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Javoreková S., Vjatráková J., Tančinová D.: **Ekologický význam mikroorganizmov v povrchovej vode.**

Medzi ekologicky ohrozené oblasti na Slovensku patria povrchové vody pretekajúce obcami bez kanalizácie a s intenzívnou poľnohospodárskou činnosťou. V takejto oblasti sa nachádzal i Cabajský potok, ktorého mikrobiologickú kvalitu sme monitorovali v období od marca 1999 do februára 2001. Výskyt sledovaných fyziologických skupín mikroorganizmov (koliformných baktérií, aktinomycét, mikroskopických húb, myxobaktérií, lipolytických baktérií a amylolytických baktérií) nám potvrdil, že potok bol v sledovanom období zaťažovaný odpadmi komunálneho pôvodu, rastlinným opadom a pôdou. V období od marca 1999 do februára 2000 sme v Cabajskom potoku zaznamenali najmä zvýšený prísun ľahšie rozložiteľných organických látok fekálneho pôvodu a v období od marca 2000 do februára 2001 v dolnej časti potoka prítomnosť ťažšie rozložiteľných organických látok. Znečistenie potoka pôdnymi časticami nám potvrdila i prítomnosť typických zástupcov pôdnych mikroskopických húb.

SELECTED AGROCHEMICAL SOIL PARAMETERS EVALUATION FROM THE VIEW OF ITS PRODUCTIONAL FUNCTION

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Abstract

Pechová B., Miklovič D., Bujnovský R.: Selected agrochemical soil parameters evaluation from the view of its productional function. Ekológia (Bratislava), Vol. 22, No. 2, 211–218, 2003.

In period 1999–2001 we have balanced yield forming potential of texturally medium heavy soils of Slovakia within the partial task "Soil nutrient potential in relationship to yield formation and fertilization strategy". We have ascertained, most of medium heavy Haplic Chernozems calcaric, Mollic Fluvisols calcaric has been permanently keeping high fertility potential from the view of soil reaction, humus amount and quantity, and nutritional offer. To fertile soils can be included also some Luvi-haplic Chernozems, Mollic Fluvisols, Eutric Fluvisols, Calcaric Fluvisols, and Haplic Luvisols, particularly at higher N, P, K nutrients levels. Less fertile Eutric Cambisols, Dystric Planosols and Albic Luvisols. Statistically significant correlations among soil parameters, i.e.soil reaction, humus, humus quality (HA:FA, C:N), total nitrogen, available phosphorus and potassium are materialized assessment of yield bringing soil potencial.

Key words: soil reaction, humus, humus quality, nitrogen, phosphorus, potassium

Introduction

Mankind has been and in next future will be existentially associated with soil that is securing plant biomass production, and contemporarily is introducing a space for its activities.

By cultivatory or anthropogenic measures soil properties have been continuously qualitatively changing. Soil quality can be judged with various aspects, besides production is established ecological assessment requirement, or environmental point of view, as soil quality is also demonstrated by its capability to secure ecological functions at concrete land use.

Agrochemical soil parameters, particularly for plant available nutrient levels, introduce summarized factor, which by nutrient of fertilizers applied assistance is significantly participating at soil productivity potential formation (Bujnovský et al., 2002; Fecenko, Ložek, 2000), as well as abroad (King, 1990; Boysen, Oehring, 1992; Sims, 2000; Bujnovský, Fotyma, 2001). Low fertilization intensity (particularly P and K) is in last decade demonstrated in their supplies gradual lowering, this is considered for soil degradation demonstration, also called soil fatigue (Lal, 1998, Isherwood, 2000).

