

ZMĚNY VLASTNOSTÍ PŮDY V EKOLOGICKÉM PĚSTEBNÍM SYSTÉMU V PRŮBĚHU ŠESTILETÉHO PĚSTEBNÍHO POKUSU V LITVĚ

Changes in soil properties in organic cropping system in a 6-year field experiment in Latvia

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Summary: In a 6-years field experiment at State Stende cereals breeding institute the changes in soil properties in organic cropping system without livestock were studied. The content of soil organic matter, mobile potassium (K_2O) and phosphorus (P_2O_5) and soil acidity (pH) were determined at each of eight crop rotations fields. The content of the soil organic matter significantly increased in a four-year period after starting the experiment. On the average for all fields, the content of the soil dry matter in topsoil was 1.8 in 2001 and 2.4 in 2006, respectively. The amount of soil K_2O and P_2O_5 was more or less stable, except K_2O content in 2003 when it significantly decreased. The soil pH level was stable over the entire six-year experiment indicating that organic cropping system may be a good alternative for maintaining the "soil health".

Key words: *crop rotation, mobile phosphorus, potassium, organic matter, pH, soil fertility*

Souhrn: V šestiletém pokusu prováděném ve Státním institutu pro šlechtění obilovin byly sledovány změny vlastností půdy v ekologickém pěstebním systému bez chovu dobytka. Obsah organické hmoty v půdě, volný draslík (K_2O) a fosfor (P_2O_5) a kyselost půdy (pH) byly stanoveny v každém z osmi osevních postupů. Obsah organické hmoty se výrazně zvýšil v průběhu čtyř let od začátku pokusu. Průměrný obsah půdní sušiny ve vrchní vrstvě půdy byl 1.8 v roce 2001 a 2.4 v roce 2006. Obsah půdního K_2O a P_2O_5 byl více méně stabilní, kromě obsahu K_2O v roce 2003, kdy byl tento obsah výrazně snížen. Hodnota pH v půdě byla stabilní v průběhu celého šestiletého experimentu, což ukazuje na skutečnost, že ekologický pěstební systém by mohl být dobrou alternativou pro udržení "zdravé" půdy.

Klíčová slova: *osevní postup, volný fosfor, draslík, organická hmota, pH, úrodnost půdy*

Introduction

Crop production in organic farming systems relies to a large extent on soil fertility. The soil fertility must be maintained via choice of crop rotation and manuring practices (Olesen et al., 2005). Moreover, maintenance of soil fertility is important goal in the development of sustainable agricultural systems (Eltun et al., 2002). In Latvia, the number of organic farms has increased during the last years therefore organic cereal seed production

has to be enhanced too. In order to increase our knowledge about soil properties under organic farming without livestock we studied how crop rotation and green manuring plants affect soil characteristics in a longer period. In a 6-years field experiment at State Stende cereals breeding institute the content of soil organic matter, mobile potassium (K_2O) and phosphorus (P_2O_5) and soil acidity (pH) were determined.

Material and methods

A crop rotation experiment was established in 2001 at State Stende Cereals breeding institute in Latvia (57°11'N, 22°33'E). The soil on the experimental site is loamy sand. At the beginning of the experiment a topsoil contained 1.8 % humus and the contents of exchangeable cations (K^+ , Mg^{2+} and etc.) were moderate or high. The size of each crop rotation field is 0.2 ha. An eight-year crop rotation is following: clover (green manure), winter

wheat, peas, oats, potatoes, rye, buckwheat (green manure) and barley. In crop rotation, 50 % of plants are cereals. Such cropping system is attractive for organic cereal seed producers. In autumn, all straw and green manure production is incorporated in soil. During six-year period the soil samples from each field were taken randomly every spring and autumn and analyzed for contents of organic matter, K_2O , P_2O_5 and pH.

Results

The content of soil organic matter increased in each of eight crop rotations fields. On the average for all eight fields, the content of organic matter increased significantly at the fourth year of the experiment (Fig.1). In 2006, the content of organic matter varied between 2.3 and 2.7 % on the experimental site. Particularly, the experimental fields with green manure plants showed the largest content of organic matter (results not shown in figures or tables). On the average for all eight fields, the content of soil mobile K_2O decreased significantly at third year of the experiment (Fig. 2). In three

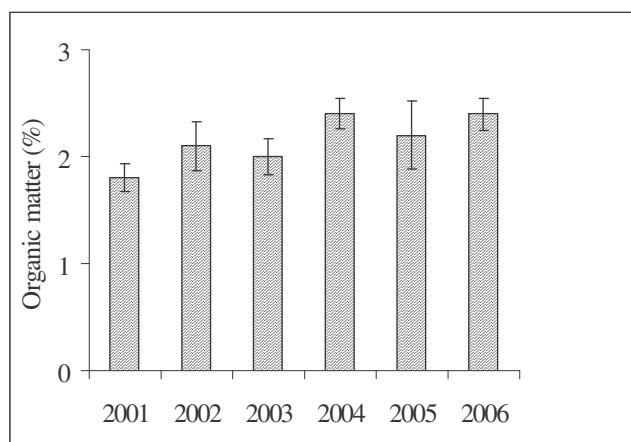
consecutive years, the content of soil K_2O increased and stabilized. However, these changes were not significant comparing with 2003.

