



Sustainable weed control through fatty acids as bioherbicide: A study on photosynthesis inhibition and seed germination



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Hypothesis

The herbicidal effect of caprylic acid (CA), a medium-chain fatty acid containing eight carbon atoms, is more pronounced than that of pelargonic acid (PA), which has nine carbon atoms. Additionally, these fatty acids can suppress seed germination.

Objectives

1. Examination of the suppressive effects of fatty acids on tomato seed germination.
2. Assessing the comparative toxicity of CA and PA to plants by evaluating photosynthetic efficiency (ETR) in green beans.
3. Enhancing the herbicidal properties of fatty acids by combining them with linseed oil compounds.

Conclusions

1. As a contact foliar herbicide, CA exhibits more severe phytotoxicity than PA.
2. No notable effects were observed when PA was combined with linseed oil compounds. However, for CA, LO acts as a mitigating agent, whereas LOE enhances its effects when used as an additive.
3. CA, PA, and their mixtures with LO compounds can be used as agents to suppress seed germination and impede root and seedling growth.

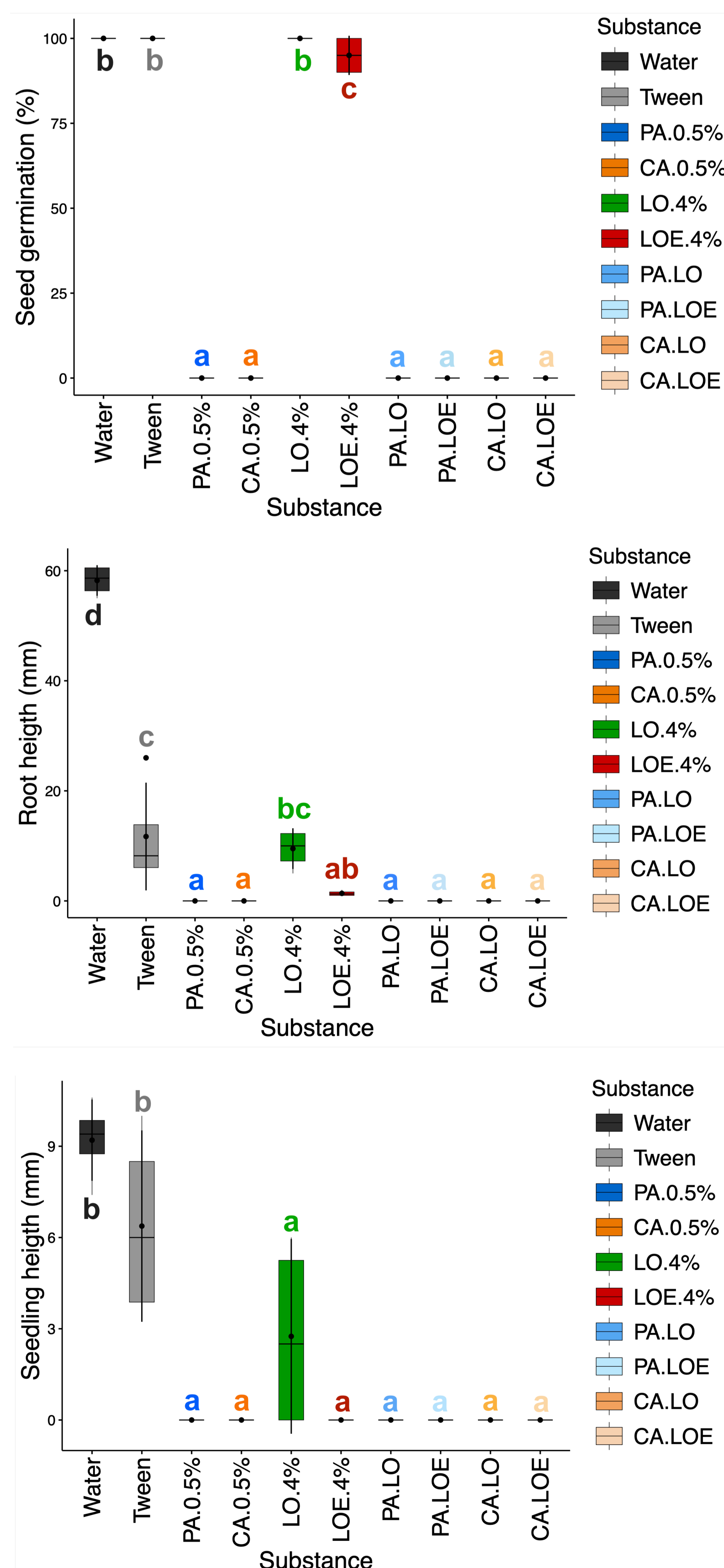
Materials & Methods

-Tomato seeds, produced at INRES-Bonn University, were soaked in petri dishes containing a 5 ml substance for 7 days.

