

АНТРОПОГЕННИЙ ВПЛИВ НА ПРИРОДНЕ СЕРЕДОВИЩЕ

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ACCUMULATE FUNCTION CONCERNING NUTRIENTS IN SLOVAK AGRICULTURAL SOILS

Accumulate soil function directly influences the nutrient movement and their accumulation in the soil. On the basis of nitrogen mineralization in the soil and chosen soil parameters (soil depth, content of gravel in the soil, soil slop, and content of clay particles in the soil). Were created five categories of the agricultural soils according to the ability of nutrients accumulation. The maps of soil ability to accumulate nitrogen, phosphorus and potassium were additionally created. There is 44 % of total area of agricultural soils with very strong ability to accumulate nitrogen, 56 % of soil to accumulate phosphorus and 16 % of soil to accumulate potassium. On the other side it is only 6 % of soil with very weak ability to accumulate nitrogen, 14 % to accumulate phosphorus and 20 % to accumulate potassium.

Key words: accumulate soil function, nutrient accumulate, soil parameters

Переміщення та накопичення поживних речовин у ґрунті безпосередньо впливає на всі функції ґрунту. Для вивчення цього питання, як основа бралися мінеральний азот ґрунту й ґрунтові параметри (глибина ґрунту, вміст гравію в ґрунті, ґрунтові включення й вміст глинистих часток у ґрунті). Були створені п'ять категорій сільськогосподарських ґрунтів відповідно до здатності накопичувати поживні речовини. Додатково були створені карти акумуляції азоту, фосфору й калію. Виявлено 44 % загальної площі сільськогосподарських ґрунтів з дуже міцною здатністю накопичувати азот, 56 % - фосфор і 16 % - калій. З іншого боку, було виявлено 6 % ґрунтів з дуже слабкою здатністю накопичувати азот, 14 % - фосфор і 20 % - калій.

Ключові слова: накопичувальна функція ґрунту, акумуляція поживних речовин, параметри ґрунту

Перемещение и накопление питательных веществ в почве непосредственно влияет на все функции почвы. Для изучения этого вопроса, как основа, брались минеральный азот почвы и почвенные параметры (глубина почвы, содержание гравия в почве, почвенные включения и содержание глинистых частиц в почве). Были созданы пять категорий сельскохозяйственных почв согласно способности накапливать питательные вещества. Дополнительно были созданы карты аккумуляции азота, фосфора и калия. Выявлено 44 % общей площади сельскохозяйственных почв с очень прочной способностью накапливать азот, 56 % - фосфор и 16 % - калий. С другой стороны, было выявлено 6 % почв с очень слабой способностью накапливать азот, 14 % - фосфор и 20 % - калий.

Ключевые слова: накопительная функция почвы, аккумуляция питательного вещества, параметры почвы

INTRODUCTION

In the first place it is necessary to give attention to the productive function of the soil at the evaluation of meaning of soil functions from the soil nutrient point of view. This basic function (soil ability to offer of biomass production) is exploited by man thousands of years. When regarding the non-productive functions of soils, e.g. functions that do not directly share on the biomass production, it is given much attention to the accumulate and transport function. These ones directly

influence the nutrient movement and accumulation in the soil and make possible for the plants to take in the nutrients for yield creating.

The accumulation itself plays very important role from the point of view of accumulation water, warmth, nutrients but also the harmful matter for the soil and plants. The soil is able to accumulate a huge amount of nutrients and nutrients accumulation is a significant part of its fertility.

The accumulate function indicates the ability of soil to keep and step by step to accumulate the plant nutrients in the soil in various forms. It is to mention that in the first place the very low mobile and fixed forms are sharing on nutrients accumulation. The ability of soil to accumulate of nutrients need not to mean the positive aspect from this point of view because first of all it is necessary to accumulate these forms of nutrients that are available for plants. However, the specific share of accumulated nutrients makes so called potential available nutrients forms, it means such form of nutrients that is momentary not available but it can on the base of dynamical balances in the soil gradually to fill up the pool, which contains nutrients forms available for plants.

MATERIALS AND METHODS

The evaluation of accumulate function concerning the nutrients went out from the soil ability to accumulate and keep the individual nutrients in the soil profile. In the case of nitrogen we oriented ourselves on its mineral form and it was getting about the soil ability to accumulate the mineral nitrogen from the organic matter (Bielek, 1998). The most important factor in phosphorus and potassium accumulation in the soil is the "volume" of soil. The methods of categorisation went out from the soil depth and content of gravel. The slope of area makes also the important role because soils on the steep slopes have naturally lower ability to accumulate the nutrients. The coefficient was attached to each parameter and on the base of their mutual combination were determined five categories of soil ability to

accumulate the nutrients - very low, low, good, high and very high.

