Brussels, 27 May 2022

COST 048/22

DECISION

Subject: Memorandum of Understanding for the implementation of the COST Action “Towards zer0 Pesticide AGRIculture : European Network for sustainability” (T0P-AGRI-Network) CA21134

The COST Member Countries will find attached the Memorandum of Understanding for the COST Action Towards zer0 Pesticide AGRIculture : European Network for sustainability approved by the Committee of Senior Officials through written procedure on 27 May 2022.

MEMORANDUM OF UNDERSTANDING

For the implementation of a COST Action designated as

COST Action CA21134
TOWARDS ZER0 PESTICIDE AGRICULTURE : EUROPEAN NETWORK FOR SUSTAINABILITY (T0P-AGRI-Network)

The COST Members through the present Memorandum of Understanding (MoU) wish to undertake joint activities of mutual interest and declare their common intention to participate in the COST Action, referred to above and described in the Technical Annex of this MoU.

The Action will be carried out in accordance with the set of COST Implementation Rules approved by the Committee of Senior Officials (CSO), or any document amending or replacing them.

The main aim and objective of the Action is to to pave the way for new crop protection strategies and practices without chemical pesticides and to co-build a new research paradigm among research communities by no longer adopting a progressive pesticide reduction approach, but rather encouraging a breakthrough in redesigning crop protection.. This will be achieved through the specific objectives detailed in the Technical Annex.

The present MoU enters into force on the date of the approval of the COST Action by the CSO.

OVERVIEW

Summary
Current crop protection in EU agriculture is heavily reliant on chemical pesticides to suppress weeds, pests and pathogens. In view of the serious health and environmental consequences, European public authorities, consumers, and society at large are demanding drastically reduced use of chemical pesticides, in the context of a production of safe, high-quality and affordable food. Furthermore, farmers are calling for research and innovation solutions to protect crops with non-chemical means while maintaining a viable farm economy. A change of direction and paradigm is needed to foster this transition, emphasizing preventive crop protection based on agroecological practices that to prevent pest outbreaks and infestations. The proposed Cost Action T0P-AGRI-Network targets the transition “Towards zer0 Pesticide AGRIculture”, aiming at preparing the future of an agriculture free of synthetic pesticides and of nature-derived pesticides that negatively impact environment and human health. T0P-AGRI-Network tackles this challenge by create and organize a wide research community with the aim to form a European leading network with high and transdisciplinary expertise around the common objective of pesticide-free agriculture, with a particular focus on young scientists. To enable a redesign of the food system as a whole, T0P-AGRI-Network will promote a concerted mobilization of scientists, farmers, processing industries, public authorities and consumers by associating them closely with the activities that will be carried out in the Cost Action.

Areas of Expertise Relevant for the Action	**Keywords**
● Agriculture, Forestry, and Fisheries: Agriculture related to crop production, soil biology and cultivation, applied plant biology, crop protection ● Agriculture, Forestry, and Fisheries: Sustainable Agriculture ● Agriculture, Forestry, and Fisheries: Biodiversity, comparative biology	● chemical pesticides ● agroecology ● sustainable agriculture ● crop protection ● transition

Specific Objectives
To achieve the main objective described in this MoU, the following specific objectives shall be accomplished:

Research Coordination
● To build our research activities on the concrete experience of end-users in two strategic agricultural sectors, together identifying barriers and levers for a zero pesticide agriculture and constructing a truly multi-actor Action.
● To assess how to achieve an agroecology-based transition of farming and food systems, in which pesticide use is marginal and only when all other options for securing crop health have been implemented
● To analyse the state of the art in the different scientific fields at the forefront of providing revolutionary innovations for zero pesticide agriculture.
● To gather multidisciplinary knowledge in the field of agroecology to enable a paradigm shift from curative to preventive crop protection in farming.
● To connect researchers with EIP Agri Operational Groups aimed at pesticide reduction.
● To raise awareness of the importance of the issue and the need for a strong research and innovation paradigm shift.

Capacity Building
● To bridge separate fields of science and technology to create a strong scientific community with a broad

representation across Europe (including 10 Inclusiveness Target Countries) oriented to develop research solutions for a zero pesticide agriculture.

● To promote scientific development of Early Career Investigators and young researchers (by offering them Summer Schools and Short-Term Scientific Missions), helping establish a new generation of research leaders with innovative mind-set looking at the problems with a holistic approach.

● To reinforce links between the production of knowledge actors and the agri-food sector actors in order to share a common understanding and willingness to co-design an environment-friendly, sustainable, fair, just and competitive agri-food sector.

● To develop dissemination tools and learning materials to empower farmers, consumers, media, and public policy makers by providing them with a source of reliable information and a trusted reference point on zero pesticide agriculture issues.

TECHNICAL ANNEX

1. S&T EXCELLENCE

1.1. SOUNDNESS OF THE CHALLENGE

1.1.1. DESCRIPTION OF THE STATE OF THE ART

The European agri-food sector has successfully ensured the ever increasing demand for safe, and high quality and affordable food over the last decades for European and export markets. This achievement was made possible by the intensification of agriculture after World War II by means of animal and plant breeding, mechanisation, fertilisation and not least the widespread and often intensive use of chemical pesticides. However, in the past decades, increasing concerns have been raised about the negative impacts of pesticides on human health, the environment and biodiversity [5;11]. Agriculture itself has been negatively impacted as pesticides have suppressed non-target organisms providing ecosystem services such as crop pollination, and biological regulation of crop pests [20]. In 2009, the EU directive 2009/128/EC defined the first reduction goals by calling for the reduction of risks and dependency on chemical pesticides. Following this directive, several initiatives to reduce chemical pesticide use and impacts were implemented at national levels in Europe, e.g., Ecophyto (FR), National Action Plan on Sustainable Use of Plant Protection Products (DE); Green Growth (DK). However, despite these efforts, pesticide use in Europe has not yet decreased. At the EU level, sales have been globally constant between 2011 and 2018, despite differences among countries, mainly related to arable land acreage, crop types and climatic conditions. Recently, the European Green Deal set new goals and defined a roadmap with multiple strategies including Farm to Fork and Biodiversity 2030. Ambitious targets have been set related to agriculture and food, with substantial reductions in the use of antibiotics, pesticides, fertilizers and nutrient losses. In particular, the goal is to reduce by 50% by 2030 the use and risks of chemical pesticides. In the absence of adequate alternative strategies for crop protection, this target could lead to large yield losses due to pests, diseases and weed competition, which could weaken domestic food security and lead to higher food imports to the European Union. To counteract this, the ambitious aim of this COST Action, “Towards zero-pesticide agriculture: European network for sustainability” (T0P-AGRI-Network), is to pave the way for new crop protection strategies and practices without chemical pesticides. We set our aim at this high ambition level to enable an out of the box thinking for the redesign of the cropping systems and entire food system, needed in order to significantly reduce pesticide use while retaining food security and farmer livelihoods in accordance with societal demands. Current crop protection in EU mainstream agriculture is largely based on curative crop protection with chemical pesticides. Cheap and effective pesticides have allowed for the development towards simplified cropping systems with short crop rotations with a low diversity of crops, absence of intercrops, homogenization of the agricultural landscapes with removal of natural habitats and increasing crop field sizes, as well as regional specialisation of monoculture crop production. A clear change of direction and paradigm is needed with a strong emphasis on preventive crop protection that avoid pest emergence, thereby shifting from the current curative approach to a future preventative crop protection giving approach that prioritises prophylaxis. The pesticide reduction actions by EU Member States have been guided by the principles of Integrated Pest Management (IPM). But the wide variety of interpretation and implementation of these principles has not led to the desired pesticide reduction targets [8]. Obstacles to reductions include that substitution actions have focused on targeted pests and the deployment of solutions in systems where pesticides still play a central role. Moreover, assessment of IPM research programs showed that IPM approaches, which aim to gradually reduce pesticide use and substitution of the most dangerous pesticides have failed to achieve any significant reductions in the use and impact of pesticides[8]. We therefore propose an alternative approach of setting the target to zero pesticide use. Reducing pesticide use by 10 to 20% is possible through efficiency gains, e.g. through precision farming and/or improved decision making tools and with mechanical or biological

