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RELACS – four successful years of research into and validation of alternatives to contentious inputs in organic farming

RELACS coordinator FiBL reflects on the project's end and the most relevant results

The RELACS project aimed to develop and validate alternatives to contentious inputs in organic crop production - copper and mineral oils, nutrient inputs - and livestock production – anthelmintics, antibiotics and vitamins. Starting from a list of alternatives of various maturity levels, we can proudly say that many have reached the final stage necessary for on-farm implementation.

Four alternative products for copper achieved advanced Technology Readiness Levels (TRL >7), mainly for grapevine and apple but also for other horticultural crops. The pilot products provided promising protection levels in a wide range of crops and pedo-climatic conditions, either as stand-alone applications, or in strategies combining alternatives and low copper doses. Copper use can be reduced on the lead target crops grapevine and apple in the next decade provided that the alternatives can be authorized. However, the supply of sufficient quantities of alternatives at an economically feasible price remains an extraordinary challenge. RELACS, therefore, advises pursuing a minimisation strategy rather than a full replacement. Such a minimisation strategy should consist of the cultivation of resistant varieties, the implementation of preventive measures (enhancing functional biodiversity, crop management practices), the use of alternative substances and Decision Support Systems that allow lowering application rates.

Two alternative products were tested to replace mineral (paraffin) oil against scales, thrips and mites in citrus production and progress was made in the development of vibrational disruption. A substantial reduction of mineral oil use by less problematic products and innovative techniques seems feasible in the near future. The mineral oil reduction strategy should include measures to enhance biodiversity, the use of alternative products based on plant extracts (*Clitoria ternatea* and orange essential oil) and the use of vibrational signals that disturb the mating behaviour of the pests. Finally, the alternatives for mineral oil as well as copper suffer from complicated approval procedures. The European Commission should urgently adapt the registration process to active substances derived from plant extracts.

The two anthelmintic alternatives tested in RELACS, biocontrol products based on *Duddingtonia flagrans*, and feeding tannin-rich fodder like heather, can reduce overall anthelmintic use by 30-50% in organic cattle, sheep and goats. The alternatives provide complementary control strategies to reduce but not replace anthelmintics. Involving vets as well as adapting registration procedures for veterinary medicines based on natural substances will be key to ensuring acceptability and rapid adoption of the alternatives.

Two alternative strategies to reduce antibiotic use in organic dairy cows were explored: an animal health and welfare planning protocol (AHWP) combining detailed farm-specific data with Farmer Field Schools (FFS) and the use of Essential Oils (EO) to control light to moderate mastitis. Both approaches are promising for the reduction of antibiotics as no difference in (mild or moderate) clinical mastitis cure between EO and antibiotic treatment was observed nor were any negative impacts on milk quality or animal health and welfare observed. Proper implementation of Animal Health and Welfare Planning has very high potential -up to 50%- to reduce antibiotic use for mastitis treatments in dairy cattle. However, it is necessary to strongly invest in advisory services and involve vets to facilitate its adoption. In the medium-term, antibiotic reduction strategies could be complemented by the use of essential oils, although research needs to confirm this. The EU should also adapt the registration process to herbal veterinary products, which is currently very long and time-consuming.

Current supplementation levels of vitamin E and other lipophilic vitamins in organic ruminants, and B2/B12 vitamins in organic poultry can be substantially reduced since reduced vitamin diets had no negative impact on animals nor on milk or meat quality. A complete phase-out, however, is not possible. It should nonetheless be possible to reduce vitamin E for organic dairy cows by ~50% and vitamin B2 for organic poultry by 30-50%.

These reductions can take place in the very short term as there are no technical constraints for the feed industry. The identification of a GMO-free yeast strain overproducing riboflavin opens up an option for an additional alternative GMO-free and non-synthetic production. Currently, the situation is precarious as only one European supplier offers vitamin B2 produced without the help of GMOs. It is essential to further develop the market and stimulate competition to avoid any shortage in vitamin B2. The European Commission is encouraged to take a clear decision on the regulatory status of products consisting of vitamin B2 produced without the help of GMOs, and it has to adapt its registration of feed additives at the EU level to facilitate the accessibility of alternatives.

The current use of and need for external nutrient inputs on organic farms in Europe was evaluated in 8 case study regions. In many areas, additional N inputs to organic agriculture are needed to increase productivity, while inputs of P and K are required to prevent soil mining. The data show that the importance of nutrient supply in organic farming has been underestimated so far. Limited availability of soil fertility inputs is the single most limiting factor for yields in stockless organic farms. Furthermore, a lack of cost-efficient supply of plant nutrients prevents upscaling of organic plant production beyond 15-20% in many regions. Reducing the dependence of organic farms on conventional manure and external nutrients from non-renewable sources is nevertheless possible in the medium term by recycling societal waste streams. It is crucial that the safety and acceptability of these products are guaranteed and that the organic sector agrees on criteria for their use.

The conclusions of the RELACS project were developed through a series of national and European workshops with researchers, policy-makers, industry, and farmer associations. The three roadmaps that resulted from them are available on the RELACS website (<https://relacs-project.eu/resources/policy-documents/>)

The objectives of the European Farm to Fork strategy add the necessity not only to replace problematic practices but also to provide widely accessible and cost-efficient alternatives in sufficient quantities. While the tools and technologies explored in RELACS fulfilled the expectations to a large extent with respect to efficacy, we also encountered major challenges with respect to the duration until alternatives may be used legally by farmers (i.e. authorization of inputs). Furthermore, many alternatives will be more expensive than the standard options thus necessitating policy support and their adoption by farmers will necessitate instruction and training.

RELACS provided the scientific information needed to identify feasible and cost-effective solutions and the way forward to implementation but also identified bottlenecks at various levels along the value chain. It has also become clear that relevant EU policies will need to be tailor-made in order to address the various issues, depending on the input type that needs to be addressed. Roadmaps for fair, reliable and implementable rules for contentious inputs addressed in the project were developed. As expected, immediate phasing out of the contentious input would create unbearable risks and costs to the sector, whereas a smart roadmap with tiered transition phases may lead to rapid and successful change in agricultural practice. It is/was essential to involve all relevant stakeholders to reach joint conclusions regarding the technical feasibility of solutions in the various pedo-climatic and socio-cultural situations of Europe.

Final project meeting

In March 2022, the RELACS consortium was able to meet again in person in the beautiful city of Seville, Spain. The RELACS project leaves an important heritage for future research and innovation. The RELACS partners will post their latest scientific publications and practice recommendations on the [website](#).





Picture 1, 4: Final consortium meeting in Seville Spain and online. (Photo: Lucius Tamm, FiBL)

Picture 2, 3: Visit to an organic farm growing vegetables, olive and citrus 25 Km from Seville. (Photo: Lucius Tamm, FiBL)

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RELACS: 'Replacement of Contentious Inputs in Organic Farming Systems' (RELACS) builds on results of previous research projects and takes far-advanced solutions forward. As a system approach to sustainable agriculture, organic farming aims to effectively manage ecological processes whilst lowering dependence on off-farm inputs. The RELACS partners will evaluate solutions to further reduce the use of external inputs and, if needed, develop and adopt cost-efficient and environmentally safe tools and technologies.

Project website: www.relacs-project.eu

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