



# Herbicidal activity of oil extracted from Sicilian lemon industry.

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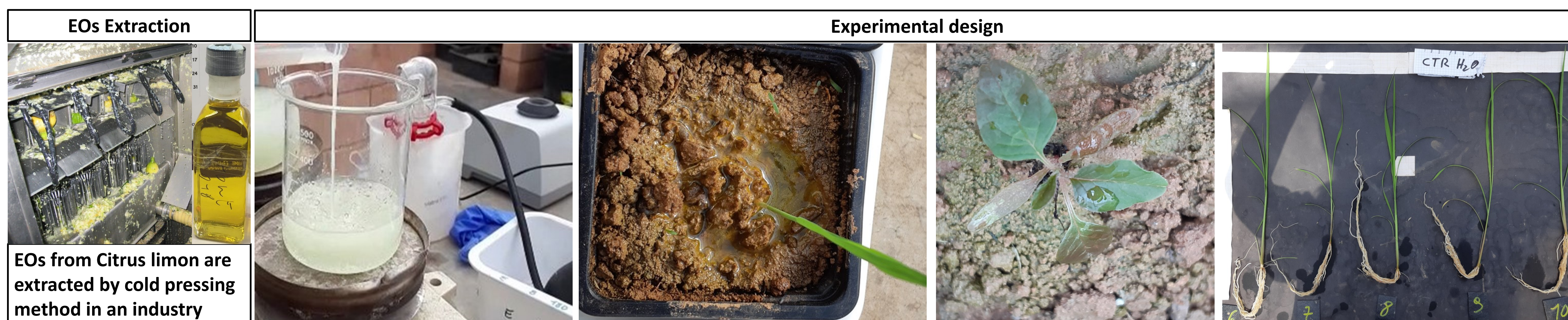
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**Introduction** Weed management is a significant challenge faced for crop yield and quality since they compete for water, light, soil nutrients and space. Weed species (*Amaranthus retroflexus*, *Portulaca oleracea*, *Echinochloa crus-galli*, *Avena fatua*) are among the ten worst annual weeds of the temperate agricultural regions of the world. They could reduce annual crops yield by up to 70%. The main features of these species include high fertility and competitiveness, great seed production and capacity for seed dispersal, and elevated growth-rates. It is important to control its interference but also preventing environmental pollution and health hazards for overuse of pesticides. So the best approach is by integrated weed management. Essential oils (EOs) are natural plant products, biodegradable. Some of them are classified as Generally Recognized As Safe (GRAS) for ingestion by the U.S. Food and Drug Administration's (FDA).

**Objectives** To test the phytotoxic potential of the industrial oil extracted from lemon for the management and control of weed.