Soil reaction has substantial effect on plant growth, soil microorganisms and on soil biological processes. In acid soil are markedly lowered levels of available nitrogen, phosphorus, potassium, magnesium and trace elements. Soil liming therefore belongs to basic measures for soil quality conservation. Soil processes heterogeneous conditions in the natural regions affect humus formation. Soil organic matter levels and quality are depending mainly from soil type, textural composition and agricultural land use. Composition and chemical structure of soil organic matter (SOM) - one of most important soil property, HA (humic acids) are depending predominantly on soil type. HA chemical structure enables relative exact indication of SOM maturity status and some its physical chemical parameters can play important role at soil type classification (Barančíková, 1997). Characteristics and soil type productivity potential were in our country assessed by Bielek et al., 1998. From their works is resulting, Chernozems and Mollisols were most productive soil types. High productive arable soils include Haplic Luvisols, Fluvisols, and Cambisols Dystric Planosol and Rendinas were productive topsoils. Eutric Regosols were less productive topsoils.

It is well known, medium heavy soils have among the kinds of soils most favorable properties physical, chemical and biological, respectively. Their fertility should be conserved by proper agrotechnics (Hroššo, 1958).

The findings obtained are presenting soil productivity potential qualitative development, contemporarily they are background for fertilization strategy and nutrient rates projection.

Material and methods

Farmland productivity potential assessment within partial task "Soil nutrient potential in relationship to yield formation and fertilization strategy" was based on the selected sites of the Slovakian Soils Monitoring (part 1) (Linkeš et al., 1997).

The study was oriented to medium heavy soil types, subtypes and varieties: Mollic Fluvisols (modal, modal-calcaric), Chernozem (haplic-calcaric, modal-calcaric, luvi-haplic), Fluvisol (arenic, modal, modal-calcaric), Haplic Luvisol (modal), Cambisol (modal-saturated), Dystric Planosol (luvic-saturated, modal-saturated).

Soil samples-depths 0.30 m, every sample was mean of 5 samples sampled. Number of soil samples studied was 112 (numbers and selection were determined by crop - here were not balanced).

Soil samples analyses (Fiala et al., 1999): pH/KCl, total nitrogen, available phosphorus (Mehlich 2), available potassium (Mehlich 2). Data of humus and HA, FA (fulvic acids) were obtained from Soil Science and Conservation Research Institute database (Kobza et al.,1997).

Results and discussion

In period 1999–2001 we have evaluated nutrition potential of medium heavy Mollic Fluvisols, Chernozems, Fluvisols, Cambisols, Dystric Planosols, their subtypes and varieties.

