

Sustainable Weed Management in Agriculture with Laser-Based Autonomous Tools



Sustainable agriculture and natural resources: WeLASER

Pablo GONZALEZ-DE-SANTOS

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- **Title**

- ☐ Sustainable weed management in agriculture with laser-based autonomous tools (WeLASER)

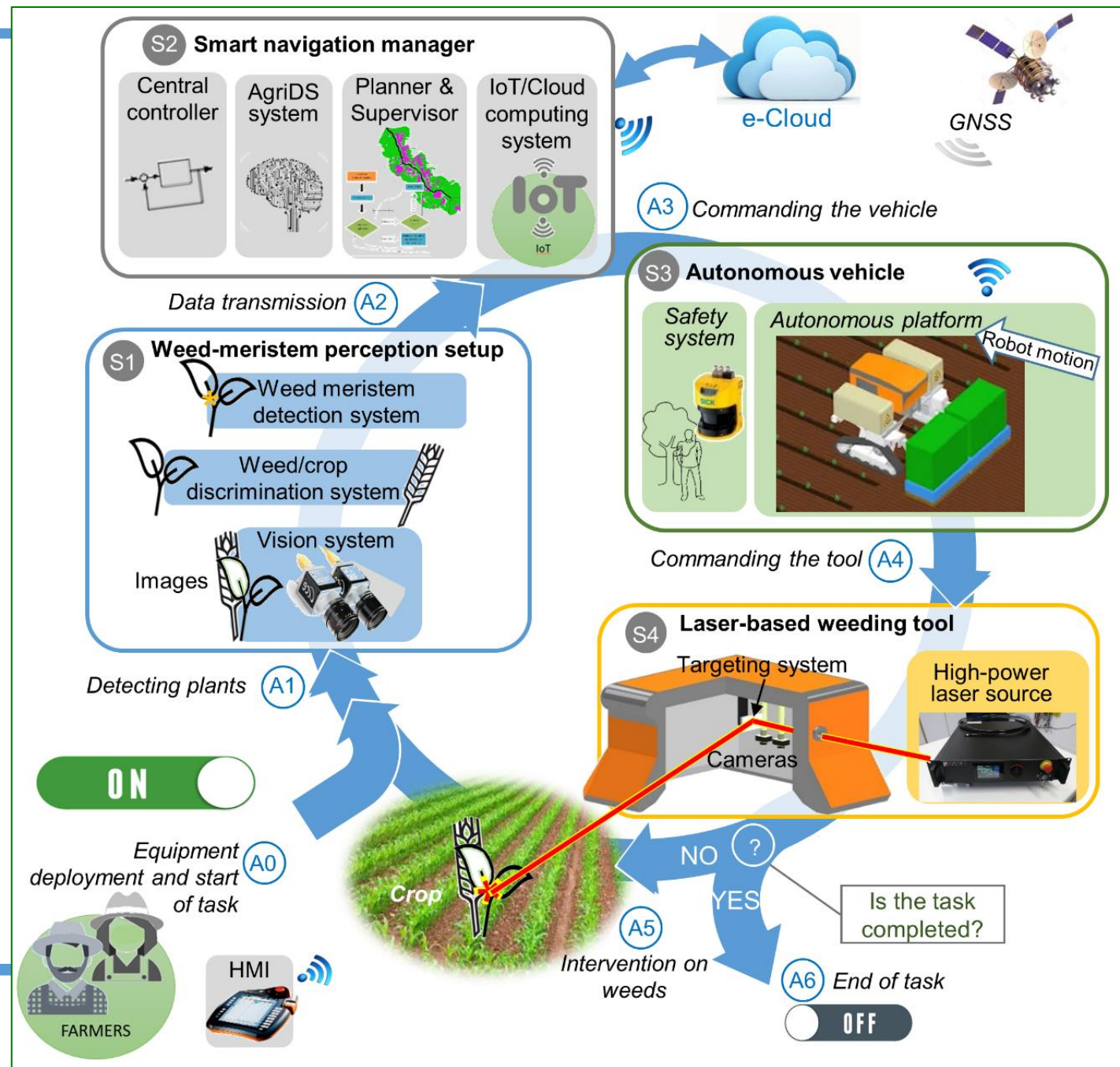
- **Call/Type**

- ☐ H2020-SFS-04-2019-020, “Integrated health approaches and alternatives to pesticide use” / Innovation Action (2020-2023)

