CHANGE OF NPK-SUPPLY OF SOIL IN BÉKÉS COUNTY BETWEEN 2005 AND 2009

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ABSTRACT
During our study, made on the basis of the results of soil examination related to the Agricultural-Environmental Management Programme, we wanted to determine the changes of NPK-supply in arable lands of Békés County between 2005 and 2009.
We analysed the results of examinations of 300-300 soil samples of Békés County coming from the first (2005) and the last (2009) year of the Agricultural-Environmental Management Programme by NPK-supply.
Comparing our results to the literature we concluded that the very good, good range of NPK-supply expressed in percentage is higher in Békés County soils than the country average. Studying the data of the opening and closing years of each farm it was revealed that soil samplings were made without circumspection and expertise. Approaching to the closing year of the second Agricultural-Environmental Management Programme we think it is worth considering that sampling must be done by accredited organisations, because usable examination results and effective fertilisation advice can be expected only after expert sampling.
We suggest a compulsory education for the farmers taking part in the financial supporting system to teach them the theoretical and practical knowledge of the modern, environment- and cost-effective nutrient supply and also the rules of professional soil- and plant-sampling.

Keywords: soil, nitrogenous, phosphorus, potassium, NPK-supply

INTRODUCTION

Today the cardinal requirement in front of farming is to be economical and environment conscious, so to adapt to the economical and ecological circumstances. Sustainable farming is a topical issue all over the world (LOCH, 2002). Many results of research and practice demonstrated the undesirable effect of intensive chemical fertilizers, which resulted in stricter environmental laws and in the introduction of new environmental and cost saving fertilizer systems (ÁNGYÁN, 2005). The basis of sustainable development is the nutrient supply, which does not mean a burden on the environment. This can be achieved by the harmonisation of the intensity of farming with parameters of production area adequately (VÁRALLYAY, 2002).
KÁDÁR (1997) found that negative nutrient scale characterized the bulk of soils of our country until the 1960s, but from the 1970s the potassium and nitrogenous scale was positive. This time the phosphorus supply of our soils also improved (KÁDÁR, 1997). The period since the mid 80's until today can be characterized by radical changes. State support for chemical fertilizers ceased, during privatisation the connected big field lands were divided into small portions allowing the establishment of smallholdings and small farms. The intensive chemical fertilizer period that persisted of about two decades was followed by an extortionate soil period.
Today the NPK-supply of our soil is like it was in the 1970's (CSATÓ et al., 2012). The rate of our soils best supplied with nitrogenous, phosphorus and potassium significantly

decreased (by about 15-25%) due to negative nutrient scales of the 1990's (KÁDÁR, 1997; KRISTÓ, 2008). The agricultural environmental management became the part of the National Rural Development Plan after Hungary joined the European Union. The Minister of Land-cultivation and Rural Development published the requirements of Agricultural-Environmental Management Programme in the 150/2004 (X.12.) statutory rule (MILE 2005). The Agricultural-Environmental Management Programme consists of 5-year cycles. The first cycle began in the 2004/2005 crop year and ended by the 2008/2009 crop year, so the first cycle lasted from 1 September 2004 to 31 august 2009. The second cycle began in the 2009/2010 crop year and will end by the end of 2013/2014 crop year, so the second cycle will last from 1 September 2009 to 31 august 2014. Farmers (who are participating in the Agricultural-Environmental Management Programme) are required to make soil analysis in accredited soil laboratory every 5 years.
In our work we analysed the results of examinations of 300-300 soil samples of Békés County coming from the opening (2005) and the closing (2009) years of the Agricultural-Environmental Management Programme. Our purpose was to evaluate changes of NPK-supply in this area.

MATERIAL AND METHOD

Our soil investigation has been carried out in Agrochemistry Laboratory of the „Hódmezővásárhelyi Mezőgazdasági Szakszolgáltató Kft.. We prepared the soil samples which arrived from the farmers by MSZ 21470-50:2006 regulation in 2004 and 2009. The soluble nutriment content of the soils has been evaluated by MSZ-20135:1999 regulation.
NO_3-NO_2-N and AL-soluble P_2O_5 content of the soils were examined with Labor MIM making Contiflo automatic, heavy-duty instrument. The AL- soluble potassium content of the soils has been analysed with GBC 906 AA type atomic absorbing spectrometer in flame emission (FAES) mode.
The results of soil examinations have been evaluated with 3RP software by the categories of *Table 1*.

