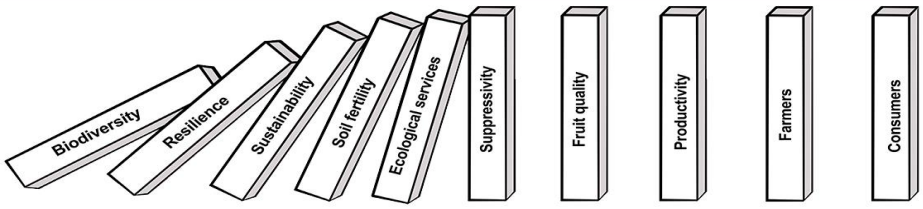
CORE organic

DOMINO



NEWSLETTER

Nº 1 December 2018

Release

This is the first issue of the DOMINO project newsletter. We want with this biannual publication inform all interested parties about the development of the project and its achievements and results.

In this issue, we provide a brief overview of the project and some basic information about its concept. We imagine the newsletter as an active tool for disseminating information, but also hosting ideas useful to further develop the project activities. For this reason, we will welcome any kind of contribution by the readers.

We take the opportunity to wish you all a Merry Christmas and a "fruitful" New Year!

The DOMINO consortium

DOMINO: introducing the idea of changing the monoculture paradigm in organic fruit production

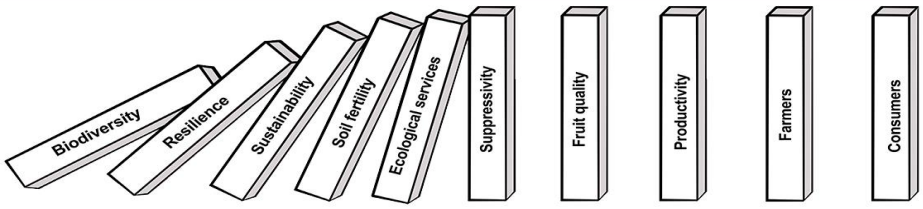
Davide Neri and Eligio Malusá

Crop protection and management, including fertilization and weed control, requires high inputs in intensive organic fruit orchards, thus leading to increasing costs and undesired ecological impacts. The fulfilment of the crops' nutrient demand while maintaining at the same time the soil biological fertility and ecosystem services is a difficult task. Currently available organic fertilizers can still induce possible nutrient imbalances and have low nutrient efficiency. This is particularly true for fruit crops, where the need of nutrients, particularly of nitrogen, in early season is high and not paralleled by organic matter mineralization and availability. On the other hand, to reduce inputs might threaten crop production and quality. At the same time, there is the need to maintain soil fertility with an ever-decreasing availability fertilizers.

Plant protection in organic farming is also a practice that finds increasing challenges from "new" pests and diseases, frequently increasing their impact due to climate change or trade globalization. This situation requires new approaches, which should include physical barriers or a better management of the microbial community, both in the soil or in the plant. To achieve this, it is necessary to better understand how we can intervene to manage the natural biodiversity as well as to introduce new practices and concepts, which are finding their root in modifying the paradigm of specialised monoculture.

Such issues are tackled by the project "DOMINO", which aims at improving the long-term sustainability and the ecological foot print of intensive organic fruit orchards. The approach is based on an integrated strategy that includes:

a) introducing a second cash crop as living mulch in the row; these dynamic "living mulches" (consisting of plants with phytosanitary characteristics or productive



capacities or multifunctional features) will be grown in the row also to help weeds control and/or in the inter-row (leguminous plants or other floral species) to increase soil fertility, N availability or biodiversity.

b) introducing new fertilizers (locally available recycled organic materials, e.g., composted waste and biogas digestates) and legume mulches in the row to increase resource use efficiency and improve ecosystem services.

c) using transitory overhead net systems to support non chemical pests and diseases control.

In addition, the strategy includes the introduction of microbial-based products and the overall adaptation of orchard management to promote ecosystem services.

