# InterVeg

# *Enhancing multifunctional benefits of cover crops − vegetables intercropping*

**INFOSHEET**

From 2011 to 2015, in the frame of InterVeg project, four field experiments were carried out in Italy, Slovenia, Germany and Denmark in order to study the effect of the living mulch introduction.

In 4 different European climatic areas, ecological services have been exploited by use of living mulches in intercropping systems for production of vegetable crops.

**What is Living Mulch?**

**Living Mulch** can be defined as **a cover crop intercropped with a main crop**: the practice of growing two (or more) crops simultaneously in the same area offers a great potential to **enhance the ecological support functions of agro-ecosystems at field and farm scale**, thus increasing crop production sustainability. Moreover, it has been demonstrated that intercropping can significantly enhance crop productivity compared to sole cropping since it grants a higher land utilization efficiency, efficient nutrients and water resources use.

The main challenge of InterVeg project was to find **the most complete and exhaustive answer to the following question:**

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| ***Can high yields be attained in intercropping systems for production of resource demanding crops such as the vegetables?*** |

**The project outcomes demonstrated as in very diverse climatic and geographic situation, agricultural choices can have positive impacts on the whole agricultural chain.**

**Living Mulch and ecological services**:

**a. Reduction of nitrate leaching risk**

Vegetables with a high nitrogen demand such as cauliflower can cause intensive leaching of nitrate to the environment in conventional as well as in organic production. In organic cropping system, the use of an in-season living mulch may decrease the risk of nitrate leaching after harvest when left growing in the field to the end of the leaching season in spring.

Our field trials demonstrate that the continued presence of living mulch in the field over winter compared to bare soil after the sole crop may reduce the soil mineral N content during the leaching season and, consequently, contribute to lower the nitrate leaching risk from the cauliflower systems.

**b. Cost and energy consumption**

Cost and energy consumption have an important role when assessing an agroecological technique. Their increase or decrease can strongly influence the farmers' decisions in choosing a specific technique for both economic and environmental reasons.

Even thought the application of living mulch at farm level is often constrained because it is perceived by farmers as a costly technique, we found out that the introduction of living mulch determines a difference in total energy consumption ranging from +14 to -4 % and a cost difference ranging between +22 and -2%.

Furthermore, the use of living mulch determined, in all the four different European countries, the change in proportion between human power and fossil fuel energy consumption. These findings have to be considered together with the yield results and, most of all, in a social perspective in the specific local context where the Living Mulch is introduced.

**c. Pest/beneficial interaction**

Biodiversity and complexity are considered to be essential for the stability and balance of the living components of ecosystems. In this frame, crop diversification is an agricultural strategy that can be used to manage insect populations: several studies demonstrated the intercropping and living mulch can have positive impact on plant pests and diseases as well as weed control.

During the project experiments, a regulatory capacity of the organic farm has been detected in all the involved countries. More in details, living mulch showed to increase the spider and rove beetle populations, while the carabid activity density has been slightly higher in the no living mulch.

**d. Crop/weed competition**

Cover crop introduction allows to optimize crop rotation providing agronomic benefits and improving weed management. Since cover crops are an important link among soils, crops, pests and weeds, they can contribute to create an unfavourable ecological environment for weeds, ensuring the biodiversity and soil protection.

In the three different European environments, the studies highlighted the role of agricultural choices in the living mulch introduction in obtaining an effective weed suppression. Both the living mulch timing of sowing and the cultivar had a key role in the competitive success of the crop against both weeds and living mulch. In particular, the late sowing of the living mulch ensures an unfavorable environment for weeds, avoiding crop suppression.

**e. Soil fertility**

Legume Living Mulch contributes to N input to the system via Biological Nitrogen Fixation (BNF): our results indicated that this contribution can range between 10 and 30 kg N/ha per cropping cycle. It is not a such big quantity, but this N probably has a high efficiency: indeed, recently the direct transfer between legume and not legume intercropped crops via root exudates has been demonstrated then the N fixed by the LM is soon available for the cash crop associated to it. Moreover, at the end of the LM cropping cycle, the fixed N reaches the soil in the organic form (plant tissues), thus it is not leachable and it is mineralised gradually over time and utilised by the following crops, in accordance to their needs.

**3. Considerations about crop yield and yield quality**

The results obtained indicated that, if properly managed, the introduction of Living Mulch does not determine yield and quality losses and has a strong potential to enhance the ecological functions of cropping systems.

Thus, considering the trade off among favourable and not favourable effects, the Living Mulch is an effective strategy to ensure an adequate yield and economic return to farmers while enhancing the agro-ecological performances of the vegetable cropping systems organically managed and, in the long term, further reducing their negative externalities.

Farmers interested in introducing this technique in their fields should primarily identify the ecological functions (i.e. weed control, beneficial arthropods enhancement) they are interested in and, accordingly, select among the different technical solutions we have tested which is the “best option” for their own condition. It is not a simple exercise since we verified that the responses of the Living Mulch introduction are crop (system) and site specific, but - thanks to the INTERVEG project - we have acquired more experience and a quite wider expertise thus we can contribute to guide these decisions.

**For learning more, watch the video on YouTube:**

*https://www.youtube.com/watch?v=tonDD6PcUZc*

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