Changes in nitrogen agricultural practices to increase farm sustainability - tomato production

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INTRODUCTION

Nitrogen (N) is a key indispensable nutrient for all living organisms including humans. For over one century, synthetic fertilizers and agriculture intensification allowed to feed the world population, but this came with high environmental costs. N is the element with the most altered cycle and constitutes the most pressing environmental issue faced today, making it the most important emerging environmental concern. Nitrogen use efficiency is the solution to improve soil, water and air quality while avoiding increased costs to the farmers. Tomato is one of the most consumed crops worldwide and requires high amounts of N inputs to achieve high yields. The need for new agricultural practices to reduce N inputs and promote N losses mitigation urges.

METHODOLOGY

One field experiment was set up to increase N use efficiency and decrease processing tomato production N footprint. Two treatments were applied: with and without *mycorrhizae* (Bowles *et al.,* 2016; Bona *et al.,* 2018). Conventional N fertilization practice in the farm served as control (N100 – 60 kg N/ha) and two other doses of N inputs were tested (N0 – 0 kg N/ha and N50 – 30 kg N/ha) in both treatments, on the same tomato variety (H1886). A *mycorrhization* protocol was designed and validated for tomato plants. Several soil, plants and fruits samples were collected for chemical analysis and N monitoring along the growing cycle. At harvest, tomatoes from each treatment and N dose were collected, quantified and weighted to determine productivity. Fruit samples were analyzed for quality validation.

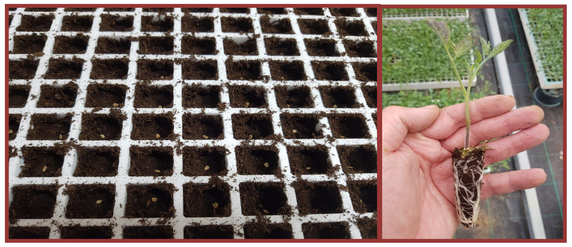

Fig 1. Seedling and germination of tomato plants

Fig 2. Tomato experimental plot

CONCLUSIONS

- Crop production yield and fruit quality were affected by treatments (with vs without *mycorrhizae)*
- Tomato production (t/ha) was not affected by the N doses applied in each treatment
- *Mycorrhizae* promote the growth of tomato plants and presents an alternative for the use of higher doses of mineral N fertilizer inputs
- This agriculture practice reduces the nitrogen footprint of tomato production

RESULTS

Experiments with *mycorrhizae* showed significant differences in mineral [N] in the soil, [N] in leaves and total number of fruits per plant for all N doses tested. Treatments with *mycorrhizae* showed a significant increase in the N uptake for the smaller N dose applied, even bigger than the treatment N50 without the fungi. Treatment N0 with *mycorrhizae* and treatment N100 without *mycorrhizae* had the same average yield (t/ha). *Mycorrhizae* promoted an increase in the content of soluble solids (Brix) regarding fruit quality.

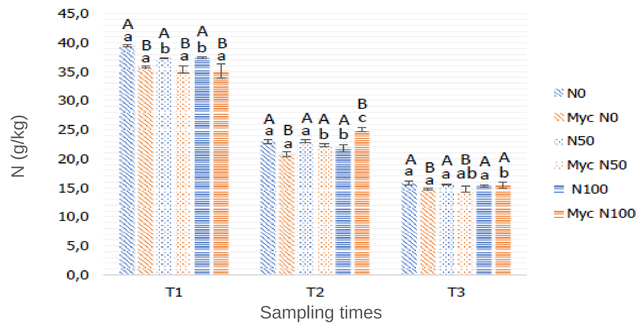

Fig 3. Mineral N content (mg/kg) in soil along the experiment

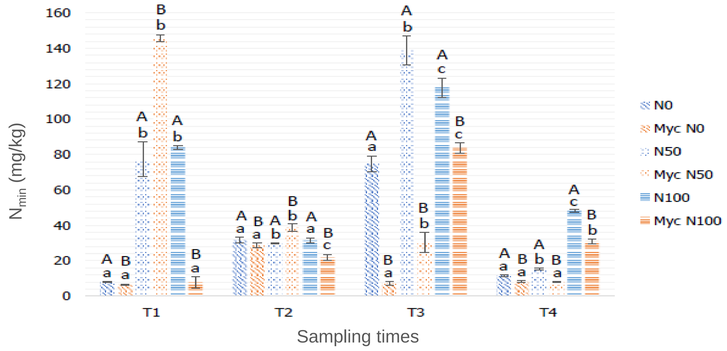

Fig 4. Total N content (g/kg) in plant leaves along the experiment

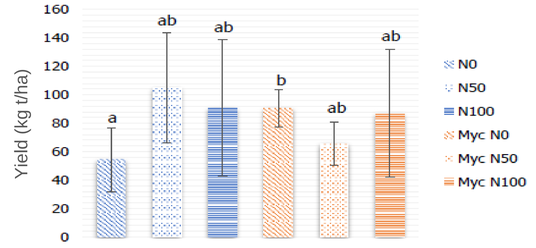

Fig 5. N uptake by plants and fruits (kg/ha)

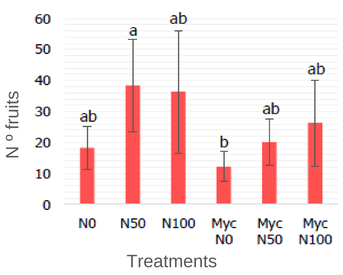

Fig 6. Total nº fruits/plant at harvesting time

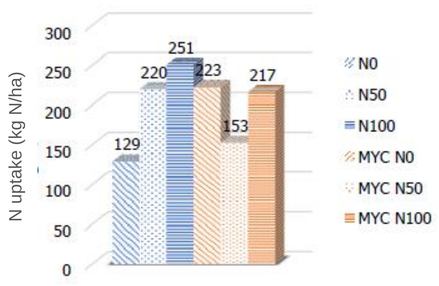

Fig 7. Average yield (t/ha)

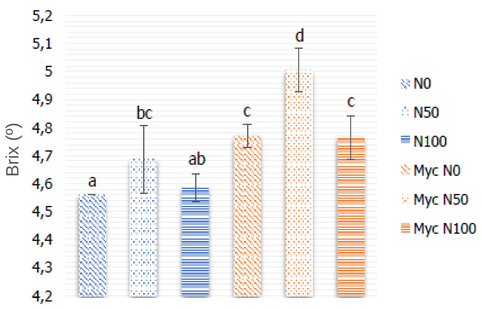

Fig 8. Fruit quality parameter (º Brix)

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