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Welcome to the third issue of the WeLASER newsletter

WeLASER newsletter is a six-monthly publication devoted to engage and keep all potential actors (farmers, agronomists, researchers, engineers, policymakers, students, business institutions and governments, investors, citizens, etc.) informed about the progress and activities of WeLASER, a project, funded under the Horizon 2020 programme of the European Commission in the call "Integrated health approaches and alternatives to pesticide use (SFS-04-2019)". The project attempts to eradicate health risks and environmental adverse effects associated with the use of herbicides by using laser and Information and Communication technologies (ICT) along with autonomous navigation systems.

In this third issue, you are being informed about the project's objectives, expected results and the activities carried out during the third semester of the project development (October 2021 to March 2022).

WeLASER achieves its mid-term focused on the preliminary system integration

WeLASER at EIMA2021 – International Agricultural and Gardening Machinery Exhibition

EIMA 2021 event –formerly held in 2020 and postponed– was finally held on 19-23 October 2021. More than 200,000 visitors –each dressing his/her mask– proved the wish of escape from the closure of the previous period, while the 1300 companies occupied every space of the Bologna expo centre. Most of the expo was oriented to traditional field machinery with a trend toward electric engines and an increasing



Robotic system at EIMA (Photo courtesy of Prof. G. Vitali, UNIBO)

interest in security. Most of the robotic applications are given by garden mowers, some re-branding other's products (e.g. Husqvarna), others produced directly (several in Italy). Their market seems in good health and growth and looking with interest to other robotic applications in landscape management. Some autonomous vehicles for field crop management were presented at EIMA (DOOD (<https://br-fr.facebook.com/EarthAutomationsOfficial>)). UNIBO delegated had the opportunity to distribute WeLASER flyers and speak with people selected from those involved in Robotics and Software applied to Agriculture (e.g. In4Agri, Elaisian, Evogreen, IBF), and interact with other EU projects, namely EU "interreg" Transform 4.0. Press releases on EIMA (in Italian) can be found at <https://www.eima.it/it/comunicati-stampa-fiera-macchine-agricole-giardinaggio.php>.

WeLASER Third Stakeholder Event

On November 19, 2021, the 3rd WeLASER Stakeholder Event was held. This online event was organised and conducted by Janusz Krupanek with the Institute for Ecology of Industrial Areas, IETU, Poland.

The event was focused on discussing environmental issues including environmental performance, key benefits and potential impacts related to the WeLASER application in practice.



After a short introduction to the project by the Project Coordinator and the status of the development of the different subsystems by the WP leaders, four presentations were given by experts related to (see the text box):

- **EU policy related to sustainable weed control in agriculture** by Aira Sevón; IFOAM - International Federation of Organic Agriculture Movements (Finland). Environmental requirements in organic farming were presented as the most demanding in agriculture in relation to EU policy. Principles of organic farming with regard to WeLASER application were reviewed and questions related to future applications in the sector were posed.
- **Sustainable weed control: benefits and challenges – organic farming perspective** by Aira Sevón; IFOAM -

**The Third
WeLASER Stakeholders' Event
gathered over 40
participants**

International Federation of Organic Agriculture Movements (Finland)
Ms. Sevón presented key environmental considerations and practical aspects of weeding in the fields managed according to organic farming principles. Key problems of Finnish organic farming and the feedback from Finnish farmers related to WeLASER concept were overviewed and discussed.

- **How can weeding with laser beams support biodiversity?** by Christian Andreasen University of Copenhagen (Denmark). Results of WeLASER testing were presented showing high efficiency of performance for destructing weed meristems with small impact on the surrounding environment (soil life). Key environmental benefits of the technique were outlined including soil life protection, safety for pollinators and beneficial animals. Lesser impact on soil compaction was argued in comparison with mechanical and chemical weeding based on heavy machinery.

- **Environmental performance of WeLASER invention – project activities** by Janusz Krupanek- Instytut Ekologii Terenów Uprzemysłowych, IETU, (Poland)
In the presentation, a brief overview of WeLASER activities related to the environment, biodiversity and sustainability were outlined along with a summary of key factors determining the environmental performance of WeLASER technique.

