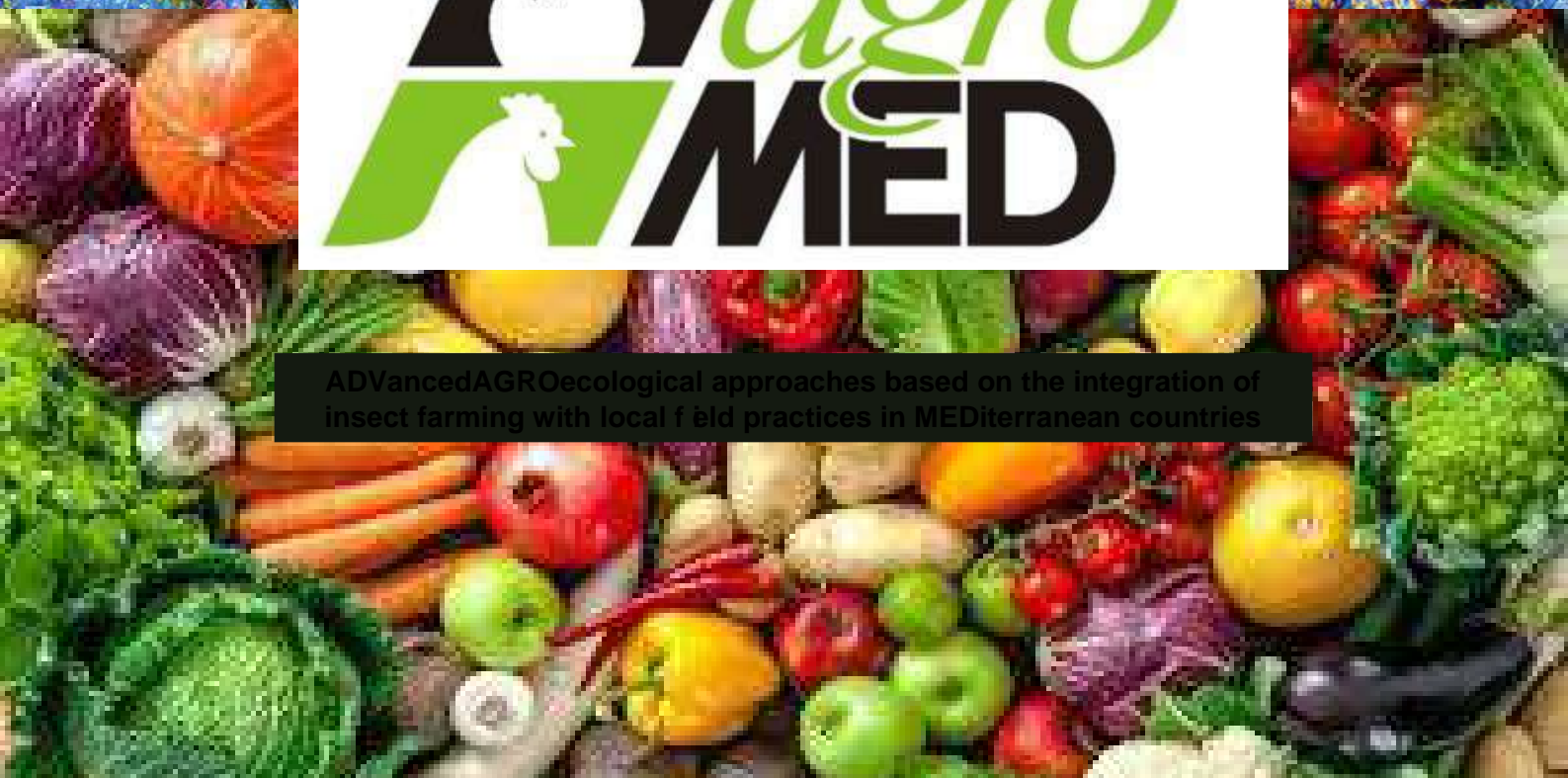




# ADV agro MED



ADVancedAGROecological approaches based on the integration of insect farming with local field practices in MEDiterranean countries





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# GREETINGS FROM WP2 COORDINATOR



## CHRISTOS ATHANASSIOU

Christos Athanassiou received his Ph.D. from the Agricultural University of Athens, Greece, in Agricultural Entomology, about insects associated with the post-harvest stages of durable agricultural commodities, food&feed. Currently he is Full Professor of Entomology at the University of Thessaly (UTH) in Greece, since 2010. After receiving his Ph.D. in 1999, he worked in different research institutes in US and Europe, while between 2007 and 2010, he worked as Research Entomologist at the United States Department of Agriculture (USDA-ARS), Center for Grain and Animal Health Research, Manhattan KS, USA.

