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## Application of NIR-lasers for the control of aphids and whiteflies

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### 1. Introduction, Knowledge, Objectives

Insecticides are often used for pest control in horticultural crops. Increasing concerns about potential residues on the produce, contamination of non-target areas, and the rising problems with respect to resistance demand new strategies. Alternative methods for pest control focus on biological methods (Schmutterer & Huber 2005, van Lenteren 2012) or biotechnical measures (Welter et al. 2005, Kumar & Poehling 2006, Diaz & Fereres 2007). The main advantage of these methods is an increase of the selectivity leading to a reduced impact on non-target insects and the environment. The approach of using lasers to directly damage treated pests is even more selective. Conconi (1983) investigated laser-based pest control of beetle species in stored foods (laser wavelengths: 488 nm and 632.8 nm, total applied energy: 3 to 480 J). Shulman (1990) discussed the control of swarms of locusts in general. Yao et al. (2008, 2009) used a laser (808 nm, 2 to 6 J) to kill up to 80 % of *Locusta migratoria* in different growth stages, while the host plants (green bristle grass, *Setaria viridis*) remained rather unharmed. Zhang (1997) and Ren et al. (2006) used the effect of laser irradiation (632.8 nm, 4 J; and 650 nm, 4 to 30 J respectively) for the control of fruit flies (*Drosophila melanogaster*). The objective of this study was to analyze the spectral characteristics of aphids and whiteflies in order to examine the suitability of high power NIR laser systems for lethally damaging pests while sparing the host plants at short irradiation times.

### 2. Material and Methods

#### 2.1 Pests and host plants

The host plants (Brussels sprout, common wheat, and common bean) were grown in greenhouse at 18/10 °C and were infected with small pest colonies (7 aphids per cage), which were derived from stock cultures. After a growth period of four weeks the pest densities reached high levels. The cabbage aphid (*Brevicoryne brassicae*), the black bean aphid (*Aphis fabae*), and grain aphids (*Sitobion avenae*) settled in all developmental stages from L1 larvae to adults (which were mostly wingless morphs) on Brussels sprout (*Brassica oleracea* var. *gemmifera*), common bean (*Phaseolus vulgaris*), or wheat plants (*Triticum aestivum* L.), respectively. For the cabbage whitefly (*Aleyrodes proletella*), only the winged adults were considered for treatments. However, the developmental stages of the pests were not differentiated in the laser irradiation tests.







