alfalfa first cut *	Alfalfa other cuts
Crude protein (%DM)	7.8	11.0	17.3
Starch (%DM)	32.1	1.9	1.5
Sugar (%DM)	0.8	7.6	7.0
NDF (%DM)	37.7	54.0	42.1
dNDF 24 hours (%NDF)	50.2	39.1	34.9
ADF (%DM)	23.8	39.7	35.9
ADL (%DM)	2.7	6.6	7.7
Net energy for lactation (Mcal kg^{-1} DM)	1.71	1.17	1.28

***** The first alfalfa cut includes grasses

Qualitative parameters of forages (average values based on CRPA data, years 2012-2014).

Problems and opportunities

Silage and hay from cereals other than maize

Problem - dry seasons and/or the practice of maize monoculture reduce maize productions.

Opportunity - the possible partial replacement of maize silage, using sorghum, triticale and other winter cereals.

While these cereals cannot guarantee the same high-energy value as maize, they can have a role in the production of silage.

Problems and opportunities

Alfalfa and high crude protein grains

Problem - dairy farming systems are highly dependent on soybean imports for proteins.

Opportunity - alfalfa could be useful for a partial replacement of soy protein in dairy cattle diet but it is important to improve haymaking.

Some grains of winter cereals are valuable for their protein content and their amino acid profiles (wheat, triticale and barley).

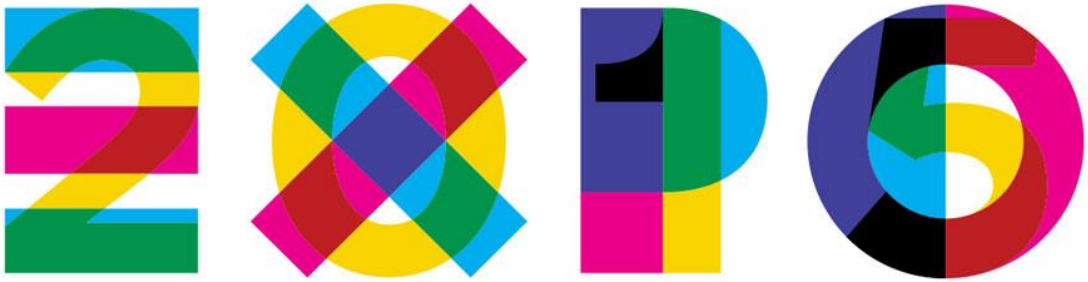
Problems and opportunities

Mycotoxin contamination of maize grain

Problem - contamination with aflatoxin of part of maize grain produced in areas subjected to heat stress and drought, especially in some years.

Opportunity - the replacement of maize grain with a source having similar nutritional characteristics, such as sorghum grain.

See you at



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