

Tree Nutrition Strategies for Organic Apple Growing: Long-term and additive effects of compost, N-fertilizer, and foliar fertilizer on N-mineralisation, yield, fruit quality, and soil fertility

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Abstract

On average, organic apple growers have 15-30 % lower yields than conventional growers do, even when plant protection worked well. Thus, worldwide, there is a tendency that organic fruit growers intensify (nitrogen) fertilization. Can this really increase the yields? Which side effects will result on inner fruit quality and soil fertility? What could be an optimal organic fertilization strategy?

In 2001, with 2-year old 'Topaz' apple trees with the rootstock 'M27,' we performed a complete factorial trial to test the single and additive effects of three different organic approved N-sources: i) biowaste compost (8000 kg ha⁻¹,y⁻¹), ii) commercial organic N-fertilizer (10% N; 40 kg N h⁻¹,y⁻¹), and iii) foliar N-fertilizer (as molasses, 5% N-content; 14 kg N ha⁻¹,y⁻¹). In all possible combinations, eight treatments resulted. Additionally, two sub-treatments with biodynamic methods and a single mineral fertilizer variant were tested (18 trees per plot, 3-fold replicated). The study was supported by the EU-project ISAFRUIT.

The dynamic of the mineralized nitrogen (N_{min}) in the tree strip showed highest values in the spring (70 kg ha⁻¹) using treatments with commercial organic N-fertilizer alone. Commercial fertilizer plus biowaste compost reached on average 40% lower amounts (50 kg ha⁻¹), indicating a certain N-fixation by the compost. Unfertilized and compost alone plots showed the lowest values, with around 35 kg N_{min} h⁻¹. To a lesser extent, (up to 9%) but significant for all years, this ranking of the treatment effect became expressed in the N concentrations of the leaves sampled at the T-stage but not in the samples at harvest. With respect to yield, fruit weight, inner fruit quality, and mineral content of the fruit, statistically significant differences became rarely apparent among the fertilized treatments, and even the completely unfertilized plots often showed a similar quantitative and qualitative tree performance. Often the effect was overlaid by the irregular depth of the Ah-horizon in the orchard. With a modest tendency, most of the soil fertility parameters assessed as organic matter content, aggregate stability, and microbial biomass were improved in the treatment receiving compost. The conclusio to optimize organic tree nutrition could be drawn.

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