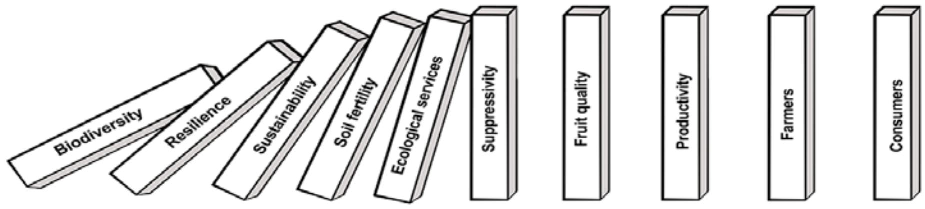
CORE organic

DOMINO



NEWSLETTER

Nº 3 January 2020

Release

Arrived at midway of the project implementation period, we are starting to gather interesting results from the trials established in the six partner countries and also from the evaluation of the status quo of the methods utilized for organic production of fruits. Therefore, we would like to share some of these results, particularly related to the effect of different fertilizers on the biodiversity of soil nematodes community, the practical experience of a farmer implementing the living mulching technique in his vineyards and the analysis of the answers from about 200 farmers and advisors about the technical and research needs for organic fruit producers. The three articles are underlining how biodiversity is affected by the agricultural practices and how innovative strategies of soil management can bear substantial positive effects on the farm income. We wish you an inspiring reading.

The DOMINO consortium

Relationships between soil fertilization practices and nematodes communities in organic apple orchard

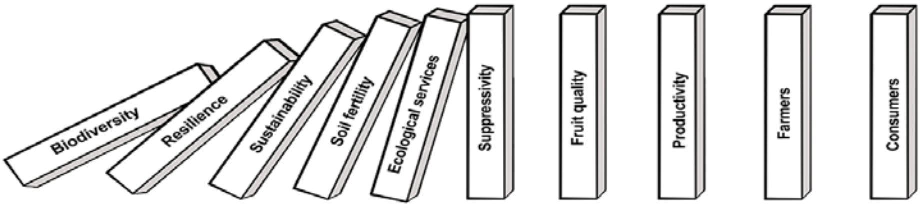
Dawid Kozacki, Grażyna Soika, Małgorzata Tartanus and Eligio Malusa

Developing optimal fertilization methods that match plant nutrient requirements while maintaining soil biodiversity is a challenge for organic fruit production. Properly developed methods should increase nutrient efficiency and improve nutrition and health of cultivated plants and soil.

The assessment of the impact of different organic fertilizers on soil nematode communities in an organic apple orchard was carried out in a trial where five types of organic fertilizers were used: dry manure, dried clover pellet, keratin-based fertilizer, biodigestate (by-product of fermentation of grain and vegetables wastes) and a stillage from yeast production (Vinassa).

Photo. 1. Oostenbrink elutriator.

The effect of the fertilizers on the nematode communities was assessed by analysing the structure of trophic groups and estimating the plant parasite index – PPI, which is a separate ecological measure proposed for nematodes feeding on higher plants. As soil nematodes are represented in many levels of a food web, the various species, genera and families have specific significance within a particular level.



Therefore, the trophic structure of nematode communities, and occasionally single trophic groups, can provide an indication of various ecosystem disturbance. Photos 2-5 are showing some specimens of nematodes belonging to the different trophic groups. The major difference is in the feeding apparatus.

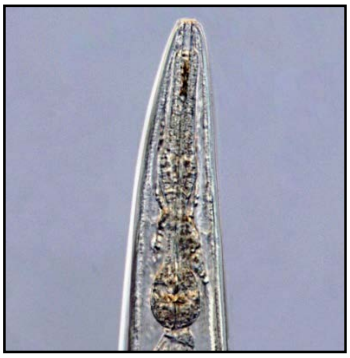


Photo. 2. Bacterial feeding nematode

Photo. 3. Fungal feeding nematode

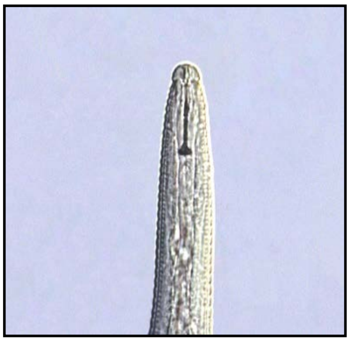


Photo. 4. Plant feeding nematode

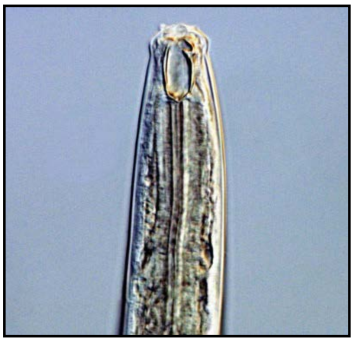


Photo. 5. Predator nematode.