Finally, a general discussion took place around the questions (i) Which factors of WeLASER technique implementation should be focused on to achieve high environmental performance?, (ii) Which environmental benefits would be the biggest gain?, and (iii) Are there environmental risks requiring special attention? (See panellists in the text box):

Over 40 participants including farmers, representatives of research and agricultural institutions, policymakers, NGOs and project partners participated in the discussion.

Panellists at the Third WeLASER Stakeholder Event

1. **Aira SEVÓN** (IFOAM - International Federation of Organic Agriculture Movements, Finland).
2. **Christian Andreasen** - University of Copenhagen, Denmark.
3. **Janusz Krupanek** - Instytut Ekologii Terenów Uprzemysłowionych, IETU, Poland.

Open house at CSIC presented WeLASER project

An Open House is a yearly activity at CSIC to introduce students to the world of scientific and technological research. Some presentations of the WeLASER project and precision agriculture techniques, in general, were given to about 70 undergraduate students in small groups following Covid-19 protocols.



Open House at CSIC

WeLASER Focus Group Interviews

WeLASER is being developed under the Multi-Actor Approach and, thus, it is devoted to take care of the social aspects concerning the adoption of novel techniques. Therefore,

WeLASER planned to hold several Focus Group Interviews (FGI) in different project-partner countries to explore different dimensions of the introduction of the new technology in agricultural practices and on the market. The FGIs were planned on

- Technical, functional and economical aspects of the development and application of the new technology
- Social and behavioral, legal and system conditions affecting farmers' adoption of the innovative technology; and
- Environmental impact of the innovative technology and the requirements concerning labour, health safety and risk management in farms.

So far, WeLASER has organized four FGI consisting of a small group of about 10 stakeholders conducted by a moderator from the organizing partner. These FGIs are:

WeLASER has organised four Focus Group Interviews, so far

- International Focus Group Interview

The first Focus Group Interview was held with participants from seven countries. It was conducted online on the 2nd of December 2021, with representatives of farmers, agricultural associations, agricultural advisors and scientists from Belgium, Denmark, Finland, Spain, the Netherlands, Germany and Italy. An active discussion focused on the opportunities and barriers related to the implementation of precision farming techniques in weed control. The focus group participants also conducted a



Presentation at the International FGI

SWOT analysis (Strengths, Weaknesses, Opportunities, Threats).

The FGI results will contribute to the improvement of the design and development of business models for the use of precision farming in weed control and will provide suggestions for European policy in this regard.

- Focus Group Interview in Poland

The first FGI workshop at the national level was organized by the Institute for Ecology of Industrial Areas (IETU) on the 3rd of February 2022. This FGI gathered 16 participants from Poland including farmers, representatives of farmers' associations, agricultural advisors, consultants and researchers. The participants demanded reliable information on the WeLASER system performance including cost/effectiveness, energy efficiency, target crops and requirements for its use in real farms. FGI's main conclusions are extended in [Practice Abstract 29](#).

- Belgian/Dutch Focus Group Interview

On February 10, 2022, the University of Ghent (UGENT) organised a FGI that brought together 13 participants from Belgium and the Netherlands, including farmers, representatives of farmers' associations, agricultural machinery dealers, consultants and researchers. During the workshop, interesting information was obtained for the successful implementation of the WeLASER system. After the focus group discussion, a SWOT analysis was performed to identify the main factors that impact the implementation of the WeLASER technique. The main conclusions are included in [Practice Abstract 27](#).

- WeLASER Focus Group Interview in Spain

COAG held on the 24th of February an online Focus Group Interview for Spanish stakeholders

• **Solución Multi-actor (MAA)**

☐ Debe unir fuerzas de socios con conocimientos complementarios en las actividades del proyecto desde su principio hasta su fin.

WeLASER – Cobertura multi-actor

Presentation at the FGI in Spain

interested in WeLASER. The objective was to exchange valuable insights regarding the future implementation of precision agriculture tools for weed management, with special attention to WeLASER weeding system. The main conclusions are included in [Practice Abstract 28](#).

FIRA 2021

WORLD FIRA is a world expert event in Agricultural Robotics held in Toulouse, France, on December 7-9, 2021, with more than 3000 physically or online attendees including researchers, engineers, robot manufacturers, agricultural businesses, investors, suppliers, producers and entrepreneurs from around the world. The event consisted of conferences and round tables, pitches, an exhibition zone and a scientific conference.