technologies. But achieving a pesticide free agriculture or even a 50% reduction require a complete redesign of farming and food systems. Therefore, research should focus on developing knowledge for an ecological, technological and social deep redesign of the European food and farming systems. Agroecology offers a scientific basis and practices for this new way of thinking of crop protection and redesigning agroecosystems. It provides the concepts that can be mobilized for this fundamental change and that include both agronomic practices and the social innovations that will have to be put in place [25]. Agroecology as a science, practice and social driver can enable producers and communities to participate in the process of co-creating innovative systems through participatory processes, to reach sustainable and low-pesticide food systems.

1.1.2. DESCRIPTION OF THE CHALLENGE (MAIN AIM)

To drastically reduce the use of pesticides in agriculture and to achieve the Green Deal objectives, we believe that research must be carried out based on a vision and within a framework that excludes the use of pesticides. This requires starting from the targeted end point, and not seeking to modify the existing production systems where the inevitable associated path dependency will prevent thorough modifications. The ambitious goal of the T0P-AGRI-Network, is to pave the way in this direction: We propose to co-build and disseminate a new research paradigm among research communities by no longer adopting a progressive pesticide reduction approach, but rather encouraging a breakthrough in redesigning crop protection, in which prophylaxis to reduce pest pressure and agroecology to maximize biological regulations play central roles. This change of direction leads us to explore new research frontiers based, in many cases, on cutting-edge fundamental research, transformative thinking and innovations. Indeed, it leads us to rethink the modes of collaboration between research and economic actors involved in this change, farmers, their upstream or downstream partners and other stakeholders. The search for solutions that are locally adapted to natural and economic contexts and territories, and even more dependent on these local conditions, is also a necessary condition for this change and requires new participatory research and innovation practices based upon multi-actors and living lab characteristics. In T0P-AGRI-Network we will focus on two important, widespread and today heavily pesticide dependent value chains in Europe: the small grains and wine chain value chains. We thereby focus on two distinct farming system types with either annual or perennial crops and with contrasting crop protection requirements and practices. Moreover, these two sectors encompass a major part of the total pesticide use in the EU, due to the large share of small grains in the total utilised agricultural area (UAA) and to the high level of pesticides use per hectare in viticulture. Small grain crops and viticulture are present in all EU countries, both in the East and in the West, with a variety of production conditions that will lead us to explore a diversity of crop protection strategies and practices. The scientific research domains that might provide breakthrough solutions in a future pesticide-free world have interfaces with both biotechnological and social sciences. The ambition to pursue is codesign suitable territorial-based agro-systems that will enable all stakeholders to move beyond incremental changes and small efficiency gains towards long-term large-scale transformational change in order to meet the society's demand for pesticide-free agriculture. The question of the distinction between these expected solutions and current organic farming practices must be clarified here. Organic agriculture bans the use of synthetic pesticides, but authorizes certain substances of natural origin whose effects on the environment can be negative, such as copper sulfate, or other substances that induce the emergence of resistance, as is the case with pyrethroids. It also bans the use of synthetic fertilizers and achieves much lower yields than conventional agriculture, raising the question of its capacity to be generalized without jeopardizing food security. However, organic farming, through its prescriptions, has explored practices and systems that mobilize relevant principles of action, and the research avenues studied should also be beneficial to it. As a consequence, organic farming situations are clearly also part of T0P-AGRI-Network. Yield levels and stability must be maintained and possibly improved under global change. Soil fertility and structure, biodiversity within the field, farm and landscape will need to be considered and enhanced. Agroecology aims to strengthen natural regulations and resilience to ensure long-term food security, as well as human and environmental health [1;7;25]. The shift from a curative to a preventive and biodiversity-based approach to pest management opens up new perspectives in several research areas and underlines the urgent need for interconnected multidisciplinarity [4;9;18]. Agroecological concepts and practices will lead us to focus also on biological regulation through competition, predation, pest

avoidance, host disruption through push-pull techniques, decomposition and mineralisation of organic matter and nutrient recycling. The ability of new cropping systems to sustainably cope with the consequences of climate change, such as heat, drought and extreme precipitation, or pressure from invasive pest and disease species, is also a major challenge that the T0P-AGRI network will address. To successfully address the challenges, T0P-AGRI-Network will answer the following questions:

- How can the redesign of farming and food systems based on agroecology be implemented and accelerated with farmers, industries and citizens?

- How can the biological diversity in farming systems be enhanced and managed to strengthen the natural regulation of pests?

- How can advanced knowledge in insect ecology, plant biology and microbiology produce alternative solutions to pesticides?

- What is the role of different plant breeding techniques for advancing the knowledge in plant immunity and evolutionary ecology?

- Which transition steps need to be taken to reach a zero-pesticide agriculture in different agricultural zones and climate change scenarios?

- How can farmers be supported in learning the knowledge and skills needed to change their practices?

- What would be an efficient and tailored public policy to support transition towards zero pesticide agriculture?

- How can the consumer awareness be increased and the coordination among the actors of the supply chains be guaranteed?

1.2. PROGRESS BEYOND THE STATE OF THE ART

1.2.1. APPROACH TO THE CHALLENGE AND PROGRESS BEYOND THE STATE OF THE ART

Our ambition goes well beyond both current basic and applied agricultural research. In T0P-AGRINetwork, we focus on highly complex farming systems that may not exist at the moment. The approach requires the understanding and combination of cutting-edge methods from agricultural, ecological, biological, molecular and social sciences. It will become a unique training field for interdisciplinary and transdisciplinary research. The following themes are investigated:

Understanding the strategies of actors and co-designing the future value chains
A zero pesticide agriculture calls for a redesign of the food system as a whole. Since the early 2000s, reducing the dependency on pesticides has been an objective shared by many European countries. in order to enable the real evolution of the farming and food systems, our Action will necessarily have to mobilise actors in the entire grain and wine value chains including scientists, farmers, upstream and downstream companies, public authorities, and consumers [12, 17]. Our action will mobilise concepts and methods for a transformative research by increasing reflexivity, participation of stakeholders, codesign and co-production of solutions. At the farm level, this change in farmers practices has to be accompanied and thought of, in terms of resilience, profitability, organisation, and complexity of work. Upstream companies – in particular those dealing with seeds, biocontrol products and agro-equipment, will have to adapt to the new prospects. Agro and food industries will also have to adapt their strategies. Crop diversification and species associations generate a greater diversity of products and a higher variability in product characteristics that raise logistics difficulties and constraints for industries and supply chains in collecting and processing the products. Value chains must be revamped, from raw

production to consumption, including marketing and processing. To do so, innovative solutions should be developed to overcome the technological lock-in which hinders crop diversification [16, 24]. Such solutions should integrate the synergies or antagonisms between upstream and downstream. At the consumer level, to appreciate the value of zero pesticide production, products' characteristics need to be identified and acknowledged by consumers. This change will thus necessarily mobilise the various stakeholders from downstream food sectors and in parallel, upstream sectors. In the past, organic agriculture has been the leading program for a fast growing demand in the retail channels such as direct sales of farmers, specialist health shops, food retailers and food discounters. Understanding the decision-making and the purchasing behaviour of consumers towards different qualities of zero chemical pesticide foods is then required.