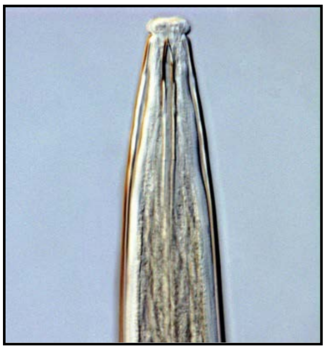


Photo. 6. Omnivore nematode.

To extract the nematodes from the soil, an Oostenbrink elutriator was used (Photo 1). This is an efficient and easy to standardize method that allows to separate the nematodes from heavier soil particles by their specific gravity in a water current. Nematodes are then collected on a set of sieves and further cleaned by passing on mesh dishes.

The effect of the application of the different fertilizers on the trophic groups of soil nematodes is clearly shown on Figure 1.

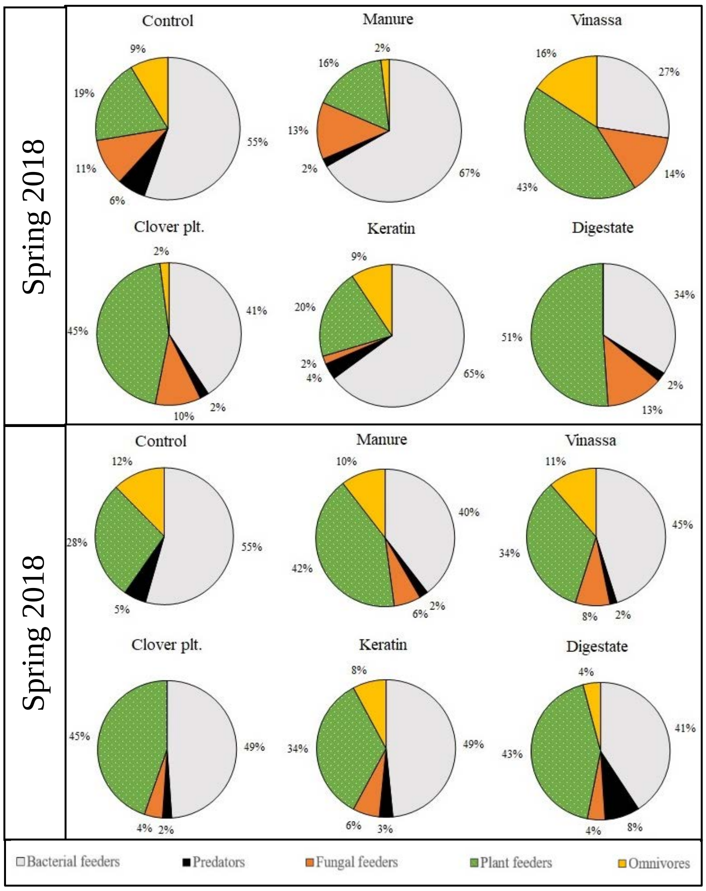
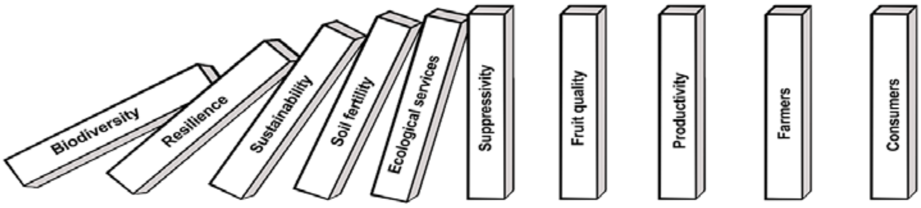


Figure 1. Effect of different fertilizers on the composition of trophic groups of nematodes in an organic apple orchard