His research is focused on insect biology, ecology and detection, and implementation strategies of chemical and non-chemical control in pest management programs for field, stored-product protection, forest pests, but also on edible insects and their utilization on the development of circular economy protocols. His group is located at the Laboratory of Entomology and Agricultural Zoology, at the Department of Agriculture, Crop Production and Rural Environment in UTH, developing a wide range of research activities on pests and beneficial insects.

Moreover he has participated in the development of several products that are now commercially available. Between 2007 and 2013, Prof. Athanassiou has served as the Convenor of the Working Group “Integrated Protection of Stored Products” of the International Organization for Biological Control (IOBC/WPRS). Also, since 2008, he has served as a panel member/expert/consultant for different international organizations, such as the Food and Agriculture Organization (FAO), the United Nations (UN), the United States Department of Agriculture (USDA-ARS and USDA-APHIS), the United States Aid for International Development (USAID), the Citizens Act for Foreign Affairs (CNFA), the Plant Health Australia (PHA/ADSW), the International Atomic Energy Agency (IAEA) etc. Through these activities, Prof. Athanassiou has developed multiple training tasks, guidelines and curricula for extension and outreach at the international level.

He served/serves as a coordinator, PI, co-PI, collaborator etc. in >120 projects that are funded by different funding bodies (Horizon 2020, Horizon Europe, LIFE, ERANET, NIFA, RPIMA, FarmBill, ENI CBC-MED, Erasmus +, COST etc.), international organizations (FAO/UN, IAEA, USDA-ARS, USDA-APHIS, EFSA, ECPA, US Forest Service etc.) and the industry.

ADVAGROMED is a very important project for the UTH group, as it combines a multi-level approach on the utilization of insects in circular economy, ranging from the use of live insects as feed to the use of insect frass as soil improver and fertilizer. His team is responsible for the implementation of WP2, between results, at the lab, semi-field and field scale trials. ADVAGROMED will provide the inferences necessary for key priorities in mass insect rearings for a wide range of uses, for which there were not that many data available so far. The coordination by a colleague as active and productive as Prof. Laura Gasco makes already this project even more exciting! Looking forward for the next steps in the ADVAGROMED adventure!

## WPs UPDATES:

### WP2

#### Evaluation of agricultural by-products as ingredients of insect diets - UTH research group

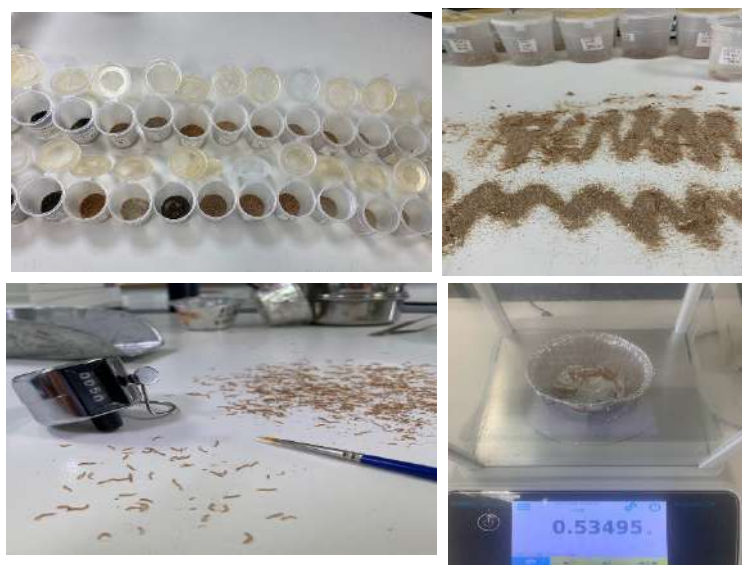
For the first deliverable of the project (D2.1), the research group of University of Thessaly (UTH) collected and evaluated the nutritional composition of several **local by-products** of the main crops that are cultivated in the Region of Thessaly, Greece.

