LIFE-DOP - Nutrient management best practices in dairy production for Italian cheese

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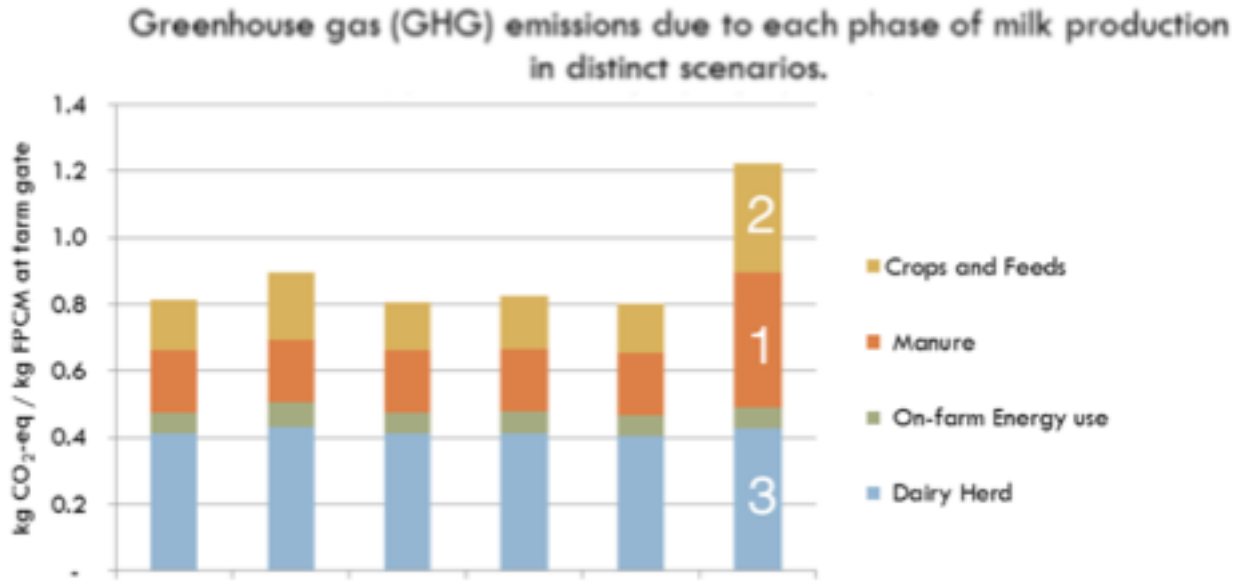
LIFE DOP goals

Frame a production model for Parmigiano Reggiano and Grana Padano that is sustainable and environmental friendly

By proper nutrient management and increased efficicency.

Key phases of dairy production causing environmental impacts

Slurry management
Nutrients use/recovery are key points of sustainable production



What LIFE DOP project aims to improve

- Slurry –manure management
- Fertilization and nutrient management in fields
- Stable management

Total dedicated area

Forerunner system baseline

Cows

Milk

Slurry

40 stables
5550 cows
Total dedicated area 2113 ha
6 Cheese factories
54.300 tons/year of milk

Forerunner system: audit and baseline

Nutrients	N ton N/year	P ton P/year
Input from feed	783	144
Input from sintetic fertilizers	63	6
Deposition	63	0
Biological fixation	163	0
TOTAL NUTRIENT INPUT	1073	151
Export (milk)	251	48
Export (meat)	37	9
NUTRIENT EXPORT	311	65
Residual nutrient load in system	762	82

Total CO_2 eq emitted due to the milk production
76092 ton/year

Specific emission
1.4
kg CO_2 eq/kg milk

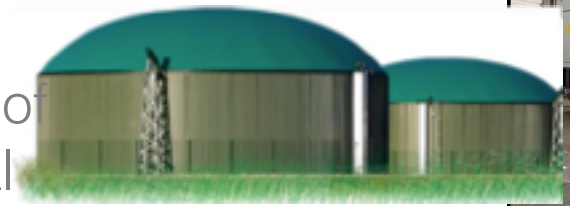
Forerunner system: audit and baseline

- The system has a huge input of nutriets from feeding import (73%of N and more than 96% of P)
- The export with products is very low compared with import
- The **local forage system** has high sustainability (low chemical N import and high biological fixation)