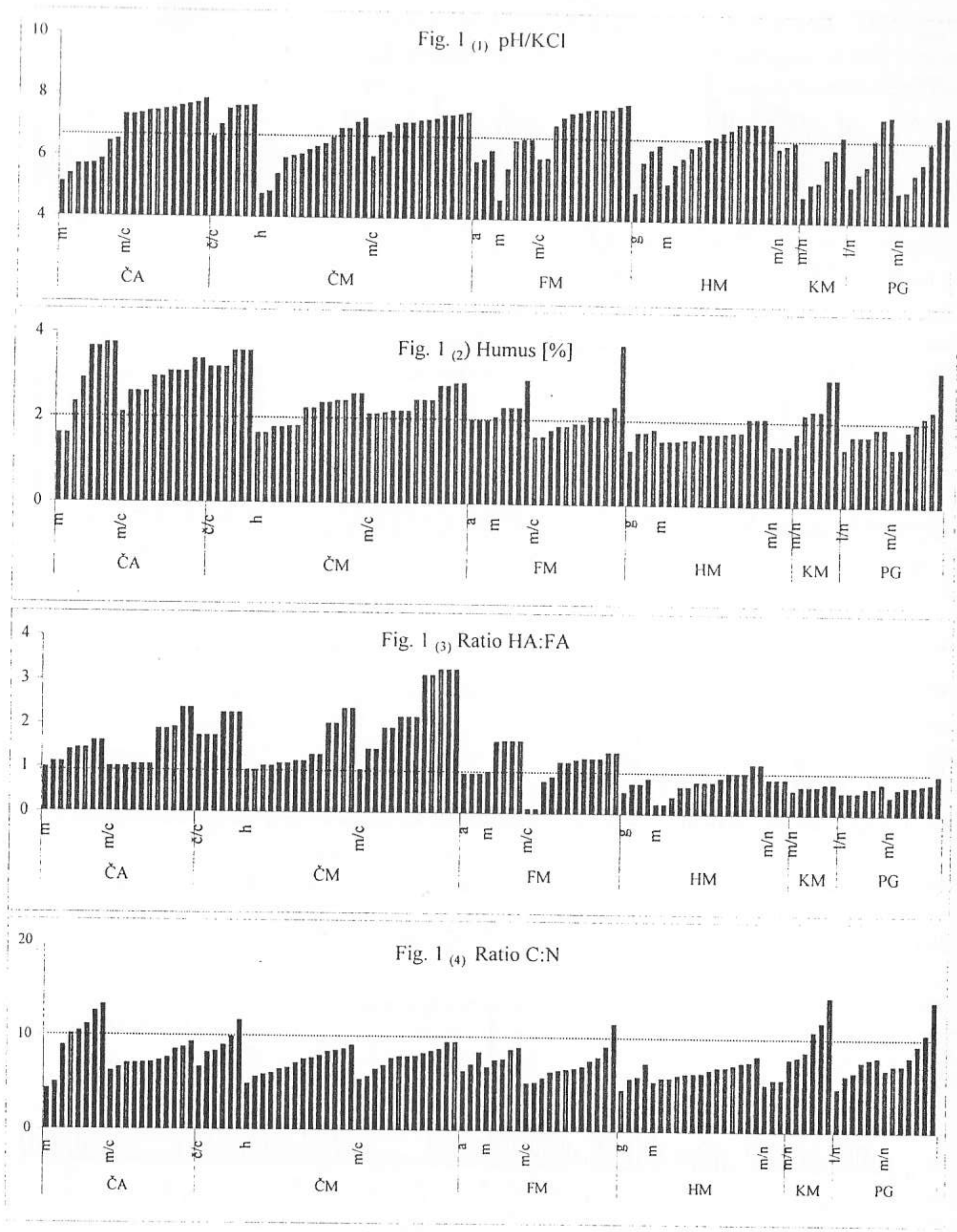


Fig. 1$_{(1-7)}$. Nutritional soil parameters judgement with aspect on their productional function.

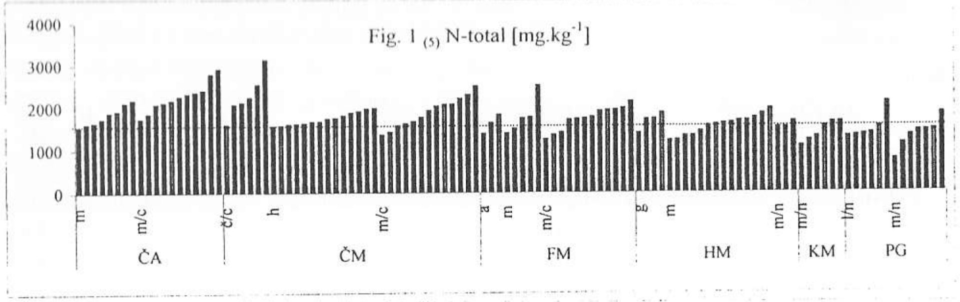


Fig. 1 (5) N-total [mg.kg-1]