Based on the nutrient composition of the tested by-products (D2.1) and the nutrient requirements of the insects, in **Task 2.2 "Evaluation of agricultural by-products as ingredients of insect diets"** the UTH research group **designed and formulated compound diets** using a model for optimal insect feeding substrate design.

Feeding trials, both at laboratory- and tray-scale, were conducted to determine the growth performance of insects in these diets and identify the most suitable one. Indicatively, twelve different diets consisting of five agricultural by-products that derive from the production of cereals and legumes were designed. Trials were conducted with one of the most commonly reared edible insect species, the yellow mealworm, *Tenebrio molitor* L. A variety of parameters were determined, i.e., individual larval weight (mg), larval survival (%), development time (days), Feed Conversion Ratio (FCR), Efficiency of Conversion of Ingested food (ECI), and Specific Growth Rate (SGR). The obtained results revealed that the diets containing one legume and one cereal by-product (i.e., lupin and triticale, as well as lupin and oat) supported more efficiently the growth and performance of the larvae, irrespective of the protein level.



Agricultural by-products of the production of lupin, triticale, oat, barley, and pea.



Feeding trials to determine the growth performance of *Tenebrio molitor* larvae in different diets (laboratory scale bioassay).

# WPs UPDATES:

WP4

Use of insect frass and poultry manure in sustainable agricultural processes



UNIVERSITY OF  
THESSALY

The first experiment of WP4 was carried out at UTH, in which the effect of insect frass and poultry manure on pepper physiology, growth and yield was studied. Two local varieties of pepper, the green “bachovitiki” and the red “Florinis” were tested in a pot experiment which lasted for three months.

The peppers were grown in two different soils, namely a medium-to-heavy textured soil and a sandy one. Several crop functional, growth, yield and nutritional parameters, were monitored throughout the cultivation period. The evaluation of crop performance is currently ongoing, with the first results being encouraging, since pepper proved to be very responsive to frass and chicken manure amendments.



The experimental trial took place from to August 2023, in Mola di Bari (BA) southern Italy. The main goal was to evaluate organic fertilizers insect frass (*Tenebrio molitor L.*) and poultry manure in sustainable agricultural process, as partial or total substitutes of chemical fertilizers in terms of their impact on the bio-morphological, quality and yield of Apulian tomato local variety “Regina”.

Nine treatments were designated:

- T1 - chemical fertilizer;
- T2 - Tenebrio frass;
- T3 - organic fertilizer;
- T4 - poultry manure;
- T5 - chemical fertilizer (75% N) and frass (25% N);
- T6 - chemical fertilizer (50% N) and frass (50% N);
- T7 - chemical fertilizer (75% N) and poultry manure (25 % N);
- T8 - chemical fertilizer (50% N) and poultry manure (50 % N).
- Finally, in the T9 treatment no fertilization was used.



Measurements were performed to assess biomorphometric characteristics, yield, fruit quality, and soil microbiological parameters at two times: at the onset of fruit set (45 days after transplant) and at full fruit ripening (80 days after transplant).

# WP DISSEMINATION



21-23 giugno 2023  
 Università degli Studi di Torino  
 Dipartimento di Scienze Agrarie, Forestali e Alimentari



Some preliminary results about the use of insect frass as soil fertilizer were presented by ISPA CNR colleague Dr. Massimiliano D'Imperio at the Società Orticoltura Italiana Congress:

***"Preliminary evaluation of the use of Hermetia Illucens L. and Tenebrio Molitor L. frass as organic fertilizer in the cultivation of «Regina» and «Cima di Rapa» tomatoes"***

The congress lectures were divided into several and engaging thematic sessions and workshops, enhanced by the presence of keynote speakers, like Dr. D'Imperio.

It was a great opportunity to present this topic amongst other issues, like the sustainable use of resources in the production process, the quality of the productions and the multifunctionality of the fruit and vegetable sector.