Improvement 1: slurry management

Slurries and manure are processed and sent to produce biogas and renewable energy

Digestate is processed to produce renewable fertilizer in place of chemical fertilizers



Improvement 1: slurry management

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Input from feed	783	144
Input from sintetic fertilizers	63	6
Deposition	63	0
Biological fixation	163	0
TOTAL NUTRIENT INPUT	**1073**	**151**
Export (milk)	251	48
Export (meat)	37	9
Export (processed digestate)	144	40
Ammonium sulphate	62	0
TOTALE NUTRIENT EXPORT	**494**	**95**
Residual nutrient load in system	579	62

Total CO_2 eq emitted due to the milk production **72055 ton/year**

Specific emission **1.3** kg CO_2 eq/kg milk

Improvement 1: slurry management

5.3 milio Kwh/year renewable energy

245 Tons/year recovered fertilizers (N and P)

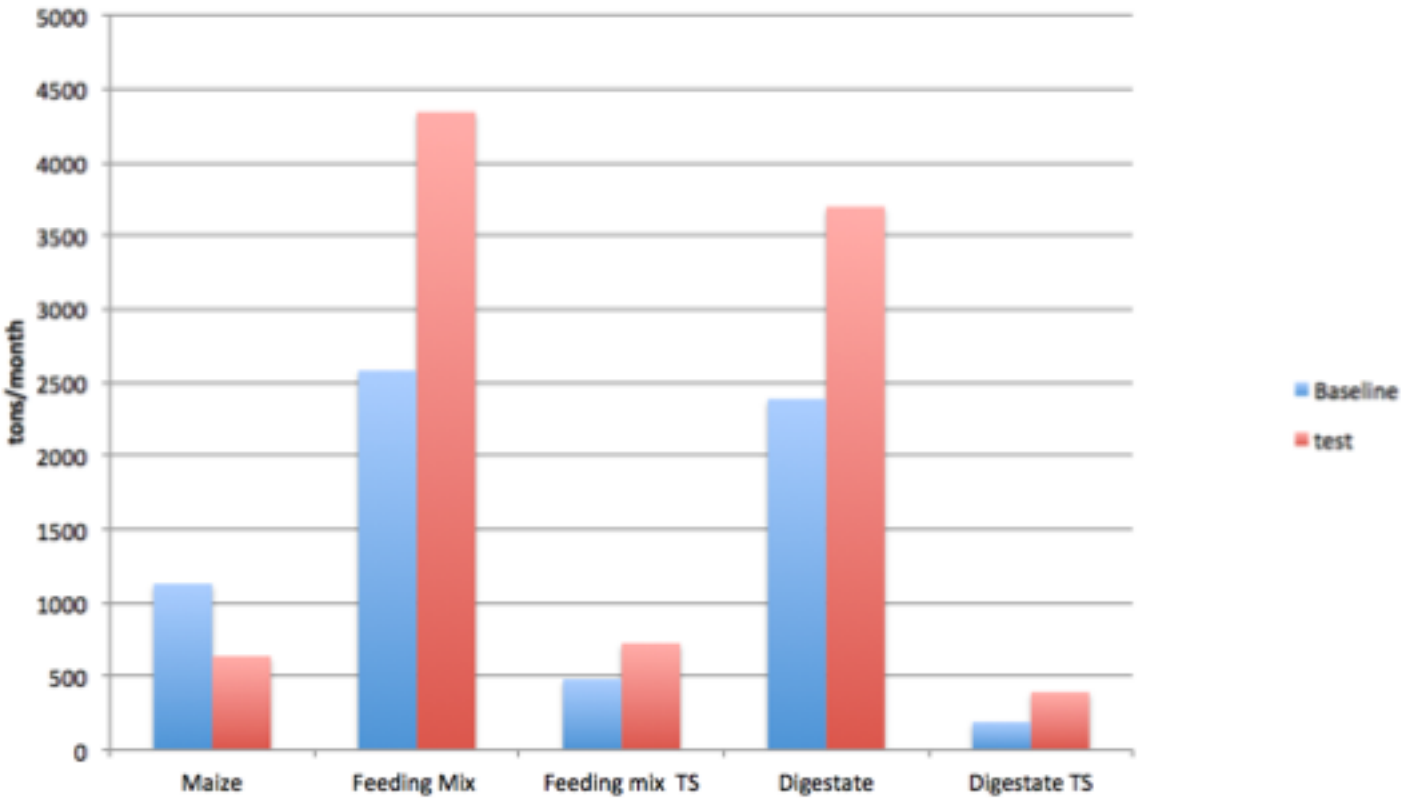
-5.2% CO_2

Slurry and manure derived fraction replace Maize in biogas plant

Slurry and manure derived fraction replace Maize numbers

Parameter	Biogas plant 1	Biogas plant 2
Maize substitution	15%	Up to 60%
Energy demand increase	Not detectable	Not detectable
Stability of process	yes	yes
Volume of digestate increase	negligible	40%
Increase in the amount of nitrogen	1.4 fold icrease	1.7 fold increase

One year mass balance: baseline vs test



Improvement 2: stable management

Detection of the state of art (ration, fodder use, management of slurry)

Evaluation of economic and environmental efficiency

Identification of improvement points and feedback to stables

Stable management baseline

Expected milk production (according to diet)	kg/cow day	33
Actual milk production	Kg/cow day	26
Inefficiency	%	21%

Causes of production loss:

