

EGU21-11456

<https://doi.org/10.5194/egusphere-egu21-11456>

EGU General Assembly 2021

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Nutrient balances and nutrient availability of organic cash crop farms in Austria

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For stockless organic farms an adequate nutrient supply is in many ways a challenge. In order to assess the nutrient management of Austrian organic stockless farms, farm gate-balances for nitrogen, potassium and phosphorus of 15 organic stockless farms located in Austria's main arable production areas were calculated. Two of the farms were located in Wald- und Mühlviertel (Northern Upper and Lower Austria), two in the Carinthian Basin (Carinthia), two in the Pre-alpine Region (Southern Upper and Lower Austria), two in the South-Eastern Lowlands (Eastern Styria and Burgenland), four in the Marchfeld region (Eastern Lower Austria) and three in the Weinviertel (North-Eastern Lower Austria). The farms were managed according to organic farming guidelines for at least five years at the time of assessment. Nutrient balances were calculated over a period of five years, subtracting all farm outputs (nutrients in sold products) from all farm inputs (seeds and fertilizers, biological N fixation). Yields were assessed in questionnaires from the farmers, nutrient contents were taken from standardized tables.

Nitrogen balances ($n = 14$ farms) were $-14.6 \text{ kg N ha}^{-1} \text{ yr}^{-1}$ on average, ranging from -61 to $+34 \text{ kg N ha}^{-1} \text{ yr}^{-1}$. Nitrogen balances were strongly negative for one farm, slightly negative for 10 farms, even for one farm and slightly positive for 2 farms. Phosphorus balances ($n = 15$ farms) were $-8.3 \text{ kg P ha}^{-1} \text{ yr}^{-1}$ on average, ranging from -23 to $-3 \text{ kg P ha}^{-1} \text{ yr}^{-1}$. Phosphorus balances were strongly negative for one farm, slightly negative for 12 farms and even for 2 farms. Potassium balances ($n = 15$ farms) were $-15.6 \text{ kg K ha}^{-1} \text{ yr}^{-1}$ on average, ranging from -31 to $-8 \text{ kg K ha}^{-1} \text{ yr}^{-1}$. Potassium balances were slightly negative for 5 farms and even for 10 farms.

Plant available potassium contents (K_{CAL}) on the farm fields ranged from 74 to 378 mg K kg^{-1} . Two farms were moderately supplied (class B of the Austrian classification scheme), 10 farms were optimally supplied (class C) and 3 farms were over-supplied (class E). Plant available phosphorus contents (P_{CAL}) on the farm fields ranged from 21 to 102 mg P kg^{-1} . Two farms were classified as undersupplied (class A), 5 farms were moderately supplied (class B) and 8 farms were optimally supplied (class C).

Potassium availability and potassium balances on the farms were not correlated ($r = 0.192$, $P = 0.899$), phosphorus availability and phosphorus balances neither ($r = -0.210$, $P = 0.881$). Potassium and phosphorus availability were not significantly correlated to the duration of organic farming as well.

Stockless organic farms in Austria are very diverse, concerning their production conditions and nutrient management. The results indicate no adverse short-term effects on soil fertility for most of the farms. In the long term though, nutrient management should be improved to secure yields and to ensure the sustainability on organically managed cash crop farms. Meaningful options are e.g. farm partnerships with fodder-manure exchange and the use of recycled fertilizers like struvite. This, however, requires an adjustment of organic farming guidelines.