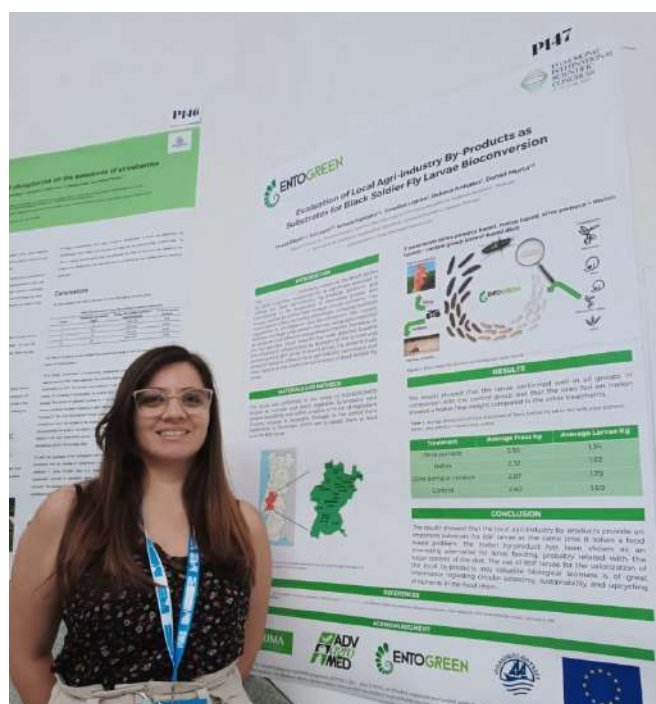
# WP DISSEMINATION



**EGAS MONIZ  
INTERNATIONAL  
SCIENTIFIC  
CONGRESS**

5 - 7th of July, 2023

Venue: Auditorium Professor Doutor Martins dos Santos



Finally, at the **6th Congress of the Egas Moniz Interdisciplinary Research Center (CiiEM)**, Monte da Caparica (Portugal) from the 5th to the 7th of July some results were presented as well.

The theme of the congress was **“Immediate and future challenges to foster One Health”**.

**Dr. Rafaela Fantatto** from **EntoGreen** (Ingredient Odyssey SA) presented a poster entitled **“Evaluation of Vegetable Byproducts as a Food Base for Black Soldier Fly Larvae”**.

This study was carried out within the scope of the Advagromed project, where selected vegetable byproducts with greater availability in the region of Santarém, Portugal (September to December) were evaluated as rearing substrates for BSF larvae.

## WP DISSEMINATION



Welcome to the **EAAP + WAAP + Interbull Congress 2023**

Lyon, France - August 26<sup>th</sup> / September 1<sup>st</sup>, 2023

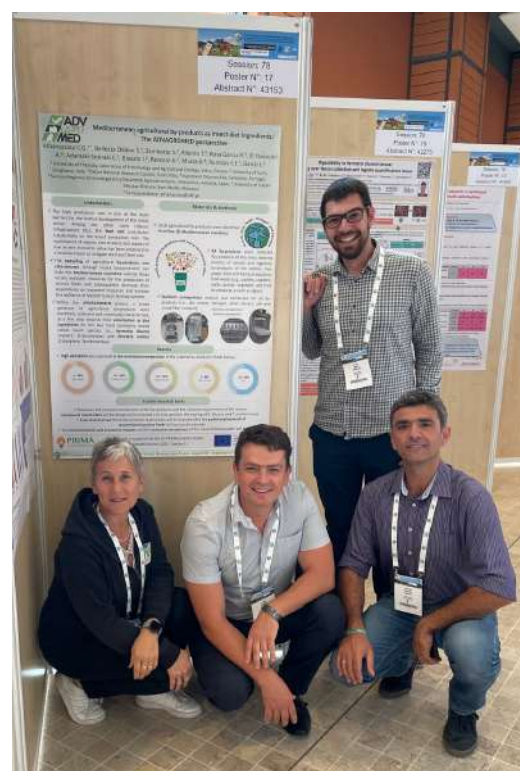
Recently, Advagromed team took part at its first Congress, **EAAP**, with a poster titled:

”Mediterranean agricultural by-products as insect diet ingredients: The ADVAGROMED perspective”

The European Federation of **Animal Science (EAAP)** Annual Meeting, was held in Lyon-France, from August 26th to September 1st, 2023.

This event covers various areas of knowledge related to animal science, from genetics, nutrition, physiology, to animal health and welfare. The congress is known for being the international network for animal science and livestock professionals.

Moreover, this congress promotes research, discussion, debate and dissemination of high quality and relevant animal science findings amongst the scientific communities, the livestock industry, civil society and groups with interests in livestock production.



