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

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Abstract

Nutrients, namely nitrogen, are essential to crop growth. Efficient nitrogen fertilization was tested in processing tomato plants with and without mycorrhizae, in the field. Mycorrhizae presents an alternative for the use of higher doses of N fertilizer inputs, because this crop is highly demanding on nitrogen fertilization and thus with great potential for heavy nitrogen losses. The objective was to produce a new markteable tomato of low nitrogen-footprint, to do processed products.

Keywords: mycorrhizae, nitrogen-footprint, processing tomato

1. Introduction

The efficient use of nitrogen (N) has been pointed out as a good solution to improve soil, water and air quality while avoiding increased costs to the farmers. Tomato is one of the most important crops worldwide and requires high amounts of nitrogen inputs to achieve high yields. The need for new agricultural technologies to reduce nitrogen inputs urges. Mycorrhizae are symbiotic associations between plan roots and soil fungi, able to increase crop growth through the improvement of plant's nutritional status. To find the best agriculture practices and technology measures, this work focused on developing low nitrogen footprint production systems for processing tomato.

2. Methodology

New agricultural practices, which include nitrogen fertilisation and mycorrhizae, were tested to increase N use efficiency and decrease the industry tomato N-footprint. Different doses of N inputs were tested on the same tomato variety, with and without mycorrhizae (Fig. 1). A mycorrhization protocol was designed and validated for tomato plants.

Fig. 1: Crop plantation and monitoring.

At harvest, tomatoes from each treatment were collected, quantified and weighted to determine productivity (Fig. 2). Samples were analysed for quality identification and the corresponding N-Footprint calculated, a tool built during this project to confirm the efficiency of the new management procedures.

Fig. 2: Harvesting and end of field experiment.

3. Results

Mycorrhizae promoted the growth of the tomato plants and increased the N uptake independ of the N dose applied to the soil.

4. Conclusions

Mycorrhizae presented an alternative for the use of high doses of N fertilizer inputs. The optimum fertilization management for tomato production was correlated with quality, and tested by national production partners.

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References

Bowles, T. M., Barrios-Masias, F.H., Carlisle, E.A., Cavagnaro, T. R., Jackson, L.E. 2016. Effects of arbuscular mycorrhizae on tomato yield, nutrient uptake, waterrelations, and soil carbon dynamics under deficit irrigation infield conditions. *Science of the Total Environment*, **566-567**, 1223-1234.

Bona, E., Todeschini, V., Cantamessa, S., Cesaro, P., Copetta, A., Lingua, G., Gamalero, E., Berta, G., Massa, N. 2018. Combined bacterial and mycorrhizal inocula improve tomato quality at reduced fertilization. *Scientia Horticulturae* **234**, 160-165.