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Fatty acids as sustainable biorationals for weed control

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Abstract

As the global population continues to grow, food production must increase sustainably. This requires enhancing crop yields while reducing the environmental impact of agricultural practices. Weeds are a significant biotic constraint to food production as they compete with crops, reducing agricultural output and increasing external costs. Synthetic herbicides have been the primary method for weed control, but their harmful environmental effects require finding sustainable alternatives. Fatty acid compounds, derived primarily from glyceridic plant oils, are one such alternative. These natural products offer low ecotoxicological side effects and high biodegradability, making them a promising alternative to synthetic herbicides. Pelargonic acid is one fatty acid which is already on the market. This study aimed to evaluate the herbicidal efficacy of an oil-in-water-emulsion preparation containing various fatty acid compounds separately and in mixtures. The greenhouse experiments were conducted on green beans, which are sensitive to herbicides, to determine the phytotoxic potential of the compounds. The results showed that pelargonic acid had high phytotoxic effects on green beans at the level of 1% and more, while caprylic acid was an effective post-emergence herbicide even at low concentrations of 0.5%. Even at the lowest concentration of 0.1%, both compounds exhibited signs of damage, and as the concentration increased, death occurred. Linseed oil (containing linolenic acid as the main fatty acid) also showed potential to exert different levels of phytotoxicity but not as strong as other compounds. The effect strongly depends on the type of fatty acid (chain length). From the experiments it could be shown that the effects of the treatments were dose-dependent, with higher concentrations leading to greater levels of damage and eventual death. Overall, the study's findings highlight the potential of fatty acid compounds as biorational post-emergence herbicides in sustainable weed management strategies. Incorporating these natural products into integrated weed management programmes could contribute to producing crops subjected to less stress in a sustainable manner, promoting sustainable food production to meet the demands of the growing population.

Keywords: Integrated weed management, sustainable agriculture