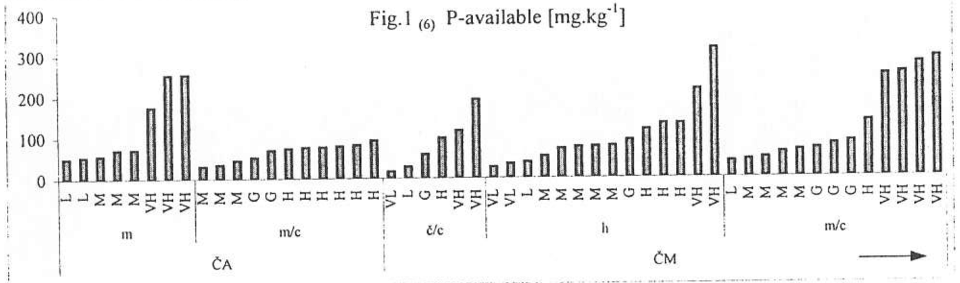
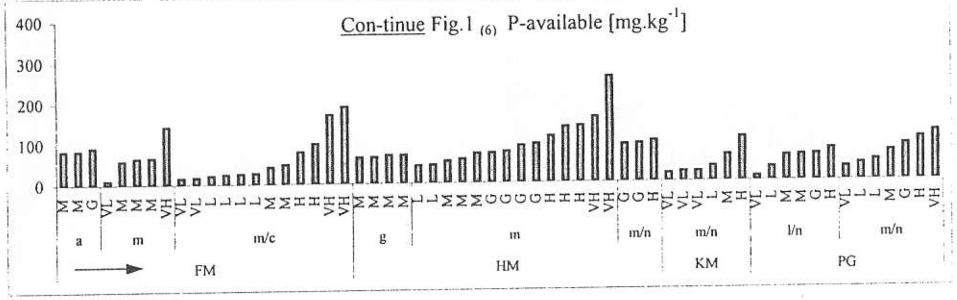


Fig.1 (6) P-available [mg.kg-1]



Con-tinue Fig.1 (6) P-available [mg.kg-1]

VL - very low, L - low, M - Medium, G - good, H - high, VH - very high P-contents

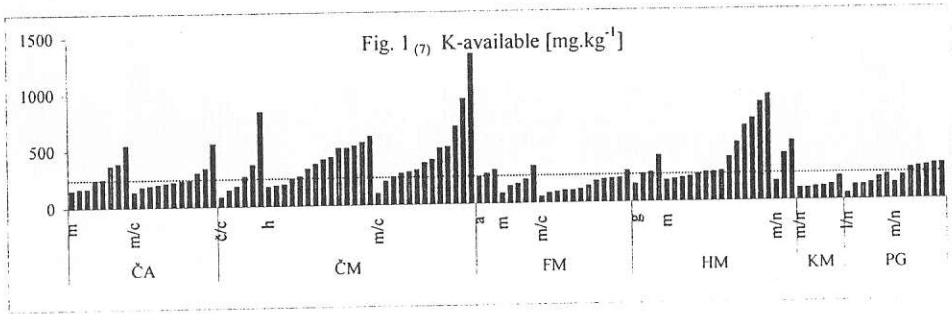


Fig. 1 (7) K-available [mg.kg-1]

Main nutrition soil potential consists of N tot, P and K available in soil. It in some circumstances is utilisable for yield formation. High level of total nitrogen in soil creates assumptions for higher offer of N inorg. Its content has considerable dynamics resulting from the conditions enabling nitrogen changes in soil.

N tot content is released into soil by SOM mineralisation. Humus is presenting soil organic matter, which passed through long development process. Ratio HA:FA is important for humus quality. Conditioning factors for implementation of N, P, K - potential in soil are soil reaction and moisture regime. Moisture fixation and possibilities of its utilisation by crops are dependent on soil physical parameters. All this parameters (with direct mediation effect on yield formation) can be called-soil plant nutrition parameters for their relationships linkage.

Soil types differed by their properties within the same soil category, subtype and variety. We have evaluated them by the Agronomic Criteria (Anonymous, 1995; Bielek, Kudličková, 1990).

From the results elaborated in the form of set Fig. $1_{(1-7)}$ resulted concentration diapazon of soil parameters balanced in the types, subtypes and varieties.

By interrupted liner is in the figures designated significant interface that illuminates positive yield-forming soil properties (above line) as well as negative ones (under line). Soil available phosphorus balance is fixed to soil texture and pH/KCl (therefore is in Fig. $1_{(6)}$ used verbal expression: VL – very low, L – low, M – medium, G – good, H – high and VH – very high contents of available phosphorus in leachate Mehlich 2).

