19th International Conference on Environmental Science and Technology

Kos, Greece, 3 to 6 September 2025

Unlocking the Potential of Operational Groups in Sustainable Weed Management: The Oper8 Project

RODRIGUEZ-RIGUEIRO FJ., FERREIRO-DOMINGUEZ N., SANTIAGO FREIJANES JJ., COUSO-VIANA A., RIGUEIRO-RODRIGUEZ A., MOSQUERA-LOSADA MR*.

[1]Department of Plant Production and Engineering Projects, Polytechnic School of Engineering. University of Santiago de Compostela. Lugo, Spain.

*corresponding author: María Rosa Mosquera Losada
e-mail: mrosa.mosquera.losada@usc.es

Abstract The Oper8 project address the urgent necessity of reducing the use of chemical herbicides in Europe by practitioners on both agricultural and forestry sectors. Thus, Oper8 relies on eight existing Operational Groups (OGs) covering seven countries of Europe and moving forward on sustainable non-chemical weed management solutions, building up seven multi-actor National Networks (NNs) developed for co-creating and scaling weed management innovative practices.

Oper8 NNs are built to identify best solutions and facilitate the exchange of knowledge among stakeholders, therefore establishing a platform for guiding the co-creation of solutions specifically adapted to local conditions and challenges. A down-top and top-down approach was applied at national and European levels in order to identify 80 best practices for the creation of easily accessible training materials (e-learning module) and knowledge objects. In addition, practical knowledge is spread to end-users through dissemination materials, cross visits, workshops and demonstration events. Best practices were thoroughly evaluated for a range of agricultural systems and countries, demonstrating their advantages for the economy and environment while minimizing implementation obstacles.

The outputs generated within the project will strengthen the EU AKIS, leading the way for reducing the reliance on chemical herbicides, contributing to more resilient and environmentally friendly agricultural practices.

Keywords: Non-chemical weed management, agricultural sustainability, e-learning, multi-actor networks, knowledge dissemination, AKIS, Horizon Europe

1. Introduction

The dependency on chemical herbicides has been identified as a critical issue for the sustainability of European agriculture. Considering the rise on herbicide resistance, the environmental and health risks associated with the expansion on herbicide usage have boosted regulatory changes and public concern (EC, 2020). In this context, the Oper8 project (Horizon Europe, Grant Agreement No. 101060591) emerged as a coordinated effort to identify, support, and disseminate effective non-chemical weed management (NCWM) solutions. The project leverages the experience of eight Operational Groups already active in various agroecological zones and integrates them into seven National Networks. These NNs serve as platforms for stakeholder engagement and co-creation of context-specific strategies to reduce herbicide reliance, strengthen resilience, and enhance ecological performance in cropping systems.

2. Methodology

Oper8 employed a participatory research and innovation framework that blended bottom-up and top-down strategies to identify, validate and integrated weed-management (IWM) practices across seven National Networks (Oper8, 2023). Initially, each Network convened stakeholder workshops, surveys and on-farm demonstrations to assess agronomic performance, environmental benefits and socioeconomic viability of over the candidate solutions to reach a final number of at least 80 Best Solutions (BSs). Thus, twelve BSs were selected for integration into dissemination materials and the Oper8 e-learning platform. In line with this, every country committed to developing at least 14 Practice Abstracts (PAs) and 11 Fact Sheets (FSs) to reach the goal of materials produced, but the United Kingdom exceeding these targets with 16 PAs and 14 FSs, since this NN was represented by two Ogs. PAs and FSs were created using standardized templates and internal scientific and linguistic review to ensure consistency and quality. To date, this process has yielded 100 PAs and 80 FSs, all translated into partner languages and linked to thematic modules of the forthcoming online course.

Descriptive analysis of material counts was performed in Python (v3.x) using the Matplotlib library to visualize distribution across six e-learning categories defined for this paper: Mechanical Weeding, Cultural Control, Mulching & Cover Crops, Technological Solutions, Bioherbicides/Variety Selection and Agroforestry.