- **Main aim**

- ☐ WeLASER aims to merge current technologies to build and push close to the market a precision weeding system based on irradiating the weed meristems with a high-power laser source with the main objective of eliminating the use of herbicides and their health and environmental adverse effects

System breakdown



- 1- Spanish National Research Council (CSIC)
- 2- Futonics (FUT)
- 3- Laser Zentrum Hannover (LZH)
- 4- University of Copenhagen (UCPH)
- 5- Agreenculture (AGC)
- 6- Coordinator of Farmer Organizations and Livestock Rural Initiative of Spain (COAG)
- 7- University of Bologna (UNIBO)
- 8- Institute for Ecology of Industrial Areas (IETU)
- 9- Ghent University (UGENT)
- 10- Van den Borne Projects (VDBP)

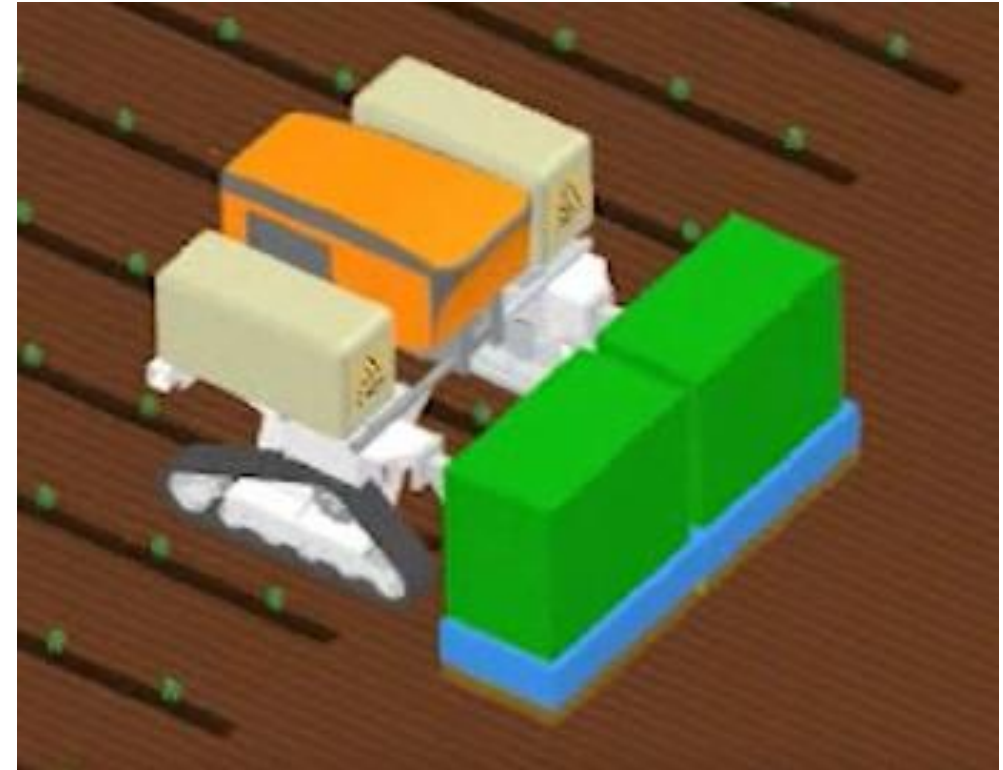


Technical characteristics

- ☐ Total weight: ~1243 Kg
- ☐ Treatment efficiency: ~65%
- ☐ Treatment speed: ~2 Km/h
- ☐ Treatment rate:
 - ❖ ~4.8 Ha/day – 1st phase
 - ❖ ~9.6 Ha/day – 2nd phase
- ☐ Position accuracy: ± 3 mm
- ☐ (2+2)-row wide
- ☐ Clearance: > 25 cm
- ☐ Treatment speed: ~ 2 Km/h

Strategies for system implementation

- ☐ Safety requirements
- ☐ Operational constraints
- ☐ Economical / business matters
- ☐ Legal issues