Our Action will address the overall concept of transformation. The concept would need to be better defined with regard to the multiple approaches that currently exist. Transformation could be considered as an evolving phenomenon in which transitions along the social-ecological-technological axis of agricultural production may lead to adaptive transformation and eventually to fair and meaningful pathways for sustainability based on participatory approaches and co-creation. With a transformation mindset that is prepared for technology readiness, it will be possible to train the future agents of agricultural transformation.

Breakthroughs in biological research offer new prospects in agroecological crop protection. We consider that three scientific domains in biological research could strongly contribute to a zero pesticide agriculture: microbiota, chemical ecology and new concepts of plant immunity. Plant-associated microbial communities (microbiota) have a tremendous and yet untapped potential to improve plant resilience to abiotic and biotic stresses and crop yields. Plants should be considered as a holobiont, composed by the plant itself and interacting with specific consortia of microbes inside (endophytes) and outside the plant tissues [23]. Molecules produced by microbes have the potential to replace chemical inputs used in conventional agriculture and microbiota diversity and composition can have a profound effect on plant health and pest/pathogen control. Prerequisite approaches will require clear understanding of the determinants of the richness and structure of microbiota on plants and their proximal environment [6;10]. Manipulations of pest-insect odorscapes are a promising approach to answer the strong demand for insecticide-free plant-protection strategies. The terrestrial vegetation produces a diversity of volatile compounds and insect species express a set of olfactory receptors that bind part of the volatile compounds present in its habitat. Insect odorscapes are thus defined as species-specific olfactory spaces, dependent on the local habitat. Odorscape is also essential to insects for finding their targeted crops (kairomones). Modifying odorscape offers prospects to reduce the access of insects to susceptible crops [3]. Integrating into plant breeding programs the latest knowledge on the complex interactions between plant and microbial assemblages that confer resistance to plants against pathogens will change the perspective. Ecological theory offers a new perspective to plant breeding approaches for maintaining diversity and optimising the production of mixtures and to develop ability of plants to perform and live alongside one another [13]. Furthermore adding microbe genes to the plant host genome could increase the plant ability to cope with abiotic (as climate change) and biotic stress as well as climate change. This opens new perspectives in addition to the more classical improvement of the plant per se, where discovery on plant immunity, analysis of the structure and phylogeny of NBS-LLR genes and effect of resistance gene pyramiding are providing new options. Moreover, new technologies, such as gene editing could provide new options for a zero chemical pesticide agroecology-based agriculture [14].

Designing new cropping systems with more functional biodiversity.
Diversification and implementation of crop rotation and spatial arrangement of different crops on the farm, at the landscape level, and the establishment of ecological infrastructures, such as flower and grass strips, have positive effects on beneficial organisms, as well as on bio-aggressors. Mobilising within-field diversity, either varietal or by adding crop species in a mix or irotaiton, fosters crop health [19]. For example, crop diversification is a promising way for controlling pest and weed without compromising yields [15,22]. Plant associations can also significantly modify the abundance and composition of soil microbiota, with a beneficial effect on crop growth and production. However,

combining varieties and crops remains a challenge, as there is a lack of knowledge to manage heterogeneous canopies. Recently, the transposal of concepts from functional ecology to crops has been proposed [2;13], in particular to promote niche complementarity and facilitation, and minimise competition among crops or/and genotypes while reducing occurrence of weeds, pests and pathogens. Targeting a zero pesticide agriculture urges to reconsider classic and emergent ecological theories dealing with the functional biodiversity and evolutionary ecology. The concept of "ecological immunology", allows to understand and promote immunity in natural environments. It considers the physiological or molecular basis of immune responses in the broader context of ecology and adaptation. Several immunity levers can thus be explored for plant protection, besides quantitative crop resistance: pest-repulsive and/or auxiliaries-attractive companion plants, stimulation of plant defenses and plant nutrition. Implementation of ecological infrastructures in the landscapes can also play an important role in designing a zero pesticide agriculture.

1.2.2. OBJECTIVES

1.2.2.1 Research Coordination Objectives

The overall aim of our Action will be setting the scientific fundament for an agroecology-based transition towards a chemical zero pesticide agriculture. The proposed Action will achieve this aim by pursuing the following research coordination set of objectives:

RO1. To build our research activities on the concrete experience of end-users in two strategic agricultural sectors, together identifying barriers and levers for a zero pesticide agriculture and constructing a truly multi-actor Action.

RO2. To assess how to achieve an agroecology-based transition of farming and food systems, in which pesticide use is marginal and only when all other options for securing crop health have been implemented.

RO3. To analyse the state of the art in the different scientific fields at the forefront of providing revolutionary innovations for zero pesticide agriculture.

RO4. To gather multidisciplinary knowledge in the field of agroecology to enable a paradigm shift from curative to preventive crop protection in farming.

RO5. To connect researchers with EIP Agri Operational Groups aimed at pesticide reduction.

RO6. To raise awareness of the importance of the issue and the need for a strong research and innovation paradigm shift.

1.2.2.2 Capacity-building Objectives

The objectives of the Action in terms of capacity-building includes:

CO1: To bridge separate fields of science and technology to create a strong scientific community with a broad representation across Europe (including 10 Inclusiveness Target Countries) oriented to develop research solutions for a zero pesticide agriculture.

CO2: To promote scientific development of Early Career Investigators and young researchers (by offering them Summer Schools and Short-Term Scientific Missions), helping establish a new generation of research leaders with innovative mind-set looking at the problems with a holistic approach.

CO3: To reinforce links between the production of knowledge actors and the agri-food sector actors in order to share a common understanding and willingness to co-design an environment-friendly, sustainable, fair, just and competitive agri-food sector.

CO4: To develop dissemination tools and learning materials to empower farmers, consumers, media, and public policy makers by providing them with a source of reliable information and a trusted reference point on zero pesticide agriculture issues.

