

Is WeLASER using the correct laser technology?

Main technologies

Two main laser technologies are under study for weed management: CO₂ and fiber lasers. The CO₂ laser is a gas laser that works at a principal wavelength band centered at 10.6 μm. In a fiber laser, the active gain medium is an optical fiber doped with rare-earth elements such as thulium, which typically emits in the range from 1.9 μm to 2.1 μm.

Advantages and shortcomings

For both laser types, the light energy is absorbed from the water in the plant leading to lethal damage. CO₂ lasers provide the highest density of energy deposition due to the direct surface absorption on the plant. However, their handling comfort is low, as the radiation must be guided from the source to the working head using mirrors, which are complex and time-consuming to align.

Fiber lasers emitting at 2 μm wavelength are much more suitable to eradicate weeds, as the radiation is not solely absorbed on the surface of the plant but permeates through the epidermis and destroys the plant's meristem. Due to the shorter wavelength and the lower absorption of the 2 μm radiation in the atmosphere, fiber lasers achieve a much better beam quality enabling much better beam forming and smaller spot sizes. In addition, fiber laser radiation can be guided through flexible optical waveguides, avoiding the disadvantages resulting from mirror misalignment due to vibrations or mechanical shocks.



Weeds treated with lethal dose of 2 μm laser radiation

Proposed solution

WeLASER will develop a 500 W highly efficient 2 μm fiber laser source. By reducing the number of splice joints in the laser system an excellent beam quality and a robust laser operation will be realized. Additionally, the new system will avoid the use of mirrors making the system more robust, lighter, more efficient, and cheaper than conventional CO₂ systems.

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