Sanitary problems

Reproductive efficiency

Feeding

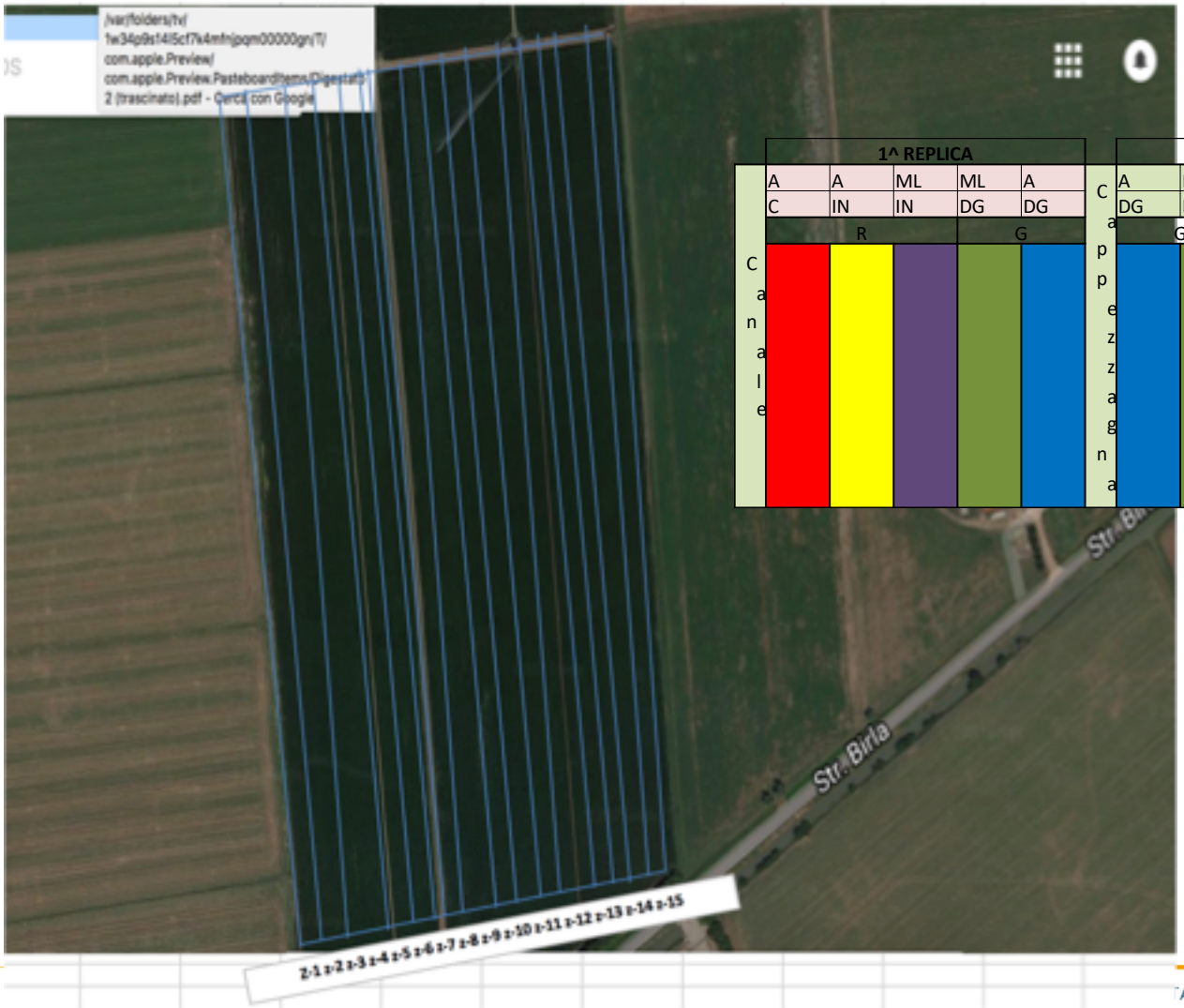
Improvement 3: Field management

Virtuous and innovative management of digestate and slurry in the fields: injection and fertigation at maize raise (precise farming)

Strong reduction of chemical fertilizer

Conservative agriculture practices that preserve soil quality: minimum tillage

Demofield



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Demofield

Good rise of culture

Good omogeneity

No weed problems in minimum tillage

Benefits

Improved air quality: reduction of ammonia emissions into the atmosphere.

Saving of fossil fuels to produce synthetic fertilizers

Better soil quality and biodiversity.

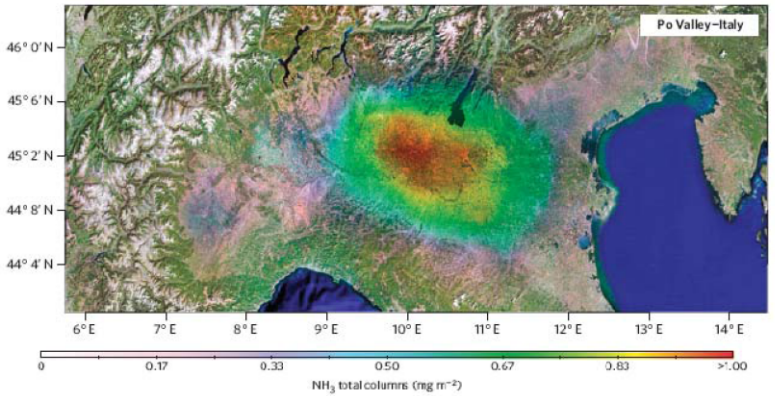

Figure 2 - Annual averaged NH_3 columns over three agricultural valleys (Clarisse et al., 2009).

Extended system : audit and baseline

Nutrients	N ton N/year	P ton P/year
Input from feed	1,045	218
Input from sintetic fertilizers	172	17
Deposition	86	0
Biological fixation	126	0
TOTAL NUTRIENT INPUT	**1430**	**235**
Export (milk)	362	68
Export (meat)	51	12
TOTALE NUTRIENT EXPORT	**413**	**81**
Residual nutrient load in system	1016	109

Calculation of the existing environmental impact (verification of current status and LCA calculation)

Measurement of the impact of the sustainable model on a demonstration scale (demofield, field measurements)

Definition of the constraints and good practices to be followed .

Implementation and certification

Thank you for your attention

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