II Convegno Nazionale
di Orticoltura e Floricoltura
Padova – 19-21 giugno 2024

Induction of growth inhibition in recycled hydroponics of basil

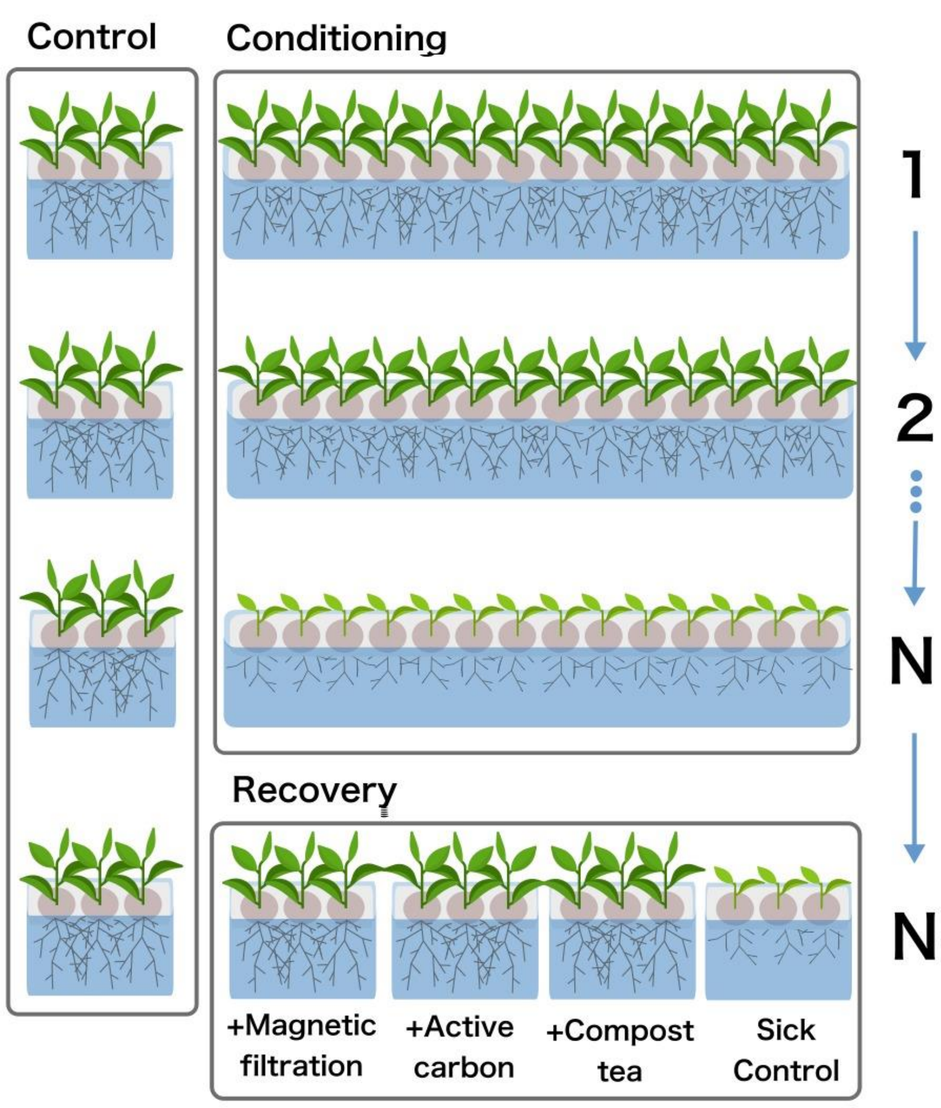
Andrea De Sio[1*], Mauro Moreno[1], Giuliano Bonanomi[1], Stefano Mazzoleni[1], Stefania Cozzolino[1], Giovanna Ceriello[1], Chiara Cirillo[1], Fabrizio Cartenì[1]

[1]Università degli Studi di Napoli Federico II – Dipartimento di Agraria – Piazza Carlo di Borbone 1, 80055 Portici (NA)

