Acta fytotechnica et zootechnica, Vol. 4, 2001, Special Number
Proceedings of the International Scientific Conference on the Occasion of the 55th Anniversary of the Slovak Agricultural University in Nitra

DESIGNING PRINCIPLES OF AGRI –ENVIRONMENTAL PROGRAMME

[1]Karol KOVÁČ, [2]Peter SABO, [3]Eva UHLIAROVÁ, [4]Anton KRIŠTÍN, [5]Ján JANČOVIČ
[1-5]Slovak Agricultural University Nitra, [2]The civic association Living Planet, Piešťany, [3]Research Institute for Graslands and Mountain Agriculture, Banská Bystrica, [4]Institute for Forest Ecology of the Slovak Academy od Sciences, Zvolen

Summary

The paper presents results of three-year project for the designing agri-environment schemes for different type of Slovak countryside. The substantial project budget was financed by the Duch OIN-MATRA Fund under supervision oj the Ministry for Agriculture, Nature Management and Fisheries of the Netherland. A consortium of the three western partners, consisting of the Avalon Foundation, (the Netherlands), the Institute for European Environmental Policy (London) and Veen Ecology (Netherlands), implemented the project in association with national partners in Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lihuania, Romania, Slovakia and Slovenia. The outputs of the project is proposal of agri-environmental programme for Slovakia. Agri-environmental schemes proposals was used by Ministry of Agriculture SR for the SAPARD program.

Key words: agri-environmental schemes, implementation, evaluation, monitoring

Introduction

Agri-environmental programme tries to integrate agrarian and environmental policies. Main goals are ecologization of the agricultural technologies, protection of the environment, preservation of biodiversity, natural and cultural heritage. The presented proposal of agri-environmental programme was preceded by the analysis of the negative impacts of agriculture on land, presented in the study „Analysis of environmental situation in agriculture of Slovakia“ (Kováè, Krajèoviè et al., 2000). The aspects of the environmental crisis in agriculture are also elaborated in a brochure „Agri-environmental programmes in Slovakia“ (Sabo, Šubová, Kováč et al., 1999).

Material and methods

The basic framework of the agri-environmental programme has been defined by the **Manual of the project „Agri-environmental Programmes for Central and Eastern Europe“,** prepared in the first phase of the project by the above mnetioned Consortium of foreign partners. The aim was to propose a pilot agri-environmental programme, suitable for testing in one or two selected regions and also to propose a general agri-environmental programme (AEP) for Slovakia. In our papers we present only AEP for Slovakia.
In formulating the strategy of the agri-environmental programme creation for Slovakia, the work-group took into consideration also these **specific criteria:**

- centuries-long extensive use of the agricultural landscape has contributed to its high biodiversity,
- agricultural activity contributes to the preservation of the rural areas and rural communities,
- in Slovakia today, the arable land area decreases, and permanent grasslands face abandonment .

Results

AEP for SR I represents a comprehensive analysis of the environmental situation in agriculture with the emphasis on the analysis of environmental impacts of the agricultural practices on the basic components of the environment and on biodiversity of the agricultural landscape.
AEP for SR II represents the proposal of the agri-environmental programme presented in this study - the system of the agri-environmental schemes proposed for the respective types of the land use and also for the needs of the more strict protection of its important habitats. These schemes can be combined and composed to so-called management packages in various ways. AEP II contains also estimates of agri-environment payments and a basic proposal of its administration.
The working study for AEP represents agri-environmental policy of the European Union, the arguments for introduction of the programme, it defines basic aims of the agri-environmental programme and describes certain selected legal and economic tools to be used in the programme realisation.
Basic types of agri-environmental measures: Horizontal schemes, which are applicable especially in the agriculturalland as a whole, **zonal schemes,** which are
applicable especially in environmentally-sensitive regions and **supplementary schemes,** which are applicable especially in the landscape as a whole, focused on the support of sustainable development in agriculture, such as integrated production, lower farming systems, organic agriculture, breeding of rare local and regional breeds and growth of local and regional varieties and renewal of the management on the abandoned land.

Basic structure of the agri-environmental schemes: Sets of agri-environmental schemes (AES) represent guidelines for agricultural activities in order to protect the environment and improve its state. Each scheme consists of two types of the sets of agri-environmental measures: **The prohibitions** denote the excluded agricultural activities, which exceed the admissible measure of the load on the environmental components, decrease the biodiversity and ecological stability. For keeping of these measures, no payment is mostly provided (with the exception of the prohibitions causing a financial damage to the agriculturalist. **The regulations** prescribe environmental land management (the ways of land management) which have not only a restricting, but also a stimulating character - support of a particular activity. It is essential that unlike the basic scheme (for keeping of which no payments are provided), these are active measures of the care for the environment. Their keeping **entitles** the agriculturalist **to receive the agri-environment (compensation) payments,** as for a presumed loss of profit or increased expenses.

Education of the programme participants: The integral part of the programme is an obligatory participation in a training for the programme participants. **The aims of the education are as follows:**

- increasing environmental awareness of agriculturalists and clerks
- providing necessary knowledge and enhancing skills of the agricultural holdings entering the agrienvironmental programme
- building capacities of the institutions delaing with administrational, eductaional, advisory and other agri-environment payments aspects

Control of the obligations fulfilment: The fulfillment of the agri-environmental obligations by the programme participants has to be controlled. According to the EU requirements, the controls have to check fulfilment of each agri-environmental measure. We recommend to choose for control at least 10 % of farms (the choice is made at random or among the risk farms). A suitable period for the control is from May to July.

In case that the control reveals breaking agri-environmental obligations from the given contract, sanctions will have to be imposed. Since the programme has been entered voluntarily, we do not recommend to begin with the system of penalties. It is sufficient to delay the payments until the things are improved or to require that the payments will have to be returned if measures are not kept.

Indicators for agri-environmental programme monitoring: The indicators simplify and quantify information on a studied region. The proposed AEP indicators should answer the questions: **what is happening** with the environment and with the socioeconomic complex (the environmental questions having priority in the programme) - **they evaluate the state,** then **the reasons for it - they evaluate the impact**, and at last **what we do with it - they evaluate the effectiveness of our response** for the given state, i.e. efficiency of the adherence to agri-environmental measures of the individual schemes.

The programme monitoring should quantify achievement of the planned aims by means of: general indicators, environmental indicators of the agri-environmental programme effectiveness, socioeconomic indicators of the agri-environmental programme effectiveness.

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IMPACT OF DIFFERENT ECOSYSTEMS AND URBANISTIC AREAS ON PHOSPHATE CONCENTRATIONS IN WATER FLOW

Jaroslav NOSKOVIČ[1] - Erika TOBIAŠOVÁ[2] - Jana URMINSKÁ[1] - Alena RAKOVSKÁ[1]
[1]Department of Environment Protection and Zoology, [2]Department of Pedology and Geology, Slovak Agricultural University in Nitra

Summary

In catchment of upper Žitava flow, in 1994-1998, impacts of different ecosystems and urbanistic areas on phosphate concentrations in Hostiansky stream were studied. Obtained results showed, that phosphate concentration in water flow was changing with dependence on time amd place sampling. In the whole experimental period, the highest average concentrations were in July and August months. In along profile of water flow, increasing tendency of their values was showed from first to last sampling place. The highest increase of average phosphate concentrations in the whole experimental period was determined under Mykoprogres. It confirmated fact, that phosphates are not possible to remove from wastes with mechanical- biological treatment.

Key words: ecosystems, urbanistic areas, phosphates, water flow

Introduction

Phosphate concentrations in surface waters are very low and they are from hundreth to tenth of $mg.l^{-1}$. Higher concentrations are result of eutrophication of surface waters.
In this time, the most important sources of contamination of surface waters with phosphates are sewage waters, phosphate fertilizers washing and scour of agricultural soils.

Material and methods

Hostiansky stream,which is in upper part of Žitava river catchment was studied. Water flow springs in Tribeč chain. It flows through Hlboká dolina, Hostie village and Topolčianky and Zlaté Moravce towns. Its issue is under Zlaté Moravce- part of Chyzerovce. The area of water flow catchment is 120 km^2. Its average yearly overflow in issue of Žitava river is 0.94 $m^3.s^{-1}$. Flood flat of water flow is covered with grass clumps, various herbs, bushes and trees.
Water flow catchment is spread on two different geographic units. Upper part of Hostie village is in Tribeč chain and lower part of Hostie village is in Žitavská upland. Tribeč is part of crystallic- mesozoic era zone of Karpaty. From soils, there are Ranker, Rendzina, Calcaric Regosol, Eutric Cambisol, and Albic Luvisol. In forest ecosystems, dominant trees are oak, beech and hornbeam. Characteristic representants of trees in water flow flood are ash and older.
Žitavská upland is amalgamated between chains Tribeč and Pohronský Inovec. From geological point of view, area is part of Zlaté Moravce bay. Dominant part, mainly in lower height levels, is covered with quarternary sediments (loess). In this soil-formation substrate, Orthic Luvisol were created. Besides this soil type, in this catchment area are Eutric Cambisols and in flat of water flow, there are Eutric Fluvisol.
With regard on agricultural production, catchment of water flow is part of beat areas. From agricultural plants, there mainly cereals crop, from which winter wheat is dominant. In 1995- 1998, from fertilizers in dose 54 kg N. $ha^{-1}.y^{-1}$ were only used. Besides of this, farmyard manure in dose 42 t. $ha^{-1}.y^{-1}$ were applicated under root- crops (data from Farm- Topolčianky). In animal production, there cattle and hog breedings are dominant.
Sampling of water from water flow was done regularly in last decades of months in 1994- 1998. Sampling place under Zlaté Moravce town, where samples were taken since March in 1995, was exception. Samples were taken from current in along profile of water flow, following sampling places were determined: 1- Forest ecosystem, 2- Under permanent grass ecosystem on the left side and forest ecosystem on the right side of water flow, 3- Under permanent grass ecosystems on the both sides of water flow, before Hostie village, 4- Under Hostie village, 5- PD Topolčianky- Hostie centre, 6- Under agroecosystem of arable soil on the both sides of water flow, before Mykoprogres, 7- Under Mykoprogres, 8- Under permanent grasses on the left side and tree and bush nurcery on the right side of water flow, before Topolčianky town, 9- Under Topolčianky, 10- Under agroecosystem of arable soil on the both sides of water flow, before Zlaté Moravce town, 11- Under Zlaté Moravce town- part Chyzerovce, in issue of water flow to Žitava river.
Phosphate concentrations in samples of water were determinated colorimetrically with stannous chloride.

