

## Organic farming, broad rotation, organic manure



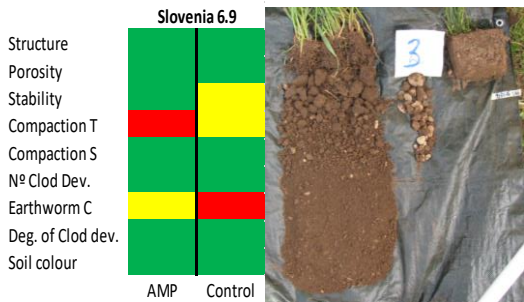
1. A five-year crop rotation.
2. At least 0.5 livestock units.
3. Nitrogen enters the soil with use of organic fertilisers or by using legumes.
4. Nutrient cycling should be kept to a maximum within the farm.
5. Prohibited use of artificially synthesized active substances in plant protection products and mineral nitrogen.
6. Use of chisel ploughs, hoes, less frequent turning of the soil, continuous soil cover.
7. Production of native local species and varieties (eg buckwheat).

## Loss of soil structure stability

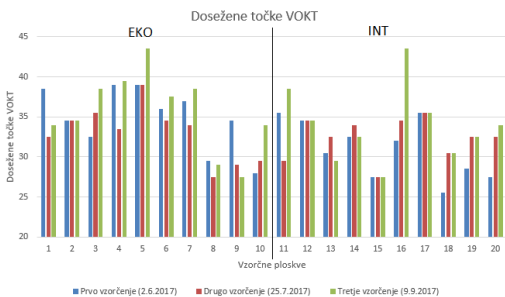


Due to the use specific soil tillage machinery in horticultural production (rotary harrow), which has destructive impact on soil structure and biota in the soil, and due to the abandonment of the use of organic fertiliser with a high proportion of plant residues (manure) risk of loss of optimal soil structure increases. The consequences are visible in the figure, when a large aggregate (clod) is exposed to water, it starts to disaggregate. Such soil develop soil crusting faster and are more prone to soil compaction, have lower water retention capability and may prevent optimal germination and plant growth.

## Scientific evidence



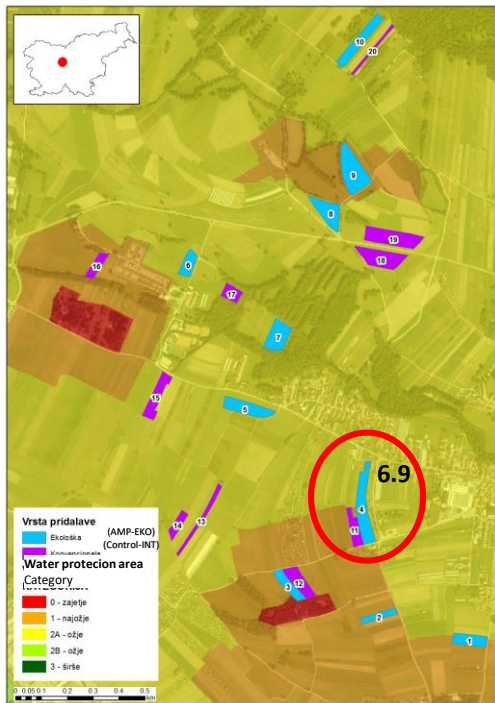
Visual assessment soil assessment (VSA) shows that, on land where organic farming is practiced (AMP-EKO), the stability of soil structural aggregates is good. The use of farmyard manure has a beneficial effect on the number of earthworms. Soil compaction is slightly worse than in the control site (CONTROL-INT) because of the method of cultivation. Soils in under both EKO and INT production are ploughed to prevent weed emergence. However, in EKO, they have to use weed-control machinery instead of a single application of plant protection products, which further affects soil compaction. In conventional tillage soil preparation includes a plough and a rotary harrow.



Comparison between organic (AMP-EKO) and conventional integrated production (control-INT) based on VSA analysis Plots:

1-5 & 11-15 - Eutric brown soil – 2nd terrace above village  
6-10 and 16-20 - riparian carbonate soil – 1st Sava terrace below the village

## Demonstration location - Kleče, Ljubljana



## Further details about organic farming in Kleče

The research was carried out in cooperation with farmers who own or rent agricultural land in the area of Lower and Upper Kleče, which lies on two Sava terraces in the municipality of Ljubljana. Visual soil quality tests were carried out on a single parcel with simple equipment (structure, porosity, color, aggregate stability, earthworm density, etc.). Both Lower and Upper Kleče lie on the south side of the Sava River, and are named after unevenly deep soils. In the places where the soil is very shallow, we immediately reached the rough stones formed by the uneven river embankments that were formed during the formation of the Sava terraces and once called „kleče“. In the fields where samples were collected for soil quality assessment, a frequent occurrence of „kleče“ was observed and, accordingly, a marked heterogeneity of soil rockiness was observed. In areas where „kleče“ have formed, farming is difficult due to the shallow soil layer and the large proportion of rocks in the soil. The entire Kleče area is located in the water protection zone (WPZ), since in Kleče it is one of the water pumping stations providing drinking water to the municipality of Ljubljana.

The soil type in the area of Lower Kleče (second terrace) is eutric brown soil (Eutric Cambisol). These are mostly shallow, moderately developed, formed in ice-age from gravel and sandy river deposits. The type of soil in the Upper Kleče area (first terrace) is riparian carbonate soil or Calcaric Fluvisol, which is shallow to deep young soil formed on sandy-gravel alluvium, where a strong reaction with HCl occurs due to the abundance of  $\text{CaCO}_3$ .

Organic farm (blue, AMP-EKO) is involved in certified organic farming since 2010. The conversion from the conventional program to the organic management program started in 2008. On 25 hectares of arable land, only fertilisers authorised for organic production are used, some of which are obtained from the farmers' own animal husbandry. The arable land is intended for the production of cereals, feed and vegetables. Livestock production is dominated by cattle with 20 head of dairy cattle, and some pigs, chickens and horses. Farmers have to sell their own agricultural produce as a supplementary activity. They have a website for promotional and informational purposes. The products they offer are cereals, dairy products and seasonal vegetables including: potatoes, onions, garlic, carrots, cucumbers, tomatoes, cabbage, parsley, celery, red beets, zucchini, beans, peppers and salad.

There are no animals at the conventional integrated farm (purple, Control-INT). On about 10 hectares, they produce vegetables, fruits and cereals. The products they offer are: tomatoes, cucumbers, peppers, potatoes, lettuce, melons, watermelons, aubergines, strawberries, onions, garlic, cauliflower, carrots, leeks, green, zucchini, beans, bitter melon, kohlrabi, chicory, parsley, pumpkin, sauerkraut and sauerkraut.

Work was carried out in the Ljubljansko polje area on two Sava terraces. The Ljubljansko polje is part of the Ljubljana Basin and belongs to the Sava River Basin.

20 fields were analysed with 10 soil samples taken on the upper terrace (plots 6-10, 16-20) and 10 soil samples on the lower terrace (plots 1-5, 11-15). The VSA method was used on a representative number of fields in the most representative soils of the study area.

Sample plots numbered 1-10 (blue) are included in organic production (AMP-EKO). Sample plots numbered 11-20 (purple) are included in conventional integrated production (Control-INT). Plots 4, 8 (AMP) and 11, 19 (Control) were included in the iSQAPER project. For SQAPP testing only plots 4 and 11 were used.



**iSQAPER**  
Interactive Soil Quality Assessment

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