2. NETWORKING EXCELLENCE

2.1. ADDED VALUE OF NETWORKING IN S&T EXCELLENCE

2.1.1. ADDED VALUE IN RELATION TO EXISTING EFFORTS AT EUROPEAN AND/OR INTERNATIONAL LEVEL

The evidenced and perceived risks for the environmental and human health posed by the widespread and intensive use of chemical pesticides across Europe have, over several decades, led to increasingly strict, but not always very effective, local, national and European legislation and action plans to reduce pesticide use. Consumers have altered their purchasing behaviour and preferences towards foods produced without pesticides. This increasing societal pressure to reduce the dependency on pesticides in agriculture was recently expressed by the European Commission in the Farm to Fork strategy, which includes ambitious goals regarding pesticide use reduction by 2050. In the last years, the European research community has therefore brought up this question in response to these emerging societal expectation. Indeed, research activities aimed at developing alternatives to pesticides were already an important part of Horizon 2020 and led to a number of research projects on plant protection and reduced pesticide use. T0P-AGRI-Network will first capitalize on knowledge, outputs and experiences already acquired from finalised European projects such as ENDURE, PURE and LIBERATION, as well as from large national programmes for pesticide reduction, e.g. Ecophyto plan, BIOEAST, NAP PSM and PestiRed. In addition to these already finalized projects,T0P-AGRINetwork will build on and integrate the progress of ongoing H2020 projects (e.g. IPMWorks, IPM Decisions, Diverfarming, IWMPRAISE, DiverIMPACTS, NEFERTITI, FAIRCHAIN, PLOUTOS) that have developed or are developing relevant approaches. We will also reach out to create synergies with ambitious projects recently funded by the European Green Deal Call (PESTnu). Despite these numerous European research initatives aiming to reduce pesticide use, this scientific issue remains central in the new Horizon Europe programme. This highlights the serious ambition of the EU to tackle this issue and further mobilise the research community for a continued exploration and expansion of science frontiers, and to break with the current paradigm of a food system heavily dependent on chemical pesticides. This motivated us to to investigate this research question in T0PAGRI-Network. We aim to expand the achievements obtained so far, but above all to go far beyond the existing research activities. Indeed, while European networks already exist or have existed on this issue (such as EraNet C-IPM which was a very active network to produce and disseminate knowledge on integrated pest management over a wide range of agricultural productions), they didn't fully cover the scientific paradigm shifts that a zero pesticide ambition requires. T0P-AGRI-Network will be the first network with a strong trans- and multi-disciplinarity to tackle the issue of zero pesticide agriculture with a systemic approach. The added value of the Action will also be in its deep multiactor involvement, offering a unique opportunity for scientists, farmers and industries to bring together their experiences with a collaborative spirit. Moreover, most academics at the heart of T0P-AGRI-Network have ongoing research projects in their respective countries, allowing to rapidly expanding the knowledge base and to maximize the impact of the COST Action at the national level (note that these projects cannot be named to preserve the anonymity of the Action). Furthermore, T0P-AGRI-Network will structure a European scientific and multi-actor community around a common objective and will therefore benefit from it to coordinate efforts towards future research projects focused on research gaps and stakeholder needs. For example, a future initiative could take the form of a Doctoral Network (under Marie Skłodowska-Curie Actions) to actively involve early stage researchers and establish a new generation of research leaders with a transformation mindset that understands the sustainability pathway components.

2.2. ADDED VALUE OF NETWORKING IN IMPACT

2.2.1. SECURING THE CRITICAL MASS AND EXPERTISE

A Europe-wide network

Agro-ecosystem processes, pedoclimatic conditions and economic and social contexts vary across Europe. Redesigning cropping therefore requires the gathering of a wide range and geographically spread experiences. A Europe-wide coverage is then necessary to propose adequate locally adapted solutions to region-specific conditions and pathways for change. To tackle this challenge, the T0P-AGRINetwork brings together participants from broad geographical areas across Europe, including members from 21 Countries, including 56% of Inclusiveness Target Countries, and experts from two International Partner Countries (IPC), which represent a highly valuable input and opportunity to build international collaborations. The network encompasses a representative wide array and diversity of local to regional environments, production systems and socioeconomic and cultural contexts. It gives access to more than 300 experimental units spread over 8000 ha and access to thousands of farms from partners local networks (they can't be named to preserve anonymity criteria) which will favor knowledge dissemination and farmers' participation.

An inclusive network with high expertise and strong transdisciplinarity

The T0P-AGRI-Network will bring together research communities with the common aim to form a European leading multi- and transdisciplinary network with high and diverse knowledge on agroecological systems. The research fields of the 54 proposers include plant genetics, plant health, crop protection, soil and crop science, agroecology, organic farming, social sciences, agricultural economics and will enable the Network to tackle the issue of a zero pesticide agriculture with a holistic approach. The network gathers academic partners with strong experimental capabilities and infrastructures and with excellent and well documented engagement and collaboration with local farmer networks, national stakeholders in the agri-food sector, the agro-industry, and with consumer organisations and NGOs. The excellence of the proposers in their respective research fields will guarantee a long-lasting impact of the Action results. T0P-AGRI-Network will also benefit from several past and on-going productive and successful collaborations among the proposers of the Action network. The presence of non-scientific actors is also a key asset of the Action to ensure the social impact of the network as expected from a Responsible research & innovation approach. Indeed, 6 key stakeholders will be included from the start of the project and will represent two major food value chains, from farm to fork. Their participation to the WGs will improve the connection between science and society and foster knowledge dissemination and innovation.

2.2.2. INVOLVEMENT OF STAKEHOLDERS

As previously presented, our COST Action, because of its thematic scope, will necessarily have to mobilise actors in the entire grain and wine value chains including scientists, farmers, upstream and downstream companies, public authorities, and consumers. Indeed, in order to enable the real evolution of the farming and food systems, the real barriers or opportunities that these actors are facing should be taken into account in the definition of knowledge gaps that should be addressed by research. As it is very important to benefit from a non-academic perspective from the very beginning of the action, the co-design process has already started at the proposal writing stage through the involvement of 6 stakeholders from the small grains and wine value chains who joined the network during the preparation and submission phase of the proposal. They could therefore bring their vision during the preparation of the Action, but these already involved stakeholders will also allow this COST network to open up to an even larger panel of non-academic actors during its lifetime. Indeed, during the kick-off meeting, a strategy to attract missing key actors participants will be outlined collectively. Already involved stakeholders will be in charge of widening membership within their stakeholder category to increase the number of partners of the T0P-AGRI-Network Action. This is all the more important as in year 1 of the Action we will host two workshops where farmers and upstream and downstream actors will share their experiences in pesticide reduction and their expectations regarding the implementation of a zero

pesticide agriculture. In order to guarantee the involvement of agricultural stakeholders, the COST Action will also rely on the EIP Agri Operational Groups for the involvement of farmers and other agricultural practitioners of scientific activities. Furthermore, the T0P-AGRI-Network aims to have collaboration with policy makers and regulatory bodies because a large number of policies, implemented at the local, national or European level, are related to pesticide use (such as the Common Agricultural Policy, food policies, innovation policies, risk assessments, registrations of crop protection products, labelling,etc). A task in WG 5 will therefore focus on converting the scientific results into policy recommendation aligned to current policy developments.