3. Results and discussion

The Oper8 Consortium has completed and categorized a total of 230 dissemination materials with 100 PAs, 80 FSs and 50 short videos across six thematic categories that align with the forthcoming e-learning module. As shown in Figure 1, mechanical weeding commands the largest share of content (28 PAs, 21 FSs), underscoring its central role in both conventional and organic production systems. Cultural control strategies (22 PAs, 19 FSs) and mulching & cover-crop approaches (20 PAs, 17 FSs) follow closely, reflecting the importance for farmers on their agronomic and environmental benefits. Technological solutions, encompassing precision spraying, robotics and laser weeding, account for 13 PAs and 11 FSs. Bioherbicide applications and variety-selection practices are represented by 11 PAs and 8 FSs, while agroforestry methods appear in 6 PAs and 4 FSs.

The balanced distribution of materials aims at meeting the holistic approach of Oper8 regarding traditional, low-input strategies such as false seedbed and crop rotation complement high-tech interventions like camera-guided mechanical weeding, thus serving to a broad spectrum of end-users from smallholders to precision-agriculture practitioners.

In preparation for the e-learning launch, the materials have been mapped to eight sequential modules. After a brief Introduction, learners will progress through a Weeds Typology overview and an Oper8 Concept module. The core of the e-learning module will address three generic strategies (physical, chemical and biological) within crop-specific modules for vineyards, horticulture and arable systems. A concluding Policy module will synthesize the regulatory and incentive frameworks that affects and promote the adoption of IWM solutions in Europe. This structure ensures pedagogical coherence with foundational concepts lead naturally to practical applications and contextual policy considerations. In addition, the creation of 50 short videos aims at strengthening the learning component and enhancing engagement.

By linking the bottom-up validation from seven National Networks with a top-down approach on best solutions assessment and e-learning architecture, the Oper8 creates a scalable model for delivering IWM innovations across diverse agroecological contexts. Continuous monitoring of user feedback and learning analytics will ensure the Oper8 remains responsive to agronomic challenges and technological advancements.

4. Conclusion

Oper8 demonstrated that creating a structured multi-actor collaboration, based in existing OGs and reinforced by cross-national knowledge exchange, can deliver impactful and scalable IWM solutions. The diversity of the strategies documented, and the comprehensive nature of the materials produced aims at reinforcing and strengthening AKIS throughout Europe. Through its participatory methodology, multilingual dissemination, and online training platform, Oper8 has created a replicable model for advancing sustainable weed control under EU Green Deal objectives.

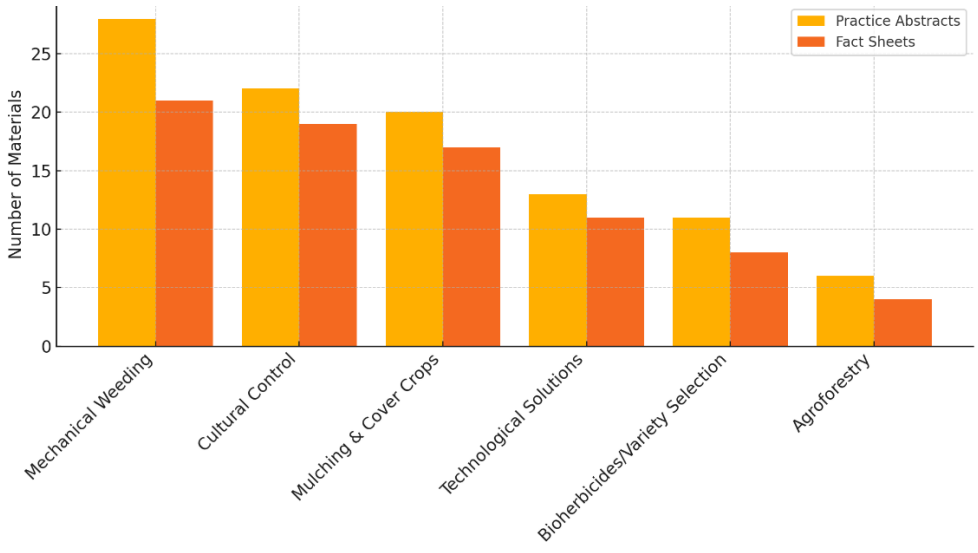

Figure 1. Number of practice abstracts (Pas) and fact sheets (FSs) created within the Oper8 project distributed per integrated weed-management (IWM) thematic categories

References

European Commission. "From Farm to Fork Strategy for a fair, healthy and environmentally-friendly food system." Brussels, 2020.

Oper8 Consortium. Grant Agreement No. 101060591 and internal deliverables (2023–2025).