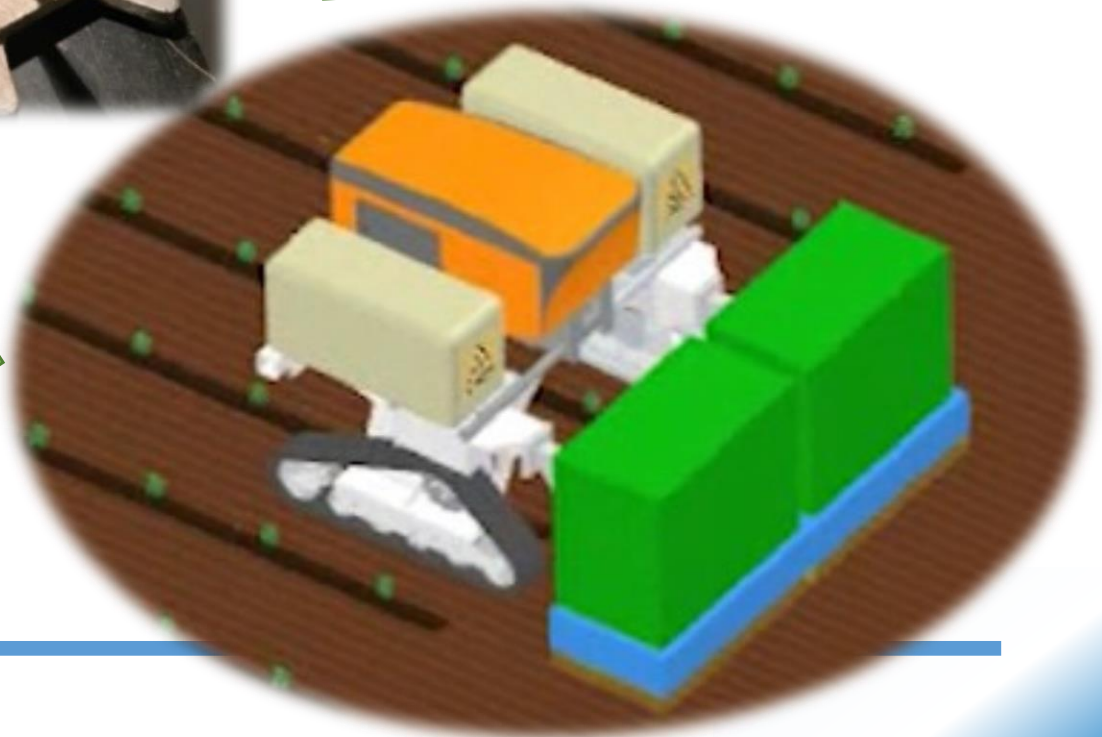


Futronics (February 2021)

Agreenculture (June 2021)



UCPH & LZH



Additional information: Practice Abstracts



Practice Abstracts

WELASER - PRACTICE ABSTRACTS

Practice Abstract 1

An efficient and profitable weeding system friendly with the environment and health -WeLASER project is on its way

English | Español

by CSIC

Practice Abstract 2

Stakeholders help defining the WeLASER system specifications

English | Español

by COAG/CSIC

Practice Abstract 3

Selecting target crops for laser weeding testing

English | Español

by UCPH

Practice Abstract 4

Selecting plants for the initial laser-weeding

English

by UCPH

Practice Abstract 5

Strategies for weeding with laser

English | Dansk

by UCPH

Practice Abstract 6

IoT in robotic systems for agriculture

English | Italiano

by UNI

Practice Abstract 7

Cloud Computing in robotic systems for agriculture

English | Italian

by UNIBO

Practice Abstract 8

Laser technology for weed management

English | Deutsch

by LZH

Practice Abstract 9

Weed management - safety requirements for laser outdoor usage

English | Deutsch

Practice Abstract N. 4
 Eco-innovative weeding with laser

Selecting plants for the initial laser-weeding test

Why Laser?

The fast development in laser technology seems to open up new opportunities for weed control based on electricity. Laser beams can deliver high-density energy on selected spots, which warm up the plant tissue and may result in plant death.

When to control weeds with a laser?

