EFFECTS OF ORGANIC VS CONVENTIONAL FARMING OVER DIFFERENT CHEMICAL PARAMETERS IN ESTONIA

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What , Where and Why?

Experiment conducted since 2008 in Eerika, Tartu (Estonia).

5-years crop rotation (barley us. red clover, red clover, winter wheat, pea, potato) experiment in 4 management systems:

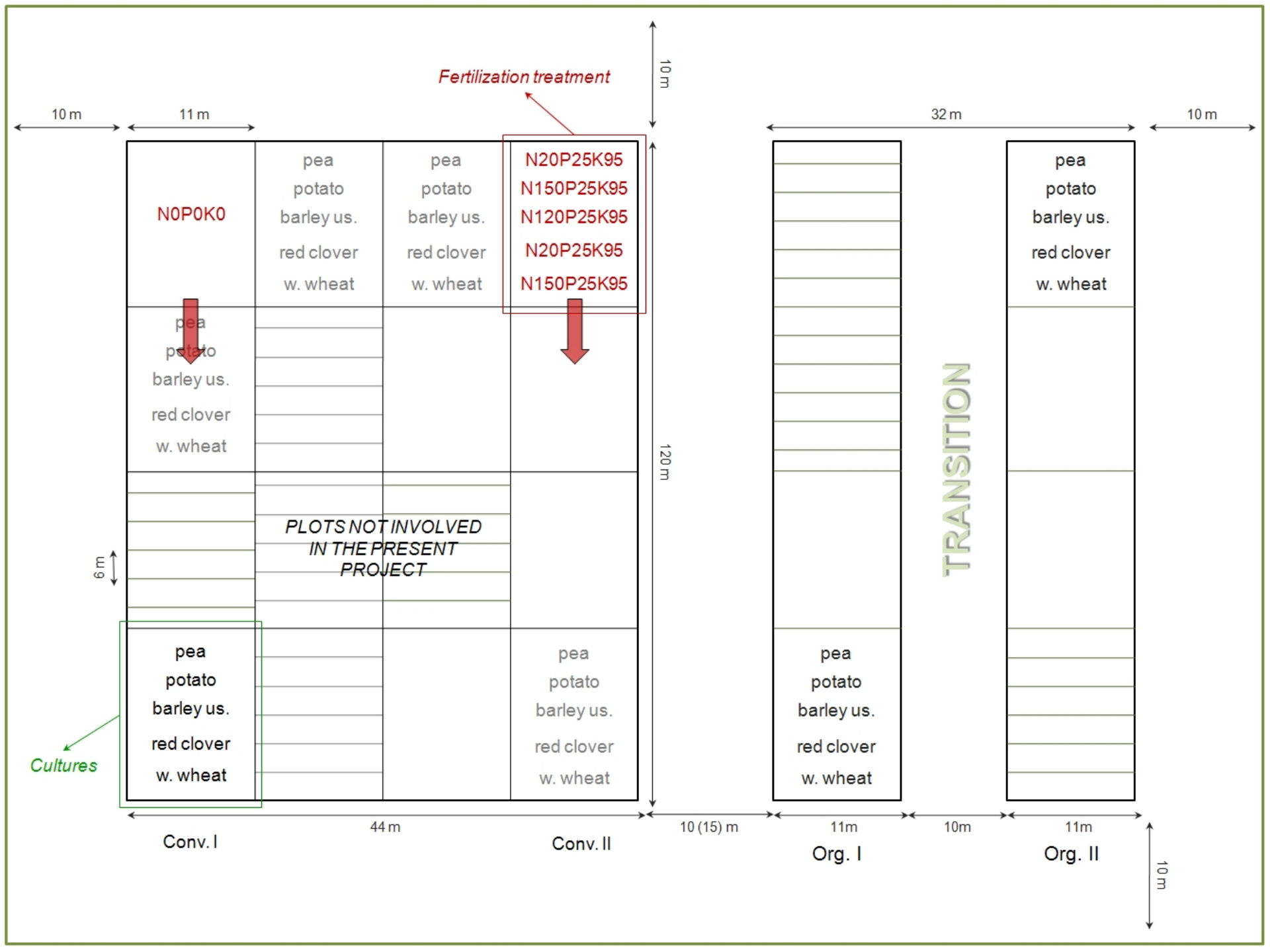
- 20 under conventional farming management* and no fertilizers = CONV. I (N0P0K0).
- 20 under conventional farming management* and maximum fertilizer level = CONV. II (N150P25K95).
- 20 under organic farming + cover crops* = ORG. I.
- 20 under organic farming management + cover crops* + manure (added to potato plots) = ORG. II.