Results and discussion

Phosphate concentrations in water flow in experimental years were changing with dependence on time sampling (Fig. 1-5). The highest average values of $P(PO_4)^{3-}$ in experimental years were determined in summer (years 1997, 1998), eventually

Mean $P(PO_4^{3-})$ value obtained in the Hostiansky Brook depending on sampling time and position during the period 1994 - 1998

Sampling time:

Figure 1

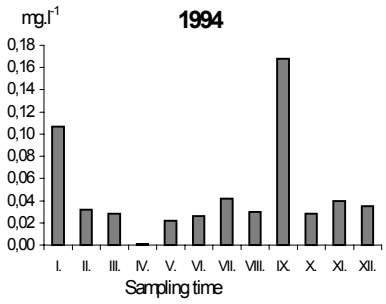


Figure 2

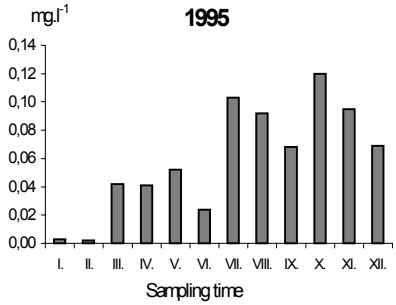


Figure 3

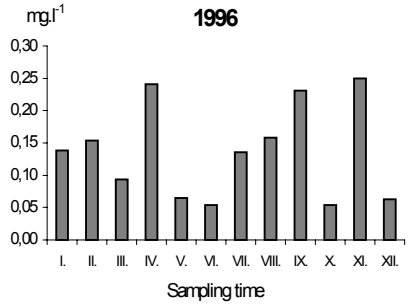
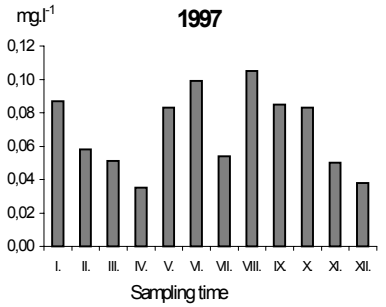


Figure 4



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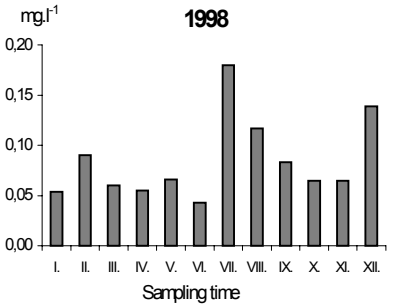
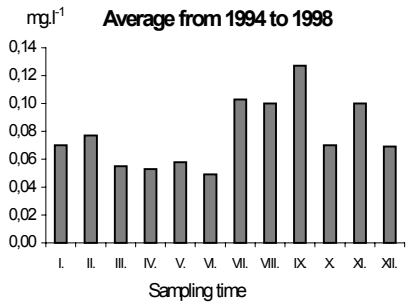


Figure 6



Sampling position:

Figure 7

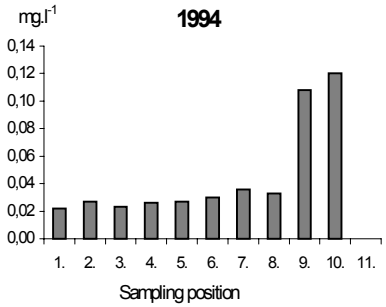


Figure 8

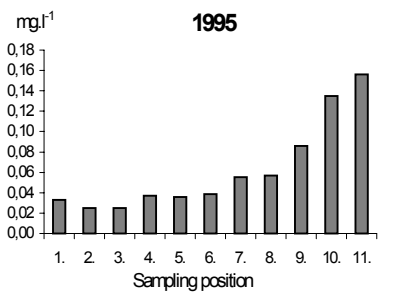
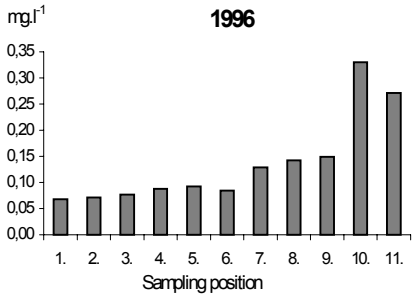


Figure 9



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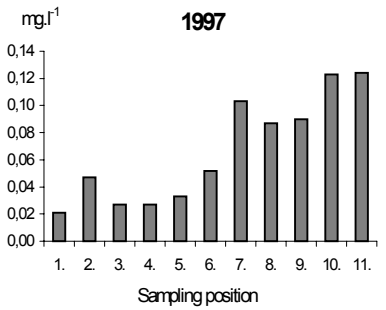


Figure 11

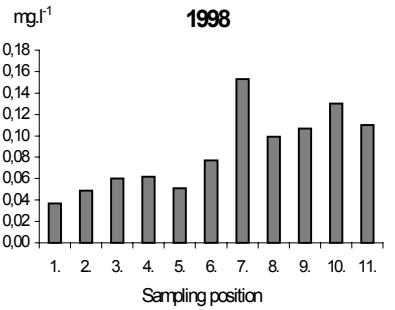
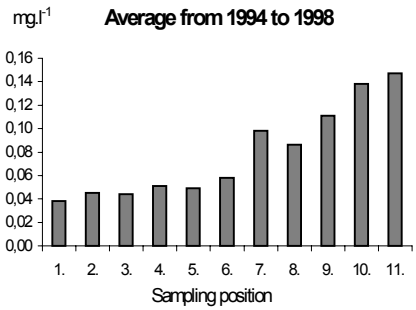


Figure 12



autumn period (years 1994-1996). In the whole experimental period, the highest average concentrations were in months July and September (Fig. 6). The results of this increase were phosphates released at decomposition of phosphorus organic substances contained in water flow. Pitter opinion (1990), that organic substances are more intensively decomposed in water at higher temperature than lower, was confirmed.
Results of average phosphate concentrations in samplig places in experimental years (Fig. 7-11), show that values ussually increase with water flow length. In the whole experimental period, phosphate concentrations in along profile of water fluctuated from 0.038 mg.l^{-1} (sampling place-1) to 0.147 mg.l^{-1} (sampling place-11) (Fig. 12). Concentration in sampling place-1, which is in forest ecosystem, was lower than Valtýni and Lalkovič (1995) presented. They determined 0.06 mg $P(PO_4)^{3-}$ in water drains away from forested catchment. Obtained results in along profile of water flow also acknowledged, that main contaminaters of water flow with phosphates are Mykoprogres (sampling place-7), Topolčianky town (sampling place- 9) and agroecosystem of arable soil before Zlate Moravce town (sampling place- 10). The highest increase of average phosphate concentrations in all experimental period were determinated under Mykoprogres. Company caused increase of concentration about 0.04 mg. l^{-1}, which is about 68.96 %. It was confirmed fact, that Mykoprogres can not remove phosphates from water flow with mechanical- biological treatment of sewage waters. Because of this reason, the technology of waste treatment in Mykoprogres must be modified, so that $P(PO4)^{3-}$ remove from waters. According to Gábriš et al. (1998), phosphates can be removed from wastes with chemical, biological and combined methods.

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BIODIVERSITY OF AGROECOSYSTEMS ON THE BASE OF SELECTED POPULATION OF RACE CARABIDS

V. PETŘVALSKÝ - V. PETERKOVÁ – J. PORHAJAŠOVÁ
Department Of Environment Protection and Zoology, Slovak Agricultural University in Nitra

Summary

Generally we can state, by comparison of results reached in frame of fallow systems and results with cultivation mono, di, three and tetra culture, that occurence of particular species analysed race Carabidae is positive for fallow system, which as from the point of topic, as from the point of trophic makes better conditions for occurence given edaphic groups. From the results it is clear, that case of ecaluated varriants of fallow farming systems doesn´t influence appearence of particular species. This shows good homeostatic ability of given environment.

Key words: edaphon, population, Carabidae, Coleoptera.

Introduction

A lot of changes take place in nature, and as a consequence of it, there has been changed structure of population and societies of animals. These changes expressively interfere and by interfere balanced condition in ecosystem and influence, or they limit existence of particular animal groups (PETŘVALSKÝ et al., 1999). And just at this reality is aimed the content of this paper.

Material and methods

We have realised research task in experimental base AF-SPU Nitra – Dolná Malanta in the year 1992. We evalueted and compared epigeic material of fallow farming with these variants – without mowing, mowing without removing, mowing with removing organic matter. The material was gained by method of ground traps at mono, di, three and tetra culture of Zea mays plant. We aimed our interest at Carabidae population (Coleoptera, Carabidae). We collected material during vegetation time since April till October at mentioned localities. We emptied and renewed traps regulary monthly.
We determinated and classified biological material in laboratory and we valued particulars indicators (FREUDE – HARDE – LOHSE, 1976). We evaluated these indicators for statistical evaluation and the whole Carabidae analysis: whole evaluation of epigeic material (abundancy), density of species, species identity by Jaccard - $I_{A,}$ density of dominance by Renkonnen - I_D, diversity degree by Shannon – Weaver - d

Results and discussion

Research results and discussion in fallow systems (Tab. 1)
There were gained 29 782 exemplars of epigeic populations by method of ground trap in evaluated time in particular variants with dominant representation of these groups:

- Collembola 10 076 ex = 33,83 %
- Acarina 7 799 ex = 26,18 %
- Coleoptera 3 103 ex = 10,42 %
- Formicoidea 2 037 ex = 6,84 %
- Araneidea 1 676 ex = 5,63 %.

Analysed race of Carabids (Coleotera, Carabidae) was represented 1275 ex with share by variants:1.variant 263 ex = 20,63 %,2. variant 393 ex = 30,82 %, 3. variant 619 ex = 48,55 %.
The dominant representation had species Harpalus rufipes (De Geer, 1774) = 63,12 %, 57,76 % a 53,15 % in particulars variants. Other species were represented in lower percentage, it was a subdominant, recedent or subrecedent representation.
When we evaluated species identity or faunistic similarity by Jaccard, which expresses concord of species content two or more compared zoocenos (I_A), the values were by particular variants: 57,14 %, 57,14% a 65,22 %.
Values of dominant by Renkonnen (I_D): 84,84 %, 73,03% a 83,04%.
Values of diversity index by Shanon – Weaver: 1.3872, 1.6466 a 1.6957.
It is clear, from these results, that evaluated farming systems as well as fallow system doesn´t show serious differences among the variants. This can be said concerning of need of regulation fallow system in agroecosystems.
Reached results in case of cultivation mono, di, three, tetra culture (Tab. 2)
During the year 1999 we realised collection of epigeic material in mono, di, three, tetra culture in plant Zea mays using the ground trap method. We got 9 902 ex epigeic representats with dominant group representation:

- Collembola 3 260 ex = 32,92 %
- Acarina 1 957 ex = 19,76 %
- Coleoptera 1 928 ex = 19,47 %
- Araneidea 1 280 ex = 12,92 %
- Diptera 591 ex = 5,97 %.

When we analysed family Carabidae form the 1 488 ex, there was representation by particular farming systems:

- by monoculture: 381 ex, what represented 25,60 %
- by diculture: 406 ex, what represented 27,28 %
- by threeculture: 397 ex, what represented 26,68 %
- by tetraculture: 304 ex, what represented 20,44 %.

