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Objectives

The application ranges of laser techniques are miscellaneous. Basic trials should investigate the applicability of lasers as a method of direct and selective plant treatment for growth depression (weed control).

Material und Methods

- Used plants:
- *Nicotiana tabacum* (dicotyledonous)
 - *Echinochloa crus-galli* (monocotyled.)
 - 3 growth stages (see figure 3 and 4)

- Used systems:
- diode laser system
 - carbon dioxide laser system
 - optimal laser set ups and modulations were established (see figure 1)

- Treatment:
- a laser spot directed to the centre of the plants (four replicates)
 - biomass measurement of treated and control plants one week after treatment

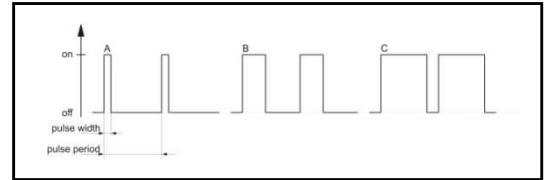


Fig. 1: different types of carbon dioxide laser modulation, from A to C: rising average output power

Results

	carbon dioxide laser	diode laser
system	Rofin ScX 20	Laserline LDF 600-250
maximal output power (W)	500	250
wavelength (nm)	10600	940
mode	quasi-continuous wave	continuous wave
pulse period (µs)	3000	-
pulse width (µs)	0 - 70	-
output power (W)	0 - 47	0 - 225
radiation time (s)	1	2
focal length (mm)	190.5	193.5
focal spot diameter (mm)	6	6
focal spot area (mm ²)	28.3	28.3
beam shape	weakly waisted	weakly waisted

Fig. 2: determined parameter settings for the laser treatments

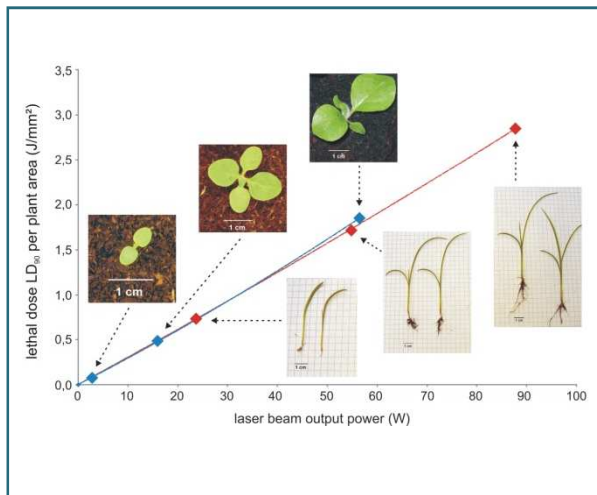


Fig. 3: carbon dioxide laser application and resulted relationship between lethal doses and output power

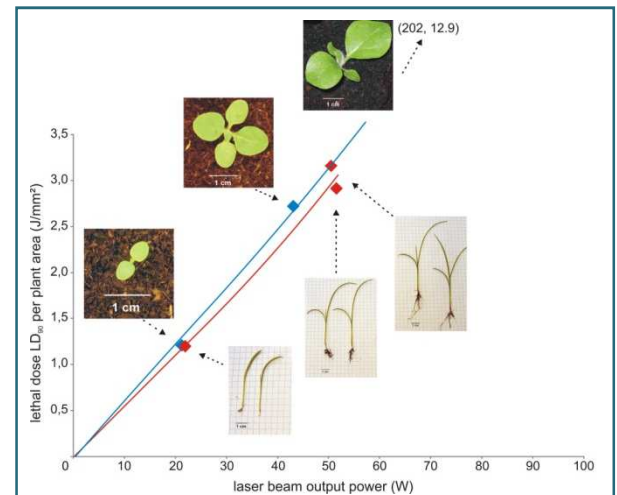


Fig. 4: diode laser application and resulted relationship between lethal doses and output power

Conclusions

- ▶ both systems can work with economical energy doses to delay and stop the plant growth
- ▶ the established data can be used for ongoing calculations and assessments
- ▶ treatment is only possible until the true-two-leaves stage of growing is reached
- ▶ automation of focusing and optimization of beam guidance should be developed