-Primary leaves of bean plants were treated with PA and CA at a concentration of 1% and LO and LOE at a concentration of 4%. The phytotoxic effects in the form of leaf damage were assessed using chlorophyll fluorescence analysis.

-Analysis of variance (ANOVA/Games-Howell) was used to compare means of treatments, and a Tukey HSD test was used to determine homogeneous subgroups at a p-value of $p \leq 0.05$.

Results



Results

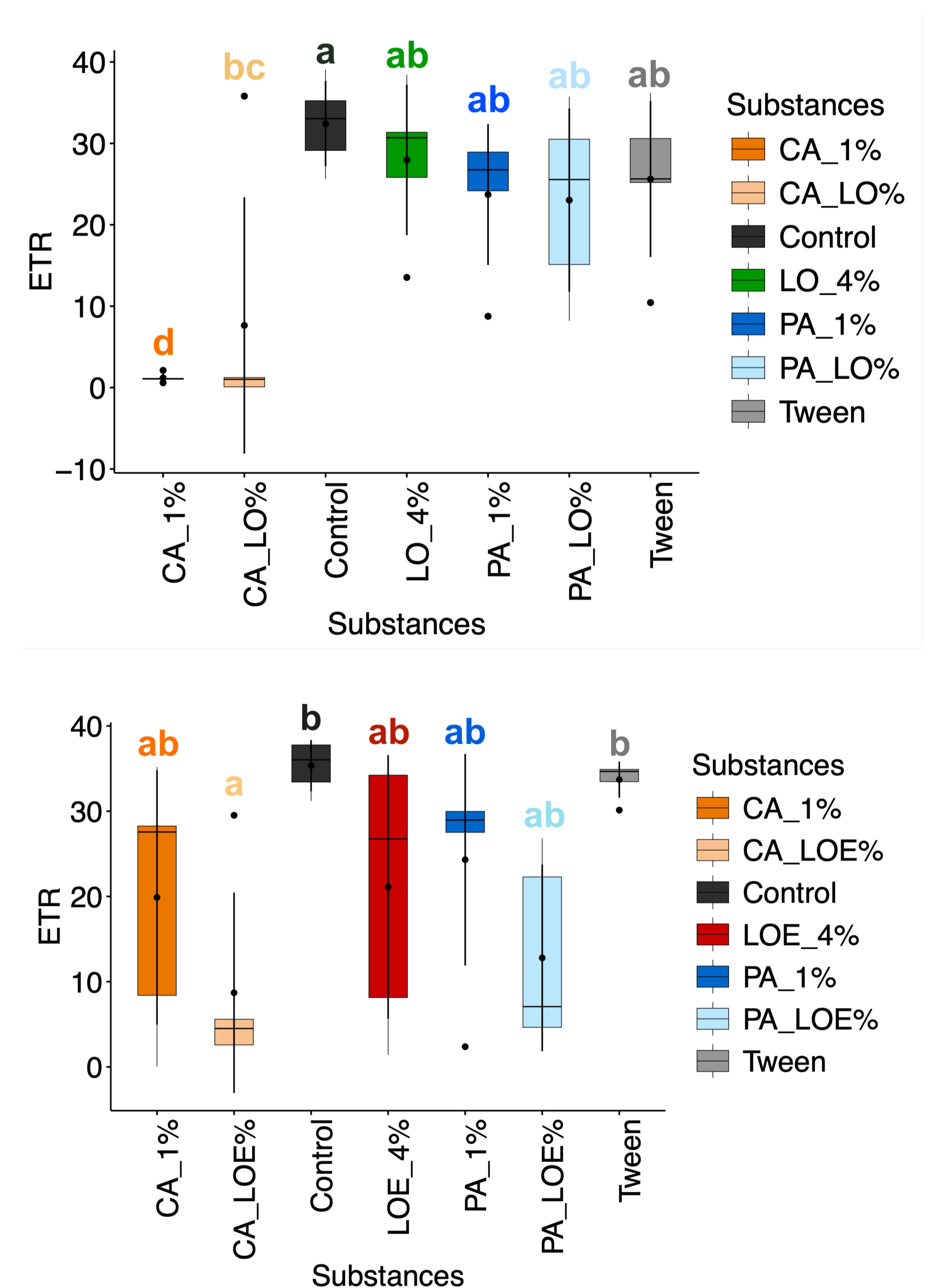


Figure 1. Germination of tomato seeds and ETR values (Electron Transport Rate ($\mu\text{mol e}^-/\text{m}^2/\text{s}$)) of green bean plants depending on treatment, (A) Effect of fatty acids, linseed oil, and linseed oil + enhancer on Seed germination(%), (B) on root height(mm), (C) on seedling height(mm), (D) Combinations of fatty acids and linseed oil, (E) Combinations of fatty acids and linseed oil plus enhancer applied on green beans.

Figure 2. Application of Caprylic acid, Pelargonic acid, Linseed oil, and linseed oil + enhancer on tomato seeds



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