The species Harpalus rufipes (De Geer, 1774) had dominant representation in case of all farming systems. It was 1 056 ex, what represents 70,97 %. For particular systems represent: 247 ex (65,79 %)
316 ex (77,84 %); 293 ex (73,80%); 200 ex (65,79 %).
The species Pterostichus melanarius (Illiger, 1798) had lower representation concerning all systems what represented 98 ex, or 6,58 %. For particular systems represent:
22 ex (6,58 %); 22 ex (6,58 %); 39 ex (9,83 %); 15 ex (4,94 %).
Other species were represented by lower percentage, it can be said subdominant. For example Brachynus crepitans (L.) is represented 71 ex, what is 4,77 %.
When we evaluated species identity by Jaccard, which expresses concord of species content two or more compared zoocenos the values similary were between 64,71 - 81,25 %. Values of dominant identity were between 79,27 – 91,56 %. Values of diversity by Shannon – Weaver by particular system were: 1.2917 in monoculture, 1.0237 in diculture, 1.0480 in threeculture, 1.3920 in tetraculture.
Reached results shows at some concord of particular systems, especially marked homeostatic abilities of this agroecosystem in system tetraculture, what is probably connected with some questions of migration of some populations during vegetation time and representation of particular plants.

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Tab.1

Locality: Nitra-Dolná Malanta		Crop:fallowland					
Num.	Species	1. variant ex	%	2. variant ex	%	3. variant ex	%
1	Abax parallepipedus (P. et M.)					1	0,16
2	Amara aenea (De Geer)	1	0,38			2	0,32
3	Amara bifrons (Gyll.)					1	0,16
4	Amara familiaris (Duft)	1	0,38	5	1,27	2	0,32
5	Amara ovata F.			2	0,51	2	0,32
6	Badister sodalis (Duft.)	3	1,14			4	0,65
7	Bembidion lampros (Her.)			1	0,25	1	0,16
8	Brachynus crepitans (L.)	8	3,04	30	7,63	46	7,43
9	Brachynus explodens (Duft.)	2	0,76	24	6,11	75	12,12
10	Calathus fuscipes (Goez.)			4	1,02	9	1,45
11	Carabus coriaceus L.	2	0,76	3	0,76	4	0,65
12	Carabus granulatus L.	1	0,38				
13	Carabus scheidleri Panz.	16	6,08	17	4,33	28	4,52
14	Carabus violaceus L.	4	1,52	11	2,8	4	0,65
15	Dolichus halensis (Schaller)					1	0,16
16	Harpalus azureus (F.)			1	0,25		
17	Harpalus distingeundus (Duft.)	7	2,66	19	4,83	71	11,47
18	Harpalus rufipes (De Geer)	166	63,12	227	57,76	329	53,15
19	Harpalus tardus (Panz.)			2	0,51		
20	Microlestes minutulus (Goez.)	3	1,14	19	4,83	6	0,97
21	Platinus dorsalis (Pontopp.)	2	0,76			4	0,65
22	Poecilus cupreus (L.)	3	1,14	1	0,25	9	1,45
23	Pterostichus melanarius (Ill.)	42	15,97	26	6,62	16	2,58
24	Trechus 4-striatus (Schr.)	2	0,76	1	0,25	4	0,65
	Together	263	100	393	100	619	100

Tab.2

Num.	Species	1. variant ex	%	2. variant ex	%	3. variant ex	%	4. variant ex	%
1	Anisodactylus binotatus (S.)	7	1,84	2	0,49	2	0,5		
2	Amara familiaris (Duft)	5	1,31					6	1,97
3	Badister sodalis (Duft.)	2	0,52	1	0,25	1	0,25	2	0,66
4	Bembidion lampros (Her.)	2	0,52	4	0,99	4	1,01	5	1,64
5	Brachynus crepitans (L.)	32	8,40	13	3,2	17	4,28	9	2,96
6	Brachynus explodens (Duft.)			2	0,49	3	0,76	34	11,18
7	Calathus fuscipes (Goez.)	1	0,26	3	0,74	4	1,01	9	2,96
8	Carabus scheidleri Panz.	3	0,79	5	1,23	1	0,25	3	0,99
9	Cicindela silvidola (Dej.)			1	0,25				
10	Harpalus distingeundus (Duft.)	48	12,6	7	1,72	3	0,76	5	1,64
11	Harpalus rufipes (De Geer)	247	64,83	316	77,83	293	73,8	200	65,79
12	Microlestes minutulus (Goez.)	1	0,26	6	1,48	2	0,5	8	2,63
13	Platinus dorsalis (Pontopp.)	6	1,57	17	4,19	25	6,3	1	0,33
14	Poecilus cupreus (L.)	5	1,31	4	0,99			4	1,32
15	Pterostichus melanarius (Ill.)	22	5,77	22	5,42	39	9,82	15	4,93
16	Stomis pumicatus (Panz.)			1	0,25				
17	Trechus pulchellus Putz.							1	0,33
18	Trechus 4-striatus			2	0,49	3	0,76	2	0,66
	Together	381	100	406	100	397	100	304	100

Acta fytotechnica et zootechnica, Vol. 4, 2001, Special Number
Proceedings of the International Scientific Conference on the Occasion of the 55th Anniversary of the Slovak Agricultural University in Nitra

DECREASING OF POTENTIALLY Mn PHYTOTOXICITY IN MAIZE BY CHANGE OF SOIL REACTION

Alena VOLLMANNOVÁ, Monika HALÁSOVÁ, *Klaudia JOMOVÁ
Katedra chémie SPU Nitra, *Katedra chémie FPV UKF Nitra

Summary

In biological test at defined temperature and moisture conditions the potentially Mn phytotoxicity in maize in relationship to changed soil reaction was tested. The extremly acid soil was used and its reaction was in one of variants changed by using of $CaCO_3$. The added $CaCO_3$ has significantly positive influence on yield of overground biomass and also on yield of roots of maize. Results of biological test show enhanced Mn contents in roots and biomass of maize in unlimed variant in comparison with limed variant. Biological test confirmed the positive influence of added $CaCO_3$ on Mn contents in roots (more than 72% lower Mn content) and overground biomass of maize (more than 77% lower Mn content in comparison with unlimed variant).
Key words: Mn phytotoxicity, maize, roots, overground biomass, soil reaction

Introduction

The soil contamination is one of the biggest environmental problems of this time. The soil is the start point of risk elements input to the food chain of the man. Heavy metals occur in soil in unavailable forms, but at changed soil conditions they can be transformed to bioavailable forms. The origin and sources of heavy metals in Slovakia soils are various. In uplands regions there are many localities with natural geochemical anomalies. But contaminated localities are often caused by various anthropic activities e.g. industry, agriculture, traffic, energetics etc. (BIELEK et al., 1998).
In Slovakia there are nine endangred regions with damaged environment. One of the nine „hot spots" of Slovakia is Stredný Gemer. ŽELBA Nižná Slaná was one of the most important contaminators of the environment in this region. Despite of strangled industry production of iron-mines Nižná Slaná, the consequence of its activity still exists. The emissions of this plant are characterised as a mixture of polymetalic dust and gass emissions.
Manganese as a component of these exhalats is one of risk elements because of its known toxic influence on animals and risk of its enhanced content in water, soil and plants (VOLLMANNOVÁ, 1998). In Slovakia Mn still isn´t cosidered for soil contaminating element. But many authors propose the maximal allowed Mn concetration in soil because of its potential risk for food chain (PODLEŠÁKOVÁ, NĚMĚČEK, 1995). The important fact of the proposals is the determination of portion of mobile and mobilisationable Mn forms by using extraction methods (GANGWAR, VINAY-SINGH, 1992; AHANGAR et al., 1995; AL-MUSTAFA, 1992; XIAOFU, SELMER-OLSEN, 1992 a o.). In most of soils Mn is prevailingly present as oxidized for plants unavailable Mn^{4+} form. Mn must be probably reduced on root surface for Mn^{2+} and in this form exhausted from soil. Mn^{2+} toxicity is often evident in extremly acid or moist soils, where Mn^{4+} is reduced for Mn^{2+} . In this form Mn is available for plants /LANGE et al., 1983/. Through increase soil pH for ca 6,5 Mn^{2+} is oxidized for Mn^{4+}, owing to Mn solubility and also bioavailability are decreased /ADRIANO, 1986/. According to prevalent knowledges /IVANIČ et al., 1984; LANGE et al., 1981; FOX et al., 1978; ADRIANO, 1986 etc./ Mn toxicity is evident at plants receipt over1000 mg $Mn.kg^{-1}$ d.w..

Material and methods

In biological test at defined temperature and moisture conditions the potentially Mn phytotoxicity in maize was tested. The extremly acid soil with pH/KCl = 4,07; H = 43,31 $mmol.kg^{-1}$; S = 94,1 $mmol.kg^{-1}$; T = 137,41 $mmol.kg^{-1}$ was used. The weight of soil on one pot was 700 g. In 1. variant only NPK fertlilizers (0,66 g of ammonium sulphate; 0,66 g of superphosphate; 0,26 g of potassium chloride) and in 2. variant also 3 g of $CaCO_3$ to one pot was added. The maize harvest was after 36 days from trial founding.
In used soil the available nutrient contents and Mn contents (total Mn content and Mn content in extract of 2 M HNO_3) by AAS method was determined (table 1). In both of variants the weight of root ans biomass yield was ascertained. After adjustment of plant samples Mn content in roots and in overground biomass by AAS method was determined (table 2).

Results and discussion

The added $CaCO_3$ has significantly positive influence on yield of overground biomass and also on yield of roots of maize. The yield of biomass in limed variant was more than 27% higher and the yield of roots more than 72% higher than those in unlimed variant.
Despite of determined Mn soil contents, which aren´t too high (the values are below by PODLEŠÁKOVÁ and NĚMEČEK proposed hygienic limits in Bohemia), determined Mn contents in roots and biomass of maize are higher than legislative obligatory hygienic limits in Slovakia valid for forages and fodders. The legislative hygienic limits for Mn content in forages

and fodders in Slovakia area followed: total feed dose: 100 mg.kg^{-1}; forage Mn content: 100 mg.kg^{-1}; fodder Mn content: 300 mg.kg^{-1}.

[mg.kg^{-1}] ***Table 1***

N-NH$_4^+$	N-NO$_3^-$	K	Mg	P	Mn (2M HNO$_3$)	Mn (Total)
19,66	44,38	64,5	90,4	24,75	574,9	1042,1

Table 2

Determined	NPK	%	NPK + CaCO$_3$	% to control
Yield of biomass d.w. [g]	5,74	100	7,30	127,18
Yield of roots d.w. [g]	0,72	100	1,24	172,22
Mn in roots [mg.kg^{-1}]	414,02	100	113,64	27,18
Mn in biomass [mg.kg^{-1}]	401,48	100	89,04	22,18

Results presented in table 2 show enhanced Mn contents in roots and biomass of maize in unlimed variant (33,72% higher than allowed legislative norm). The positive influence of added CaCO$_3$ is evident in 2. variant, where Mn content is 70% lower than allowed legislative norm.
These results confirm the possibility to elimine Mn phytotoxical influence on maize plants by application of CaCO$_3$ i.e. by adjustment of soil reaction.
It is evident that monitoring of heavy metal soil contents is one of the most important claims of this time. It is also necessary to ascertain maximal allowed hygienic soil limits for the other metals e.g. Fe, Mn a.o. because of their in high concentrations negative influence on living organisms and risk their input into the food chain of the man.