RESULTS AND DISCUSSION

The ability to accumulate nitrogen is very important characteristics of the soil. Although nitrogen is containing in the soil in many forms, we were oriented ourselves on its mineral forms. According to Bielek (1998) the mineralisation of nitrogen is dependent on the soil quality, or on point values of BPEU. The amount of mineralised nitrogen for each soil bonited unit can be calculated on the base of exponential equation $y=2,01 \cdot e^{0,0045x}$, where y - the amount of mineralised nitrogen and x - point value of soil (Fig.1). Bielek (1998) determined three categories of intensity of nitrogen mineralisation but we divide these soil ability to five degrees for the synchronisation to other mentioned nutrients (tabl. 1).

Accumulation of phosphorus depends in first place on the "volume" of soil. It means it goes out from the gravel content and depends on slope of individual sites. The categorisation of soil ability to accumulate of phosphorus was made on the base of combination of mentioned soils and sites parameters. When regarding three categories of soil depth (shallow – less than 0,3 m, medium – 0,3-0,6 m and deep – more than 0,6 m), four categories of gravel content (non or sporadic gravelly – less than 10 % of gravel, slightly gravelly – 10-25 %, gravelly – 25-50 %, very gravelly – more than 50 % of gravelly) and five categories of slope (plain or slope less than 3°, moderate slope 3-7°, medium slope 7-12°, expressive slope 12-17° a steep slope more than 17°), it were obtained 60

Table 1

Point values of individual categories according to the nitrogen mineralisation in the soil

Category of soil ability to accumulate of nitrogen	The amount of mineralised nitrogen (mg $N_{an} \cdot kg^{-1}$ of soil in 14 days)	Point values
Very low	less than 2.100	0 - 20
Low	2.101-2.350	25 - 40
Good	2.351-2.600	45 -60
High	2.601-2.850	65 -80
Very high	more than 2.850	85 -100

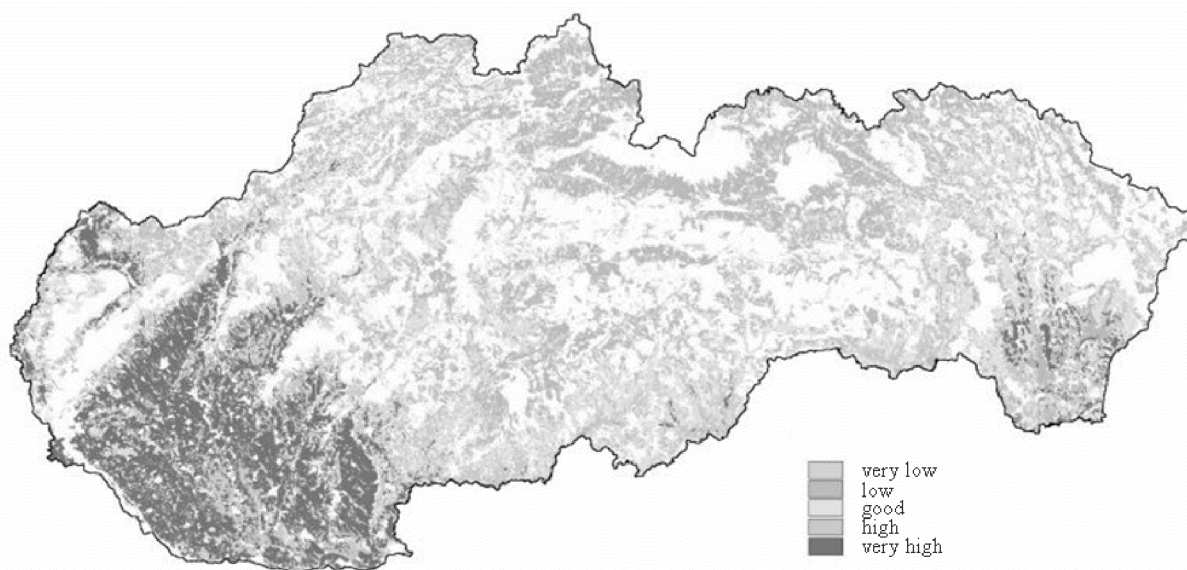


Figure 1 – Soil categorisation according to nitrogen accumulation in agricultural soil in Slovakia

Table 2

Point values of individual categories according to the phosphorus accumulation in the soil

Category of soil ability to accumulate of phosphorus	Coefficient	Point values
Very low	less than 0.048	0 - 20
Low	0.048 – 0.126	25 - 40
Good	0.127 – 0.238	45 -60
High	0.239 – 0.384	65 -80
Very high	more than 0.384	85 -100

combination of these parameters (Fig. 2). The coefficients were assigned to each parameters - for soil depth 0.20, 0.45 and 0.80, for gravel content in the soil 0.60, 0.70, 0.85 and 1.00 and for slope 0.2, 0.4, 0.6, 0.8 and 1.0. The mutual relationship of these coefficients determined five categories of soil ability to accumulate phosphorus (tabl. 2).