From left to right: Prof. Laura Gasco, Dr Sergiy Smetana, Dr Dusan Ristic, Dr. Christos Rumbos



Dr. Christos Rumbos

This year, the main topic was: “Climate change, biodiversity and global sustainability of animal production”

Moreover, during the last day of the congress, **Dr. Christos Rumbos** presented additional results about the use of hemp by-products as rearing substrates for edible insects, with **Dr. Ilaria Biasato** as co-chair of the session!



## WP DISSEMINATION



The **European Researchers' Night** is an event where researchers have the opportunity to present to the audience their work, trying to explain them, in a practical and engaging way, their **experimental trials and the aim of their projects**.



For its 2023 edition, the city of **Turin** (Piedmont region) hosted the UNITO team in the beautiful venue of **Giardini Reali**, in the heart of the city, where different stands had been placed in the medieval gardens of the royal family, each representing a specific area of research.

Along with the colleagues of **CREA (Council for Agricultural Research and Economics)** which research focuses on **snails**, another invertebrate suitable for the circular economy concept, we explained the **life cycle and behavior of insects and snails**.

Through interactive games and show-and-tell, the public was entertained and instructed on how **insect rearing** can be an efficient solution to bio-convert all kinds of leftovers, from the food production chain waste into living biomass (the larvae) and subsequently into animal feed. These steps can effectively upcycle by-products that would be otherwise discarded, therefore reducing the environmental impact.

# STAKEHOLDER CORNER: FATTORIA GALLOROSSO



**Good morning Dr. Di Cuia and thank you for taking part to this interview, giving us the opportunity to know a professional point of view about this sector.**

**Us and our readers are curious to learn more about your activity and your opinion on present and future challenges in the fertilizer industry.**

**Before starting, we would like to know more about you and your role within the Fattoria Gallo Rosso**

My name is Giuseppe di Cuia, I graduated in "Plant Medicine" at University of Aldo Moro, Bari (Italy).

Since 2018 I'm the CEO of Fattoria Gallo Rosso and since 2015 I coordinate the "vermicompost" (or earthworm humus) production chain, recognised as a soil conditioner (D.lgs n. 75/2010) and the earthworm farm. As years passed our business grew, with more than 1 h of surface dedicated to earthworms litter, allowing us to expand our vermiculture plant and becoming one of the biggest in Italy.

Inside the plant there are currently 8 vermicompost production lines, characterized by different granulometry (with particles ranging from a few micrometers up to 10 mm in diameter, aka pellets) adaptable to being distributed with different kind of devices.

Recently, a particular technique has been tested that allows the production of "vermicompost extract" in liquid form. Since 2021 I've started an insect farm (*Hermetia illucens* and *Tenebrio molitor*) with the larvae destined to be fed to birds. Our beekeeping business, that I care firsthand, started within the same year: at the moment we have 140 bee colonies.



**What are the most relevant topics for "Fattoria Gallo Rosso", how are they effectively addressed in your business?**

Our aim is to increase the ecological and environmental awareness of the players in this industry, spreading sustainable organic methods and promoting the use of correct agricultural practices. The company is located inside the "Natural Historical Archaeological Park of the Rock Churches of Matera" in Montescaglioso, Matera. The geographical location enhanced our sensitivity to environmental issues, so our techniques evolved towards organic farming, banning the use of chemical fertilizers and adopting environmentally friendly measures, like the cultivation of thousands of plants on 70 h of productive land. All this motivated us to improve the use of vermicompost, first in our home gardens and later in plantations, leading us to improve the vermicomposting usage too, starting from our family garden to reforestation systems.

With vermicomposting, we are also able to add value to by-products of the agri-food industry, by diverting them from landfill disposal and converting them into factors of production. This has the dual effect: improving soil fertility and helping to sequester CO<sub>2</sub>, whilst ultimately improving soil fertility and sustainability of agricultural activities.

**2022 was a challenging year concerning availability and cost of raw materials, including fertilizers, for the domestic and international agricultural sector.**

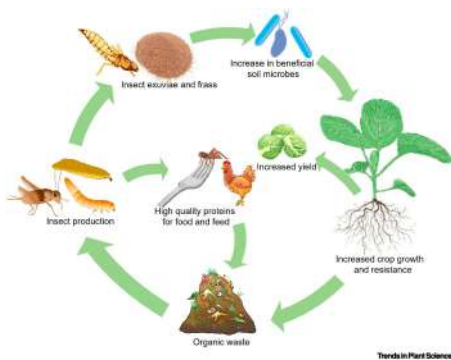
**What repercussions similar events on the present and future agronomic supply chains in Italy and Europe? How long will it take to recover from such an event?**

2022 was a very difficult year for the agricultural sector because of the availability and costs of factors of production (which doubled considerably compared to the previous year) and the climatic conditions particularly adverse.