2.2.3. MUTUAL BENEFITS OF THE INVOLVEMENT OF SECONDARY PROPOSERS FROM NEAR NEIGHBOUR OR INTERNATIONAL PARTNER COUNTRIES OR INTERNATIONAL ORGANISATIONS

T0P-AGRI-Network will strongly support cooperation between COST member countries and international countries. This effort is already visible with the participation of two International Partner Countries (IPC) in the preparation of the proposal. The involvement of Argentina and Chile which provides the added value of being located on another continent, allows for widening the explorations in the Action to different climate, cultures and socioeconomic contexts. A larger participation from Near Neighbour Countries (NNC) and IPC countries is expected over the tenure of the COST Action, as the environmental and health problems linked to the widespread use of pesticides on agriculture concern all regions of the world. Furthermore, the involvement of IPCs and NNCs will allow for cultural differences among consumers to be considered, as well as different best practices. Global connections will moreover enable fast dissemination of findings through the respective national experts and allow promoting the Action activities in non-European countries. Further opportunities will be explored also after the inauguration of the Action through existing partnerships and newly established collaborations that will arise from the Action`s activities.

3. IMPACT

3.1. IMPACT TO SCIENCE, SOCIETY AND COMPETITIVENESS, AND POTENTIAL FOR INNOVATION/BREAKTHROUGHS

3.1.1. SCIENTIFIC, TECHNOLOGICAL, AND/OR SOCIOECONOMIC IMPACTS (INCLUDING POTENTIAL INNOVATIONS AND/OR BREAKTHROUGHS)

T0P-AGRI-Network aims at establishing a strong scientific community working in different disciplines and at strengthening the link between scientists, stakeholders and consumers. In the short term, it will foster new scientific collaborations in promising areas of research to prepare the future of agriculture and to disseminate new approaches on how to significantly reduce the use of pesticides in agriculture. In the longer term, it will feed into the agricultural transition and transformative adaptation towards a zero pesticide agriculture based on the principles of prophylaxis and agroecology. This will be made possible by a profound redesign of cropping systems, supported by new economic actors in the biocontrol, seed companies and digital agriculture sectors, and by changes in strategies in the downstream sectors of agriculture. The main scientific, technological or socioeconomic impacts are presented below, distinguishing short term (ST) that is next 4 years (project duration), medium term (MT) i.e. 4 to 10 years and long term (LT), i.e. more than 10 years.

Scientific impacts

- (ST) A created consensus on new research paradigms required to target a zero pesticide agriculture.

- (ST) Strong collaborations and knowledge exchange between the various scientific disciplines involved in designing the transition towards agroecological and zero pesticide agriculture.
- (ST) New and existing knowledge and resources that will benefit the research community and will be transferred to larger audience through summer schools and STMS.
- (MT) Scientific disciplines redesigned by inclusion of new scientific concepts: functional biodiversity, chemical ecology, plant immunity, prophylaxis, agroecology, institutional destabilization.
- (LT) New generation of multi-disciplinary researchers prepared to develop research programs inside these paradigms and thus reinforce the EUs research capacity in the field, leading to new scientific breakthroughs.

Technological impacts

- (ST and MT) Enhanced uptake of research results by private companies in the sector of bio-control (e.g. microbiome and kairomone-pheromone based technologies) and digital agriculture (e.g. precision agriculture, and equipment to sort grains of associated crops or crops mixtures).
- (MT) Developed technologies allowing early detection (i.e. sensors) of bioagressors to adapt the treatments and to monitor population trends and dispersion.
- (MT and LT) New breeding strategies established to produce varieties with higher pest resistance (MT) and suited to diversification (LT) and to take into account the latest knowledge on the interactions between plant and microbial assemblages into breeding programs (LT).

Socioeconomic impacts

- (ST) Achieved understanding of challenges and opportunities for farmers to conduct the transition toward a sustainable and zero pesticide agriculture by :1) Analysing lock-ins and levers faced by farmers, as well as the economic and sustainability consequences for farmers to conduct this transition, and 2) Analysing trade-offs between short-term business opportunities and long-term sustainability needs.
- (ST) Improved understanding of upstream and downstream operators in agri-food value chains and other relevant actors across food systems with regard to facilitating/hindering transition.
- (ST) Contribute to a better understanding by policy makers and food industry actors of the potential longer term negative and positive feedback effects of transition pathways toward a sustainable zero pesticide agriculture.
- (MT) Contribution to organizational innovations along the supply chain and to the implementation of private incentives to foster implementation of zero pesticide value chains.
- (MT) Contribution to the definition and implementation of territorial, national and EU policies that better respond to the concerns of value-chain operators and farmers and that effectively incentivise a large-scale and long-term shift in agricultural practices to enhance the transition.
- (MT) Significant contribution to the achievement of the objectives and targets of The European Green Deal and in particular to reducing the overall use and risk of chemical pesticides by 50% by 2030.

3.2. MEASURES TO MAXIMISE IMPACT

3.2.1. KNOWLEDGE CREATION, TRANSFER OF KNOWLEDGE AND CAREER DEVELOPMENT

Knowledge creation: In order to break with the vision of traditional agriculture and establish a new paradigm for crop protection, agronomic research must also change its paradigm. This is why different promising fields of knowledge will be considered for investigation in T0P-AGRI-Network, and the Action will develop new knowledge, based on current advances in sciences. The knowledge creation will be made possible through dedicated scientific tasks undertaken in each of the WGs 2 to 4. Indeed, these 3 WGs are intended to advance knowledge on different and interdisciplinary fronts of science previously identified in a co-creation process (WG1) with key stakeholders, and considered as essential to enable the agroecological transition towards a zero pesticide agriculture. This new developed knowledge will be packaged into a set of deliverables intended for the scientific community, including scientific reports, scientific review, etc. This new scientific knowledge developed will also serve as material support for the knowledge transfer activities that will be undertaken, and will be also converted into various nonacademic outputs intended for dissemination actions (especially through the Action website and social media).

Knowledge transfer: The transfer of knowledge will be very important in the Action, first of all within the scientific community with the organisation of webinar sessions, training schools and Short-Term Scientific Missions (STSMs) planned in the 3 thematic working groups. Webinars will be fed by the results obtained thanks to the scientific tasks developed, and will be used to transfer this new knowledge created to existing scientific communities. Summer schools will also have the special task to transfer the knowledge to the PhD students, Post-docs and ECIs. Beyond a scientific audience, the Management Committee will focus on increasing the non-academic participation in the network over its tenure, as the involvement of participants from all areas of the agri-food sector will be critical to ensure relevant approaches, co-design, and expedite knowledge translation.Towards the end of the project, three interactive webinars will be held to transfer all the Action's knowledge generated by WG2,3 and 4 to a general audience.

Career development: During the course of the Action, specialized summer schools will be organized in order to prepare the incoming research community to new paradigms and cognitive frameworks provided by agroecology sciences. Three summer schools (one per WG 2 to 4) will be developed for the next generation of ECIs, PhD and Post-doc students, with specific content derived from the activities of the Working groups. Beyond researchers from the academic field, the summer schools will also be open to researcher coming from private sector (e.g from biocontrol companies), which will thus maximize the impact of the knowledge generated, directly on the ground. These summer schools along with the Short-Term Scientific Missions (STSMs) will engage young talents and will provide them with the opportunity to structure their future career by improving their research skills, paying attention to develop a systemic and multidisciplinary approach in the way we address the question of moving towards zero chemical pesticide agriculture. Moreover, we will offer career development for young academics by providing them a clear perspective for continued funding beyond the lifetime of the Action, e.g. through Horizon Europe opportunities (ERC or MSCA grants).

