

Long-Term Conservation Tillage Impact on Soil Properties and Crop Productivity

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Abstract : The main ambition for nowadays agriculture is to get the economically effective yield and to secure the soil ecological sustainability. According to the effect on the main soil quality indexes, tillage systems may be separated into two types, conventional and conservation tillage. The goal of this study was to determine the impact of conservation and conventional primary soil tillage methods and soil fertility improvement measures on soil properties and crop productivity. Methods: The soil of the experimental site is Dystric Glossic Retisol (WRB 2014) with texture of sandy loam. The trial was established in 2003 in the experimental field of crop rotation of Vėžaičiai Branch of Lithuanian Research Centre for Agriculture and Forestry. Trial factors and treatments: factor A- primary soil tillage in (autumn): deep ploughing (20-25cm), shallow ploughing (10-12cm), shallow ploughless tillage (8-10cm); factor B - soil fertility improvement measures: plant residues, plant residues + straw, green manure 1st cut + straw, farmyard manure 40tha-1 + straw. The four - course crop rotation consisted of red clover, winter wheat, spring rape and spring barley with undersown. Results: The tillage had no statistically significant effect on topsoil (0-10 cm) pH_{KCl} level, it was 5.5 - 5.7. During all experiment period, the highest soil pH_{KCl} level (5.65) was in the shallow ploughless tillage. The organic fertilizers particularly the biomass of grass and farmyard manure had tendency to increase the soil pH_{KCl}. The content of plant - available phosphorus and potassium significantly increase in the shallow ploughing compared with others tillage systems. The farmyard manure increases those elements in whole arable layer. The dissolved organic carbon concentration was significantly higher in the 0 - 10 cm soil layer in the shallow ploughless tillage compared with deep ploughing. After the incorporation of clover biomass and farmyard manure the concentration of dissolved organic carbon increased in the top soil layer. During all experiment period the largest amount of water stable aggregates was determined in the soil where the shallow ploughless tillage was applied. It was by 12% higher compared with deep ploughing. During all experiment time, the soil moisture was higher in the shallow ploughing and shallow ploughless tillage (9-27%) compared to deep ploughing. The lowest emission of CO₂ was determined in the deep ploughing soil. The highest rate of CO₂ emission was in shallow ploughless tillage. The addition of organic fertilisers had a tendency to increase the CO₂ emission, but there was no statistically significant effect between the different types of organic fertilisers. The crop yield was larger in the deep ploughing soil compared to the shallow and shallow ploughless tillage.

Keywords : reduced tillage, soil structure, soil pH, biological activity, crop productivity

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