On the average for all eight fields, the content of soil P_2O_5 decreased and ranged from 280 mg/kg in 2001 and 210 mg/kg in 2006. In some of the crop rotation fields and the experimental years, these changes were significant, particularly in fields where cereals and potatoes were grown after each other (results not shown in figures or tables). Consequently, there were not

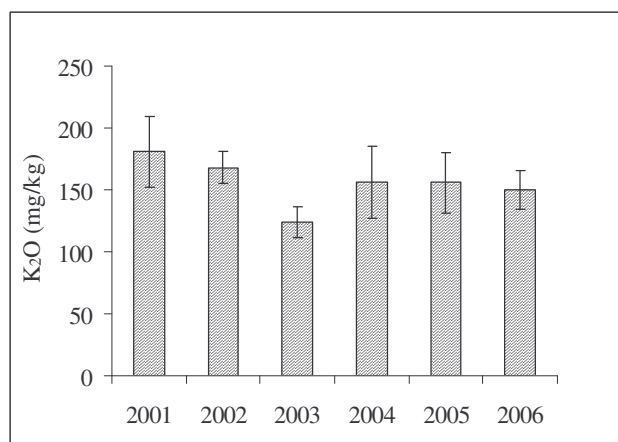
significant changes in P_2O_5 content in soil during whole experimental period (Fig.3). The soil acidity or pH did not change and was more or less stable (Fig. 4). On the

average for all eight fields, the pH ranged from 6.2 to 6.4 over the entire six-year experiment.

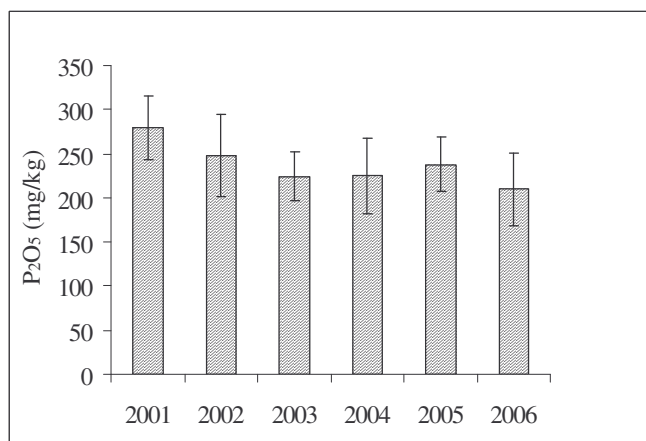
Graph 1: The content of soil organic matter on the average for all crop rotation fields (n=8)



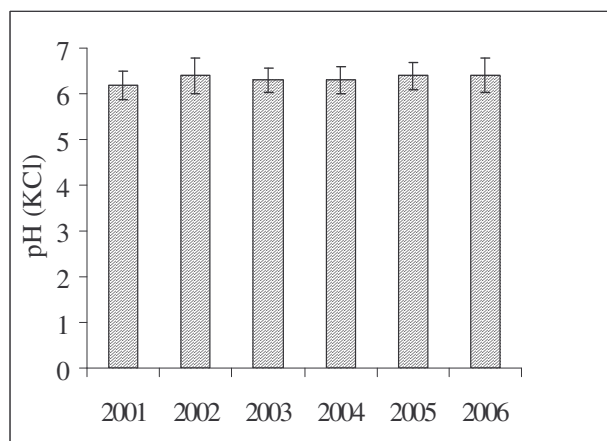
Graph 2: The content of soil potassium (K_2O) on the average for all crop rotation fields (n=8)



Graph 3: The content of soil phosphorus (P_2O_5) on the average for all crop rotation fields (n=8)



Graph 4: The soil acidity (pH) on the average for all crop rotation fields (n=8)



Conclusion

Six-year experiment showed that cropping system factors, such as the crops used in the rotation, may affect soil properties and soil fertility. The content of the soil organic matter significantly increased in a four-year period after starting the experiment. There was obtained reduction in the amount of soil K_2O and P_2O_5 , however, these changes were not significant, except potassium

content in 2003. The soil pH level was stable over the entire six-year experiment. Thus the presented organic farming crop rotation system maintained and even improved particular soil properties. More knowledge is, however, needed both to maintain soil fertility and to ensure acceptable yields in longer-term.

References

- Eltun, R., Korsaeht, A. and Nordheim, O. 2002. A comparison of environmental, soil fertility, yield, and economical effects in six cropping systems based on an 8-year experiment in Norway. *Agriculture, Ecosystems and Environment* 90, 155-168.
- Olesen, J.E., Askegaard, M. and Rasmussen, I.A. 2005. Learning from a long-term crop rotation experiment. NJF seminar 369, *Organic farming for a new millennium-status and future challenges*, Alnarp, Sweden. 91-94.

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