3.2.2. PLAN FOR DISSEMINATION AND/OR EXPLOITATION AND DIALOGUEWITH THE GENERAL PUBLIC OR POLICY

WG5 will be dedicated to dissemination and communication of the Action's plans and results, in other words to disseminate the knowledge generated through Action activities to the different audiences of T0P-AGRI-Network. A Science Communication manager will be appointed among ECIs. He/she will be responsible for the overall implementation of the dissemination plan, including the development and maintenance of the website, editing the newsletter, updating social media, and coordinating the development of communication materials for distribution (leaflets, flyers, infographics, posters etc.).The following dissemination actions (but not limited) will be implemented, as mean to ensure the uptake of research results by all the stakeholders and end-users:

Online dissemination actions to a general audience:

- Creation of the T0P-AGRI-Network Action website which will be regularly updated and will contain information accessible and intended for a wide public audience. Stakeholders will find information on the Action as background and objectives of the Action, ongoing activities, and scientific and technological achievements. The website will also contain information specifically intended for the scientific community (information for Master's and PhD students, and Post-docs looking for career opportunities). The Action website will also have internal database (members only area) for the participants containing scientific materials created through the Action's activities (scientific papers, synthesis paper, etc.).
- Action's social media presence (Twitter, Linkedin) will be launched and kept updated very regularly in order to communicate with the general public.
- A six-monthly newsletter, containing the WG1-WG4 results for the attention of the public at large will be broadcast by electronic channels (email, social networks). The newsletter will provide information in a synthetic form, which will be accessible in full version on the project website.

All partners, in collaboration with their respective public relations/communication departments, will also disseminate outcomes in their respective communication channels (social medias, public talks, TV talks, podcasts or articles in newspapers) and will enhance visibility of T0P-AGRI-Network in public events, such as open institute days, field site excursions, etc.
The different target groups of T0P-AGRI-Network will also be informed with different means adapted to their needs: by creating a European consortium with internationally renowned experts as well as fully integrated industrial partners, we will be able to support policy-making. A position paper will be produced, presented, disseminated to policy makers (EU, national and local) to ensure that the results produced by the Action will be fully considered by policy makers.
The Action will also organize Concept-knowledge workshops where practitioners (farmers, industries) will be invited to discuss with scientists and give the overview of the current needs and barriers for the implementation of the agro-ecological transition. The objective of these meetings will be to discuss collectively new approaches on how to significantly reduce the use of pesticides in agriculture, with a view to co-designing with the actors in the field, who are also the bearers of innovation. A closing conference will be organized to present the collaboration results obtained during the T0PAGRI-Network Action lifetime, with all related scientific fields involved in the Action. This final conference, in addition to the three interactive webinars that will be held at the end of the project will give the members of the Action opportunities to acquaint wider audiences with the objectives and results achieved by the Action. The plan will be adjusted each year at Action's Working Groups meeting, taking into account the achievements of the Action itself (through new achievements and ideas, research progress) and joining of the new countries.

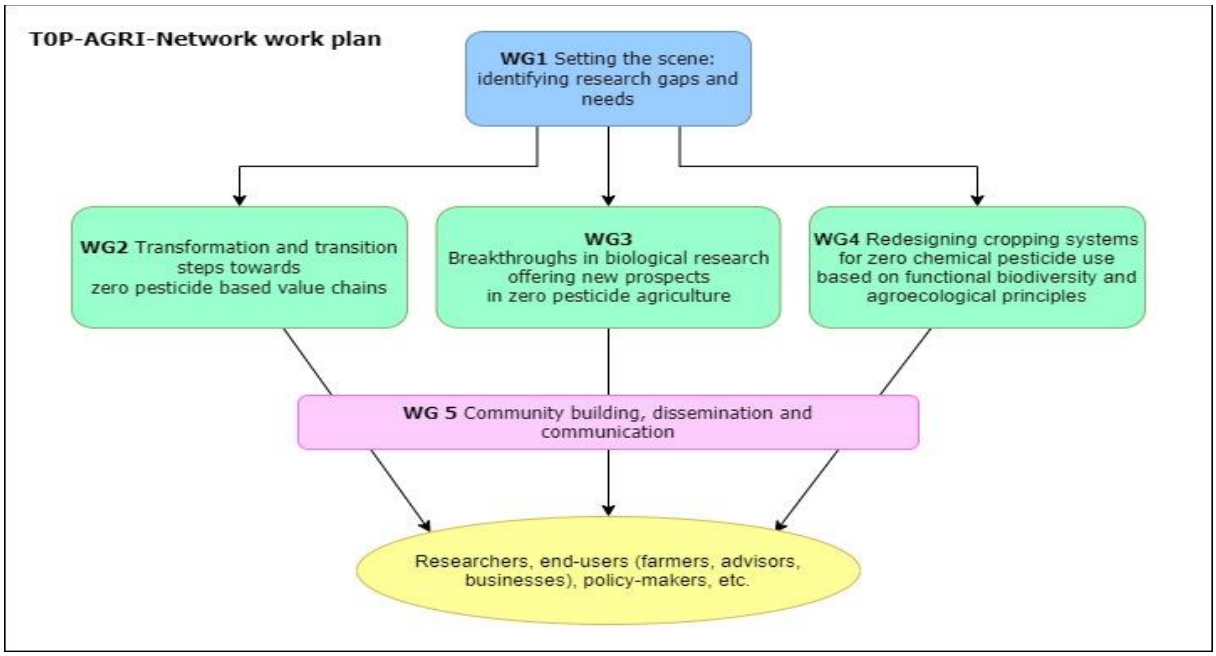
4. IMPLEMENTATION

4.1. COHERENCE AND EFFECTIVENESS OF THE WORKPLAN

T0P-AGRI-Network is organized in 5 Working Groups (WG) that build upon each other to develop a global framework and ensure the achievement of the Action's objectives. WG1 will conduct preliminary tasks within a multi-actor approach and will feed WG2, 3 and 4. WG2, 3 and 4 are thematic working groups which will be dedicated to create and transfer knowledge of different promising science fronts which need to be explored in order to make possible the agroecological transition towards a zero pesticide agriculture. The first tasks of these thematic WGs are expected to produce scientific content that will serve as a reference on the advances made in terms of breakthrough knowledge on the respective science fronts. This scientific content will feed the organisation of knowledge transfer to researchers, with a focus on Early Career Investigators and young researchers, via Training Schools and Short-term scientific missions (STSMs). WG5 will focus on research community building, dissemination and communication.

The Action will be supervised and coordinated by a Management Committee (MC) whose tasks and responsibilities will follow the "Rules and Procedures for Implementing COST Actions" (COST 132/14 REV 6). The proposed MC will consist of the Chair and Vice-Chair, two representatives per country, Working Group (WG) Leaders and a dedicated Training and STSM Coordinator. Each WG will be led by a representative from academic research but WG1 and WG4, which are implementing a multi-actor approach, will also be led by a co-representative from the non-academic world. WGs leaders and co-leaders will monitor the research activities of each WG. In WG1, three Multi-actor liaisons will be in charge to ensure that the research gaps and needs identified in WG1 are taken into account in WG 2, 3 and 4.