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Acta fytotechnica et zootechnica, Vol. 4, 2001, Special Number
Proceedings of the International Scientific Conference on the Occasion of the 55th Anniversary of the Slovak Agricultural University in Nitra

PHYTOTOXIC EFFECTS OF RISING DOSES OF CHOSEN ELEMENTS IN INITIAL PHASES OF WHEAT GROWTH

Ladislav DUCSAY, Peter KOVÁČIK
Department of Agrochemistry and Plant Nutrition, SPU Nitra

Summary

In laboratory conditions were investigated effectivness upward doses of arsenic, cadmium, lead, stroncium, molybdenum and manganese on quality and quantity of cultivated biomass wheat (Triticum aestivum L.) during 21 days and production of chlorophyll a and chlorophyll b. The most expressive decrease of growth crops we finded out at As > Cd > Pb. The increase of their concentration (with Cd from 5 to 15 and with As and Pb from 30 to 90 $mg.kg^{-1}$) in soils caused increase of their concentration in biomasse. The most expressive decrease of production chlorophyll a and chlorophyll b we finded out at cadmium. Increasing rates of Mo, Mn, Sr negatively affected synthesis of chlorophyll a and b, changing strongly the ratio of chlorophyll a: chlorophyll b at the same time.

Key words: cadmium, lead, arsenic, chlorophyll, Triticum aestivum

Introduction

Enter of trace risky elements into ecosystem is accompanied by the consequences in air, water, soil and in the end in cultural plants from which their way goes on to sphere of foods. Irreplaceable role of some metal elements in plant metabolism is very well - known, but recently the knowledge and facts about the depressing effect of higher concentrations of As, Cd, Pb, Mo and some other elements on the yield and its quality are deepened (KULICH, 1994; MERIAM, 1991; HANÁČKOVÁ, 1998; KOČIK and DUCSAY, 1999; MALIŠ and KOVÁČIK, 2000). Investigation of the effect of risky elements on quality and quantity of winter wheat biomass and continous determination of chlorophyll content within short time interval of vegetation period represented the main objective of this work.

Material and methods

Phytotoxicity of gradual increase of the rates of As, Cd and Pb was investigated under the conditions of laboratory vegetation test with, defined characteristics of light intensity, temperature and moisture. Appropriate light intensity was maintained and regulated by fluorescent tubes. Above stated elements were used in the form of Na_2HAsO_4, $CdCl_2$, . 1 ½ H_2O and $Pb(NO_3)_2$, $(NH_4)_6Mo_7O_{24}$, $MnSO_4$, $Sr(NO_3)_2$. Applied rates are stated in tab.1. NPK nutrients were applied in the form of Knopp solution amounting 100 ml per pot.
There was weighed 500 g of silicious sand and 500 g of soil in each pot. The soil came from the locality of Kolíňany and its chemical characteristics were as follows: Orthic Luvisol loamy soil, pH/KCl = 6.83, humus content = 1.42 %, good supply of nutrients. Winter wheat (Triticum aestivum, L.), variety Viginta was chosen as a tested crop. The plants were cultivated 21 days for each individual element and experimental arrangement included four treatments (variants) in five replication. After application of NPK nutrients and risky elements in the form of empirical solutions, the seeds of model crop were sown white the moisture of the substrate was maintained on the level of 75 % of full water capacity. After passing 21 days of vegetation period the following characteristics were determined: content of chlorophyll according to method of ŠESTÁK, ČATCKÝ (1996), measure of growth inhibition (GGI), (LEITA et al., 1993) and both quantity and quality of production.
GGI = [(C – T)/C].100, where C represents weight of dry matter in control treatment and T represents weight of dry matter in individual treatments with risk elements. The concentrations of investigated elements in dry matter were determined by AAS method and obtained results were processed by Stratgraphics computer statistical programe (LSD – test, analysis of variance).

Results and discussion

The results of biological test showed that increasing doses of high-toxical elements (As, Cd, Pb) negatively affected winter wheat biomass formation. Concentration range of arsenic doses (30 - 90 $mg.kg^{-1}$ of substrate) represented various levels of phytotoxicity for wheat (tab. 2). Even the rate of 30 $mg.kg^{-1}$ of substrate caused statistically significant retardation of biomass formation in comparison with control treatment. The next two application doses of arsenic (60 and 90 $mg.kg^{-1}$) showed even stronger retardating effect on wheat growth, which is represented by an increase of GGI (growth of great inhibition) values by from 46.28 (at the least rate of As) to 52.12 (at the highest rate of As). ALEXEJEV (1987) considers a plant environment to be phytotoxical where the yield of biomass in reduced by more than 10 % in comparison with control treatment. As a result of increasing doses of Cd in substrate the dry matter production of wheat was reduced. Even the rate of 5 $mg.kg^{-1}$ of substrate acted phytotoxically (GGI = 17.81). Measure of growth inhibition (GGI) in a consequence of the rates of 10 and 15 $mg.kg^{-1}$ of substrate deepened to the values of 21.17 and 23.65, respectively (tab. 2). Although the yield retardation by the

effect of increasing Cd doses is evident, there was not found statistical significance in comparison to control treatment. STRNAD et al. (1990) determined that even the concentration of 2 mg of Cd.kg^{-1} of substrate caused the depression in yields of barley, potatoes and maize.

Table 1 Arrangement of variants

Element	Variant	Nutrients	Doses of elements (mg.kg^{-1})	Element	Variant	Nutrients	Doses of elements (mg.kg^{-1})
As	1	NPK	-	Mo	1	NPK	-
	2	NPK+As	30		2	NPK+Mo	30
	3	NPK+As	60		3	NPK+Mo	60
	4	NPK+As	90		4	NPK+Mo	90
Cd	1	NPK	-	Mn	1	NPK	-
	2	NPK+Cd	5		2	NPK+Mn	300
	3	NPK+Cd	10		3	NPK+Mn	600
	4	NPK+Cd	15		4	NPK+Mn	900
Pb	1	NPK	-	Sr	1	NPK	-
	2	NPK+Pb	30		2	NPK+Sr	30
	3	NPK+Pb	60		3	NPK+Sr	60
	4	NPK+Pb	90		4	NPK+Sr	90

Table 2 Influence increasing doses of elements on biomass formation and statistical evaluation

Variant	Yield (g/pot)	GGI	Variant	Yield (g/pot)	GGI	Variant	Yield (g/pot)	GGI
NPK	6,85 a	-	NPK	6,85 a	-	NPK	6,85 a	-
NPK+30As	3,68 b	46,28	NPK+5Cd	5,63 a	17,81	NPK+30Pb	5,98 a	12,70
NPK+60As	3,35 b	51,09	NPK+10Cd	5,40 a	21,17	NPK+60Pb	5,93 a	13,43
NPK+90As	3,28 b	52,12	NPK+15Cd	5,23 a	23,65	NPK+90Pb	5,80 a	15,33
NPK+30Mo	4,98 b	27,30	NPK+300Mn	5,30 b	22,63	NPK+30Sr	6,08 a	11,24
NPK+60Mo	4,90 b	28,47	NPK+600Mn	5,13 b	25,11	NPK+60Sr	6,25 a	8,76
NPK+90Mo	3,55 c	48,17	NPK+900Mn	3,55 c	48,17	NPK+90Sr	6,80 a	8,73

- means (in column for respective element) indicated with different letters are statistically significant (P = 0,05; LSD - test)

Lead, as a next high-toxical element, caused decrease of yield, however without statistical significance to control treatment. In comparison to Cd and As, Pb shared to growth retardation in the least extent. The values of GGI confirm this fact and range from 12.70 (at the leastrate of Pb) to 15.33 (at the highest rate of Pb) (tab. 2).

Increasing rates of Mo caused strong inhibition of growth with the highest values of GGI amounting 48.17 at concentration of 90 mg . Mo . kg^{-1} of soil in comparison to control treatment. Yield of above-ground phytomass was negatively affected by increasing rates of Mn, when the GGI values ranged from 27.3 to 48.17. Rising doses of Sr (from 30 to 90 mg.kg^{-1} of substrate) did not cause statistically significant retardation of growth.

Rise of risky elements concentration in substrate induced unambiguous and statistically significant accumulation of these elements in dry matter of wheat biomass (tab. 3). Their contents were increasing in dependence on the rise of investigated elements rates in substrate.

Violation of some plant pigment formation (chlorophyll a, b) seerus to be a part from the yield retardation and toxic element accumulation in dry matter a collateral effect of metal phytotoxicity (SYMEONIDIS, KARATAGLIS 1992), (TUKENDORF, BASZYNSKI 1991).

Cadmium even at the rate of 5 mg.kg^{-1} in substrate statistically significantly reduce both contents of chlorophyll a and b; at the dose of 20 mg.kg^{-1} of substrate the reduction is even more expressive in comparison with NPK treatment (tab. 4). Ratio of investigated pigment contents howevere fluctuated on the level of NPK treatment at the both applied rates. KRUPA, OGUIST, HUNER (1993) pointed out that Cd negatively influenced chlorophyll synthesis in plants. TUKENDORE and BASZYNSKI (1991) attribute the reduction of both chlorophylls to Fe and Mg deficiency as a consequence of presence of Cd. On the other side STOBART et al. (1985) refers this effect to the inhibition of synthesis of δ aminolevulic acid and

protochlorophylidreductase complex. MERAKCHIYSKA, NIKOLOVA (1986) state that chlorophyll synthesis in beans (Phaseolus vulgaris) can be stimulated by low rates of Pb (10^{-5} mol.l^{-1}). However, the dose of 90 mg Pb.kg^{-1} of substrate reduced chlorophyll a and b synthesis in comparison to control treatment.