This innovative management is expected to maintain and enhance soil fertility, enhance inputs efficiency, improve plant nutrition and health, also by increasing the orchard biodiversity. We expect that the increase of overall biodiversity will make these intensive cropping systems more resilient to climate changes, reducing the dependency on external inputs and will improve the orchard carbon balance (i.e. the organic matter budget).

The overall hypotheses, which are the fundament of the project, are:

1) The management of herbs containing essential oils and commercial phytochemicals as living mulches in the tree rows will increase the biodiversity of secondary species and improve the control of weeds and rodents, representing meanwhile a second cash crop.

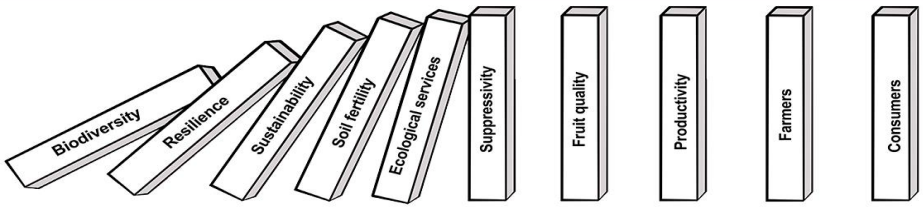
2) The use of leguminous species as living mulch, and applying fertilization using microorganisms' inocula and local recycled materials (e.g., food wastes, biogas-digestates) will provide a more balanced nutrient management and better fruit tree root growth because of improved soil fertility.

3) The use of the proposed fertilization and living mulching strategies will increase the nutrient use efficiency and will have a beneficial impact on fruit and soil quality, improving the current fertilization practices.

4) The use of semi-closed cover systems as physical barriers will reduce the need of external inputs for plant protection leading to a limited impact on biodiversity while ensuring better plant health and higher fruit quality.

5) The more efficient plant protection strategy will reduce the use of copper and sulphur, which affects the soil chemical characteristics and overall fertility.

The proposed practices should thus introduce the concept of vertical production, with the exploitation of different layers of the orchard, above and below ground, reducing the potential long-term impact of intensive organic orchards and increasing the agroecosystem resilience with a "domino" effect on biodiversity, fruit quality and overall sustainability of the cropping systems.



Agro-ecological engineering for a sustainable intensification

Serena Polverigiani

It is nowadays widespread the approach that aims to increase the sustainability of agricultural practices by promoting the biodiversity of the ecosystems. However, the further challenge consists in moving from a **greater biodiversity** (Fig.1) to a **targeted** management of **diversity** within the ecological communities. The difference is substantial and is based on the achievement of precise objectives.

A quarter of the soils in our planet are at great risk of degradation, and there are evidences that organic

Figure 1. A general increase of biodiversity in the agro-ecosystem s not always compatible with intensive systems.

farming cannot unequivocally fight similar dynamics; it can do so at the cost of a less efficient land use. Organic farming is also particularly exposed to the risk of leaching and eutrophication and the achievement of greater precision in nutritional management can be considered as a primary objective for the sector. The idea is that the promotion of biodiversity focused on specific changes in the composition of the weed communities could allow a greater sustainability, but also an increased stability of the ecosystems.

Figure 2. Tap root weeds are not compatible with an increase in land-use efficiency.

The goal is not to replace intensive with extensive systems, evidently not sustainable from an economic point of view, but to model biological diversity so that agro-ecological services could compensate, at least in part, the needs for an increasing intensification.

The growing world population requires increasing resources and it is clear that the road to reducing the intensity of land use is hardly viable in a large scale. What we should aim for is, instead, a “different” intensification: a process of intensification still based on the protection of biodiversity, which, however, will include a further analysis of the **composition of the plant communities**, rather than simple diversity.

