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Sustainable Intensification and Nitrogen Management in Organic Vegetable Production

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Abstract

The global agenda as stated in the UN sustainability goals and by the EAT-Lancet Commission asks for high and efficient food production in a sustainable way. The goal is a substantial reduction of the impact on climate, environment and biodiversity. A major part of the solution to the global challenges is a significant increase of vegetable consumption. This asks for implementation of sustainable intensification and an advancement of nitrogen management in organic farming production of open-field vegetables to achieve high yielding systems, while nitrate leaching is limited. For example, controlled traffic farming increased crop yields by 27-70 %, root abundance 2-25 times and nitrogen availability in spring by 2-41 kg N ha^{-1} compared to random traffic in three vegetables tested in Denmark. Accordingly, a 5-year crop rotation trial was designed with the aim to further implement sustainable intensification in organic vegetable production including double cropping, plant-based fertilizers, catch crops, green manures and controlled traffic farming. The system was compared to a more standard organic crop rotation fertilized by liquid manure. Crop growth, plant and soil nitrogen pools, potential nitrogen mineralization, soil enzymatic activity and leaching potential were studied in two years. Results showed that yields calculated per area were maintained for each crop and increased for the season in the double cropping system. Effects on soil

nitrogen availability and leaching potential were ambiguous. Potential mineralization increased by more than 15% and soil dehydrogenase and β-glucosidase activity by more than 20% in the double cropping system compared to the standard system across the five fields in the crop rotation. In conclusion, yields and soil fertility increased in the double cropping system. However, at future implementation at farms attention is needed to the winter plant cover to avoid increase of leaching losses in this system based on sustainable intensification.