Abbreviations (in Fig. 1 and Table 1):

soil type: ČA - Mollic Fluvisol, ČM - Chernozem, FM - Fluvisol, HM - Haplic Luvisol, KM - Cambisol, PG - Dystric Planosol

soil subtype: a - arenic, č - mollic, chernozemic, g - pseudogleyic, h - luvic, m - modal, l - luvisol

soil variety: c - carbonatic, n - saturated, k - acid.

Assessment of positive, yield-forming agrochemical soil properties (in the set Figures 1 and Table 1):

soil reaction neutral to alkaline (above pH/KCl 6.5, Fig.$1_{(1)}$), medium to very good supply

T a b l e 1. Positive and negative parameters in soil reaction, humus quality and supply and nutrient levels from the view of soil fertility [%]

Positive factors		ČA		ČM			FM		HM		KM	PG	
		m-c	m	č-c	m-c	h	m	m-c	g	m	m-n	l-n	m-n
pH/KCl	N-A	100	0	100	92	29	60	83	0	71	17	33	43
Humus	M-VG	100	75	100	100	57	80	42	0	21	83	0	43
HA:FA	(H-F) -H	73	88	100	92	71	80	67	0	14	33	0	0
N tot.	M-VH	100	88	100	77	79	60	75	75	50	0	17	14
P-av.	G-VH	73	38	67	69	57	20	25	0	57	17	0	29
K-av.	G-VH	64	63	50	85	79	20	17	75	79	0	17	71
Positive mean		85	58	86	86	62	53	51	25	49	25	11	33
Negative mean		15	42	14	14	38	47	49	75	51	75	89	67
Positive dominance		**70**	17	**72**	**72**	24	7	3	-50	-2	-50	-78	-33

of humus (i.e. above 2.0%, Fig. $1_{(2)}$), humic-fulvic to humic humus type with ratio HA:FA (above 1, Fig.$1_{(3)}$), medium to very high N tot (above 1600 mg N kg^{-1}, Fig. $1_{(5)}$), available phosphorus level (Mehlich 2 - verbally balanced , Fig. $1_{(6)}$), and available potassium (Mehlich 2 - above 200 mg K kg^{-1}, Fig. $1_{(7)}$). As mean is considered ratio C:N = 10:1, i.e. 10 (Fig.$1_{(4)}$).

Positive (negative) properties occurrence influencing soil fertility, resulting from soil analyses (set Fig. $1_{(1,2,3,5,6,7)}$) is percentile expressed in Table 1. The table is materializing higher data number evaluation, however suitable is contemporal confrontation with data in Figures (some positive soil properties are only tightly above borderline).

From Table 1 is resulting soil percentile share requiring liming, i.e. at pH/KCl under 6.5, P and K-fertilization on soils with lower humus and nitrogen (negative factors = 100 positive factors). In Table 1 were not included soils with lower areas (Eutric Fluvisols, Haplic Luvisols).

Soil reaction is condioned by chemical soil properties. Decisive are mainly calcium and magnesium levels. From Fig. $1_{(1)}$ is resulting soil reaction variability in studied soils. Acid soil reaction was typical particularly for heavy Mollic Fluvisols (m), Haplic Luvisols (g), Cambisols (m-n), Chernozems (h), Dystric Planosols (mainly 1-n). Soils with alkaline soil reaction are not included into soil reaction negatives enumeration. They could be negatively assessed, if alkaline reaction was conditioned by presence of sodium cations in sorption complex and sodium carbonate in soil solution.

Medium heavy Mollic Fluvisols (m-c, m) and Eutric Fluvisols (m) most contained accumulated humus of high quality, Cambisols (m-n) medium humus level of fulvi-humic type. In Haplic Luvisols (g) and Dystric Planosols (l-n) was found lower quality humus in lower level.