The thropic structure of the nematode communities at spring time represents the situation before the application of the fertilizers. Bacterial feeding nematodes (Photo 2) are generally reacting very rapidly to environmental changes, especially to introduction of nitrogen compounds, as is the case with organic fertilizers. The enrichment stimulates bacteria and fungi activity and subsequently can promote nematodes development. Comparing with the unfertilized soil, the bacterial feeders were increased particularly after the application of manure (67% of the total community); fungal feeders (Photo 3) were promoted by Vinassa (14%), while the biodigestate induced an increase (51%) particularly of plant feeders (Photo 4). Predators (Photo 5) and omnivores (Photo 6) represent the highest trophic level amongst soil microfauna and their presence is thus underlining the complexity of the nematodes community in the soil. They are highly dependent on soil properties and very sensitive to pollutants. The highest share of omnivores was observed in soil fertilized with Vinassa (16%), while predators were highly present after application of the biodigestate (8%).

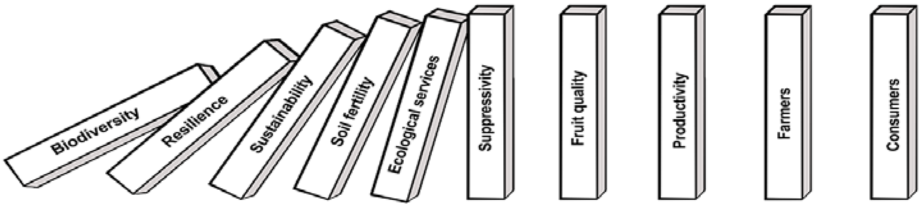


Interesting from the point of view of the farmers, is the evaluation of the Plant Parasite Index (PPI), i.e. the share of plant parasite nematodes within the whole nematodes community. A significant increase of PPI was induced by manure and keratin (Table 1), while other fertilizers (e.g. the clover plt or the Vinassa) provoked a reduction of the index value in comparsion to the untreated control. It is known that PPI increases with increased levels of primary production, including root growth, and soil physical properties. However, the feeding of these nematodes can have a negative impact on plant health.

Table. 1. PPI – Plant Parasite Index in soils with different fertilizers

Row material	Spring 2018	Autumn 2018
Control	2.91	2.88
Manure	2.44	2.70
Vinassa	2.91	2.76
Clover plt	2.73	2.52
Keratin	2.45	2.64
Digestate	2.63	2.67

We are continuing the analyses to have a full evaluation of the impact of the fertilizers on the soil biodiversity also considering the availability of nutrients and the behaviour of the populations of other soil microorganisms (bacteria and fungi), trying to link this to the plant growth and yield.



To valorise the biodiversity: an experience with living mulches.

Matteo Zucchini and Davide Neri (Polytechnic University of Marche, Italy)

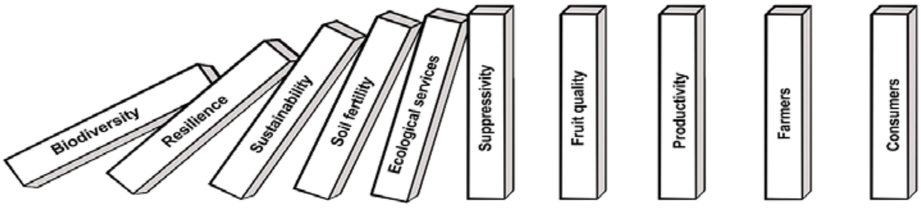
What does it mean to produce organic wine? For some producer this may simply mean to replace chemical inputs with products allowed by strict regulations. But, at Colle Stefano, to produce organic it means something more. It means focusing on the endogenous resources of a rich and complex agro-ecosystem, it means betting on biodiversity as a source of resilience. That is how, at Colle Stefano, weed management in the line turned from a problem into a resource: when, just for fun, the first wild strawberries have been introduced as live mulching in 2007. The innovative power of this idea was, perhaps, not entirely clear at that time. But after a few years, the collaboration with the Faculty of Agriculture of the Polytechnic University of Marche and the inclusion of the company in the international research project DOMINO http://www.domino-coreorganic.eu/ , the Colle Stefano intuition is, today, a case study to be taken as a model.