WeLASER participated in FIRA-2021 (Toulouse, France)

WeLASER was represented in the exhibition zone by AGREENCULTURE (see its booth in the next picture) and in the scientific conference by Christian Andreasen (UCPH) and Jesus Herrera-Diaz (CSIC), who gave two talks on WeLASER results (see section Communication and dissemination activities-papers in conferences).



AGREENCULTURE booth at FIRA 2021

WeLASER test and demo fields – First campaign

CSIC started the preparation of the fields for tests and demos in September 2021. The site, located in the Centre for Automation and Robotics (CSIC) based in Arganda del Rey, Madrid, Spain, consists of three fields measuring 60 m x 20 m to grow wheat, maize and sugar beet (the project target crops). Four campaigns were initially planned to provide fields for tests and demos: October-November 2021, May-June 2022, October-November 2022, and May-June

First crops obtained at WeLASER Experimental Field

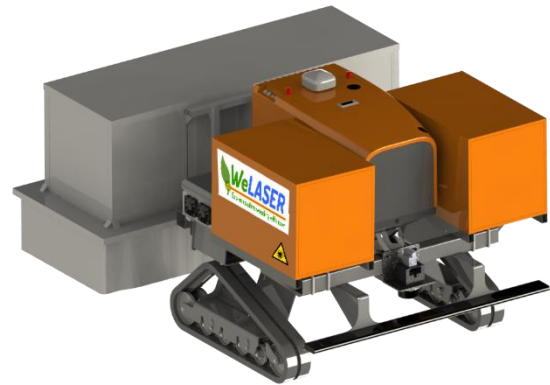
2023. The first campaign was carried out with bad crop results (wheat and maize). Therefore, it was decided to advance the second campaign in 2022 for about one month (September – October 2022). In addition, the campaign May-June 2022 has been split into February-March 2022 and May-June 2022 because there is a need to advance the equipment tests (February-March 2022) and also make sure that proper crops in the period May-June 2023 can be obtained to carry out the final tests and demonstrations.



WeLASER Experimental Field

WeLASER preliminary integration

Close to the project mid-term, WeLASER consortium planned a preliminary system integration consisting of assembling all the systems onboard the mobile platform and checking the mechanical, electrical and



Integration scheme of the WeLASER components

communications interfaces. This preliminary integration has been delayed from mid-March to the end of April 2022, due to delays in the delivery of parts and components caused by the current pandemic and political crises. UNIBO carried out the deployment of the IoT sensor network in the testing field at the end of March 2022. The integration of the cloud computing apps (UNIBO), the high-power laser source (FUT), the AI-perception system and the scanning system (LZH), and the second prototype of the mobile platform (AGV) have been re-planned for April 2022 and the



UNIBO researchers deploying the IoT sensor network on the experimental field

integration main results will be provided in the next WeLASER newsletter (September 2022).

Integration planning

- IoT sensor network (UNIBO). End of March 2022
- The cloud computing apps (UNIBO). Mid-April 2022
- Second prototype of the mobile platform (AGV). Mid-April 2022
- High-power laser source (FUT). End of April 2022
- AI-perception system and the scanning system (LZH), End of April 2022

Communication and dissemination activities

During the third semester of the project development, WeLASER consortium has been active in communicating and disseminating the project activities and results using the following means.

Articles in scientific journals

- Ildar Rakhmatulin, Andreas Kamilaris, and Christian Andreasen, “Deep Neural Networks to Detect Weeds from Crops in Agricultural Environments in Real-Time: A Review”, *Remote Sensing* 2021, 13(21), 4486.
<https://www.mdpi.com/2072-4292/13/21/4486>

- Christian Andreasen, Karsten Scholle and Mahin Saberi, “Laser Weeding with Small Autonomous Vehicles: Friends or Foes?”, *Frontiers on Agronomy*, 07 March 2022
<https://doi.org/10.3389/fagro.2022.841086>

Papers in conferences

- Christian Andreasen, Mahin Sabari & Ildar Rakhmatulin, “Weed control with laser beams using autonomous vehicles: pros and cons”, World FIRA 2021, Toulouse, France, 7-9 December 2021

- J. Herrera, L. Emmi, P. González-de-Santos, “Enabling navigation for autonomous robots in early-stage crop growth”, World FIRA 2021, Toulouse, France, 7-9 December 2021.