A Training and STSM coordinator, nominated among ITC representatives, will support WG leaders and co-leaders in organizing Training Schools and STSMs and will make the connection with WG5. As illustrated in the Gantt Chart, T0P-AGRI-Network will organize 5 Management Committee meetings and 7 Working Groups meetings (either physical or via videoconference). MC meetings will serve as milestones at intermediary control points during which corrective measures can be taken if needed. We will strive to organise these meetings with other Action activities (e.g. WG meetings and TS) to consolidate travel expenses. To complement the MC, a Steering Committee (SC) will be established, consisting of Chair, Vice-Chair and WG leaders and co-leaders. The SC will be in charge of maintaining a fully operational Action and will six-monthly meet at MC meetings or virtually whenever needed.



4.1.1. DESCRIPTION OF WORKING GROUPS, TASKS AND ACTIVITIES

WG1 Setting the scene: identifying research gaps and needs:

To pave the way for a transition towards zero pesticide agriculture producing enough of safe, secure and affordable food, T0P-AGRI-network will focus on barriers and opportunities that end-users, i.e. actors in the entire value chain, will face as pesticide use is significantly reduced. By adopting a multi-actor approach in our first working group, we will ensure that the experience and knowledge of the relevant actors are taken into account to cover actual needs. Identifying research gaps and needs together with our non-academic partners and additional stakeholders in WG1 will improve impact as we expect enhanced use of project results by actors because they were involved in generating them. **Task 1.1 Analyze research gaps and needs based on an innovative multi-actor approach:** *two Concept-knowledge (C-K) workshops* – one per value chain studied – bringing together researchers, non-academic partners from the consortium as well as other various stakeholders (including EIP Agri

Operational Groups aimed at pesticide reduction), will be organized. Farmers and upstream and downstream actors will share their experiences in pesticide reduction and their expectations regarding the implementation of a zero-pesticide agriculture. Different success stories in sustainable agricultural transformation (i.e. local case studies providing learning experience for the transition towards zero pesticide) will be previously identified and presented at this workshop. A *synthesis report* (D1.1.1) summing up the results of the workshops will be published and *testimonies of some workshops participants* (D1.1.2) will be disseminated of the web platform.

Task 1.2 Analyze research gaps and needs based on literature review: a *scientific review paper* (D1.2) analyzing obstacles and levers faced by end-users, strategies of actors, impacts of private initiatives and public policies aiming at reducing pesticide uses and developing pesticide free chains will be drafted. It will also include the main messages from the synthesis report D1.1.1.

WG2 Transformation and transition steps towards zero pesticide based value chains:

WG2 is a scientific thematic working group focused on transformation and transition research. The working group will focus on pathway design. It will include approaches for technical and organizational re-design through co-creation processes that involve supply chain actors and stakeholders. The ultimate goal will be to successfully transform agricultural production to agroecological systems with a zero dependence on chemical pesticides. The working group will develop a practice of change and disseminate it.

Task 2.1 Describe the theoretical perspective of transformation: concepts, approaches, methodologies. The first aim will be to answer the question on how to align transformation viewpoints with agroecology as science, practice and social driver for change. A literature review on agroecological transition and transformation concepts will be shared during a *scientific seminar*, published as a *scientific opinion paper* (D2.1), and presented during an *international scientific conference* devoted to crop protection.

Task 2.2 Using a Transformation Lens to develop suitable economic and ecological methodological approaches applied to the two studied supply chains: the objective will be to investigate what are the lessons learnt, the obstacles, chances and enablers to move from efficiency gains towards large-scale adoption and implementation of zero pesticide food chains. A *scientific synthesis paper* will be published (D2.2.1) to evaluate the effectiveness of the participatory approaches for agricultural transformation and to propose measures for all stakeholders in European agriculture. A *Commentary and information brochure* will also be published (D2.2.2).

Task 2.3 Transfer the created knowledge to future generations of researchers: A *Training School on transition towards zero pesticide agriculture* will be held based on the findings consolidated in the two scientific papers. *STSMs* will also be organized between the Action's partners so that they can share methods and techniques and gain skills on this specific science front.

WG3 Breakthroughs in biological research offering new prospects in zero pesticide agriculture:

Agroecology offers a strong paradigm for re-designing new cropping systems with more genetic diversity and functional biodiversity where biological regulations ensure lower pest and disease pressure and better crop protection. Major advances have recently been achieved and large research programs are on-going in biology, microbiome, chemical ecology and genetics, which offer new perspectives for innovations and effective implementation of crop protection based on the concepts of agroecology and pave the way towards development of a zero-pesticide agriculture.

Task 3.1 Build knowledge in biology research: topics such as the ones below will be studied in this task:

- Microbiome, a new universe with major impacts on plant nutrition and plant health.
- Chemical ecology and odorscapes: studying new approaches for understanding the insect behavior and subsequent damages and for designing zero-insecticide crop protection while preserving multi-trophic insect diversity.
- Plant immunity and resistance genes: understanding the structure of plant resistance genes and studying new approaches of plant resistance and plant immunity.

A *perspective paper* (D3.1) will sum up and formulate new paradigms based on the most prominent scientific breakthroughs and a *webinar* dedicated to researchers will be held.

Task 3.2 Build critical knowledge on how to leverage breakthrough discoveries on microbiota, chemical ecology and genetics/genomics **with technological innovations**, with the pragmatic goal to forecast technological innovations based on the assessment of opportunities, bottlenecks, and externalities with emphasis on the rational use of agricultural functional biodiversity
A scientific *workshop* will be held to discuss the leverage potential of these technological innovations and to formulate guidelines on how to forecast the development and adoption of the next generation green technologies in plants and microbes for pesticide-free agriculture. A *webinar* presenting the results of the workshop will be organized for end-users.
Task 3.3 Transfer the created knowledge to future generations of researchers: A *Training School on breakthroughs in biological research* will be held based on the findings consolidated in the scientific paper. *STSMs* will also be organized between the Action's partners.

WG4 Redesigning cropping systems for zero chemical pesticide use based on functional biodiversity and agroecological principles:
Biodiversity-based farming and landscape solutions need to be developed for improved crop protection without chemical pesticides. Following agroecological principles and in line with IPM basics, zero chemical pesticide crop protection requires an emphasis on preventative approaches in contrast to the curative approach offered by pesticides. Cropping systems need to be redesigned to harbor an enhanced cultivated and associated biodiversity that via their ecosystem functions and services, replaces pesticides with biological regulations of weeds, pests and diseases. This entails pushing new research frontiers and diversifying cropping systems based on ecological knowledge at the field, farm and landscape scales.
Task 4.1 Build knowledge on functional biodiversity and agroecological principles: three specific topics will be studied in this task:

- Exploring management of cultivated and wild functional biodiversity of genotypes and species, on the control of weeds and pests, as well as on key ecosystem functions such as crop yield and quality, carbon storage, nutrient cycling and soil formation.
- Designing zero pesticide farming to provide biodiversity-based effective, resource efficient, adaptable and resilient crop protection in the context of climate change, including identifying technology needs.
- Scaling up to designing agricultural landscape and ecological infrastructures to achieve zero-pesticide biodiversity-based agriculture with minimized crop losses.