C:N ratio of most of the Slovakian soils studied was smaller than 10, this was witnessing about marked organic matter decrease due to intensive mineralisation (Fig.$1_{(4)}$). Although mineralisation increases soil nitrogen, however is necessary to replenish its sources. Such soils need organic matter regular application. High organic matter mineralisation intensity was typical almost for all soil types studied. Only small soil percentage showed wider C:N ratio. Similar information published also Fecenko, Ložek (2000). By Hraško, Bedrna (1988) C:N ratio above 10 means humus of highest quality. Mineralisation process is controlled particularly by temperature and moisture regimes. In lowland warmer regions is danger of humus losses higher than in cooler mountainous zones (Bedrna, 1998).

Bielek (1998) published C:N ratio in the soil types in following amplitudes: Mollic Fluvisol and Mollic Gleysols 9.8–9.9, Eutric Fluvisols 4.6–11.0, Haplic Chernozems 6.1–7.1, Haplic Luvisols 5.3–6.2, Albic Luvisols 4.0–8.1, and in Eutric Cambisols 6.8–14.3. In the soil types studied was detected more wider C:N amplitude, this was resulting from sites selection (Fig. $1_{(4)}$).

In medium heavy Mollic Fluvisols (m-c), Haplic Chernozems (č-c, m-c, h) there dominated more often good N, P, K-nutrient offer. In more acid Mollic Fluvisols (m) was registered lower P-available levels with good N and K-supplies. Higher K-available was registered also at Haplic Luvisols (g, m).

Lower P-available level was observed in all the Haplic Luvisols (g), Dystric Planosols (l-n) studied, was overwhelming also in Eutric Fluvisols (m, m-c), Eutric Cambisols (m-n) (Fig. $1_{(6)}$, Table l).

Lower K-level was overwhelming particularly in medium heavy Eutric Cambisols (m-n), Eutric Fluvisols (m-c, m), Dystric Planosols (l-n) (Fig. $1_{(7)}$, Table l).

Table 2. Correlation relationships among soil parameters balanced

Parameters	pH/KCl	Humus	N-tot	C:N	HA:FA	P-av.	K-av.
pH/KCl	1						
Humus [%]	0.185	1					
N tot [$mg.kg^{-1}$]	**0.335**	**0.538**	1				
C:N	-0.,091	**0.650**	-0.267	1			
HA:FA	0.240	**0.441**	**0.405**	0.128	1		
P-available [$mg.kg^{-1}$]	-0.017	0.184	0.159	0.065	**0.410**	1	
K-available [$mg.kg^{-1}$]	0.040	-0.042	0.197	-0.216	**0.320**	**0.674**	1

N = 112 ... $R_{(0.01)}$ = **0.242**, $R_{(0.05)}$ = 0.185

N-total values were registred in all the Eutric Cambisols (m-n) and almost in 85% Dystric Planosols (l-n, m-n) under 1600 $mg.kg^{-1}$. They are adequate to very low – low nitrogen level (Fig. $l_{(5)}$, Table l).

When increasing soil reaction in texturally medium heavy soils, statistically evident were increased humus amount and quality (HA:FA) and total nutrient level, respectively.

By humus increase also its quality and content were increasing. By C:N ratio increase total nitrogen decreased as well as soil available potassium.

In the soils studied at humus quality increase, statistically evident was also increased levels of total nitrogen, available phosphorus and potassium (Table 2).

Conclusions

Among the parameters balanced (soil reaction, humus amount and quality and nutrient offer) of texturally medium heavy soil types (subtypes, varieties) ascertained was natural concentration variability.

Based on percentage expression of positive (negative) soil properties occurrence expression from the view of their fertility potential was stated, our most fertile Haplic Chernozems calcic and Mollic Fluvisols calcic, Mollic Fluvisols have been permanently keeping higher levels of nitrogen, available P and K and humus of highest quality, when having optimum soil reaction.

To most fertile soils can be associated also some Luvi-Haplic Chernozems, Mollic Fluvisols (weakly acid, with higher P-available level), Eutric Fluvisols, calcic (with higher available nutrient levels) and Haplic Luvisols (having higher humus quality and nitrogen level).