Parameters studied: pH, C_{org}, N, P, K.

*Conventional management includes the use of different fungicides, herbicides and insecticides

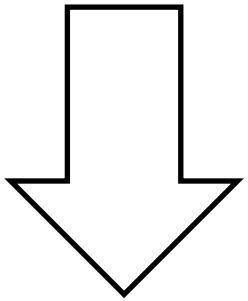
**Cover crops: w.oilseed-rape after pea, w. rye after potato and ryegrass after w. Wheat.


ORGANIC
CONVENTIONAL
92
92


Fertilization treatment
10 m
10 m
11 m
32 m
10 m
N0P0K0
pea
potato
barley us.
red clover
w. wheat
N20P25K95
N150P25K95
N120P25K95
N20P25K95
N150P25K95
120 m
PLOTS NOT INVOLVED IN THE PRESENT PROJECT
TRANSITION
6 m
Cultures
44 m
10 (15) m
11m
10m
11m
10 m
Conv. I
Conv. II
Org. I
Org. II

What , Where and Why?

Aim of the research: to study and compare different soil properties, physical, chemical and biological, between two cropping systems: conventional and organic under different fertilizing treatments in a long term crop rotation.



Advices to farmers (change or not to change into organic farming?), fertilization programs, solution to soil problems, effects of crop rotation combined with cover crops, etc.

How?

Samples taken once per year in April.

Samples air-dried and sieved (2 mm).

Laboratory analysis methods:

- KCl solution (1 M) (1:2.5) → pH
- Tjurin method → C_{org}
- Kjedal digestion → N_{tot}
- Ammonium lactate (AL) method → plant available nutrients phosphorus (P), potassium (K)

Statistic analysis:

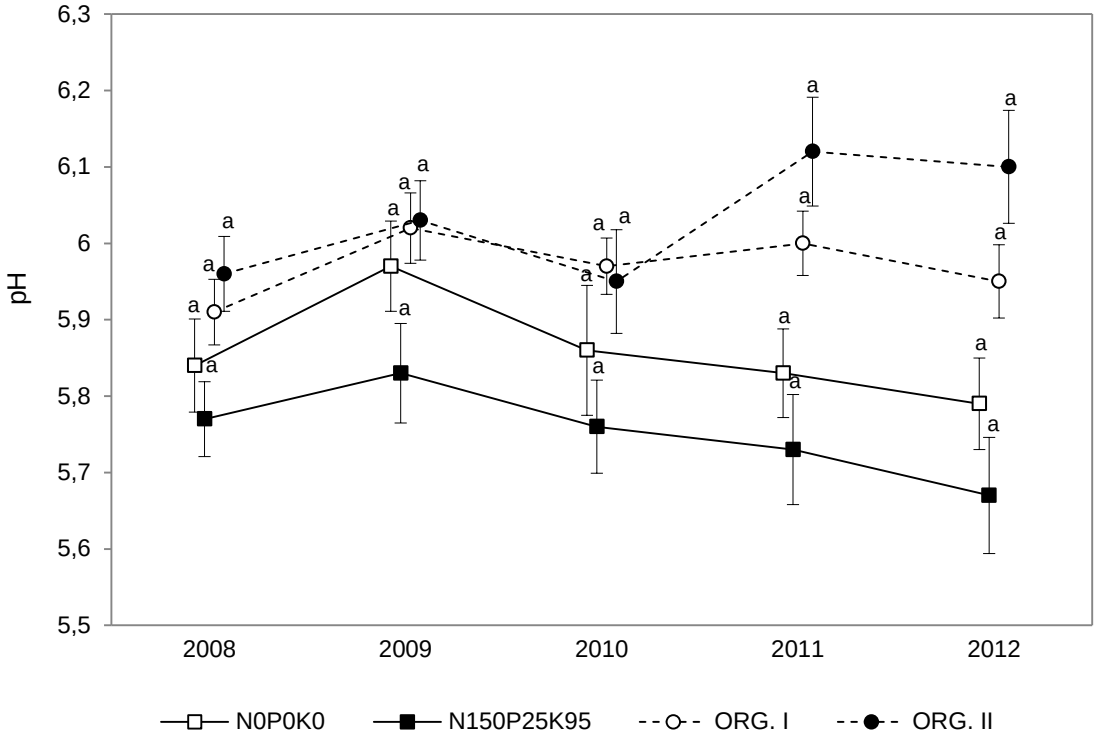
One-way analysis of variance followed by least significant difference (LSD) test ($P < 0,05$)

Results and discussion

pH:

– Yearly variations relativerly small → No significant differences.

