Effects of plant density and the number of emitters on plant growth and nitrate concentration in spinach cultivated in substrate

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Abstract

The effects of plant density and the number of emitters per Styrofoam box on plant growth and nitrate (NO_3^-) concentration were evaluated in spinach (*Spinacia oleracea* L. cv. Tapir). Spinach seedlings were transplanted at 45 days after emergence into Styrofoam boxes filled with the substrate and were grown during winter in an unheated greenhouse with no supplemental lighting. The experiment was carried out with four treatments, including two plant densities (160 and 280 plants/m^2) and two number of emitters per Styrofoam box (4 and 8 emitters). Each planting box was irrigated daily and fertigated with a complete nutrient solution. Shoot dry weight was not affected by plant density. However, yield increased with plant density and emitter number. Leaf-blade NO_3^- concentration was not affected by the interaction between plant density and number of emitters, but petioles NO_3^- concentration was greater in treatment with 160 plants/m^2 and 8 emitters. Although leaf-blade NO_3^- concentration was not affected by plant density, it decreased

with the number of emitters. On the other hand, petiole NO_3^- concentration was not affected by plant density or number of emitters. Leaf-blade NO_3^- concentration ranged from 3.2 to 4.1 mg/g fresh weight, occurring the highest value in the treatment with 280 plants/m^2 and 4 emitters. Petiole NO_3^- concentration ranged from 3.5 to 5.3 mg/g fresh weight, values that were higher than allowed by EU regulation.

Key words: *Spinacia oleracea*; soilless culture systems; nutrient solution volume