INTRODUCTION

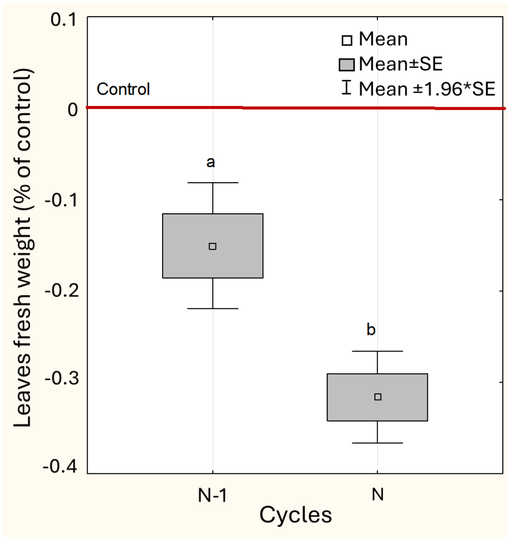
Hydroponic systems are used to achieve time-stable high-end yield and to avoid soil-borne diseases and climate limitations. Recycled hydroponics make cultivation cost-effective and environmental-friendly, but over time yield-decline is usually observed. Mazzoleni et al. [1] have demonstrated the inhibitory effect of self-DNA on growth of several plant species linking this phenomenon to soil-sickness. Here we aim the effect of repeated cycles on basil growth, yield and quality.

MATERIALS AND METHODS



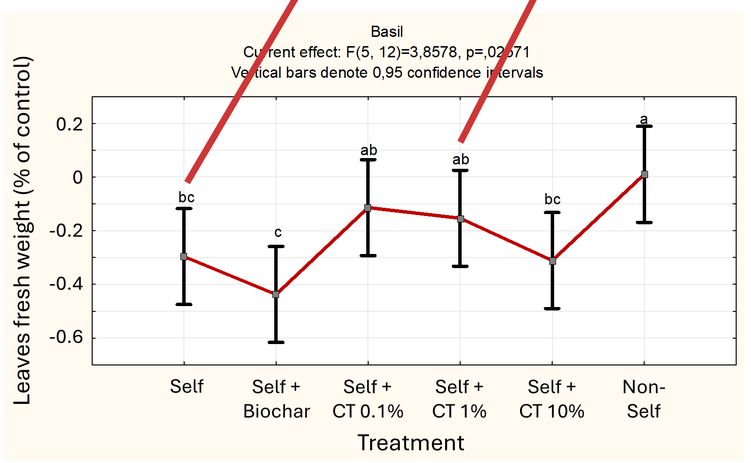
A closed floating system was designed to host basil plants (*Ocimum basilicum* var. *Eleonora*), with an air pump for oxygenation and no water-filters. Five consecutive 30-days growth cycles were carried on. A modified Hoagland nutrient solution was used and rebalanced between cycles to avoid nutrient-related growth decline. Number of plants, pH, and EC were analysed weekly, whereas fresh and dry weights of both roots and leaves were assessed at the end of each cycle. At the same time, the same amount of repeated growth cycles with chives (*Allium schoenoprasum* var. *Naomy*) were performed. A further growth cycle to test the hypothesis and possible recovery methods is underway.

RESULTS (CONDITIONING PHASE)



Basil growth decline was evident after three cycles. Plants grown under recycled hydroponics showed lower fresh and dry weights of both leaves and roots, and generally poorer health conditions compared to control.

RESULTS (ONGOING RECOVERY PHASE)



We performed a further growth cycle (N+1) to test "water-sickness" recovery methods. Basil plant were grown on recycled nutrient solutions of basil ("Self") and chives ("Non-Self"). Self nutrient solutions were also treated with different diluitions of commercial compost-tea(CT), biochar.

Non-Self treatment was compared to control, while Self treated plants were on average 30% smaller. CT treatments at lower concentrations reduced water-sickness.

CONCLUSIONS

Several authors (e.g. [2], [3]) reported a declining trend in the growth of various horticultural crops in closed hydroponics systems after consecutive cuts or long cycles. Different hypotheses have been made explaining this phenomenon and solutions proposed. Mazzoleni et al. [1] demonstrated that extracellular self-DNA causes species-specific roots growth inhibition which may be the cause behind soil sickness in agriculture. Here we confirmed the species-specificity of this phenomenon also in hydroponics and tested different recovery methods. Cross growth on recycled solution of other species fully removes the problem while compost tea has mitigation effect.

References

[1] *Mazzoleni S. et al*. Inhibitory effects of extracellular self-DNA: a general biological process? New Phytol. 2015 Apr;206(1):127-132.
[2] *Mondal, M.F et al.* 2013. Recovery from autotoxicity in strawberry by supplementation of amino acids. Sci. Hortic. 164,137–144-
[3] *Modarelli, G.C. et al.* Hydroponic and Aquaponic Floating Raft Systems Elicit Differential Growth and Quality Responses to Consecutive cuts of Basil Crop. Plants 2023, 12, 1355

Italian Society for Horticultural Science