Practice abstracts

Fifteen new practice abstracts have been published on the WeLASER websites focused on (i) Is WeLASER using the correct laser technology?, (ii) How laser weeding can contribute to improving the environment and sustaining biodiversity I & II, (iii) Stakeholders point at enhancing environmental and health benefits of WeLASER system application, (iv) Preliminary competitive analysis of the WeLASER solution, (v) Focus Group Interview strengthens understanding of the WeLASER technique implementation, (vi) Deep learning helps autonomous navigation in early-stage growth crops, (vii) Safety Issues with Laser Weeding (1) - Heat and Fire Risks, (viii) Safety Issues with Laser Weeding (2), (ix) Safety Issues with Laser Weeding (3), (x) Belgian/Dutch Focus Group Interview to get insights into the future implementation of the WeLASER technique, (xi) WeLASER Focus Group Interview in Spain: main results, (xii) The multiactor approach in WeLASER: a midterm overview, (xiii) Risks from exposure to laser radiation during weed control, (xiv) Possible release of hazardous substances during weed control using laser radiation and (xv) Boundary conditions for the operation of a laser robot. These new abstracts are available at <https://welaser-project.eu/practice-abstracts/>.

News in on-line platforms

- EcoInventos: WeLASER, the laser system that wants to kill weeds surgically (in Spanish), January 4, 2022.
https://ecoinventos.com/welaser/?utm_source=dlvr.it&utm_medium=twitter
- Fresh Fruit Portal. Laser system to kill weeds with surgical precision, March 15, 2022.
<https://www.freshfruitportal.com/news/2022/03/15/laser-system-to-kill-weeds-with-surgical-precision/>

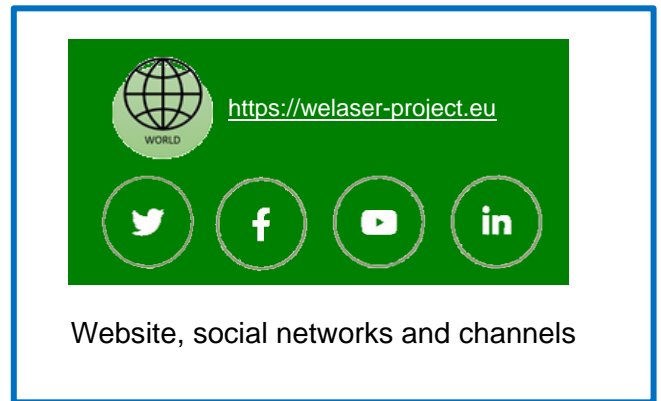
Dissemination in academia

Prof. Christian Andreasen (University of Copenhagen) presented and discussed the WeLASER project with 15 bachelor students in the Thematic course:

Plant Science at University of Copenhagen - Robotics in agriculture. 5440-B2-2E21;
Tema: Plantevidenskab. November 24, 2021.

Social networks

We invite you to be updated with the latest WeLASER activities and news: follow us in our website and social networks!”



Project Title:

Sustainable Weed Management in Agriculture with Laser-Based Autonomous Tools

Coordinator:

Spanish National Research Council (CSIC)

Duration:

36 months (October 1, 2020 to September 20, 2023)

Funding scheme:

EC H2020 programme – Innovation Action (Grant Agreement No. 101000256)

Project website:

<https://welaser-project.eu>

Social media and channels:



Consortium:

1. CSIC - Spanish National Research Council, Spain
2. FUT - Futonics Laser GmbH, Germany
3. LZH - Laser Zentrum Hannover e.V., Germany
4. UCPH - University of Copenhagen, Denmark
5. AGC - Agreenculture, France
6. COAG - Coordinator of Professional Agricultural Organisations, Spain
7. UNIBO - University of Bologna, Italy
8. IETU - Institute for Ecology of Industrial Areas, Poland
9. UGENT - University of Gent, Belgium
10. VDBP - Van den Borne Projecten BV, The Netherlands