Table 1. The categories of nitrogen, phosphorus and potassium supply of soil

Categories	NO_3-NO_2-N ($mg \cdot kg^{-1}$)	K_2O ($mg \cdot kg^{-1}$)		P_2O_5 ($mg \cdot kg^{-1}$)	
		$K_A < 42$	$K_A > 42$	$CaCO_3 < 1\%$	$CaCO_3 > 1\%$
very weak	≤5,0	≤70	≤80	≤60	≤60
weak	5,1-10,0	71-130	81-140	61-80	61-80
medium	10,1-20,0	131-180	141-190	81-120	81-140
good	20,1-30,0	181-240	191-250	121-170	141-190
very good	30,1-50,0	241-550	251-550	171-350	191-350
extreme	50,1≤	551≤	551≤	351≤	351≤

RESULTS

By studying the nitrogen supply of the examined soils it can be determined that the very weak category decreased from 7 % to 6 %, while the weak category increased from 10 %

to 12 % and the medium category also increased from 35 % to 39 % between 2005 and 2009 (*Figure 1*). The rate of good and very good nitrogen-supply soils also decreased in the studied years, the good category from 44 % to 41 % and very good category from 4 % to its half, 2 %.

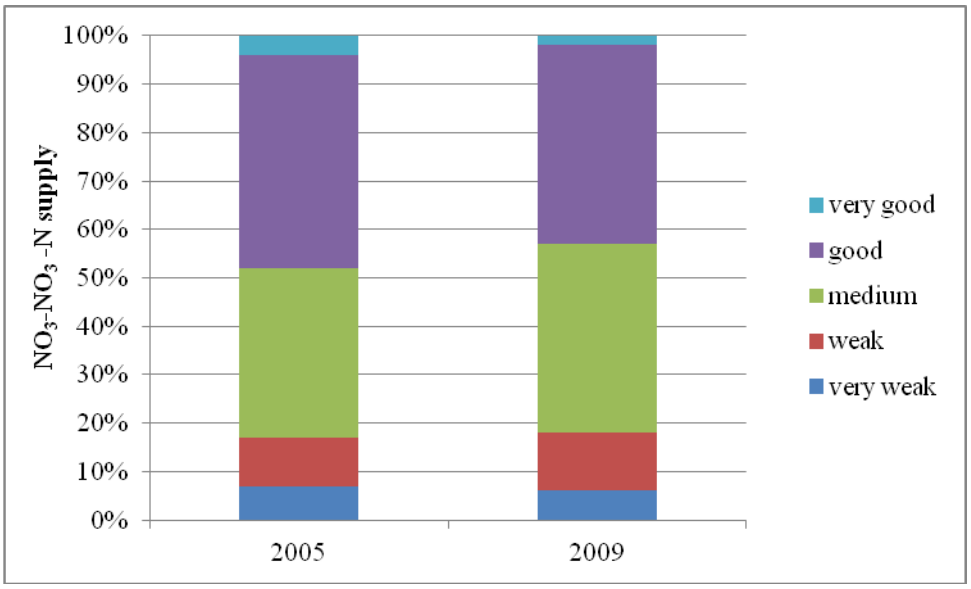

Figure 1. Nitrogen supply in arable lands of Békés County between 2005 and 2009

Figure 2 is showing the change of phosphorus-supply level between two examined years (2005, 2009). In 2005, out of the 300 soil samples of Békés County 7% fell into the weak category, 25% in medium, 19% in good, 42% in very good and 7% in the extreme.
On the basis of our research results in 2009 it can be determined that the phosphorus level of the of 300 samples of Békés County was very weak 2%, weak 9%, medium 27%, good 17%, very good 40% and extreme 5%.
It can be seen that in the second examined year (2009) the very weak level (2%) appeared, the weak, medium rate category increased by 2%, while the good and very good rate category decreased

