Lysimeter experiments in the Czech Republic

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Introduction

First field lysimeter experiments have been established by Central Institute for Supervising and Testing in Agriculture in 1984 on selected experimental stations in connection with the need of better understanding of nutrients movement in the soil. The aim of subsequently obtained findings was to evaluate a process of nutrient translocation in the soil from point of view plant nutrition, fertilization economy and nowadays especially environmental compatibility.

The lysimeters construction was made according representation of natural soil and water conditions. The collecting equipments were installed in undisturbed soil profile in the deeps 40, 60 and 80 cm (eventually in 40 and 60 cm only).

Picture 1: **Review of experimental lysimeter stations in the Czech Republic**

Methodics of obersavations

The basic long-term constant climatic and soil parameters are known from every standpoint (monthly and annual rain and temperature normal, kind of soil, parent soil substrate, bulk density of dry soil, maximum capillary water capacity).

Running, every year observed parameters are meteorological data, growing crop, its yield, used fertilisers, percolation water retained in collecting equipments, used irrigation water, N_{min} content in the soil - early in the spring, after crop harvest, before soil freezing. From spring sampling are determined base agrochemical soil properties - pH and available nutrient content (P, K, Mg, Ca).

In percolation, rain and irrigation water are determined pH value, nitrate and ammonia nitrogen, Cl, P, K, Mg, Ca, Na and SO_4. Analyse of plant material (main and by product) contents determination of dry matter and essential nutrients (N, P, K, Ca, Mg).

On the base of results from lysimeter standpoints we are able in complex to observe inputs of nutrients from mineral and organic fertilisers, from rain and irrigation water to the soil. On the other hand it´s possible to observe outputs nutrients taken off by crops and nutrient losses determined in percolation water. From all this data we are able to calculate nutrient balance.

The N_{min} determination in three terms makes it possible to observe dynamism of nitrate and ammonia nitrogen in soil and calculate the nitrogen losses during the winter. The primary aim of lysimeter measurements on the base of analyses of percolation water is a monitoring of nutrient movement, especially of ni-

Table 1: **Characteristics of percolation water in soil horizon 80 cm (average values of pH + nutrients)**

Experimental station	Precipitation in mm	Percolation water in % from amount of precipitation	pH	NO_3	NH_4	P	K	Mg	Ca
						in kg . ha^{-1}			
Jaromerice	488	0,7	7,9	4,6	0	0	0,2	4,1	6,3
•atec	488	1,5	7,7	2,9	0	0,1	0,4	1,8	13,5
Domanínek	619	6,8	7,0	14,6	0,1	0,4	0,9	5,1	15,1
Hradec n/S.	622	4,1	7,3	14,1	0,7	0	0,7	1,0	28,9
Chrastava	751	10,3	7,0	15,1	0	2,7	3,2	10,5	55,9
Lípa	571	5,9	7,0	3,2	0,1	0,1	0,7	12,3	9,0
Závišín	835	0,4	6,9	0,1	0	0	0,1	0,9	2,7

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trogen, in soil. Important contents of nutrients in percolation water are especially in deep 80 cm. These contents mostly represent losses for crops and at the same time are as a danger for quality of ground water.

Results of observation

For evaluation of lysimeters in the Czech Republic was selected seven localities; of these two represent drier area (Jaromerice, •atec), three humid area (Domanínek, Hradec nad Svitavou, Chrastava) and two are on grassland without mineral fertilising (Lípa, Závišín).

All these selected localities are red encircled in the *picture No. 1*.

The *table No.1* shows on selected localities the amount of precipitation, the share of percolation water from precipitation and its long-term average characteristics - pH value and content of essential nutrients in percolation water captured in soil horizon 80 cm.

The share of percolation water from total amount of precipitation is lower on the experimental places in drier area. The percolation water has in all cases neutral or alkaline reaction. Due to smaller amount of captured percolation water in drier area and on grassland the amounts of determined nutrients are smaller, too. The contents of ammonia nitrogen, phosphorus and potassium are insignificant, content of magnesium is slightly higher. The contents of nitrate nitrogen and calcium are significant and in humid area represents losses approximately 15 kg of $N\text{-}NO_3$. ha^{-1} and 15 - 55 kg of Ca . ha^{-1}.

Conclusions

The losses by the leaching outside of root sphere of agricultural crops are very small. For the nutrient balance are important the losses of nitrate nitrogen and calcium only, especially in humid area. In this areas it´s suitable to fertilise during growing season only and the application doses of nitrogen to portion out. The nitrogen is most usable by crops and its leaching to the under soil is minimal.

Inputs of nutrients by the rainfall are very variable, significant are especially inputs of nitrate and ammonia nitrogen.