– Slightly increase of the pH with time (except $N_{150}P_{25}K_{95}$).



Futher differences in long term expected?:

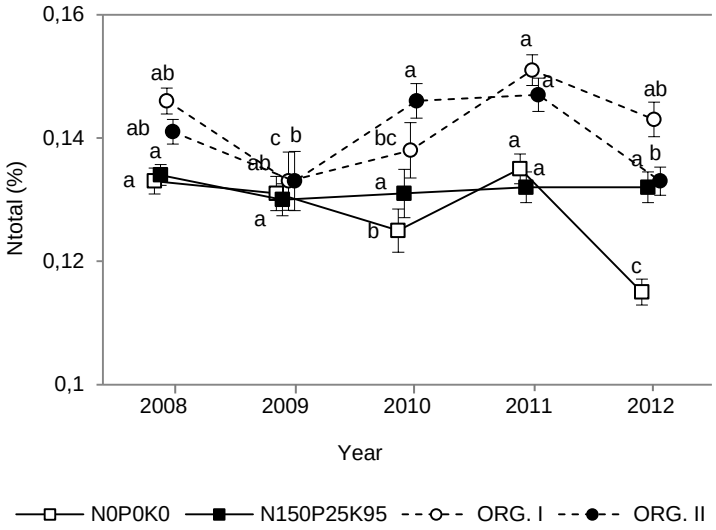
– Increase of soil acidity due to the application of nitrogen fertilizers in $N_{150}P_{25}K_{95}$ (Hati et al., 2008).

– Expected slightly increas of pH in the organic plots (Bulluck III et al., 2001; Liu et al., 2007).

Results and discussion

Ntot:

- Decreasing values after 5 years (significant loses in the N0P0K0 plots).
- Ntot seems to be connected with the crop uptaking.
- Very heterogenous effect of organic amendments (Rodrigues et al., 2006).
- Legume N-fixation cappacity may be affected by extreme temperatures.

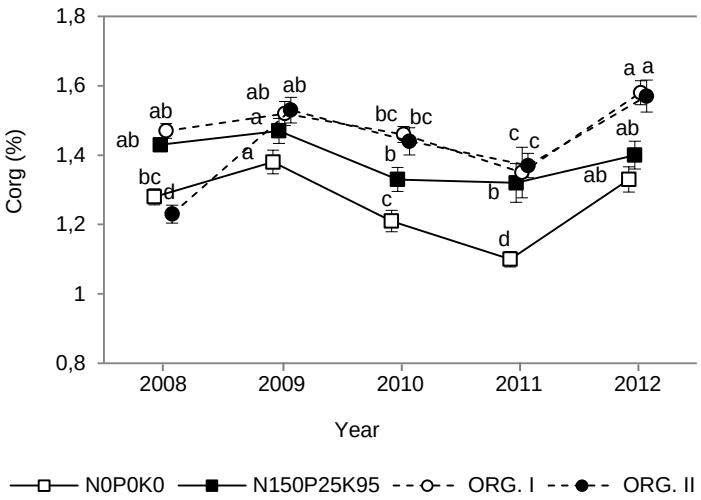


N0P0K0			N125K25			ORG. I			ORG. II		
'08	'12	Dif.	'08	'12	Dif.	'08	'12	Dif.	'08	'12	Dif.
0.133	0.115	**-0.017**	0.134	0.132	-0.002	0.146	0.143	-0.003	0.141	0.133	-0.008

Results and discussion

Corg:

- The Corg increased for all the treatments after first year.
- Significant diferences after 5 years in ORG. II plots → cattle manure + cover crop residues increase significantly the SOC content (Hoyt and Rice, 1977; Mathers and Steward, 1984; Wong et al., 1998, Chirinda et al., 2010).
- Only source of C conventional plots via incormporation of cropresidues in autum.



