

VOLATILE ETHANOL AFFECTS GERMINATION AND GROWTH OF LETTUCE, RADISH, SOYBEAN AND WHEAT SEEDS

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ABSTRACT

Volatile organic compounds (VOCs) are important indoor air pollutants, mainly in spaces lacking adequate ventilation and containing off gassing materials and are particularly acute in closed environments, such as spacecraft. The objective of this research is to determine the effects ethanol (EtOH) on the growth and development of various salad crops that have been previously evaluated for their potential for growth and cultivation on extended space missions.

Seeds of *Lactuca sativa* L. cv. Red Romaine; *Glycine max* (L.) Merr cv. Hoyt, and *Triticum aestivum* L. cv. USU Apogee were exposed to 0, 50, 100, 250 and 500 ppm EtOH for 5 to 7 days in VOC exposure chambers and germination, shoot length measured, and threshold limits (T₁₀, T₅₀, and T₉₀) determined. Seeds of six radish cultivars (*Raphanus sativus* L. cv. Cherriette, Cherry Bomb, Reggae, Sora, Sparkler White, and White Globe) were also exposed to EtOH for 5 days to determine threshold values.

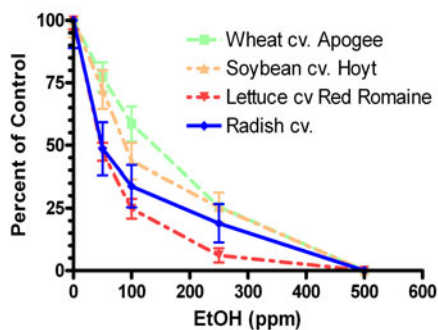


Figure 1: Effect of volatile ethanol concentration of total length of emerging shoots from wheat, soybean, and lettuce and radish seed.

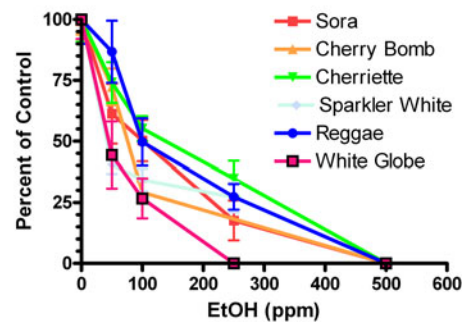


Figure 2: Effect of volatile ethanol concentration on total length of emerging shoots from seeds of six radish cultivars.

Differences in tolerance to EtOH between species was observed with lettuce <radish <soybean <wheat (Fig 1). Similarly, differences in radish cultivar sensitivity was observed with Cherry Bomb <Cherriette <Reggae <Sora <White Globe <Sparkler White (Fig 2).

All species and cultivars showed phytotoxic effects at concentrations <5% (50 ppm) of accepted exposure limit of 1000 ppm established by NASA, OSHA and ACGIH for humans. Concentrations less than 50% (500 ppm) of the EtOH exposure limit were lethal to emerging seedlings in all cases. Seed germination was completely inhibited at 500 ppm EtOH for all species and cultivars. These findings highlight the need to develop specific VOC guidelines for plant growth facilities including controlled environment agriculture conditions where VOC accumulation can occur.

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