SOIL CHEMICAL PROPERTIES UNDER DIFFERENT NUTRIENT MANAGEMENTS IN ESTONIA

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INTRODUCTION

In the last decades organic farming has been presented as an environmental-friendly alternative to conventional farming, but the questionable sustainability of this practice regarding to the nutrient balance in the soil, and controversy in results by different authors and studies, make difficult to farmers to choose between one or other farming practice.

MATERIAL AND METHODS

The field experiment is situated at the experimental station of the Estonian University of Life Sciences (EMÜ) in Eerika, Tartu, Estonia (58°22'N, 26°40'E).

The experimental design consists of 80 plots of 66 m^2 where a five-year crop rotation was established in 2008 on a sandy-loam soil described as *Albic Stagnic Luvisol* (FAO, 1998). Cultures involved in the rotation are: pea, potato, barley, red clover and winter wheat.

The distribution of the plots shown in Figure 1. is explained below:

a) 20 plots under conventional management without any addition of chemical fertilizers ($N_0P_0K_0$).

b) 20 plots under conventional management where different concentrations until establish a final concentration of $N_{150}P_{25}K_{95}$.

c) 20 plots under organic farming conditions with the same rotating crops but including winter oil-rape after pea, winter rye after potato and ryegrass after winter wheat as cover crops (**ORGANIC I**).

d) 20 plots under organic farming conditions including the same crop rotation and same cover crops, plus the addition every spring of 40 t ha^{-1} cattle manure in those plots where potato is cultivated, except in 2012 when manure was divided between winter wheat 10 t ha^{-1}, barley 10 t ha^{-1} and potato 20 t ha^{-1} (**ORGANIC II**).

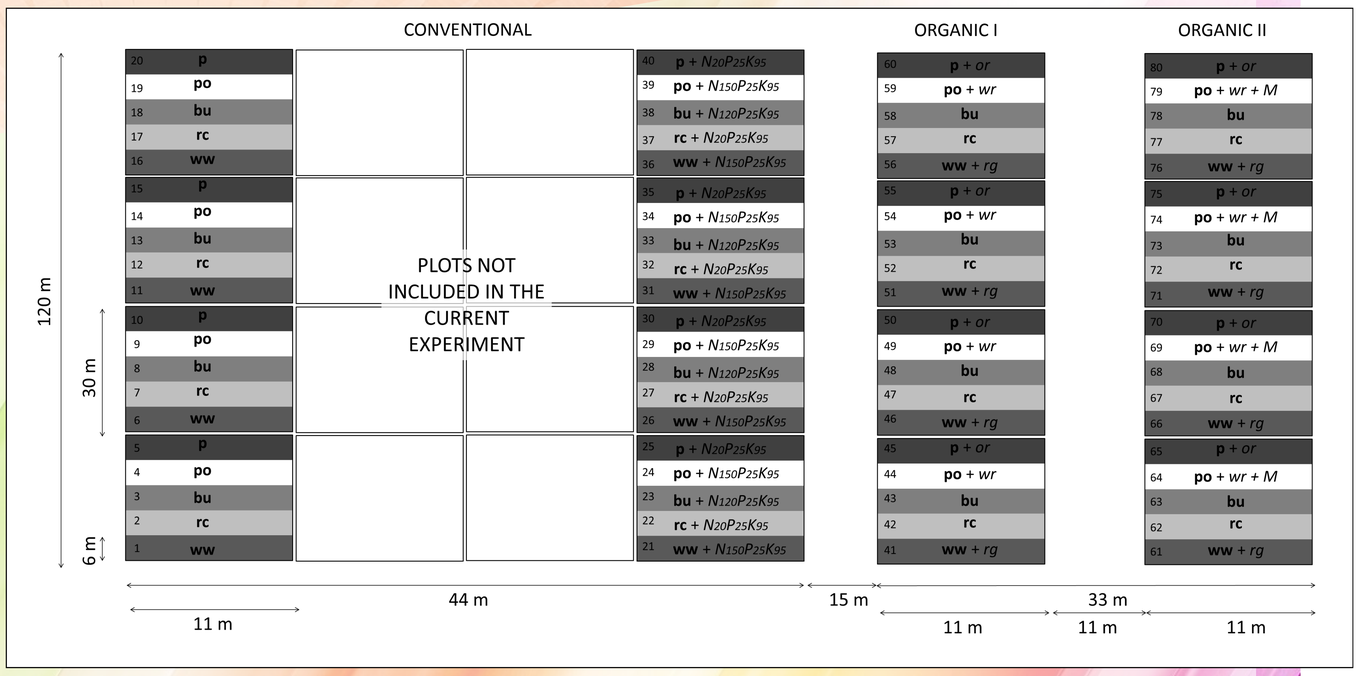

Figure 1. Spatial distribution of the crop rotation in experiment. Small bold letters indicate the culture (**p**: pea, **po**: potato, **bu**: barley undersown, **rc**: red clover, **ww**: winter wheat); cursive small letters indicate amount of chemical fertilizers in conventional fertilized plots and cover crops in organic treatments (*or*: winter oil-rape, *wr*: winter rye, *rg*: rye-grass); *M*: manure.

