Soil biotic component indicators in Lombardy agro-ecosystems

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INTRODUCTION

Aim of the project is to evaluate the effects of early stage application of Conservative Agriculture techniques and organic matrices (digestates) distribution on soil biodiversity and soil functionality. Four sites characterized by a very intensive agriculture and representing Lombardy soils (Aquic Hapludalfs, Typic Hapludalfs, Dystric Eutrudepts) were chosen.

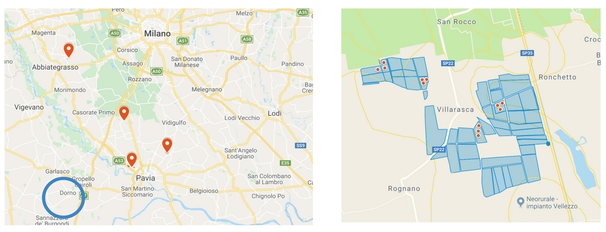


Fig.1: maps

Over them, three typical crops were analyzed: corn, wheat and rice.

Fig.2: Corn

Fig.3: Rice

Fig.4. Wheat

All sites were managed under Conservative Agriculture practices (at early stage) and fertilized with digestate at the beginning of spring before sowing. During spreading the digestate was directly incorporated into the soils.

Fig.5: Digestate fertilization

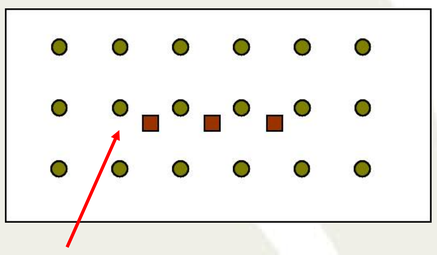
METHODS

Two different soil biodiversity indicators were chosen: QBS-ar Index (Parisi 2001 - Dynamic extraction of edaphic microarthropods with Berlese-Tüllgren selector) and Earthworms Index (FAO 2008 - Visual Soil Assessment Worm Earth).

The Qbs-ar Index refers to the pedofauna and is based on the principle that microarthropods groups, particularly adapted to edaphic life, are more present if the soil ecosystem is not disturbed by anthropic activities. Earthworm Visual Soil Assessment is based on accounting the earthworms number in a known volume of soil: greater is the number, better are the soil quality conditions.

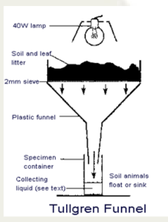
The indicators sampling was carried out two times during the agricultural year: before sowing and after harvest, for rice and corn; during the growing season and after harvest, for wheat.

The soil fauna communities composition changes with the seasons but also depends from soil temperature and humidity conditions. Sampling must not take place in excessive dryness conditions or after heavy rainfall.



Replicas (distance 10 m, sample 10x10 cm)

Each replica is placed on an extractor. The extraction is dynamic: it takes advantage from the micro-arthropods reaction, escaping from light and drying conditions caused by a light bulb turned on continuously for 7 days.



MAIN RESULTS

We chose those indicators because they:

- are simple to sample and to analyze;
- are reliable in most type of environment;
- runs without expensive equipment;
- allows to convert what we found in a soil aggregate into a soil quality judgment.

Hereafter the results of indices determination and quality judgements in our sites.

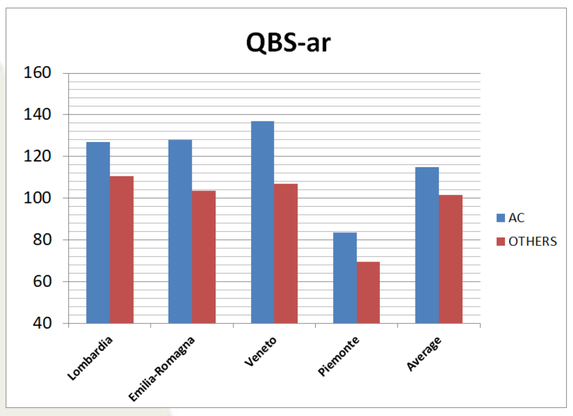
Crop	QBS Max
Corn	75
Rice 1	66
Wheat	86
Rice 2	63

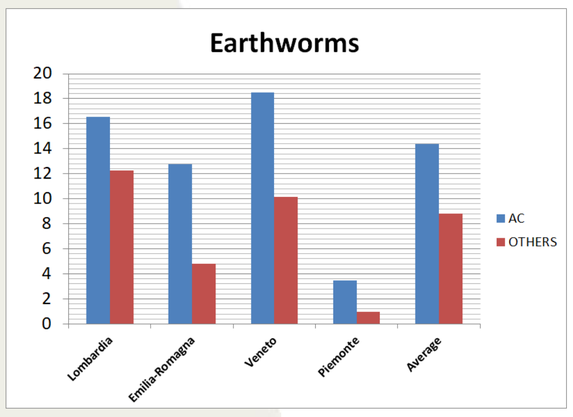
QBS-ar Index Value	Judgement	Quality Class
>120	Excellent	I
101-120	Good	II
81-100	Fairly Good	III
61-80	Sufficient	IV
41-60	Modest	V
31-40	Poor	VI
<30	Null	VII

Crop	N° Earthworms
Corn	6
Rice 1	1
Wheat	5
Rice 2	1

Index Value	Judgement	Quality Class
>8	Good	I
4-8	Sufficient	II
<4	Poor	III

And here is a comparison with the Life Helpsoil project results, which used the same soil biodiversity indicators, splitted by Conservative sites (AC) and conventional ones (others).





CONCLUSIONS

The QBS-ar values show a slight increase during these projects, partially due to the organic material distribution into the soils. For rice paddy sites QBS-ar and Earthworms indices seems less interesting due to the occurrence of anaerobic conditions for a long time during the growing season. The index fluctuations, observed during the year, seem to be strongly linked with the sowing preparation processes. The comparison with the Life Helpsoil data shows that these indicators are able to demonstrate that conservative management improves the soils biological quality after few years of application. The use of these indices contributes to raising awareness of how to enhance soil management, protection of agricultural ecosystems and also food security.

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