A *concept-knowledge (C-K) workshop* with non-academic partners and end-users will be organized to discuss the three topics, to learn from farmers' experience and to co-design future production systems. A *synthesis paper* (D4.1) will be written based on these exchanges and literature review.
Task 4.2 Transfer the created knowledge to future generations of researchers: A *Training School on functional biodiversity and agroecological principles* will be held based on the workshop results and the handbook. *STSMs* will also be organized between the Action's partners.

WG 5: Community building, dissemination and communication
WG5 will aim at the effective dissemination and outreach of the Action results. The main objective of this WG is to transfer the scientific knowledge that will be created to all audience. With the following tasks, the WG will aim to deliver the tools and guidelines to stakeholders and policy-makers concerning new approaches developed on how to significantly reduce the use of pesticides in agriculture. The overall objective of this WG is to ensure visibility of the Action and its developed outcomes at European and International level.
Task 5.1 Dissemination, promotion and outreach of the network: The Action's *website* (5.1.1), designed as an interactive platform for multi-actor benefits, will be set-up to host the scientific materials created through other tasks (scientific papers, synthesis paper, interviews of workshops participants, seminars, conferences, webinars, etc.). *General promotional and informational materials* (5.1.2) will also be created and feed the web platform (newsletter, articles, links to other networks and resources, etc.) as well as a Twitter account. A *position paper on the research gaps that should be explored under Horizon Europe* (5.1.3), specifically aimed at policy-makers, will be drafted and disseminated.
Task 5.2. Supporting the transfer of knowledge to future generations of researchers and the general public: this task will be dedicated to the *operational organization and the outreach of the three Training Schools and STSMs* of WG2, 3 and 4 with the help of the Training and STSM coordinator. In

addition, three *interactive webinars* will be held towards the end of the action to transfer all the Action's knowledge generated by WG2,3 and 4 to a general audience. These webinars will be hosted on the European web platform and available in replay.
Task 5.3 Organization of meetings and events: MC meetings, WG meetings, presentation of T0P-Agri network in professional events such as annual ABIM meetings, T0P-Agri-Network closing Conference will be organized in this task.

4.1.2. DESCRIPTION OF DELIVERABLES AND TIMEFRAME

WG	Task	Deliverables (D) and activities	Objective(s) targeted	Timing
WG1	**Task 1.1**	2 Concept-Knowledge (C-K) workshops	RO1, RO5, CO1, CO3	Q2
		D1.1.1 Synthesis report	RO2, RO6	Q2
		D1.1.2 Interviews of workshops participants	RO1, RO6	Q2
	Task 1.2	**D1.2** Scientific review paper	RO1, RO2, RO6	Q3
WG2	**Task 2.1**	Scientific seminar	RO2, RO3, CO1	Q4
		D2.1 Scientific opinion paper	RO2, RO3, RO6	Q6
		International scientific conference	RO2, RO3, RO5, RO6, CO1, CO3	Q8
	Task 2.2	**D2.2.1** Scientific synthesis paper	RO2, RO3, RO4, RO6	Q8
		D.2.2.2 Commentary and information brochure	RO2, CO4	Q9
	Task 2.3	Training School on transition towards zero pesticide agriculture	RO6, CO2	Q9
		STSMs	CO2	Q10-11
WG3	**Task 3.1**	**D.3.1** Perspective paper	RO2, RO3, CO1	Q4
		Webinar	RO3, RO6, CO1	Q4
	Task 3.2	Scientific Workshop	RO3,RO6,CO1	Q5
		Webinar	RO3,RO6,CO1	Q6
	Task 3.3	Training School on breakthroughs in biological research	RO6, CO2	Q6
		STSMs	CO2	Q6-Q7

WG4	**Task 4.1**	C-K workshop	RO1, RO2, RO3, RO4, CO1, CO3	Q9
		D4.1 Synthesis paper	RO2, RO3, RO4, RO6	Q10
	Task 4.2	Training School on functional biodiversity and agroecological principles	RO6, CO2	Q13
		STSMs	CO2	Q14-Q15
WG5	**Task 5.1**	**D5.1.1** Action's website	RO6, CO1, CO3, CO4	Q1
		D5.1.2 General promotional and informational materials	RO6, CO3, CO4	Every semester
		D5.1.3 Position paper	RO6, CO3, CO4	Q14
	Task 5.2	Three interactive webinars	RO1, RO6, CO1, CO3, CO4	Q13-14-15
	Task 5.3	Closing conference	CO1	Q16

4.1.3. RISK ANALYSIS AND CONTINGENCY PLANS

As part of the Management activities in T0P-AGRI-Network, a risk management plan will be drawn up at project start. For each risk identified, a member will be responsible for following the risk and advising the SC of the appropriate contingency action to put in place. Members will also be asked to identify new risks on a regular basis in the project reports and at project meetings.

Risk #1 : Covid-19 pandemic travel restriction : Face-to-face workshops are not possible to be organised due to pandemic periods. Project activities stopped or delayed.
Contingency Plan : It has already been planned that many activities will use new communication technologies (such as webinars). As far as possible, the research schools and conferences will be face-to-face, but if necessary measures will be taken to organize this virtually. Moreover, participants have recent experience in designing and organising interactive virtual events, ensuring productivity and knowledge exchange in a context discouraging travel.

Risk #2 : Lack of consensus between Action participants, or lack of involvement of Working groups leaders.
Contingency Plan : A large number of this Cost Action participants have already worked together in the past, in European projects or other initiatives, which will promote good understanding and productivity and limit risk of disagreement. Moreover, working groups leaders have closely worked during proposal writing process, which allows to make them all aware of their commitments.

Risk#3 : WG participants do not achieve their deliverables in the expected delays
Contingency Plan : Deadlines for submission of deliverables will be planned and set in advance. WG leaders will ensure that WG participants and contributors adhere to milestones and deliverables schedules.

Risk #4 : Limited involvement of farmers and other stakeholders (for instance insufficient participation at events)

Contingency Plan: Six non-academic members are actually members and others stakeholders already showed a clear interest in the Action, which will allow us to build a crital mass. Each partner also benefits from an already well-identified national network of practitioners. Moreover, during the kick-off meeting, a strategy to attract missing key actors participants will be outlined collectively, and at Action's yearly meetings detailed dissemination plan for next year will be prepared and discussed.

Risk #5 : Budget constraints
Contingency Plan : The scope of the work will be adapted according to the budget. The risk of insufficient funding will be mitigated by complementing the activities using existing local, National and European sources, in order to ensure that the STMs will have sufficient operating funds.

4.1.4. GANTT DIAGRAM

		TIMELINE															
		Year 1				Year 2				Year 3				Year 4			
		Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16
Management	MC Meeting	x					x			x				x			x
	WG meeting	x			x		x		x	x		x		x			
Milestones		M1					M2			M3				M4			M5
Deliverables		D5.1.1 D5.1.2	D1.1.1 D1.1.2	D1.2	D3.1 5.1.2		D2.1 D5.1.2		D2.2.1 D5.1.2	D2.2.2	D4.1 D5.1.2		D5.1.2		D5.1.2 D5.1.3		D5.1.2
Activities	Training schools						x			x				x			
	STSMs						x				x				x		
	Workshops,seminars or conferences		x		x	x			x	x							x
	Webinars				x		x							x	x	x	