Laser weeding should be done early in the growing season when weeds only have developed a few leaves for monocots and 2-4 permanent leaves for dicots. The smaller the weeds are, the more sensitive they are to the laser treatment. However, if treatments are done too early in the growing season, some weeds may escape the treatments because they germinate later. In such cases, the treatment has to be done several times to reduce weed pressure significantly. Therefore, it is essential to decide the right time to control the weeds and that depends on factors such as the weed flora composition, crop type and the weather.

Common chickweed (*Stellaria media*) at three stages of development

The weed flora

In WeLASER, we study in detail how different types of weeds react to the laser treatment. We study the dose-response relationship by treating weeds with lasers with different energies in different time periods at different growth stages. We focus on common annual grass weeds, dicots and some perennial weed species (*Chenopodium album*, *Stellaria media*, *Poa annua*, *Alopecurus myosuroides*, *Viola arvensis*, *Sonchus arvensis*, *Cirsium arvense*), optimizing the control using as less energy as possible.

Authors: University of Copenhagen (UCPH)
Date: 25 January 2021

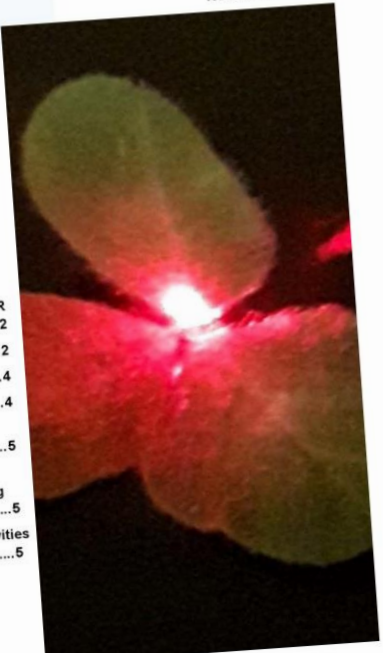
WeLASER Newsletter

Issue N. 1
March 2021

Contributing authors: CSIC, COAG, UNIBO, LZH

Inside this issue:

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Logos: CSIC, FUTONICS, LZH, UNIVERSITY OF COPENHAGEN, AGREENCULTURE, COAG, ALMA MATER STUDIUM UNIVERSITA DI BOLOGNA, IETU, GHENT UNIVERSITY, van den borre aardappelen

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Introducing WeLASER


What is it?
WeLASER is a new autonomous intervention system that will destroy weeds using high-power laser technology. This intervention tool will consist of a high-power laser source and a laser targeting device in charge of applying a laser dose on the weed meristems that impairs the



Main characteristics

- Dimensions: 2.4 x 2.1 x 1.65 m
- Weight: 0.25 m
- Capacity: ~1243 Kg
- Working distance: from 1.26 m to 2.40 m
- Intervention efficiency: > 65%
- Intervention speed: ~2 Km/h
- Intervention rate: ~9.6 Ha/day – With the adequate tool

Milestone 1
The consortium met together in a General Assembly on December 17th, 2020, to review the characteristics and crops for final tests. The meeting was modified according to the suggestions received during the ER Stakeholder Event. The consortium agreed on a few changes on the characteristics and crops for final tests. The meeting is essential for the project and the sub-system design and to be started. With this decision, the consortium achieved project milestone 1 and



Sugar beet


Target crops

6-month project

1.5 M€ total funding
9 M€ EC funding
Partners from 8 EU countries

Project start
The project officially started on October 1st, 2020, and ended on September 30th, 2023. The project meeting was held virtually on 20, bringing together the partner


Partners:
Danish National Research Institute of Food and Veterinary Research, Futonics Laser GmbH, Germany, Fraunhofer ILT, Zentrum Hannover e.V., University of Copenhagen, AgreenCulture, France, Coordinator of Professional Agricultural Organisations, Spain, University of Bologna, Italy, Institute for Ecology of Industrial and Agricultural Systems, University of Gent, Belgium, In den Borne Projecten BV, Netherlands