Table 3 Accumulation of risky elements and their statistical evaluation in dry matter of wheat

Element	Content of element in dry matter (mg.kg^{-1})			
	NPK control	NPK+low dose	NPK+medium d.	NPK+big dose
As	0,43 a	9,03 b	10,18 c	14,43 d
Cd	0,04 a	4,70 b	5,05 c	6,70 d
Pb	3,40 a	3,90 b	6,20 c	15,19 d
Mo	0,11 a	57,30 b	65,80 c	68,30 d
Mn	63,33 a	1 170,80 b	2 612,80 c	3 457,50 d
Sr	87,80 a	495,50 b	853,80 c	1 361,80 d

- means in rows indicated with different letters are statistically significant (P = 0,05; LSD – test)

Table 4 Content of chlorophyll a, b in wet biomass of wheat and statistical evaluation

Element	Variant	Chlorophyll a	Chlorophyll b	Ratio chlor.a : chlor.b
		mg.g^{-1}		
	NPK control	1,65 a	0,73 a	2,26 a
As	NPK+30 As	1,54 a	0,64 a	2,39 a
	NPK+90 As	1,88 a	0,69 a	2,72 b
Cd	NPK+5 Cd	1,25 b	0,57 b	2,22 a
	NPK+10 Cd	1,18 b	0,52 b	2,27 a
Pb	NPK+30 Pb	1,71 a	0,72 a	2,36 a
	NPK+90 Pb	1,11 b	0,53 b	2,10 a
Mo	NPK+30 Mo	1,28 b	0,52 b	2,45 a
	NPK+90 Mo	1,47 a	0,60 b	2,52 a
Mn	NPK+300 Mn	1,78 a	0,67 a	2,65 b
	NPK+900 Mn	1,45 a	0,54 b	2,67 b
Sr	NPK+30 Sr	1,27 b	0,62 a	2,05 a
	NPK+90 Sr	1,62 a	0,69 a	2,34 a

- means (in the rows for respective element) indicated with different letters are statistically significant in relation to control treatment (P = 0,05; LSD – test)

In the consequence of the dose of 30 mg As.kg^{-1} of substrate, at first the depression in chlorophyll formation was registered, but after application 90 mg.kg^{-1} there was determined increase of chlorophyll contents in comparison to control treatment, however without statistical significance. Ratio of chlorophyll a : b (2.72) at the high dose of As was statistically significantly higher comparing to ratio of NPK control (2.26) which was caused by the big disproportion of individual pigment contents (tab. 4).
Increasing rates of Mo, Mn, Sr negatively affected synthesis of chlorophyll a and b, changing strongly the ratio of chlorophyll a: chlorophyll b at the same time (tab. 4).

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IMPACT OF DIFFERENT ECOSYSTEMS AND URBANISTIC AREAS ON CONDUCTIVITY VALUES IN WATER FLOW

Jaroslav NOSKOVIČ[1] - Erika TOBIAŠOVÁ[2] - Jana URMINSKÁ[1] - Jana PORHAJAŠOVÁ[1]
[1]Department of Environment Protection and Zoology, [2]Department of Pedology and Geology, Slovak Agricultural University in Nitra

Summary

In catchment of upper flow of Žitava river, in 1994-1998, impacts of different ecosystems and urbanistic areas on conductivity values in water flow Hostiansky stream were studied. Results showed, that time sampling in experimental years had different influence on conductivity values changes. In along profile of water flow, average conductivity value was gradually increasing from first to last sampling place in the whole period of experiment. The highest increase was recorded under Topoľčianky village. It was probably caused by soluble anorganic and some organic substances, which contaminated water flow through the untreated wastes (sewage works is not built- up in village).

Introduction

Conductivity values of surface waters and usual underground water are usually from 5 to 50 mS. m^{-1}. These values can be above 10^3 mS. m^{-1} in some industrial wastes (Pitter, 1990).
In wastes, in which anorganic substances are dominant (fresh water, most of surface waters, some wastes) conductivity is approximate point of mineral electrolyte concentration. In wastes, in which salts of organic acids and bases are presented, conductivity is point of mineral and organic electrolyte concentrations (Gábriš and Noskovič, 1998).

Material and methods

Hostiansky stream,which is in upper part of Žitava river catchment was studied. Water flow springs in Tribeč chain. It flows through Hlboká dolina, Hostie village and Topolčianky and Zlaté Moravce towns. Its issue is under Zlaté Moravce- part of Chyzerovce. The area of water flow catchment is 120 km^2. Its average yearly overflow in issue of Žitava river is 0.94 m^3. s^{-1}. Flood flat of water flow is covered with grass clumps, various herbs, bushes and trees.
Water flow catchment is spread on two different geographic units. Upper part of Hostie village is in Tribeč chain and lower part of Hostie village is in Žitavská upland. Tribeč is part of crystallic- mesozoic era zone of Karpaty. From soils, there are Ranker, Rendzina, Calcaric Regosol, Eutric Cambisol, and Albic Luvisol. In forest ecosystems, dominant trees are oak, beech and hornbeam. Characteristic representants of trees in water flow flood are ash and older.
Žitavská upland is amalgamated between chains Tribeč and Pohronský Inovec. From geological point of view, area is part of Zlaté Moravce bay. Dominant part, mainly in lower height levels, is covered with quarternary sediments (loess). In this soil-formation substrate, Orthic Luvisol were created. Besides this soil type, in this catchment area are Eutric Cambisols and in flat of water flow, there are Eutric Fluvisol.
With regard on agricultural production, catchment of water flow is part of beat areas. From agricultural plants, there mainly cereals crop, from which winter wheat is dominant. In 1995- 1998, fertilizers in dose 54 kg N. ha^{-1}. y^{-1} were only used.

Besides of this, farmyard manure in dose 42 t. ha^{-1}. y^{-1} were applicated under root- crops (data from Farm- Topolčianky). In animal production, there cattle and hog breedings are dominant.
Sampling of water from water flow was done regularly in last decades of months in 1994 - 1998. Sampling place under Zlaté Moravce town, where samples were taken since March in 1995, was exception. Samples were taken from current in along profile of water flow and following sampling places were determined: 1- Forest ecosystem, 2- Under permanent grass ecosystem on the left side and forest ecosystem on the right side of water flow, 3- Under permanent grass ecosystems on the both sides of water flow, before Hostie village, 4- Under Hostie village, 5- PD Topolčianky- Hostie centre, 6- Under agroecosystem of arable soil on the both sides of water flow, before Mykoprogres, 7- Under Mykoprogres, 8- Under permanent grasses on the left side and tree and bush nurcery on the right side of water flow, before Topolčianky town, 9- Under Topolčianky, 10- Under agroecosystem of arable soil on the both sides of water flow, before Zlaté Moravce town, 11- Under Zlaté Moravce town- part Chyzerovce, in issue of water flow to Žitava river.
Conductivity values of water samples were determined on conductometer OK 102/1.

Results and discussion

Impact of sampling time in experimental years on average conductivity values in water flow was different (Fig.1-5). It means that seasonal regularity in dynamic of conductivity values in experimental years was not recorded. Average conductivity value in the whole experimental year fluctuated with dependence on time sampling from 35.9 mS. m^{-1} (April) to 56.6 mS. m^{-1} (October) (Fig.6). Changes of conductivity values in water flow during the year Dubová and Bublinec (1994) showed.
In along profile of water flow, average conductivity value had usually increasing tendency in all experimental years, from first to last sampling place (Fig. 7-11). Analogous tendency of average conductivity values was also for the whole period of experiment (Fig. 12). These values were fluctuating from 39.2 mS. m^{-1} (sampling place 1) to 59.4 mS. m^{-1} (sampling place 10). The highest increase of average conductivity value in the whole experimental period was determined in sampling place 9 (under Topoľčianky village), where this value was about 6.7 mS. m^{-1} (about 13.21 %) higher than in sampling place 8, which is located before Topoľčianky village. This increase was probably caused by soluble anorganic and some organic substances, which come from untreated wastes and contaminated water flow (sewage works is not built- up in village).
According to Tőlgyessy et al. (1984), soluble substances are presented in sewage wastes in 2/3 of all substances. At the consumption of 200 L of water per person per day, in sewage waters approximately 625 mg. l^{-1} of soluble substances are contained.

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Mean conductivity value obtained in the Hostiansky Brook depending on sampling time and position during the period 1994 - 1998

Sampling time:

Figure 1

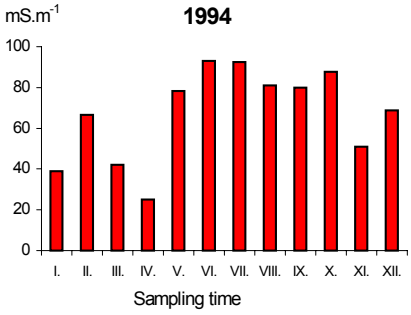


Figure 2

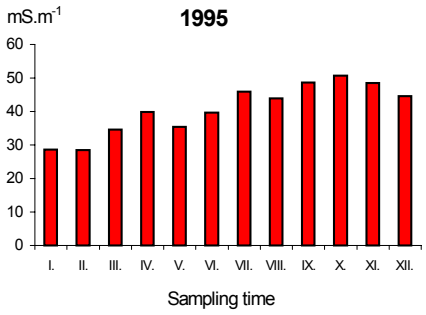


Figure 3

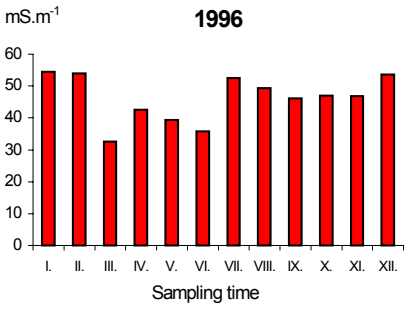


Figure 4

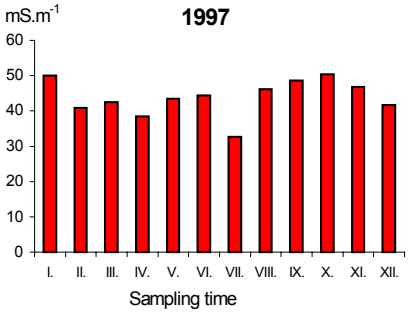


Figure 5

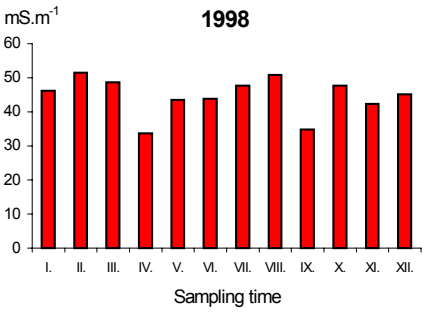
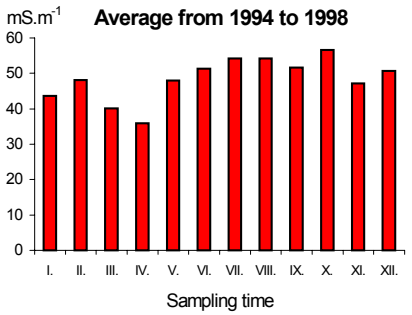


Figure 6



Sampling position:

Figure 7

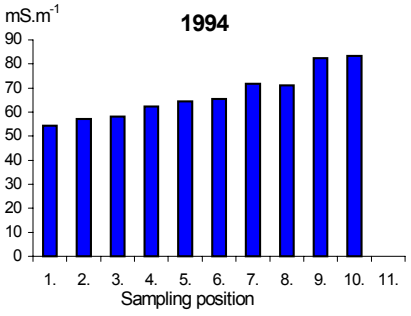


Figure 8

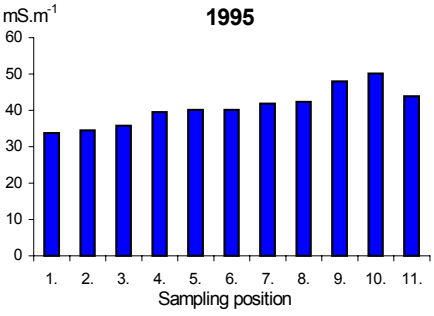


Figure 9

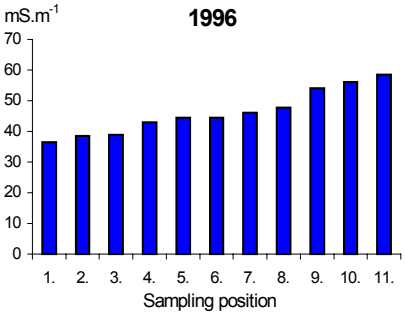


Figure 10

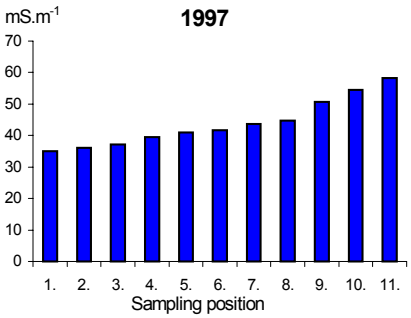


Figure 11

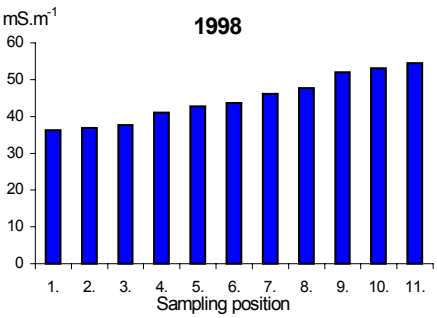
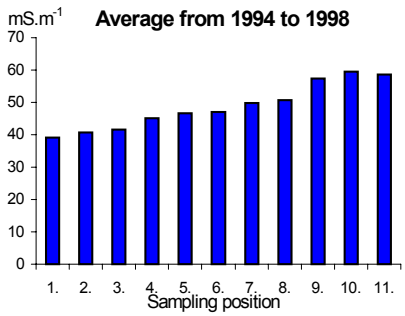


Figure 12



Acta fytotechnica et zootechnica, Vol. 4, 2001, Special Number
Proceedings of the International Scientific Conference on the Occasion of the 55th Anniversary of the Slovak Agricultural University in Nitra

CHEMICAL AND PHYSICAL PROPERTIES OF GROUND MAGNESITE ROCK AS MAGNESIUM MANURE

J.TOMÁŠ, P.LAZOR, A.VOLLMANNOVÁ, T.TÓTH, M.HALÁSOVÁ
Dept. of Chemistry, Faculty of Agronomie, Slovak University of Agriculture in Nitra, Slovakia

Summary

According to valid STN, the semi-product is understood as a suitable manure containing magnesium and calcium after ejecting fraction above 0,5 mm. In average, the semi-products and raw materials in question contain 86,64 % $MgCO_3$ a 8,30 % $CaCO_3$, that responds to 46,46 % MgO and 4,65 % CaO. It is also suitable for alternative agriculture, where is required sufficient contents of magnesium in matured products. The decisive portion of magnesium is bound in carbonates, magnesium in silicate forms complements it. The product has got a relative high contents of manganese of 1643,68 $mg.kg^{-1}$, however the mobilisable contents of it represents only 0,3%. Also other controlled micro-elements (Cu, Zn, Co) are appeared in forms not suitable for vegetables.

Keywords: magnesite manure, magnesium, calcium, grain composition, heavy metals, trace elements

Introduction

Magnesium is ranked as a basic nutriment of vegetal and animal organisms. Vegetables contain it bound in chlorophyll, animals in various body organs, in bones, blood serum etc.
The question of magnesium insufficiency and the effect of it on agriculture products yield reducing was searched by many authors (FECENKO, 1995; HOLOBRADÝ et all.1975; NEUBERG et all.1995; MATULA et all.,1996; RUŽICKA, 1996;BAIER,1996;VANEK,1996). What concerns of the nutrition of vegetables with magnesium, the authors specify the following contents of exchange cations in soil as "optimal": 60 % Ca, 10 % Mg, 20 % H a 5 % K. For sorptive saturated soils (muck, brown soil, black soils and fluvial soils), the contents of calcium mostly exceeds 65%, and the contents of magnesium is in contrary less than 10%.
Generally, the average contents of magnesium in vegetal dry residue is given as 0,2 % and 80 μmol.g-1. From countries with high intensification are given more and more references on the symptoms of vegetal starvation not only on sand soils, but also on heavy soils (FECENKO 1986).

Materials and methods

For valuation of grain composition, chemical characteristics, contain of accesible nutrients, biological influential microelements, heavy metals (risky elements) and value of pH the samples were acquired from intermediate products in plant SMZ Jelšava, a.s. The samples were acquired from 10 various places to stored tumble of deposited waste from magnesit production. In samples were analysed chemical and physical properties.

Raw material and semi-products of SMZ Jelšava a.s.

The subject of our interests comprises the basic raw materials and semi-products of the magnesite factory of Jelšava, which are of carbonate type, and exploitable for nutrition of vegetables with magnesium as well as for soil de-acidification, however the problem is not still not resolved on the level of experimental and practical exploitation.
Classification of grain composition according to exploitation of semi-products and raw materials as magnesite, magnesite-calcareous and calcareous-magnesite manure.
With magnesite, magnesite-calcareous manure, their grain composition is taken as their determining physical property.
According to valid STN, the size of particles is figured in mm, by residue on sieve, or fall through the sieve of specified mesh.

The results of grain assessment (granulometry) of ten samples taken from the stack of semi-products and raw materials deposited in the area of the factory are given in table No.1.
We express the size of particles in millimetres through a residue on the sieve in a size interval above 3 mm and under 0.05 mm in the following fractions:
No.1 > 3 mm; No.2 > 2 mm; No.3 > 1 mm; No.4 > 0,5 mm; No.6 > 0,05 mm; No.7 < 0,05 mm
The results of sieve analyses are referred in weight % as arithmetic average, average deviation and standard deviation.
Following the results obtained, the size of the grains of the analysed semi-products and raw materials above 3 mm represents an average value of 4,68 % of their total weight. However, this value is strongly impacted by the size of the particles of the sample No.7 that comprises also grains above 3 mm, the ratio of which is more times higher than the ratios of other nine samples. In fact, such size of the grains of the classified materials is practically agrochemical indifferent, and therefore we assume such ratio as not suitable what concerns of agrochemical application. The next fraction of grains above 2 mm represents 10,59 %. The fraction less than 2 mm and above 1 mm represents 9,45 % particle ratio. Within the fourth

fraction we specified an average of 24,79 % of particles of a size under 1 mm and above 0,5 mm. The lowest percentage particle ratio of the referred size was within the sample No.7, namely 16,73 %. With other samples, the particle ratio of the

Table 1 Grain composition of semi-products and raw-materials

Sample No.	(1) >3 mm	(2) >2 mm	(3) >1 mm	(4) >0,5 mm	(5) >0,1 mm	(6) >0,05 mm	(7) <0,05 mm
1	2,42	9,13	8,69	23,58	52,79	3,23	0,16
2	5,68	8,08	9,63	24,12	49,85	2,44	0,20
3	2,25	9,44	12,26	30,93	43,40	1,52	0,20
4	3,23	6,15	8,88	23,25	55,91	2,35	0,23
5	5,65	8,45	10,11	21,88	50,18	3,35	0,38
6	2,78	12,28	8,3	22,85	50,78	2,72	0,29
7	14,22	12,78	7,32	16,73	45,20	3,44	0,31
8	4,01	12,48	14,94	31,51	36,79	0,24	0,03
9	3,86	12,16	6,34	26,10	49,17	2,20	0,17
10	2,71	15,04	7,98	26,93	45,01	2,10	0,23
Average	4,68	10,59	9,45	24,79	47,91	2,36	0,22
Average deviation	2,30	2,31	2,52	3,26	4,25	0,68	0,07
Standard deviation	3,39	2,85	3,26	4,13	5,16	0,91	0,09

referred sizes was significantly higher. The highest percentage, for all samples, was determined in the interval of sizes under 0,5 mm and above 0,1 mm. The average percentage ratio represents 47,91 % , with minimum of 36,79 % and maximum of 55,91 %. The rest is represented by very fine grains under 0,1 mm that create 3,36 % with minimal differences in individual samples, but under 0,05 mm we determined a ratio of 0,22 %.

The interpretation of the given specification of fractions is that 74,27 % ratio of grains is contained in an interval of sizes under 1 mm, while the grains of a size above 1 mm represent 22,73 %. In our case it means a requirement for separation of the fraction above 0,5 mm.

In the case of hard limestone and dolomite limestone dominate such opinions that particles above 0,5 mm are of low agrochemical efficiency, and grains above 1 mm are classified as not efficient at all. The referred is to be fully applied also for the materials containing magnesium and calcium, analysed by us.

Classification of the effective constituents contents of semi-products and raw materials:

Beside the granularity, the next decisive feature of magnesite, magnesite-calcareous and calcareous manure is the contents of efficient constituent. It means at first the contents of magnesium acting as a nutriment, the way of its bound that determines solubility and agrochemical efficiency also.

Technical requirements for the quality of calcareous and magnesite manure according to valid STN prescribe that minimally 65 % of carbonate forms should be represented by $CaCO_3$ – $MgCO_3$ and maximal humidity of 1 %. A calcareous-magnesite manure according to STN 721210 with magnesium in carbonate form have the contents of $MgCO_3$ in dolomite limestones 4,6 – 22,9 %, in limestone dolomites 22,9 – 41,2 % and in dolomites 41,2 – 45,7 %.

Sample withdrawal for chemical analysis of the semi-products and products of SMZ Jelšava a.s. was executed according to STN 721210 as stated for calcareous and magnesite-calcareous manure produced from natural rocks by grinding exclusively.

Methodical procedures of chemical analyses

pH/H_2O: in suspension (20 g of fine soil sift through 2 mm sieve) prepared from fine soil and distilled water 1:2,5, and measured by electrometer method.

pH/KCl: in a suspension of fine soil and 1 M KCl in a ratio of 1:2,5, and measured by electrometer method.

Assessable Mg: 10 g of fine soil + 100 ml 0,05 $CaCl_2$ shake for one hour in a horizontal shaker, Mg in filtrate will be determined by atom absorption spectroscopy method (AAS).

Heavy metals total contents: mineralization by dry procedure and subsequent lixiviaton with HNO_3. Determination of Cd, Pb, Cr, Ni by AAS method and Hg on a single-purpose analyser TMA 254.

Microelements Cu, Zn, Mn, Co: mineralization by dry procedure and their determination by AAS method.

Results of chemical analysis

The average chemical composition of the semi-products and raw materials of SMZ Jelšava a.s. is given in Table 2.