The phosphorus accumulation in the soil directly depends on the soil depth and indirectly on the gravel content in the soil and slope of site. The deep soils, without gravel that are on the plains or slope less than 3° are able to accumulate the phosphorus in the great amounts. For the shallow soils with high content of gravel and soils on the slopes more than 12° is this ability to low.

Potassium accumulation, like phosphorus one, depends in the first place on the soil “volume” but the content of clay particles makes an extraordinary important role. Unfortunately we did not know the quantitative composition of clay minerals in the soils but the fact is that potassium can be very simply fixed not only on their surface but directly in their structure. Therefore this parameter has the most important significance in the case of potassium accumulation. The categorisation of soil ability to accumulate potassium went out from the same characteristics like at phosphorus but the next one was assigned - the clay content in the soil. Regarding above mentioned categories of soil depth, gravel content in the soil, sites slope and following five categories of soil texture (sandy

and loamy sand – less than 20 % of clay, sandy loam – 20-30 %, loam – 30-45 %, clayey loam – 45-60 % and clayey and clay – more than 60 % of clay) were obtained 300 combination of these four parameters. By the same way, like at

phosphorus, the coefficients were assigned to each parameter (in the case of texture 0.125, 0.250, 0.375, 0.525 and 0.675) and their mutual relationship determined five categories of soil ability to accumulate potassium (tabl. 3).

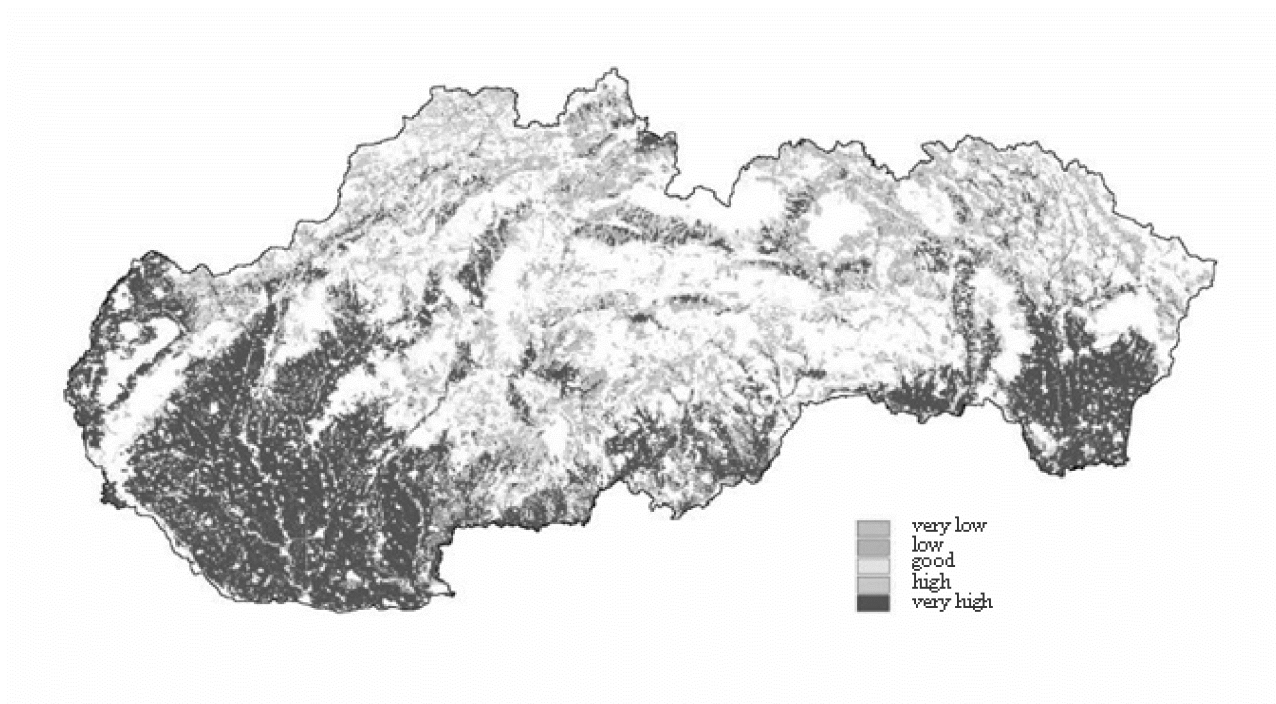


Figure 2 – Soil categorisation according to phosphorus accumulation in agricultural soil in Slovakia