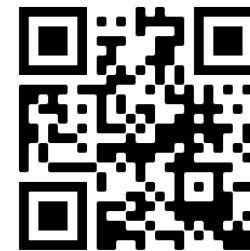
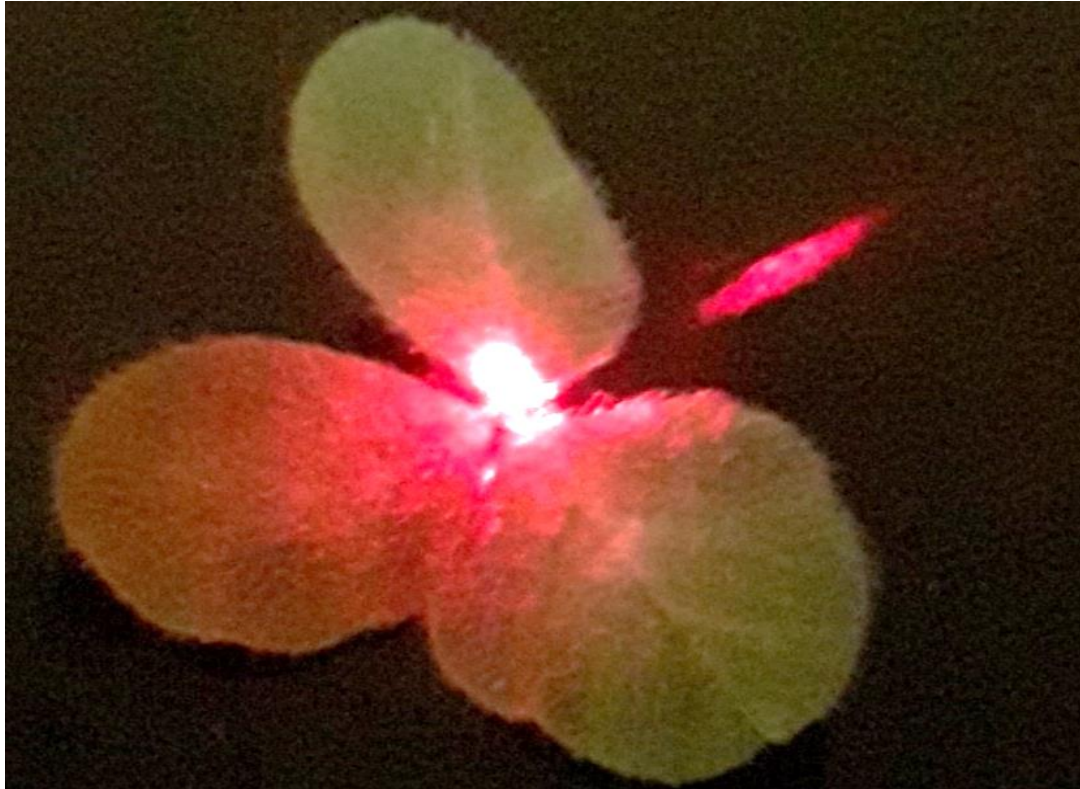
Communication and dissemination activities

During the first semester of project development, the consortium has been very active in communicating the project activities. Nine practice abstracts have been published at the AGRI-EIP website and WeLASER website illustrating different aspects of the different subsystems and the activities carried out. Moreover, some press releases have been issued in Germany, recently, and Spain. In Spain only, the press releases had impact on the following publications: [CAMPO GALEGO](#), [INTEREMPRESAS](#), [AGROINFORMACIÓN](#), [AGRODIGITAL](#), [CAMPO DE CASTILLA Y LEÓN](#), [AGROBANK](#), [CAMPO CASTILLA Y LEÓN](#), [AGROCLM](#), [INNOVAGRI](#), [DIARIO DE ÁVILA](#), [LA TRIBUNA DE TOLEDO](#), [LA TRIBUNA DE ECONOMISTA](#), [ALBACETE](#), [DIARIO PALENTINO](#), [EL](#)

Dissemination of preliminary project results in academia have been achieved through the following scientific articles:
Ildar Rakhmatulin, Christian Andreasen, "A Concept of a Compact and Inexpensive Device for Controlling Weeds with Laser Beams", *AGRONOMY* Vol 10, No. 10, 2020.
Giuliano Vitali, Matteo Francia, Matteo Goffarelli, Maurizio Canavari, "Crop Management with the IoT: An Interdisciplinary Survey", *AGRONOMY* Vol 11, No. 1, 2021.



Laser device
tested on plants using different focal diameters and power densities.



www.welaser-project.eu



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