**Influence of Agricultural Service Crops on the fluctuations of the soil mineral composition**

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**Implications**. Sustainable agricultural production is becoming more actual not only for organic production, but also for integrated production approaches. Especially it is important in vegetable production, where fresh commodities are consumed and often their chemical-biochemical composition is directly influenced by the soil agrochemical composition. Usage of organic fertilizers and agricultural service crops (ASC), e.g. green manure (GM), catch crops, living mulch, are the main tools to ensure soil fertility to obtain high quality organic vegetables. From the one season results we can conclude that green manure crops (winter rye and rape) have some positive influence on the maintenance of mineral nutrients balances in vegetable cropping systems. The differences between vegetables influence on the soil mineral composition were stronger expressed – cabbage notably reduced nitrate content in the soil, whereas onion did not.

**Background and objectives.** Agricultural service crops are the crops which are not yielding a cash crop (in our case - vegetable crops), but they have indirect influence on the yield by improving the soil properties and increasing availability of nutrients for following crops in a sustainable way. The main task of these crops in the relatively cool and moist climate of North Europe is to prevent leaching of mineral nutrients from the soil during the winter-early spring period, when precipitation exceed evaporation and low temperature slows down vegetation (Canali et.al., 2010; Canali et als, 2014). Efficiency of ASC crops under Latvia agro-ecological conditions for vegetable growing has not been investigated till now. Therefore field trials where established in the Institute of Agricultural Resources and Economics during the season of 2015/2016 in Dižstende, with the aim to clarify the influence of ASC on cabbage and onion crops and compare with traditional soil management systems.

**Key results and discussion.** Establishment and overwintering conditions for ASC crops were good, and the canopy of ASC crops was developed well in the spring before GM incorporation. The DM biomass of incorporated plants was quite high, 2.64 t ha-1 for rape and 7.01 t ha-1 for rye. It had recognizable influence on the dynamic of the soil mineral nutrient contents (Table 1).

**Table 1**

Soil mineral nutrients composition in three different periods of the trial, 2015/2016

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Variant | P2O5, mg/kg | | | K2O, mg/kg | | | N/NO3, mg/kg DM | | | N/NH4, mg/kg DM | | |
| 9.2015. | 5.2016. | 10.2016. | 9.2015.. | 5.2016. | 10.2016. | 9.2015. | 5.2016. | 10.2016. | 9.2015. | 5.2016. | 10.2016.. |
| **Control** onion | 223.00 | 119.6 | 205.7 | 164.00 | 122.2 | 126.8 | 3.20 | 1.30 | 2.40 | 1.50 | 4.60 | 3.40 |
| **Control** cabbage | 223.00 | 119.6 | 183.7 | 164.00 | 122.2 | 121.8 | 3.20 | 1.30 | 0.80 | 1.50 | 4.60 | 3.10 |
| **Rye GM**- onion | 201.00 | 91.20 | 173.9 | 145.00 | 95.65 | 167.5 | 3.10 | 0.90 | 3.60 | 1.20 | 4.30 | 3.30 |
| **Rye GM**- cabbage | 201.00 | 91.20 | 152.9 | 145.00 | 95.65 | 134.9 | 3.10 | 0.90 | 0.70 | 1.20 | 4.30 | 3.60 |
| **Rape GM**- onion | 178.00 | 138.75 | 160.6 | 126.00 | 119.9 | 143.6 | 2.90 | 1.30 | 2.30 | 1.30 | 4.00 | 3.30 |
| **Rape GM**- cabbage | 178.00 | 138.75 | 140.6 | 126.00 | 119.9 | 104.4 | 2.90 | 1.30 | 0.40 | 1.30 | 4.00 | 3.20 |
| **Cow manure**- onion | 208.00 | 167.35 | 197.00 | 148.00 | 189.00 | 185.6 | 6.20 | 1.50 | 3.50 | 2.20 | 4.30 | 3.50 |
| **Cow manure** -cabbage | 208.00 | 167.35 | 165.2 | 148.00 | 189.00 | 168.1 | 6.20 | 1.50 | 0.50 | 2.20 | 4.30 | 3.80 |

From the soil analyses data we found that P2O5 and K2O were reduced, except for K2O in the manure treatment, during the winter period – leached or taken up by ASC. The results were most pronounced with rye GM and for P2O5 also in the non-fertilized control treatment. A decrease of these two elements in the soil may have been caused by the ASC plants root activity if these elements were solved by the root exudates and became plant-available and taken up by ASC plants and/or subjected to leaching (Wang et al, 2010). The NO3 and NH4 relation in the soil had seasonal character – higher NO3 concentration was detected in the autumn than in spring, but for NH4 – vice versa. It can be explained by the soil processes influenced by temperature – in autumn when soil is still warm from summer, nitrification takes place more intensively in comparison to the cold conditions in spring (Brauer et al, 2002). There was no sharp difference in agrochemical parameters between treatments. The differences between vegetables were more clear – cabbage reduced nitrate content in the soil, whereas onion did not. It can be explained by plants nutritional particularities – cabbage demands more nitrogen in comparison to onions (Thorup-Kristensen K., 2007).

From the one season results we can conclude that ASC crops have some positive influence on the maintenance of mineral nutrients balances in vegetable cropping systems, but more investigations are needed to find particular regularities.

**Methodology.** Six soil treatments were compared for each vegetable crop: two GM treatments when ASC biomass of a) winter rye (*Secale cereale* L.) and b) winter rape (*Brassica napus* L.) was incorporated in the soil in the spring; two roller crimper (RC) treatments in which a) rye (*Secale cereale* L.) and b) rape (*Brassica napus* L.) was flattened by a roller-crimper before vegetable planting to create a mulch layer. These four ASC treatments were compared with: control 1 (no ASC, with soil tilled before crop planting) and control 2 (cattle manure ploughed into the soil before vegetable planting). Soil agrochemical analyses were performed before sowing of ASC in the autumn of 2015, in the spring of 2016 when ASC was incorporated and in the autumn after vegetable harvest. Average soil sample per treatment was collected and analysed. The lack of replications for soil analyses does not allow us to perform statistical analyses, but the major tendencies are inferable. Due to severe infestation by perennial weeds in RC plots, mostly by field horsetail (*Equisetum arvense* L.) and perennial sow-thistle (*Sonchus arvensis* L.), both roller-crimper variants were excluded from the trial. All the other treatments (both controls and chopped/incorporated green manure) were evaluated in the trial. Fluctuations of organic matter, P2O5 mg kg-1, K2O mg kg-1, C mg kg-1, NO3 mg kg-1 and NH4 mg kg-1 are referred in the paper.

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