These have seriously compromised the production compartment, bringing operators in the agri-food sector almost to their knees. It has been very difficult for them to be able to cope with expenses and cost increases for such a long time, causing the economic convenience to decline to produce.

Given the indication of the European Union to reduce the use of synthetic fertilizers of 20% by 2030, a possible solution could be the incentives predisposition for the use of organic fertilizers and for the diffusion and adoption of environmentally sustainable production practices.

**Speaking of fertilizers, among the different options that have been investigated recently and proposed by some companies, the possible use of insect frass as an alternative to the partial or total replacement of synthetic fertilizers has been presented. Would your company be interested into testing it? Have you ever investigated their possible applications or do you have already considered its use for some particular or specific crop? Concerning the organic sector, do you think it could have a successful impact?**



We firmly believe that insect frass will become increasingly relevant in the future, with the rise of several insect farms on the Italian and European scene aiming to obtain proteins to be used for animal feed.

Therefore, it is plausible that the amount of frass available will increase substantially too. However, more information and dissemination are needed to raise awareness among the agricultural sector operators, such as practical advices on how to use frass. In our company, we have tested *H. illucens* frass on various horticultural crops (tomatoes, peppers, zucchini, radish leafy vegetables, broccoli and fennel) with satisfactory qualitative and productive results. Therefore, we recommend its use.

**Current European legislation requires frass to be heat-treated at 70°C for at least 1 hour to ensure product safety. Do you agree? Given nowadays high energy costs, do you think this precautionary measure is too costly?**

Since human health must be protected first, such precautionary measure is indeed very expensive, even if one decides to resort to alternative energy sources.

We believe that there is a need to evaluate alternative methods with less environmental impact to sterilize this product. It should also be noted that, in addition to reducing or eliminating pathogenic microorganisms, these sanitizing measures can also negatively affect those microorganisms that play a useful role for plant growth and self-defense.



**Your focus on your customers gives you a front-line view of farmers' perceptions of products like innovative fertilizers and manure. In your opinion, how could insect frass be perceived by your clients?**



When we started the vermicompost production from manure, this amendment was mostly unknown to farmers and technicians, although humus exists in nature and has been a source of nourishment for plants for millennia.

Over the years, after being widely evaluated on numerous crops, both horticultural and fruit, vermicompost has become part of the fertilization system in farms that adopt organic production systems.

In our opinion, a similar path could be designed for insect frass too, even if it is essential to define a distinctive production, allowing insect frass to be standardized as much as possible. However, it still is a highly variable organic matrix (in terms of nutrient content for plants) as it is affected by the insect feeding substrate.

**Within the ADVAGROMED project one of the objectives, in accordance with the European Green Deal, is to decrease the use of chemical inputs like synthetic fertilizers and develop alternative solutions.**

**Considering the chemical composition in N, P and K of insect frass, what in your opinion could be the reduction % that could be obtained considering an estimated availability of 1.5 million tons of frass on a European basis?**

The Resolution of the European Parliament of 16 February 2023, on the communication of the European Commission about ensuring the availability and affordability of fertilizers, identifies insect frass as "sources of organic nutrients currently not fully utilized" in agriculture. Therefore it encourages their use, recognizing an important role in meeting the soil nutrient requirements. Moreover it "invites the Commission, in this regard, to encourage the use of frass by eliminating unnecessary legislative and administrative burdens as soon as possible".



Furthermore, considering an increase in the cost of nitrogenous fertilizers, which was 149% in 2022, and the reduction of macronutrients availability (such as phosphorus for example) the decrease of chemical fertilizers could be significant (reaching 30-40%) in favor of increasing the use of organic fertilizers. As demonstrated by the feedback received from many of our new customers who, although under conventional agriculture, in 2022 and in the first half of 2023, bought our products (allowed in organic farming).

**Thanks to Dr. Di Cuia for giving us such an interesting talk,  
about a renovated Italian productive reality like  
Fattoria Gallorosso  
[www.fattoriagallorosso.it](http://www.fattoriagallorosso.it)**

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## Discover the teams involved



# CONTACTS

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