

Soil management strategies and observations on their effect on soil fertility: Survey of German organic fruit growers

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Abstract

An online survey of organic fruit growers on the topic of soil fertility was conducted from September to November 2023. The survey was sent to organic farmers via the organic fruit growers' association FÖKO e.V. mailing list. 58 farmers completed the survey. Information was collected on soil management strategies: fertiliser inputs, tillage operations, mulching and biomass transfer from the inter-row area into the tree row. In addition, the farmers were asked about their goals and reasons for changing soil management strategies and their observations on changes in soil fertility and tree performance.

55% of the farmers stated that they had changed soil management measures (mainly to less intensive soil tillage) in the past five years with a focus on enhancing physical and biological properties of the soil. 47% of these farmers observed positive changes in the orchard since implementing these adaptations, for example in soil structure, plant growth and plant health. In total, the majority of farmers were relatively satisfied with the soil fertility in their orchards.

Keywords: soil fertility, organic fruit production, soil properties, orchard management.

Introduction

Soil fertility can be defined as the physical, chemical and biological soil properties which positively influence plant growth. This definition includes soil characteristics like soil structure, water and air balance, temperature regulation, nutrient supply and occurrence of pests and pathogens (Paulsen, 2019). Organic farmers in particular rely on fertile soil for sustainable production, which is why one of the objectives in organic production is maintaining long-term soil fertility (European Union, 2018). To enhance and maintain soil fertility, Paulsen (2019) recommends supply of organic matter, maintaining a suitable pH by liming and adapting soil cultivation to prevent compaction.

At present, little is known about the measures used by organic fruit growers to protect soil and preserve soil fertility. Therefore, one goal of the EIP-Agri-Project "Appreciation, value creation and valorisation of environmental services in organic fruit growing" is to assess and evaluate the soil management practices currently used by practitioners regarding soil protection and soil fertility and to get a better understanding of the relevance of the topic for farmers. To tackle these questions, a survey of organic fruit growers in Germany was undertaken.

Material and Methods

An online survey was developed and sent to 219 organic farmers via the organic fruit growers' association FÖKO e.V. mailing list and was open for participation from September to November 2023. Farmers were asked about fertilisation strategies, tillage and mulching including biomass transfer from the inter-row area to the tree row. In addition, they were asked about management changes in the last five years, their aims and reasons for any changes, and whether they had observed any effects on soil fertility or tree performance.

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Farmers were also asked how satisfied they were with the soil fertility in their orchards, whether they planned to change their strategy in the future and what their motives would be for doing so.

Results and Discussion

The 58 fruit farmers who completed the questionnaire came from 10 German federal states, with most of them (55%) from Baden-Württemberg. 64% of the farms were converted to organic farming over 10 years ago, 22% were converted 5 to 10 years ago and 14% were converted one to 5 years ago. The fruit production area per farm ranged from 1 to 80 ha, with a median of 12 ha.

Most of the farmers (89%) rated soil fertility as important or very important to them. On a scale from 1 (very dissatisfied) to 6 (very satisfied) 48% of the farmers indicated their satisfaction with the soil fertility in their orchards as 4, followed by 34% with 5. 55% of all farmers reported changes in their soil management strategies in the last five years. Half of these farmers plan further changes in the future. Of those farmers who had not yet made any changes, 46% plan changes in the future.

Regarding soil tillage treatments, 53% of the farmers had not made changes in the last five years. 36% of the farmers had reduced the number of treatments to 3.4, 10% had increased the number to 4.7 treatments in average. In total the number of tillage treatments ranged from 0 to 7 with a mean of 3.5 treatments per year. Farmers who plan changes indicated that they currently till the soil an average of 4.3 times per year. The vast majority of these plan less treatments in the future. The maximum tillage depth was 20 cm and for the majority (66%) 10 cm. 31% of the farmers did not till the soil at all or only superficially. Changes in the last 5 years and planned changes all tended towards shallower tillage.

The median fertilisation value was 34 kg N per year. Only 24% of the farmers had changed their strategy in the last 5 years and only 10% plan changes, the vast majority of these to a lower amount of N.

The most important reasons cited for changing strategies in the last 5 years were aspects of soil fertility (physical and biological properties and nutrient availability) (Figure 1).

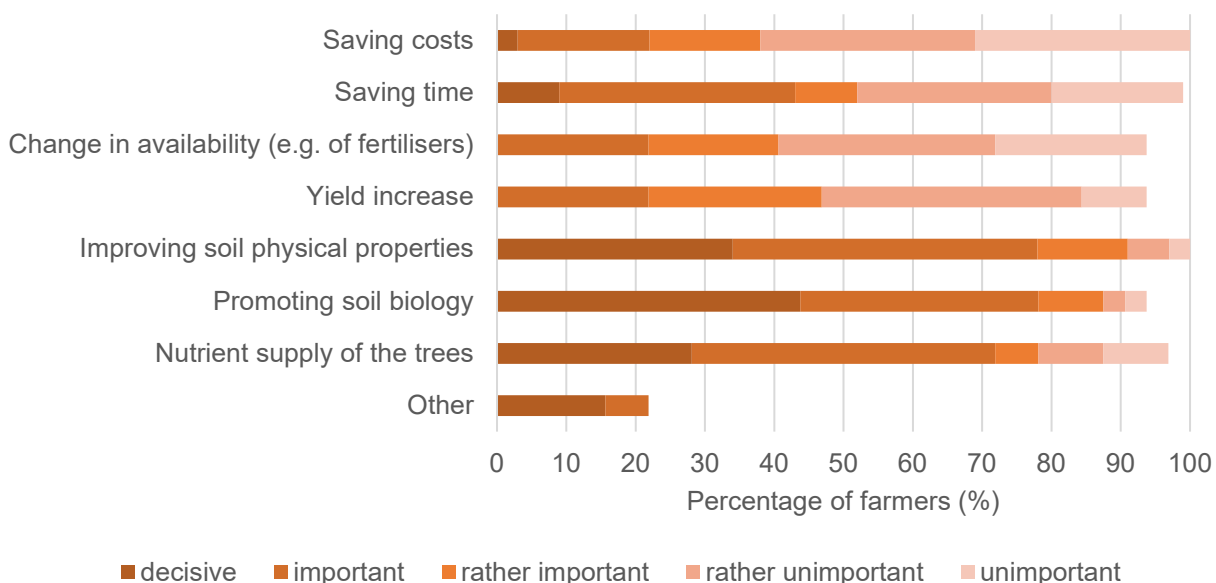


Figure 1: Percentage of farmers reporting relative importance of reasons for changing strategies in the last five years (n=32).

53% of the farmers that had made changes in the last 5 years did not observe any effect on soil fertility or plant growth performance, while 47% (15 farmers) did observe positive changes in the orchard. 13 farmers reported improved soil structure, although two of them also observed weaker plant growth or lower yield at the same time. 8 of the farmers had observed more optimal plant growth and 8 farmers better plant health. Higher yields were not observed, however this is not a priority in a mature orchard so much as a stable yield and continuous productivity.

This survey revealed that the participating farmers were aware of the importance of soil fertility and its enhancement. Orchard management strategies were focused on promoting soil fertility. Differences in tillage can in part be explained by site-specific requirements or restrictions due to drought or heavy rainfall events, voles, different soil conditions, age of the orchard and number of years of organic management. Overall a trend towards less soil disturbance was apparent, which seemed to have a positive effect as the farmers were satisfied with the resulting soil fertility in their orchards.

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