Sources of nitrogen supply in organic crop production and consequences for crop rotation

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The development of production of organic agricultural products will be one of the priorities of the Strategy of Agriculture and Rural Development in Ukraine 2015-2020. Yaroslav Krasnopol’skiy, the First Deputy Minister of Agrarian Policy and Food, stated this at a round table discussion on food security, held in the framework of “AGRO-2015” exhibition.

He stressed that organic products is currently one of the most promising areas of agriculture in Ukraine. In particular, about 400 companies are already manufacturing organic products. The production employs more than 300 thousand hectares. “The fields that have taken root in Europe 10 years ago, are now beginning to develop in Ukraine. Farmers have set a fast pace and, in my opinion, have achieved quite a lot over such a short period of time,” Yaroslav Krasnopol’skiy said.

Besides, Ukrainian organic products have already been winning European markets. In particular, our products are in demand in Italy, Poland and other EU countries. For its part, the Ministry of Agrarian Policy is inclined to fully support the development of organic industry, including at the legislative level. “We are close to finalizing a draft law on organic production. It is not yet perfect, but this is the first step that will allow us to implement the standards and requirements of the European Union”, the First Deputy Minister said.
To solve the nitrogen challenge is important for organic farms without animal production

Soil fertility is the most important fundament for “organic crop production”.
It depends mainly on 2 factors

1. nitrogen supply
2. humus

- Humus is the driving force to create soil fertility
- Nitrogen or nitrogenous substances is the most important fuel for this engine.
Organic farms with animal production have own N sources. Without animal husbandry you have to look for alternatives …

Organic farming actually bases on the principle closed production cycle integrating animals in the circle.
Why nitrogen strategy is important for organic farms without animal production

- When crops get not sufficient access to nitrogen, harvest volume and quality will neither satisfy farmers nor buyers. In first years after conversion no problem, but on a longer notice ist could be a challenge.
- Without own manure and no possibilities to import synthetic fertilisers there is a big questionmark how to solve the N problem.
- Only a high supply of nitrogen in relation to the carbon leads to build up humus layer.
- When the nitrogen balance in a crop rotation is negative, problems with harvest quantity and quality are likely or to lose humus content and worse the structure of soil.
A high share of humus is essential for organic crop production. One benefit is the capability to store water.

With a higher humus content, the water can be kept in the soil (capilar systems)

Source: Organic Soil
DOK trial Switzerland

With a lower humus content, the water can’t be stored

Source: Conventional Soil
DOK trial Switzerland
Sources for nitrogen in organic farms without animals / manure

- Clover grass ley
- Grain legumes
- Undersowing clover in main crops
- Green manure (intercropping)
- Compost
N source: **Clover grass ley** can be considered as battery for nitrogen fixation

- Mixtures with red and white clover and Alfalfa preferred
- A missing or too low share of clover grass ley in the crop rotation leads to problems with N fixation, a reduction of humus content, a stepwise soil degradation (reduced soil fertility) and a higher weed pressure (root weeds)
- Better to cut as to mulch clover grass lay (lower N losses)
Clover grass ley is the best starting point for the crop rotation on organic farms without animal husbandry
Clover grass ley area can also be used with suckler cow (calf) or extensive cattle fattening
New idea: Green manure from clover grass ley

- Idea: Clover grass ley can be used as source for nutrition
- It can be applied directly on fields with corn as organic fertiliser
- It can be applied fresh, dried, sillaged or as compost
- Nutrition value of clover cley grass similar to other organic fertilisers
- Best to cut the ley in an early stage, when the clover is still full of nitrogen.
- There is no technical application yet developed specifically for this purpose – therefore simple manure spreader/distributor are used.
Mulch from clover grass ley is distributed and incorporated before sawing corn
N source: Grain legumes

- Neutral with regard to N fixation
- Able to collect N from the air
- Positive as previous intercrop before potatoes
- Not perfect for weed management as it not covers the soil completely
- only 25% in crop rotation (Legume tiredness and pest suppression)
N source: Undersowing clover in main crops

- Nitrogen and humus collection for the next main crop
- Favoured smaller clover crops, like white or yellow clover
- Can be used in cereals, corn, sunflower, legumes
- Not recommended in dry areas < 450 mm rain (competition)
- Positive: N fixation and weed suppression
Undersowing: Example clover in wheat

- Suppression of weeds
- Improvement of soil structure and protection against erosion
- Improvement of soil fertility
- Additional feed for beans and other insects
- Improves the bearing capacity of the soil
- Undersowing best between tillering and bolting of the cereals, e.g. after the last Striegel application.
N source: Green manure by intercropping

«Intercropping is the feed bridge for insects between the main crops.»
Intercropping: Different tasks

- Conversation of nutrients in summer and winter periods
- N-fixation via legumes
- Nutrition supply for next main crops
- Suppression of pests and weeds
- Improvement of soil structure and protection against erosion
- Improvement of soil fertility
Intercropping: Very popular “Landsberger Gemenge”

- Landsberger mixture: Vetch (*Vicia villosa*) 21 kg, Crimson Clover (*Trifolium incarnátum*) 9 kg, Italian Rye-Grass 30 kg (*Lolium multiflorum*)
- N fixation: 50-100 kg/ha
N Source: Organic matter

- Soils with high humus degree (3 – 4 %) contain up to 5’000 kg N per ha (N battery)
- Every year mobilsation of app. 2 – 3 % of the fixed N
- Degree of N mobilisation depends on temperature, soil structure and moisture, the pH-level and the C/N-relation of organic matter
- Incorporation of green manure from inercropping supports the mobilsation of nitrogen
N Source: Compost

- Excellent fertiliser for P, K, Mg.
- As only nutrition source less favoured.
- Positive nutrition effect in combination with cultivation of legumes
- Increases the humus degree in the soil
- Mobilisation of N hardly to calculate
- Ideally to incorporate in late summer in combination with intercropping
Crop rotation – to keep humus and nutrient level in balance
Manifold and heterogenous crop rotation better than only to focus on market demand / price situation

- Optimal to start with a clover grass ley for 2 years - Why?
  - Produces sufficient N reserves for following crops
  - Supports weed regulation
- At least 20 % legumes as clover grass ley
- Max. 15 % grain legumes
- Max 60 % cereals
- Max. 25 % from the same crop
- Change of winter- und summer crops
- Integration of intercrops
- Change of legumes and crops with high nitrogen consumption
- Change of crops with deep/broad root system with crops with reduced roots
Better large than short crop rotation chains

Reasons for large crop rotation

- Maintain soil fertility
- Maximal fixation of nitrogen
- Weed regulation
- Suppression of pests and deseases
Practical steps of crop rotation planning

- Definition of maximum number of elements in crop rotation
- Set clover grass ley and legumes to the crop rotation
- Distribute nitrogen demanding crops to the rotation

**Example**

- Clover grass ley
- Clover grass ley
- Corn
- Winter wheat / Intercrop
- Soybean / Horse bean
- Spelt
- Buckwheat
Wanted: The longterm success with crop rotation

• Organic crop production is not a sprint competition. It is similar to a marathon.

• Therefore, not the expected annual profit should influence the crop rotation. In organic farming the profit along the whole crop rotation has to be considered as a total sum.

Thank you for your attention
Announcement

- International Trade Show; Business Match & Conference
- Hamburg, Germany - November 25-26, 2015
- International traders meet export oriented organic producers

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