Table 2 Average chemical composition of the semi-products and raw materials

Determined constituents	**%**
MgO	40,46
CaO	4,65
$MgCO_3$	84,64
$CaCO_3$	8,30
SiO_2	1,90
R_2O_3 (Fe_2O_3 + Al_2O_3)	4,71
MnO	0,22
Loss through heat	50,22
Humidity	0,042

Following the table, the classified semi-products and raw materials contain 84,64 % $MgCO_3$ a 8,30 % $CaCO_3$ in average at an average humidity of 0,042 %. It represents 40,46 % MgO and 4,65 % CaO in average. For comparison, MgO contents within the magnesite manure of sulphate forms that are most spread (soluble forms) are as follows: kieserit (crystal) 27 % MgO, kieserit (granules) 25 % MgO, bitter salt 16,2 % MgO. This applies not only for intensive agriculture production where magnesium deficit prevails (more magnesium is taken from soil than added therein), but also for alternative agriculture where the goal is production of products with sufficient magnesium contents that is not replaceable.
According to the results we can conclude that the determining portion of magnesium and calcium is bound in carbonate forms as proved by average 50,22 % loss through heat. Magnesium along with other elements presented in silicate form is a complement of the composition of the classified materials. It is documented by the magnesium content as well as SiO_2 contents of 1,90 % in average.
In table No.3 are given the results of the classification of the chemical composition variability of samples taken on ten various places of the deposited materials in question.

Table 3 Classification of chemical composition variability

Sample	Determined constituents					
	MgO	CaO	SiO_2	R_2O_3	Humidity	Loss through heat
1	40,49	3,96	1,66	4,33	0,015	49,90
2	40,75	4,11	2,68	4,38	0,015	49,95
3	40,40	3,52	2,14	4,38	0,055	49,93
4	41,51	4,01	2,13	4,38	0,075	50,36
5	40,55	4,74	1,31	6,22	0,065	50,44
6	41,40	4,85	2,43	3,80	0,005	50,25
7	39,37	5,74	2,14	5,81	0,055	50,50
8	40,54	5,06	1,34	5,47	0,065	50,09
9	39,04	5,71	1,16	4,46	0,015	50,35
10	40,49	4,83	1,98	4,49	0,050	50,45
Average	40,46	4,65	1,90	4,71	0,042	50,22
Aver.deviation	0,508	0,602	0,42	0,55	-	-
Stan. deviation	0,726	0,708	0,48	0,67	-	-

Table 4 Active reaction (pH/$H_2$0), exchange reaction and (pH/KCl) and CS module

Sample	pH/H_2O	pH/KCl	CaO:SiO_2
1	7,89	8,99	2,38
2	7,91	9,33	1,53
3	8,09	9,13	1,67
4	7,11	9,31	1,88
5	7,87	9,38	3,61
6	8,23	9,36	1,99
7	8,84	9,63	2,68
8	8,37	9,44	3,77
9	7,97	9,33	4,92
10	8,35	9,35	2,43
Average	8,16	9,33	2,68
Aver.deviation	0,23	0,11	-
Stan. deviation	0,29	0,16	-

Results given in table No.3 imply that MgO contents varies about an average of 40,46 % with a variational interval from R_{min} 39,04 to R_{max} 41,51 %, with average variation of 0,5081 and standard variation of 0,7264. The variability of CaO contents is similar, and varies about an average of 4,65 % with practically balanced values of average deviation as it is with MgO. The value of losses through heat is also balanced acknowledging that we are dealing with carbonate forms of magnesium and calcium.

In comparison to a neutralising activity standard represented by calcium carbonate (figured as 1,00), the activity of magnesium carbonate that create decisive part of classified materials is figured as 1,19 (HOLOBRADÝ and BUJNOVSKÝ 1977).
In table No.4 are given results of assesment of pH/H_20 (active reaction) and pH/KCl (exchange reaction), as well as CS module (calcium silicate modul).
The obtained results imply that the average value of pH/H_20 is 8,16 and pH/KCl 9,33. It is reasoned by different solubility of magnesium and calcium in used solutants.
The CS module expresses CaO : SiO_2 ratio, and depends on the solubility of the semi-products and raw materials. If the module is greater than 2, the matter is calcium magnesite, if less than 2, silicon magnesite. According to table No.4, for this case is the average value of CS module figured as 2,68, that means the matter is calcium magnesite.
In table No.5 we refer the total contents of some foreign (risky) elements and biologically significant microelements.
With calcium, magnesium-calcium manure and magnesite manure it means cadmium, chrome, lead and mercury. Arsine isn't controlled in carbonate forms of manure.
Following the results given in table No.5, all specified elements are bellow maximally allowed values (NPM). For cadmium it means 0,729 mg.kg^{-1} against NPM of 1,5 mg.kg^{-1}. The average contents of total chrome is 6,31 mg.kg^{-1} against 50 mg.kg^{-1}. The average contents of lead in the specified materials is 8,17 mg.kg^{-1} against NPM of 30 mg.kg^{-1}. The mercury average is 0,0124 mg.kg^{-1} against NPM of 0,5 mg.kg^{-1}.

Table 5 Total contents of foreign (risky) elements and biological microelements

Sample	Chemical elements									
	Ni	Cr	Pb	Cd	Hg	Zn	Cu	Co	Fe	Mn
1	6,13	7,28	13,59	1,469	0,0248	11,49	6,05	6,23	25389,8	1673,74
2	5,44	7,82	7,38	0,718	0,0113	8,18	4,39	5,51	25483,9	1630,86
3	5,35	5,66	7,09	0,639	0,0110	10,13	4,20	5,61	25480,7	1634,56
4	5,80	5,00	8,80	0,650	0,0188	7,60	4,45	6,29	25479,8	1649,77
5	6,26	7,13	7,70	0,610	0,0103	5,60	5,40	6,54	24594	1674,75
6	5,38	5,95	8,01	0,741	0,0102	10,81	4,65	5,49	25090,1	1627,75
7	6,11	6,63	7,10	0,540	0,0117	6,30	4,60	6,18	24067,6	1599,32
8	5,31	5,91	7,11	0,541	0,0084	5,61	4,05	5,36	21782,9	1632,16
9	5,49	3,84	7,11	0,660	0,0081	6,19	3,65	5,56	23896,0	1633,33
10	5,88	7,87	7,80	0,720	0,0092	12,20	4,00	5,83	25172,5	1680,57
Average	5,72	6,31	8,17	0,729	0,0120	8,41	4,54	5,86	24643,8	1643,68
Average deviation	0,32	1,04	1,21	0,150	-	2,20	0,50	0,36	846,78	-
Standard deviation	0,35	1,22	1,88	0,255	-	2,42	0,67	0,39	1105,38	-

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Acta fytotechnica et zootechnica, Vol. 4, 2001, Special Number
Proceedings of the International Scientific Conference on the Occasion of the 55th Anniversary of the Slovak Agricultural University in Nitra

RELATIONSHIP OF SOIL PROPERTIES TO Cr AND Cd MOBILITY FROM VIEWPOINT OF RISK TRANSFER INTO THE PLANTS

Ladislav LAHUČKÝ - Alena VOLLMANNOVÁ - Jozef KULICH - Ján TOMÁŠ
Department of Chemistry, Slovak Agricultural University in Nitra

Summary

The total chromium and cadmium content was determined after mineralization of soils by the atomic absorption spectrophotometry method. The chromium and cadmium content in soil by the same method after its extraction with 2M HNO_3, 0,05M EDTA and 0,01M $CaCl_2$ were determined. Achieved data were compared to allowed limit values.
In model conditions the reaction of soil on Cr and Cd loading was observed. Also the extent of Cd and Cr sorption in soils was tested. The Cr compounds in majority of tested soils are relatively fest fixed , only smal risk of soil contamination by Cr was in this work confirmed. The Cd compounds in majority of tested soils are bounded in light released forms. This fact presents enhanced risk for ecosystems with possibility contamination of food chain.

Key words: Cr and Cd forms in soils; Cr and Cd content in various soil extracts

Introduction

Heavy metals are perhaps most troublesome toxic components introduced into the environment. One of the sources of soil and water pollution on large areas are atmospheric dust of anthropogenic origin. Power industry and non-ferric metals industry are the main sources of pollution of the atmosphere. One of important sources of pollution of the environment are industrial and municipal sewages and chemical substances leaching from dumping grounds of various wastes.
Heavy metals goiing into soil and water are fixed by the solid phase, and therefore it is not possible neither to remove them nor reduce their amount. An important thing is that soils and bottom sediments cumulating underground waters from pollution and reducing the intake by plants. Ecological role of soil as a heavy metals can be very adsorbed by soil is decided first of all by its sorption capacity, determined by the quantity and quality of colloids creating so called soil sorption complex. Other factors are soil reaction, salinity, redox potential, as well as concentration and the form in which the metals occur (1).
Chromium occurs in inorganic systems in several chemical forms and valences. Only Cr^{3+} and Cr^{6+} are significant in biological systems. Trivalent chromium, (Cr^{3+}) is an essential nutrient for animal and human glucose and lipid metabolism. Chromium deficiency in humans mimics diabetes mellitus and causes the formation of arteriosclerosis in rats. The average human ingests from 0,03 - 0,10 mg of chromium (in all valences) each day. Deficiences in chromium also lead to an increasing of lead toxicity, while excess chromium (VI) in biological systems has been implicated in specific forms of cancer (5)
Cd gets into the soil by atmospheric deposition, application of sewage sludge and industrial fertilizers. Phosphate fertilizers with enhanced Cd contents are one of the important sources of Cd input into the soils (6). Despite of improvment of situation because of phosphates with low Cd content and decreasing of industrial fertilizer doses this problem still exists. The Cd contents in soils are often higher than maximal allowed concentrations under Vestník MP SR (7).
The input of Cd into the plants by roots from soil and by leaves from atmosphere is risky for food chain of the man because of negative influence of Cd on living organisms (4). Cd in form of its cation is cummulated in arable horizont of soil. Mobility of Cd is increased with enhanced pH, by application of organic matter in soil (3). Cd also forms complexes with organic and inorganic ligands, whose are one of causes of enhanced Cd mobility. Cd can substitute Zn in some enzymatic systems, whose are by this way inactived (1).
Total Cr and Cd contents, their mobile forms in extracts of 2M HNO_3, 0,05M EDTA and 0,01M $CaCl_2$ were determined in tested soils. In model conditions the reaction of soil on Cr and Cd loading was observed. Also the extent of Cd and Cr sorption in soils was tested.

Material and methods

The chromium and cadmium content in tested soils were determined after their draining, finish and decomposition by HF + $HClO_4$ mixture by AAS (atomic absorption spectrophotometry) method with instrument PYE Unicam SP9. The Cr and Cd content in soil by the same method after its extraction with 2M HNO_3 , 0,05M EDTA and 0,01M $CaCl_2$ mobile forms were determined.
The cnock - down colums in model kinetic conditions were used for observation of Cr and Cd sorption. The columns were full with 0,5 kg of soil, the maximal water capacity of soils was determined and then solution $Cr(NO_3)_2 . 9H_2O$ and $Cd(NO_3)_2$.