Eutric Cambisols, Stagni-Haplic Luvisols, Dystric Planosols, Eutric Planosols, Luvic Stagnosols most are less fertile. Only some positive properties affecting soil fertility were registered, dominantly in lower percentage of the soil studied.

Among mentioned soil parameters were observed statistically evident correlations that are materializing soil fertility evaluation.

Translated by P. Jambor

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Pechová B., Miklovič D., Bujnovský R.: **Zhodnotenie vybratých agrochemických parametrov pôdy z hľadiska jej produkčnej funkcie.**

V rokoch 1999–2001 sme vyhodnocovali úrodutvorný potenciál stredne ťažkých pôd Slovenska v rámci čiastkovej úlohy „Potenciál pôdnych živín vo vzťahu k tvorbe úrod a stratégii hnojenia". Zistili sme, že väčšina stredne ťažkých černozemí čiernicových karbonátových, modálnych karbonátových a čierníc modálne karbonátových si stále udržuje vysoký úrodnostný potenciál z hľadiska pôdnej reakcie, množstva a kvality humusu a živinovej ponuky. K úrodným pôdam možno zaradiť aj niektoré černozeme hnedozemné, čiernice modálne, fluvizeme modálne, modálne-karbonátové a hnedozeme modálne, najmä pri vyššom obsahu N, P, K živín. Menej úrodné sú kambizeme modálne nasýtené, pseudogleje modálne nasýtené a luvizemné nasýtené. Štatisticky významné korelácie medzi pôdnymi parametrami, t.j. pôdnou reakciou, humusom, kvalitou humusu (HK:FK, C:N), celkovým dusíkom, prístupným fosforom a draslikom objektivizuje hodnotenie úrodnostného potenciálu pôd.

INFLUENCE OF CHEMISTRY OF PRECIPITATION ON WATER SOURCES

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Abstract

Dubová M., Bublinec E.: Influence of chemistry of precipitation on water sources. Ekológia (Bratislava), Vol. 22, No. 2, 219–224, 2003.

The Slovak mountain forests situated at higher altitudes are subjected to a strong load due to the acid deposition. Because these forests represent headstreams of rivers, there is a potential danger of decreasing the water sources quality. The data of the precipitation chemistry from our database were generalised and arranged according to the vegetation and altitude zones: oak (below 400 m a.s.l.), beech (400–700 m), spruce (700–1200 m) and upper forest line (above 1200 m). The most acid precipitation has been found within 700–1200 m, with pH values 4.8 and 4.0 for open area (OA) and forest stands (ST), respectively. The deposition below 400 m is an exception. Here the inputs of nitrogen and sulphur are enormous high (agriculture, fertilisation of soils, intensive car traffic). Neglecting this zone, the acid components of deposition reach the maxims in the zone 700–1200 m (both in OA and ST). The corresponding values for OA and ST are in kg ha^{-1} $year^{-1}$: sulphate sulphur 33 and 59 kg, nitrate nitrogen 10 and 13 kg, nitrate and ammonium nitrogen about 30 kg N, fluoride 2.5 and 1.9 kg, hydrogen ion 0.1 and 0.7 kg. The inputs of acid components in the zone above 1200 m were in general higher (at least equal) compared to the zone 400–700 m. The values of nitrogen input in stands under 400 m and above 1200 m are practically the same (40 and 38 kg N ha^{-1} $year^{-1}$), at the upper tree line they were even higher than the input of sulphur (34 kg S ha^{-1} $year^{-1}$).

Introduction

The input of human made components (anthropogenic deposition) into the natural environment in forms either of dry, wet or bulk deposition is subjected to the intensive world-wide ecological study (Parker, 1984; Johnson, 1992; Šály, Pichler, 1993; Zarski et al., 1999). The abundant knowledge obtained under various natural conditions in different ecosystems (forest, aquatic, terrestrial) is summarised, examined and enable us to generalize about commonly valid principles. This contribution is focussed on the strong acid load in Slovak