A generic increase in diversity above, as well as below ground, based on the random inclusion of many species can lead to competitions and

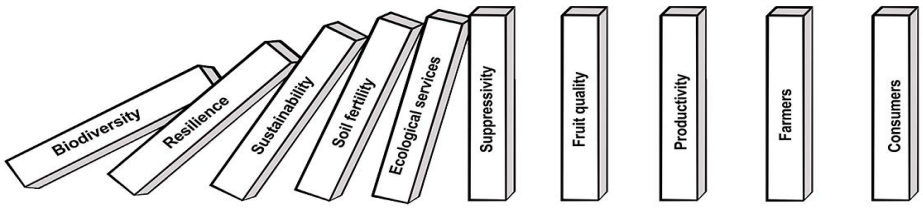


Figure 3. Selected ecological communities reduce competition and increase ecological services. Here stoloniferous species, with fibrous roots, increase soil holding capacity without a detrimental competition.

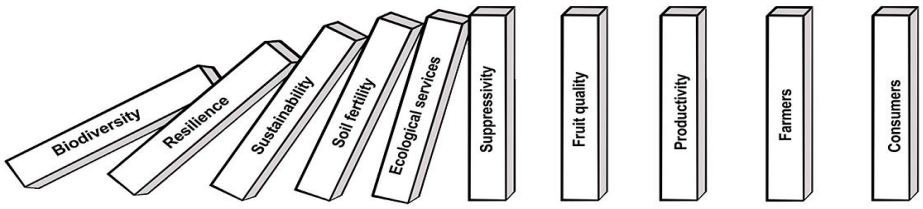
imbalances hardly manageable in a productive context. The DOMINO's innovative proposal consists of a targeted programmatic approach to improve services and functions within the agro-ecosystem.

The challenges are thus related towards the identification of combinations of plant species able to offer services to the system and, at the same time, characterized by precise traits that limit their competitiveness with respect to the main crop.

The selective weeding

In Mediterranean climate, the Università Politecnica delle Marche, tested the opportunity to manually select the weed community in the row of an orchard of young apricots grafted on Mirabolano.
Weed selection was performed in May by manually removing all creepers, tall and tap root species, considered as highly competitive with the main crop *(Fig.4).*

Figure 4. Examples of species selectively removed.



After 4 months the average canopy eight of the population was a 22% lower than in the control, not weeded treatment. The manual selection of the weeds induced a significant advantage to the main crop, being the apricot trunk development, 20% greater in the selectively weeded parcel (Fig.5).

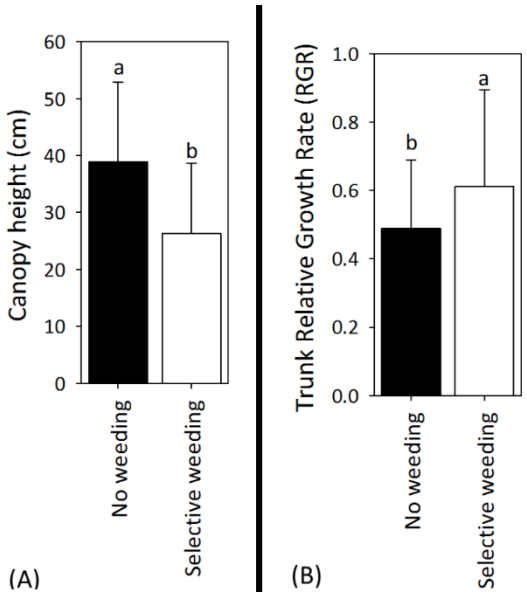


Figure 5. Effect of selective weeding on weed community canopy height (A) and apricot trunk growth (B)

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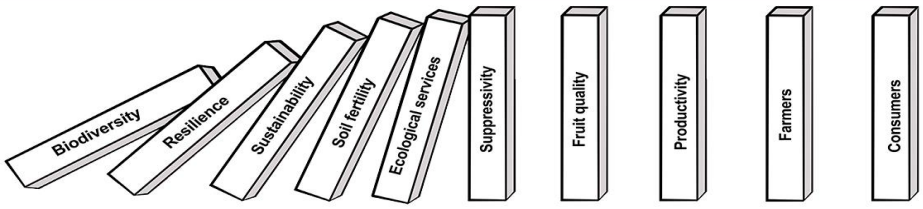

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