The wild strawberries, chosen among native ecotypes, are now planted in all new vineyards of the company: one plant at each side of the trunk, during autumn of the first year. Three hectares have been already renewed by such technique. Within the first growing season, thanks to the abundant rain, the fresh soil and an appropriate management, the strawberries produce a large set of runners and succeed in covering the soil and reduce weed development up to over 50%. A full weed suppression can be achieved starting from the second year, in the area surrounding the trunk. There, any other manual weeding would no longer be necessary.

Beside the contribution to weed management under the line, living mulches provide ecological advantages and increases the multi-functionality of the vineyard. A permanent soil cover strongly reduces the risk of erosion and leaking, dramatic in the hilly region where the company is located. Furthermore, mulches produce a large amount of organic matter that enriches the soil, thus increasing its chemical, but also, physical and biological fertility.

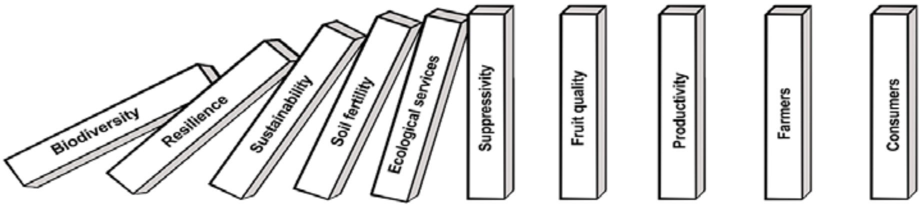
In a virtuous loop, a permanent cover of the floor increases the resilience by limiting thermic excesses and improves water management and the overall sustainability of the cultural system, thus reducing the need for external inputs. Mulching species (not just strawberries, but potentially, also many other stoloniferous) must be selected among local ecotypes and to be scarcely competitive: of short size and whit a moderate summer growth. In such integrated system, plant protection is achieved by valorising endogenous resources, with a drastic reduction of anthropic intervention toward an increasing ecologic (ecosystemic services), economic (secondary income and input reduction) and social (better use of labour with more diversified activities) sustainability.

Strawberries, ripening in May, also have an interesting aesthetic impact. The company cares a direct relationship with costumers and offers to visitors a rich sensorial experience. To visit Colle Stefano vineyard it means to experience how anthropic activity can melt with the



landscape improving it further, it means to meet a successful experience of multifunctionality and to take home an example of organic production on its most authentic mission: to promote soil fertility and agroecosystem biodiversity.

Check for more at https://www.youtube.com/watch?v=SiIKRZ2lIA4



What is the status quo for organic fruit producing farms in Europe and in which areas is research needed?

Friedli Michael and Boutry Clémence (FIBL)

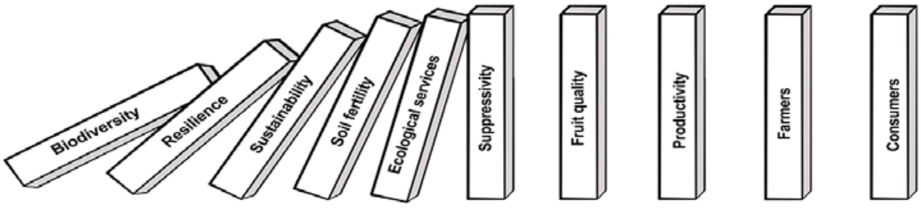
Within the CORE Organic project DOMINO, a questionnaire-based survey was conducted to evaluate the status quo in organic farming including the structure of the farm, biodiversity, fertilization, and areas with need for research. The results are used to draw conclusions for the development of the project.

The aim of the project DOMINO is to demonstrate that innovative orchard management can enhance soil fertility, biodiversity and economic sustainability of intensive organic fruit orchards. However, to evaluate the current status of organic fruit (particularly apple) farms, a survey was conducted in Italy, Bulgaria, Poland and Switzerland, involving a total of 140 participants (farmers and agricultural advisors). The questionnaire aimed at collecting data about the farm structure, the major practices utilized and the needs for technical support. We are presenting here the most interesting results.

Considering the period of time the farmers are producing organically, Swiss farmers are those practicing it for the longest time (around 25 years on average), followed by Italy (around 15 years on average), while organic farming is quite new in Poland and Bulgaria (3 years on average).