Table 3
Point values of individual categories according to the potassium accumulation in the soil

Category of soil ability to accumulate of potassium	Coefficient	Point values
Very low	less than 0.0230	0-20
Low	0.0230 – 0.0462	25-40
Good	0.0463 – 0.1428	45-60
High	0.1428 – 0.2940	65-80
Very high	more than 0.2940	85-100

Table 4

The share of individual soil categories concerning nitrogen, phosphorus and potassium accumulation (% of agricultural soil areas in Slovakia)

	Soil ability to accumulate of nutrients				
	Very low	Low	Good	High	Very high
Nitrogen	6	13	16	21	44
Phosphorus	14	12	9	9	56
Potassium	20	8	10	46	16

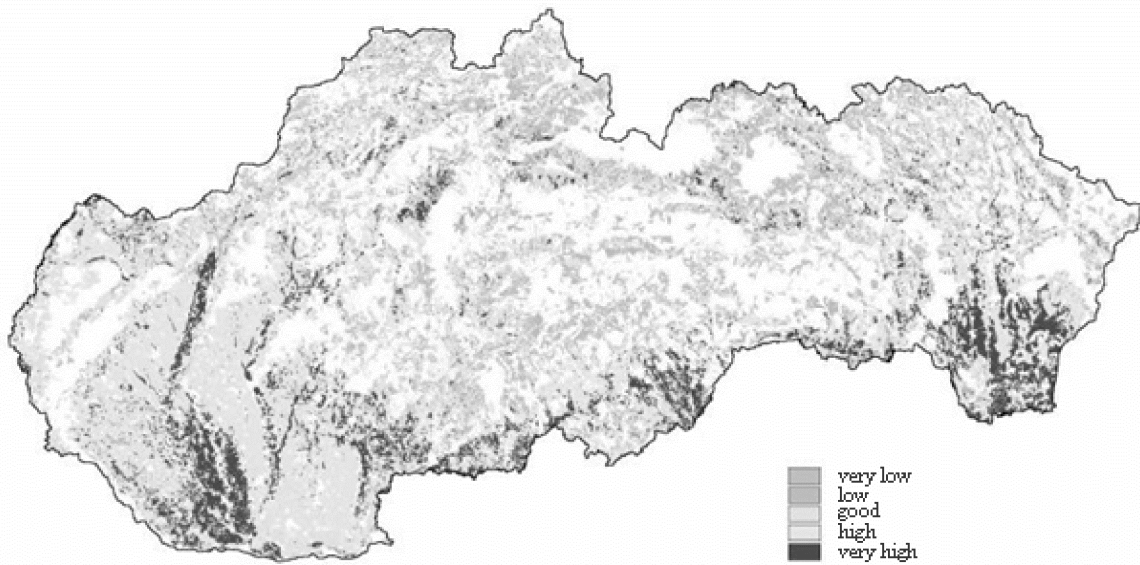


Figure 3 – Soil categorisation according to potassium accumulation in agricultural soil in Slovakia

The potassium accumulation in the soil directly depends on the soil depth and clay content in the soil and on the other side indirectly on the gravel content in the soil and slope of site. The deep soils with high content of clay (clayey loam soils, clayey soils and clay) without gravel that are on the plains or slope less than 3° are able to accumulate the potassium in the great amounts in comparison with shallow, sandy soils, soils with high content of gravel and soils on the slopes more than 12°.

It can be stated that the soil ability in Slovakia to accumulate all three basic plant nutrients is very good. Till 65 % of agricultural soil area has high and very high ability to accumulate nitrogen and phosphorus, in the case of potassium it is 62 %. It means that the nutrient losses are relative low and they occur mainly on the slopes (caused by water erosion) and on the texturally light soils (leaching of potassium).

SUMMARY

On the base of nitrogen mineralisation intensity in the soil, chosen soils and sites parameters (soil depth, gravel content in the soil, slope of the sites and content of clay

particles in the soil) were determined five soil categories according to soil ability to accumulate nitrogen, phosphorus and potassium. The next step was to create the maps of this function. Almost 45 % of agricultural soils have very high ability to accumulate nitrogen, more than 56 % to accumulate phosphorus and 16 % to accumulate potassium. On the other side, very low ability to accumulate nitrogen has only 6 % of agricultural soils, in the case of phosphorus it is 14 % and in the case of potassium 20 % of agricultural soils in Slovakia.

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