CORE organic II

INTERVEG

Enhancing multifunctional benefits of cover crops – vegetables intercropping

The hilly landscape of Marche (Italy)

Main research questions:

Organic vegetables may benefit from intercropping with living mulches, and in this project, scientists from four Northern and Mediterranean EU countries assess and evaluate the effects of the technique on the product and on the environment.

The project wants to answer the following questions:

Do the introduction and proper management of living mulch (LM) in vegetable production systems allow similar yields and quality in comparison to the sole cropping systems?

Does LM provide agro-ecological services that could contribute to make the vegetable cropping systems more environmentally and economically sustainable?

In more detail:
Does legume LM deliver a significant amount of N to the cropping system via Biological Nitrogen Fixation (BNF)?
Does non legume LM contribute to reduce the risk of NO_3 losses (leaching) from the system?
Does LM compete against weeds, avoiding or reducing mechanical weed control?
Is LM able to increase the presence and activities of soil arthropods (functional biodiversity indicators) and change the arthropods pest/beneficial relationships?

Main outcomes at this stage

The first field experiments were carried out on cauliflower, leek and artichoke, either on research farms or pilot (private) farms. The main, preliminary outcomes available are:

- The introduction of early sown LM (i.e. at crop transplanting) in cauliflower cropping systems reduced the yield and the quality. Conversely, in the late sowed LM (i.e. 2 to 4 weeks after cauliflower transplanting, according to local conditions) no significant differences in yield and yield quality were observed. Permanent LM strips could represent a feasible option to design and manage vegetable intercropped systems.
- In the Northern EU countries, where vegetables are mainly cultivated in summer, the continued presence of the living mulch in the field over winter may reduce the soil mineral N content during the leaching season in comparison to the bare soil (after the sole crop). Consequently, it may contribute to lower the nitrate leaching risk from the systems. The LM substitutive design (reduction of crop plant density to leave room to LM) tended to increase leaching. This may be due to a lower N uptake ability of the living mulch compared to the cauliflower that was replaced. Whereas the addition design, where the living mulch was introduced in-between the rows of cauliflower (same crop plant density), tended to reduce leaching. However, since these outcomes are strongly depended by the climatic conditions, we need to verify these preliminary evidences in the light of the next year results.

- Living mulch sowing time and the choice of the cultivar had a key role in the competitive success of the cash crop against both weeds and living mulch. Preliminary outcomes showed that late sowing of the LM ensured an unfavourable environment for weeds avoiding crop suppression. Moreover, our findings indicated similarities in competitiveness between hybrid and open pollinated/local adapted cultivars.
- Preliminary results obtained in the Italian cauliflower 'scenario' showed that LM introduction did not affect the infestation of *P. brassicae*, showing no detrimental effect of this technique on pest dynamics. In LM treatments, the *P. brassicae* parasitisation by the braconid *Cotesia sp*. was higher than the no LM treatment (88 % and 63 %, respectively). LM also showed to increase the spider and rove beetle populations, while the carabid activity density was slightly higher in the no living mulch.

Living mulched artichoke in the Italian experiment

Recommendations to end-users

If properly managed, LM does not decrease yield and quality losses and have a strong potential to enhance the ecological functions of cropping systems. Farmers should identify the ecological function (i.e. weed control, beneficial arthropods enhancement) they are primarily interested in and design the system accordingly. However, since we observed that the responses of the LM introduction were crop (system) and site specific, farmers are advised to verify the effectiveness of the technique in their own conditions.

Relevance

Since the research activities have been carried out in four countries (IT, DK, DE and SLO) and in sites having different soil characteristics and climatic conditions, the outcomes achieved are probably transferable to most EU territories. Indeed, the experiences carried out in DK, DE and SLO are valid for the Central and Northern EU countries, where vegetables are mainly grown in spring and summer. On the other hand, the results obtained in

Cauliflower field experiment in Italy

The German field experiment (cauliflower)

Italy (vegetables grown in the autumn-winter season) are applicable in the Mediterranean areas (i.e. Southern Europe, North Africa and Middle East).
The LM technique is applicable not only in organic farms, but also in conventional farms that rely on agro-ecology to achieve sustainable production models.

New and important research questions

- Is the LM substitutive approach sustainable? Is there a trade off between areal yield reduction, production cost reduction, increase of energy use efficiency and enhancement of ecological performances of the system?
- Is the LM technique a tool to exploit the allelopathic potential of some plant species to manage the weed/crop interference?
- Is the LM technique a tool to enhance the attitude of some vegetable crops (i.e. artichoke) to sustain mycorrhiza and obtain an improved plant nutrition?
- Can the LM technique be introduced in protected (i.e. greenhouse) vegetable production systems to enhance their sustainability?

Pieris brassicae on a cauliflower leaf (Italy)

Coordinator

Senior researcher Stefano Canali, Agricultural Research Council, Italy
E-mail: stefano.canali@entecra.it

Partners

Researcher Gabriele Campanelli, Agricultural Research Council, Italy
Scientific board member Livia Ortolani, Associazione Italiana Agricoltura Biologica, Italy
Associate professor Giovanni Burgio, Università di Bologna, Italy
Researcher Fabio Tittarelli, Agricultural Research Council, Italy
Prof. Dr. Peter von Fragstein und Niemsdorff, University of Kassel, Germany
Associate professor Hanne L. Kristensen,Aarhus University, Denmark
Assoc. Prof. Dr., Martina Bavec, University of Maribor, Slovenia

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Further information

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Read more at coreorganic2.org/InterVeg.