N0P0K0			N125K25			ORG. I			ORG. II		
'08	'12	Dif.	'08	'12	Dif.	'08	'12	Dif.	'08	'12	Dif.
1.28	1.33	+0.05	1.43	1.40	-0.03	1.47	1.58	+0.11	1.23	1.57	**+0.34**

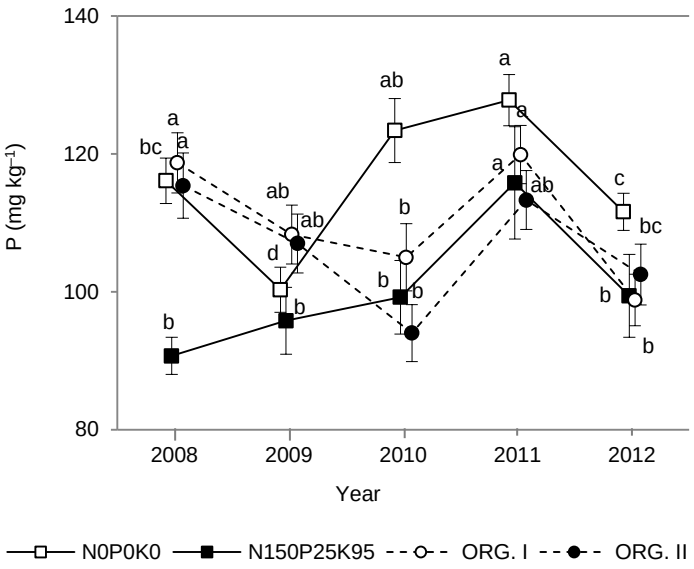
C:N ratio:

N0P0K0		N125K25		ORG. I		ORG. II	
'08	'12	'08	'12	'08	'12	'08	'12
9.6:1	11.6:1	10.7:1	10.6:1	10.1:1	11:1	8.7:1	11.8:1

Results and discussion

P:

- Irregular tendencies.
- After 5 years only N150P25K95 plots showed an increase (even if the starting value was lower than the rest of plots). Organic plots show significant loses (Løes and Øgaard, 2001 have reported lower concentration of P and long-term loses in different soils in Norway)
- Astover et al., 2006 → low level of P in Estonian soils (average amendments of 10–15 kg P ha^{-1})

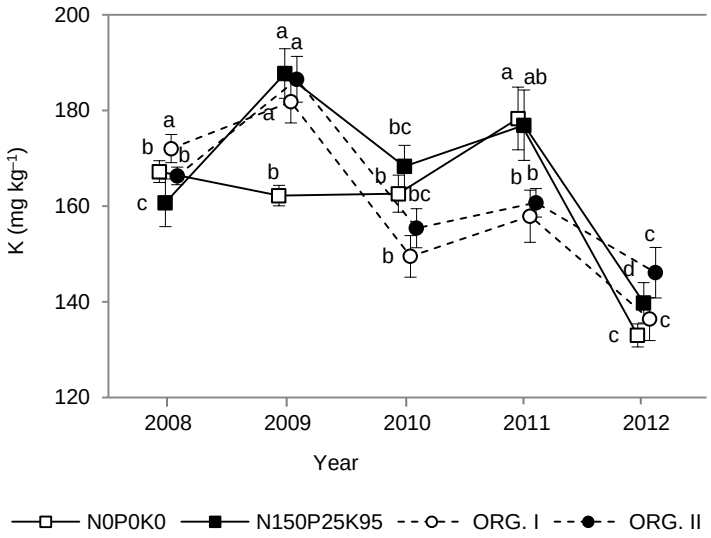


N0P0K0			N125K25			ORG. I			ORG. II		
'08	'12	Dif.	'08	'12	Dif.	'08	'12	Dif.	'08	'12	Dif.
116.1	111.6	-4.5	90.7	99.4	+8.7	118.7	98.8	**-19.9**	115.4	102.5	**-12.9**

Results and discussion

K:

- Decrease significantly for all the treatments after 5 years.
- Loide et al. in 2004: Fertilizer demand classification for Estonian soils depending on their structure and organic carbon content → low to very low demand of K.
- Variations may be related with changes in crop nutrient uptake.



N0P0K0			N125K25			ORG. I			ORG. II		
‘08	‘12	Dif.	‘08	‘12	Dif.	‘08	‘12	Dif.	‘08	‘12	Dif.
167.2	133.0	**-34.2**	160.7	139.8	**-20.9**	172.0	136.4	**-35.6**	166.3	146.1	**-20,2**

Conclusions

- Election of one or other farming sytem has effect on the soil fertility.
- After 5 years of experiment (1st crop rotation) any of the fertilization treatments proposed is enough for preventing nutrient loses.
- Even if the levels of K are enough for cover the plant needs, could suppose a limiting factor in long term for all the treatments.
- Tendencies coud be expected in long term (especially in the organic plots)
- Better choice combination of treatments?

Thank you!