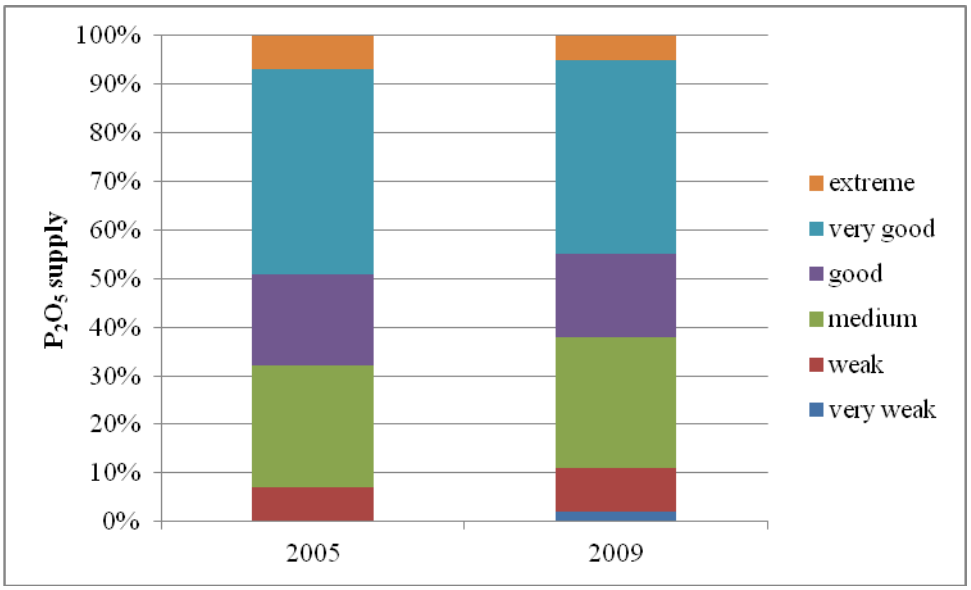

Figure 2. Phosphorus supply in arable lands of Békés County between 2005 and 2009

By studying the potassium supply the categories were the following: weak 4%, medium 25%, good 43%, very good 22% and extreme 6% of examined soils in 2005 (*Figure 3*).

In 2009 the potassium level of soil samples of Békés County was very weak 2%, weak 5%, medium 22%, good 46%, very good 20% and extreme 5%.
On the basis of potassium content of soils it can be determine that the very weak category appeared and the weak level increased by 1% and the good category by 3% in 2009 (*Figure 1*). But the percentage of medium, very good and extreme potassium content soils decreased between 2005 and 2009.

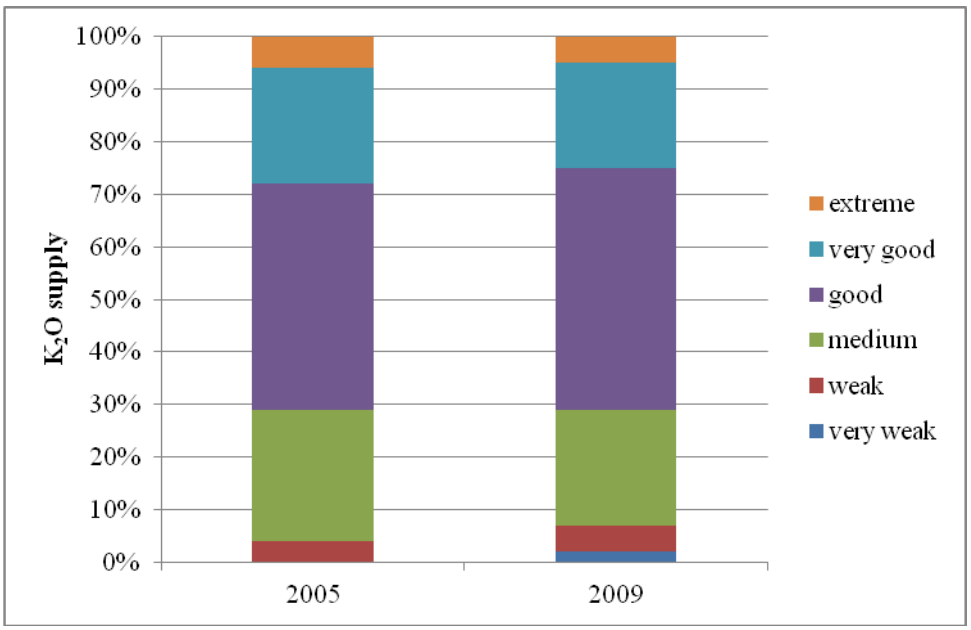

Figure 3. Potassium supply in arable lands of Békés County between 2005 and 2009

CONCLUSIONS

Today farmers have the fundamental task to sustain the fertility of soils without increasing the environmental load. The regular soil analysis (at least every 5 years) is the basis of a production area specific nutrient supply.
On the basis of the results of laboratory tests, farmers can make a nutrient-plan, which has many benefits: higher yield, better quality, healthier and more balanced plants. Conscious nutrient supply can decrease the environmental load and can be more cost-effective.
Comparing our results to the data of CSATHÓ et al. (2012), we experienced that the percentage of *very good, good* NPK-supply in arable lands of Békés County is higher than the national average. But we can determine on the basis of results of examined soils that the *very weak* level appeared in the phosphorus and potassium supply from 2005 to 2009. It shows that growers take account of nitrogenous supply only and they don't apply the phosphorus and potassium fertilizers because of financial reasons.
When analysing the data we detected that there were anomalies in the changes of soil content of certain farms (which made their soil tested in this laboratory in both years). These anomalies can happen if the soil sampling is incorrect. Soil samples, which do not or poorly represent the given area, result in incorrect laboratory results and fertilization proposals which cannot be used in practice. We can get proper data of soil investigation by properly done soil sampling.

In our opinion soil sampling should be carried out by an agricultural engineer or soil sampling training for the farmers has to be organised. It is worth considering to force farmers to do right nutrient management by allocating or removing subsidies.

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