The size and type of orchards differed quite widely from country to country. In Italy, the farm size is rather small, with an average size of around 6 ha. Apple production represents about three quarters of the fruit producing area, and an average yield of 50 t/ha is attained (planting distance 3.0 x 0.9 m). Poland and Switzerland have a quite similar average farm size, but different production structures: around 20 ha in Poland, used almost exclusively for fruit production, around 30 ha in Switzerland, with only about half of it used for fruit production (about ¾ dedicated to apple as in Italy) and the remaining used as grassland or for production of fodder or arable crops. In Bulgaria, the farm size is very heterogeneous and ranging from 0.4 to 100 ha with a great share of walnut producers.

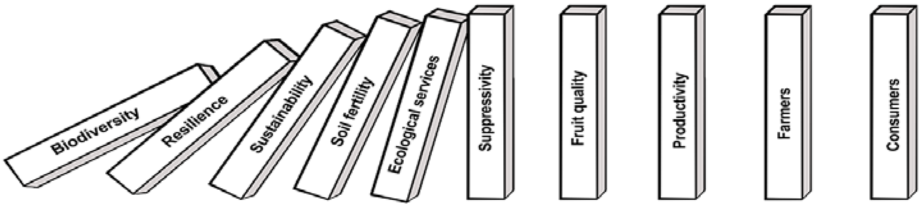
Hedges and flower strips are two important biodiversity elements in the orchard as they offer food and habitat for beneficial insects or animals. However, hedges were more often present in the orchard compared to flower strips, but farms having hedges often have flower strips as well. Farms in Italy, Poland, and Switzerland have hedges in 76%, 54% and 26% of the cases, respectively. Any Bulgarian farm resulted to have hedges. These are most of the time located outside the orchard as opposed to inside the orchard, and include a wide array of species: bushy types (bladder-senna, boxwood, elderberry, forsythia hop-hornbeam, ligustro, lilac, rosehip, sea buckthorn, shark roses) and tree types (acacia, ash, black alder, chestnut, dogwood, downy oaks, hazel, quaking aspen, white horn, wild cherry, wild figs, and willow). Flower strips are very



common in Italy (71% of the farms), in Switzerland only one in five farmers is implementing this practice, and none or almost none are using it in Poland and in Bulgaria. Other biodiversity elements implemented in Italian and Swiss farms are nesting boxes, cairns and insect hotels. On the other hand, the concept of biodiversity is rather new in Bulgaria and Poland, and farmers in these countries are just starting to add biodiversity elements to their orchards.

Regarding soil fertilization, around half of the farmers in Italy, Poland, and Switzerland are using a decision support system, with soil analyses being the main tool mentioned by farmers. Overall, only a limited number of fertilizers is used. In Bulgaria, Poland, and Switzerland farmers use mainly farmyard manure (dung, compost) as fertilizer, while in Italy commercial fertilizers are widely applied (Fig. 1). In case of the farmyard manure, most common are cattle dung (compost) in Italy, chicken dung in Poland and green compost in Switzerland (Fig. 2). Fertilizers are mostly applied in spring and/or fall, and usually only into the tree row. Another method to provide nutrients is through the use of legumes (e.g. clover, faba beans, peas, vetch) as intercrops in the orchard. However, only around 20% of farmers in Italy and Switzerland are using legumes as intercrop, and none in Poland and Bulgaria.

When asked about the needs for research activities in order to further develop organic orchards, the majority of participant farmers expressed a need for research activities related to plant health. A high number of respondents considered useful to search for methods to control the main diseases (e.g. apple scab, sooty blotch) and pests (e.g. codling moth, aphids, and invasive species such as stink bugs or *Pseudococcus comstocki*). Related to this was the request for new resistant varieties suited for organic farming as well as about knowledge on the "ecologization" of the orchard, for biological control of pests with beneficial insects, birds and animals. Always related to plant health, another area for research seen as important was the relationship between soil health and diseases. Finally, farmers asked for alternatives to the widely used copper and lime sulphur, and for new plant protection products including biological control products, or for an extension of the list of plant protection products allowed for organic farming. Interestingly, considering the variety palette, an early apple variety with good storability was also among the priorities. New solutions for the tree strip management and weed control, citing either with undergrowth grazing or new machines for mechanical weed control as possible solutions, were also suggested to be addressed. However, the emphasis from several respondents was to not forget the economic viability of any new proposed technical solution.