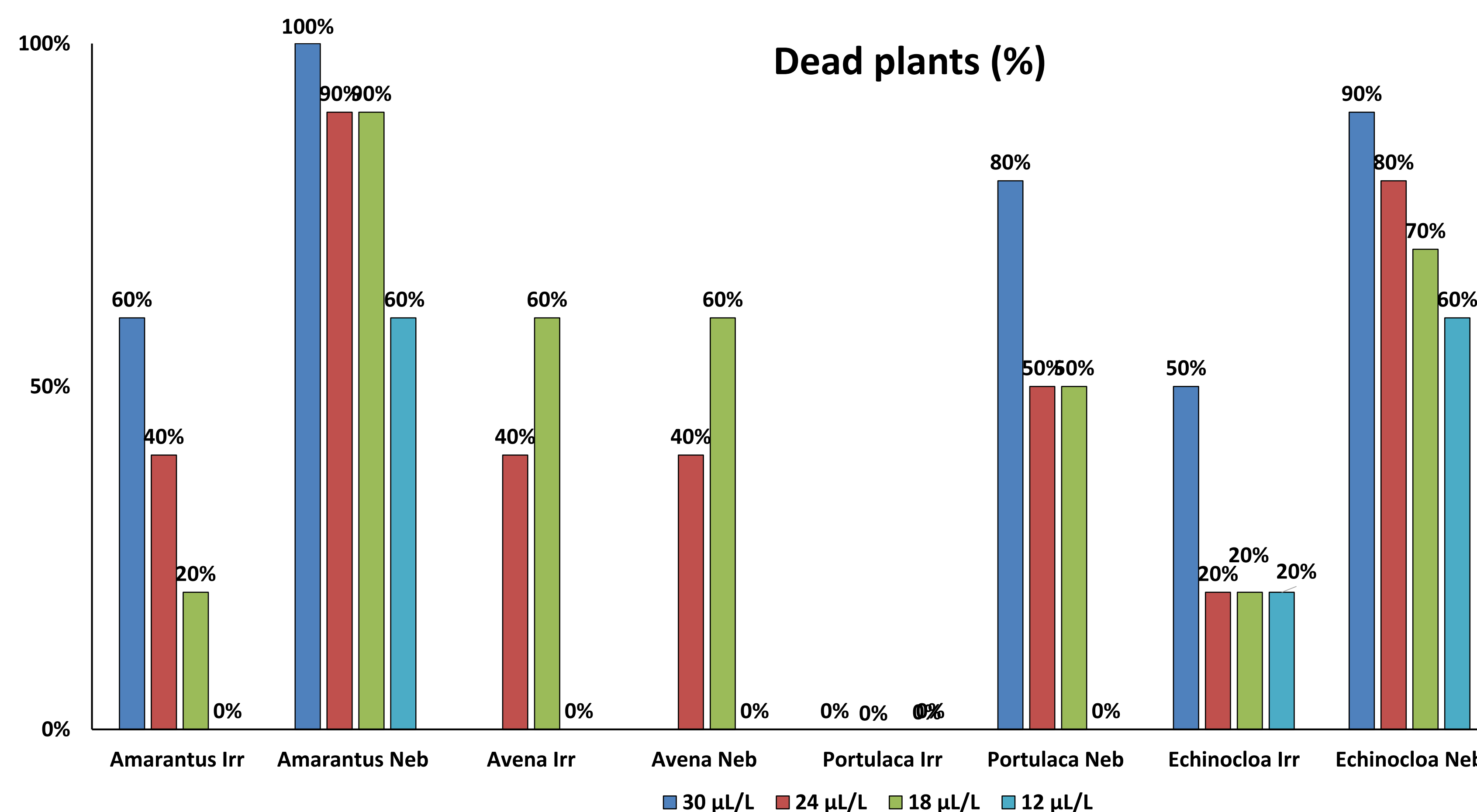
## Materials and Methods



The experiments were performed in vivo applying oil in postemergence, irrigated and sprayed. Soil for the experiments was collected from the topsoil (<5cm) in a citrus field non treated with herbicides, then was air-dried and sieved at 1 cm. Weed seeds were purchased from Herbiseed (England), and germinated in a germination-growth chamber during June and July 2018, at 30 ± 0.1 °C, 14 h in light and 20 ± 0.1 °C, 10 h in dark for summer weeds and at 18 ± 0.1°C, 16h in dark and 23 ± 0.1 °C 8h in light for *A. fatua*. Once the seedlings emerged, they were placed in pots (8x8x7 cm) previously filled with 2 cm of perlite and 5 cm of soil. Ten replicates per treatment were prepared. Pots were placed in the greenhouse of the UPV. In order to find the most effective dose of oil and its adequate mode of application, different concentrations were used: 12, 18, 24, 30 µL/mL. Fitoil was used as emulsifier a concentration of 0.05% (v/v). Plants of *A. fatua* and *E. crus-galli* were treated at two-leaf stage, plants of *A. retroflexus* and *P. oleracea* were treated at five leaf stage, all were treated using two methods: irrigating and spraying.

**Plant analysis** To monitor the experiments, photos were taken after 24, 48 and 72 hours; and then once a week. The photos were processed with Digimizer software to take different data: efficacy of the treatment, level of damage, height of plants. Moreover, after one month from the treatment the plants were uprooted and the fresh and dry weight and the length of the plants (aerial parts and roots) were carried out.

## Results and discussion



All treatments were active inhibiting weed development in all species except in the case of *P. oleracea* treated by irrigation, where no significant differences were observed in the treated plants compared with the control. In this treatments no plants died.

Moreover, as can be observed in the graph, but also in the photos above, the application by nebulization with equal doses was more effective than the irrigation method. This affirmation was also reinforced by the fact that plants at lower doses even if they did not die were smaller than those irrigated at the same doses. For all species, the increase of the dose reduces the size of the plant, with the exception of the *P. oleracea* plants irrigated. This statement was not valid for the total number of dead plants. In all cases the optimum and most effective dose was the highest, 30 µL/mL

**Conclusion:** Lemon EO showed phytotoxic activity against some important weeds: *Amaranthus retroflexus*, *Portulaca oleracea*, *Echinochloa crus-galli* and *Avena fatua* and could be used for the development of natural herbicides. More studies are needed to better understand its herbicidal activity and to determine the adequate doses, moment of application and mode of action. With this study we can state that the nebulized application method at 30 µL/mL dose could be a good starting point for field applications.