RESULTS AND DISCUSSION

- Concentration of organic carbon (C_{org}) in the soil decreased for all the treatments except for the ORGANIC II where there is a significantly (*P<0.05*) increase due the cattle manure amendment in combination with the incorporation of the cover crop residues in the soil.
- Conventional fertilized plots ($N_{125}P_{25}K_{95}$) showed a better respond in terms of total nitrogen (N_{total}) and plant available phosphorus (P) the conventional , with lower year-to-year losses of N, and an slightly increase in the concentration of P.
- Plant available potassium (K), decreased significantly (*P<0,05*) with time for all the treatments, being less pronounced in the case of the $N_{125}P_{25}K_{95}$ and the ORGANIC II plots.

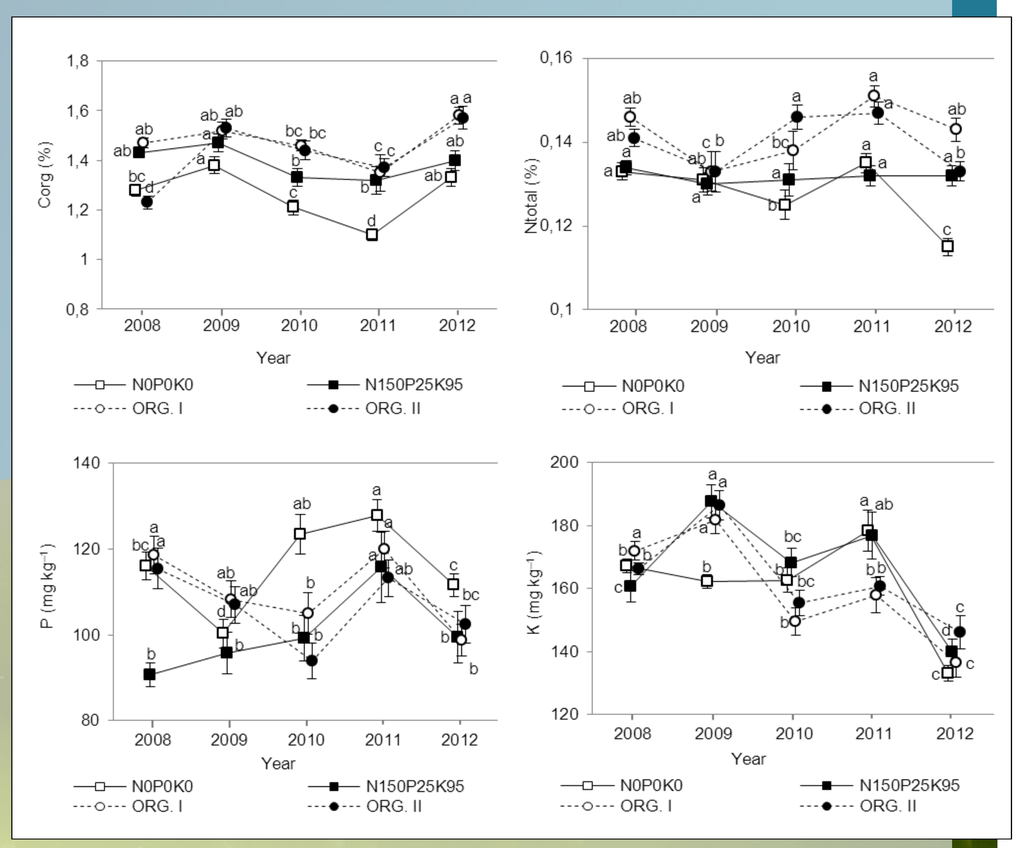

Figure 2. Mean nutrient concentration in soil with time (2008—2012). Different small letters indicate significant influence (Fisher's LSD; P<0.05) of year. ± value represents standard error of the mean (SE). n=20 (one year), n=100 (average of 2008–2012).

CONCLUSION

Any of the nutrient amendments presented in the current experiment seem to be enough for mantaining an adequate nutrient levels in the soil in long-term. A combination of mineral fertilizers and organic manures may give better results.

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