The outcome of the survey was confirming that the practices addressed by DOMINO are matching several requested areas for new research, particularly the new management strategies for the tree strip, the improvement of the nutrient balance with new regional available fertilizers or legume intercropping, the reduction of diseases and pests incidence by weather protection systems, all performing an economic evaluation of the proposed strategies.

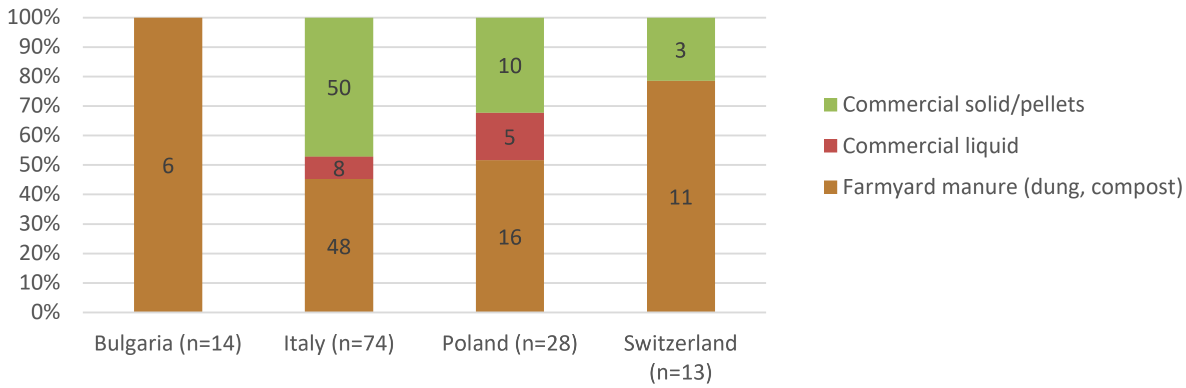


Figure 1: Type of fertilizer used by farmers per country. Values in brackets indicate the number of answers; values within the column indicate the number of mentions per category (multiple mentions possible).

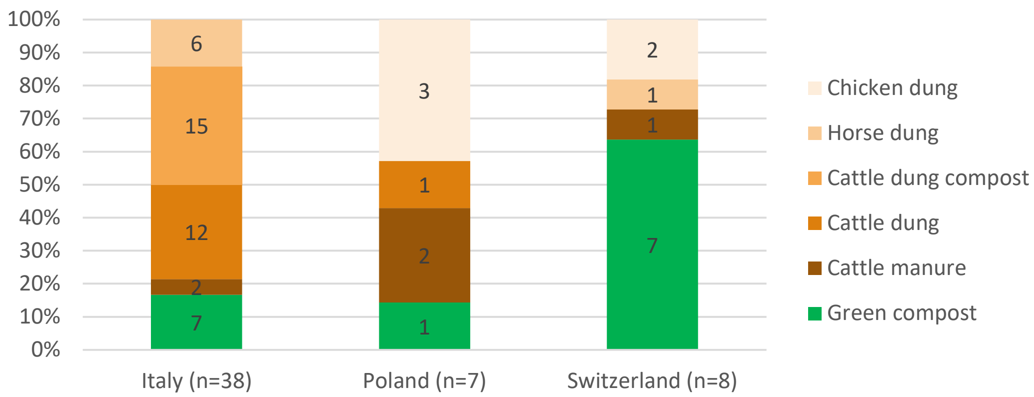


Figure 2: Type of farmyard manure used by farmers per country. Values in brackets indicate the number of answers; values within the column indicate the number of mentions per category (multiple mentions possible).

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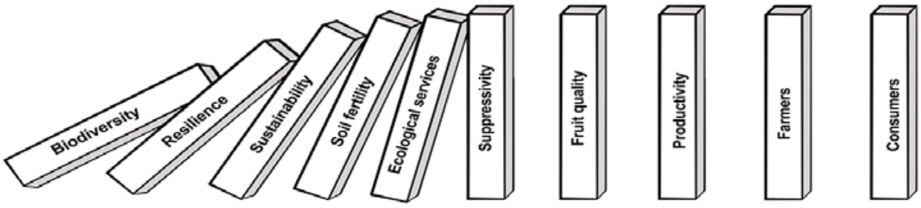

Read more at the CORE Organic website: *http://www.coreorganic.org/*
find publications from the project at: *http://www.domino-coreorganic.eu/*

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