$2H_2O$ with double of limit value A (260 mg Cr.kg^{-1} ev. 1,6 mg Cd . kg^{-1} of soil) was aplicated (7). The Cr and Cd contents were determined in extraction solutions (2M HNO_3 , 0,05M EDTA, 0,01M $CaCl_2$) after taking to pieces by AAS method.

Results and discussion

The total Cr content in soils were 18,90-74,00 mg.kg^{-1}. The mobile forms, determined in 2M HNO_3 extract were 0,59-3,72 mg.kg^{-1} (3,2-9,1 % of the total Cr content), in 0,05M EDTA extract were 0,09-0,70 mg.kg^{-1} (0,1-1,3 % of the total Cr content), in 0,01M $CaCl_2$ were 0,00-0,14 mg.kg^{-1} (0,0-0,6 % of the total content). The Cr compounds in majority of tested soils are relatively fest fixed , only smal risk of soil contamination by Cr was in this work confirmed.
The soil behavior towards chromium was variable but relatively similar. Different properties shown Regosol, Cambisol and Stagnic Glossisol, where chromium migration to the lower column layers were determined. Chromium content in used extracts was in range 0,01 - 57,17 % (in 2M HNO_3), 0,00 - 2,09 % (in 0,05 M EDTA) and 0,00 -0,45 % (in 0,01 M $CaCl_2$) of added chromium amount. The Cr compounds in majority of tested soils are relatively fest fixed, only smal risk of soil contamination by Cr was in this work confirmed (2).
The total Cd content in soils were 0,53 - 1,35 mg.kg^{-1}. The determined content of Cd were higher (75 % results) than the maximal allowed concentration (0,8 mg.kg^{-1}). The mobile forms, determined in 2M HNO_3 extract were 0,06 - 0,79 mg.kg^{-1} (16,7 - 53,7 % of the total Cd content). The determined content of Cd were higher (41 % results) than the maximal allowed concentration A_1 0,3 mg.kg^{-1} (7). The mobile forms, determined in 0,05M EDTA extract were 0,08 - 0,38 mg.kg^{-1} (12,07 - 28,3 % of the total Cd content). The mobile forms, determined in 0,01M $CaCl_2$ extract were 0,00 - 0,21 mg.kg^{-1} (0,00 - 15,45 % of the total Cd content).
The soil behavior towards Cd was variable but relatively similar. Different properties shown Regosol, Albic Luvisol, Stagnic Glossisol, Haplic Chernozem and Eutric Fluvisol, where Cd migration to the lower column layers were determined. The Cd content in extract 2M HNO_3 was in range 0,00 - 4,98 mg.kg^{-1} (0,00 - 51,6 % of added amount). The Cd content in extract 0,05M EDTA was in range 0,00 - 4,42 mg.kg^{-1} (0,00 - 46 % of added amount). The Cd content in extract 0,01M $CaCl_2$ was in range 0,00 - 1,70 mg.kg^{-1} (0,00 - 17,7 % of added amount). The experimental results signal the Cd risk for ecosystems (3 , 4).

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INPUT OF SOME HEAVY METALS INTO THE PLANTS PRODUCTION IN IMMISSION AREA OF OFZ ISTEBNÉ

Monika HALÁSOVÁ, Alena VOLLMANNOVÁ, Alžbeta HEGEDÜSOVÁ
Katedra chémie SPU Nitra, *Katedra chémie FPV UKF Nitra

Summary

Region of Down Orava is one of problem localities of Slovakia. OFZ Istebné since 1952 as the source of polymetallic dust significantly partakes on this fact. Improvement of emission situation of this metallurgical plant calls for a actualisation of knowledges about ability of agricultural soil to give hygienic unexceptionable production. Despite of significantly decreased contamination of observed area the risk of overlimit contents of some heavy metals (Cr, Cd) still exists.

Key words: heavy *metal contents, hugienic limit, polymetallic dust, soil contamination*

Introduction

Immission area of Down Orava is one of the nine regions with risky agricultural soil and vegetation in Slovakia. Since 1952 Oravské ferozliatinárske závody (OFZ) in Istebné is very important source of polymetallic dust. The emission situation is significantly changed from beginning of plant working till this time. Determined values of wet and dry deposition before

mounting of removing system were in range 39 – 1794 t.km^{-2} (HOLOBRADÝ, 1985). After technical improvement of removing system in 1985 workers from VÚPÚ in Bratislava identified the extent of contamination of agricultural soil and plant production (HOLOBRADÝ, 1985; KALÚZ-REBIČOVÁ, 1989; KALÚZ-MOCIK, 1988).
If amount of emited polymetallic dust in 1984 was 6864 t (KALÚZ, 1989), in 1990 it was 3088 t and in 1991 it was only 120 t, presented value in 1992 was 70 t (ŠVEHLA, 1983). The last value means atmospheric input of 1632 kg of Cr, 540 kg of Zn, 280 kg of Mn as the major components of emissions and also lower amounts ot other heavy metals (W, Ni, Pb, Cd, Co, Cu and As). Despite of decreased amount of emissions there is the possibility of high heavy metal contents in soil and in plant produstion and risk of their input into the food chain of the man.

Material and methods

Soil samples were selected from many points of immission region of OFZ Istebné. Underground and overground parts of plants (washed and unwashed) were mineralized by wet way under STN 560065. Heavy metal contents in various extracts (0,05 M EDTA, 2 M HNO_3 and 0,01 M $CaCl_2$) were in samples by using of AAS method determined.

Results and discussion

In tested localities situated in various distances from emission source Istebné the Cr soil contents under valid legislative norms were determined. The cultivated plants were evaluated under Potravinový kódex SR or under legislative allowed limits for risk matters in fodders.
Contents of potentially mobilisationable fractions of heavy metals (table 2) were in many cases higher than reference value for ascertained element (Zn in 1, Mn in 1, Cr in 7 and Cd in 8 ceses from 9 determined samples). Heavy metal inputs into the soils caused various intensity of heavy metal transfer into various sorts of plants (table 1).
Accepted heavy metal contents were evaluated by comparison of analysis of washed and unwashed overground plant parts. Various values confirmed significantly importance of secondary atmospheric contamination in observed locality. Permanent grass showed relatively high Cr and Cd contents in camparison with other observed plants. This fact is conditioned by Cr cumulationability in top soil layer because low mobility of its soil forms. Enhanced Cd and Pb contents were determined also in overground parts of cereals. Root system of plants appeared as significant bariere for heavy metal transfer into the overground parts of plants. Potatoes confirmed exceptional ability of heavy metal transfer.
Despite of significantly decreased contamination of observed area surrounding of OFZ Istebné in last years the risk of overlimit soil contents of some heavy metals (Cd, Cr) still exists.

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Table 1 and Table 2

locality			Cr content	($mg.kg^{-1}$)	Cd content	($mg.kg^{-1}$)	Pb content	($mg.kg^{-1}$)	Zn content	($mg.kg^{-1}$)	Mn content	($mg.kg^{-1}$)
distance (m)	plant	part of plant	washed	unwashed	washed	uuwashed	washed	unwashed	washed	unwashed	washed	unwashed
1(2000)	perm.grass	overground	4,17	7,70	0,629	0,456	0,00	3,88	45,50	46,70	70,10	73,00
2(2000)	potato	root	1,12		0,500		0,00		8,79		105,30	
		bulb	0,00		0,044		1,87		1,72		0,87	
		overgr. mass	0,00	2,56	0,478	0,535	4,90	5,80	28,10	32,64	99,70	144,00
3(2500)	perm.grass	overgr. mass	4,70	6,30	0,411	0,811	3,30	3,70	43,60	33,90	28,00	36,80
4(2000)	clover	overgr. mass	0,99	6,60	0,410	0,698	6,70	7,36	50,60	49,90	60,40	61,82
5(1500)	wheat	root	24,16		0,830		18,71		24,00		289,50	
		straw	0,71	0,86	0,300	0,610	8,50	8,99	12,10	25,30	8,50	8,99
		ear	0,00	0,00	0,310	0,330	0,28	2,59	11,80	25,40	17,40	16,40
6(1000)	oats	root	15,80		0,680		9,66		38,80		92,70	
		straw	0,00	2,05	0,160	0,730	0,00	1,57	12,00	15,90	18,30	19,00
		ear	0,66	0,85	0,280	0,490	0,00	0,95	16,14	20,10	28,60	30,05
7(1000)	clover	overgr. mass	0,00	2,25	0,230	0,710	3,80	5,86	26,90	30,20	14,70	17,40
8(3000)	perm.grass	overgr. mass	2,23	2,39	0,258	0,630	3,10	5,95	30,00	33,70	33,70	33,90
9(3500)	barley	root	2,38		0,637		12,70		48,00		185,90	
		straw	0,10	0,47	0,250	0,610	2,18	2,62	23,50	31,90	17,60	25,70
		ear	0,10	1,10	0,440	0,520	0,76	1,81	39,50	50,04	10,96	17,93

locality	Cr content ($mg.kg^{-1}$)			Mn content ($mg.kg^{-1}$)			Zn content ($mg.kg^{-1}$)			Pb content ($mg.kg^{-1}$)			Cd content ($mg.kg^{-1}$)		
distance (m)	2M HNO_3	0,05M EDTA	0,01M $CaCl_2$	2M HNO_3	0,05M EDTA	0,01M $CaCl_2$	2M HNO_3	0,05M EDTA	0,01M $CaCl_2$	2M HNO_3	0,05M EDTA	0,01 $CaCl_2$	2M HNO_3	0,05M EDTA	0,01M $CaCl_2$
1(2000)	95,0	4,04	0,140	1076,2	202,80	0,66	43,82	19,3	0,04	44,76	15,78	0,14	0,810	0,412	0
2(2000)	4,3	0,44	0,000	398,8	130,20	5,65	18,94	7,82	0,04	12,58	5,08	0	0,488	0,248	0
3(2500)	10,4	0,68	0,000	363,4	138,40	1,40	21,32	6,54	0,08	16,08	5,58	0,06	0,544	0,270	0
4(2000)	15,4	0,64	0,020	300,8	120,60	1,00	12,4	3,84	0,06	13,18	4,70	0	0,408	0,260	0,32
5(1500)	14,5	0,52	0,000	507,8	131,40	1,40	18,32	3,76	0,02	15,88	5,54	0	0,556	0,208	0
6(1000)	12,8	0,68	0,020	372	155,00	1,86	17,06	3,96	0,04	15,54	5,62	0	0,426	0,214	0
7(1000)	19,6	1,06	0,020	529,6	168,40	2,40	19,62	4,82	0,04	16,62	5,92	0	0,496	0,270	0
8(3000)	10,8	0,34	0,020	407,4	163,00	7,00	14,8	5,06	0,06	11,38	4,52	0	0,610	0,250	0
9(3500)	9,5	0,22	0,060	296,2	164,20	1,90	8,38	2,52	0,02	11,30	4,34	0	0,284	0,164	0

Acta fytotechnica et zootechnica, Vol. 4, 2001, No 5
Proceedings of the International Scientific Conference on the Occasion of the 55th Anniversary of the Slovak Agricultural University in Nitra

OCCURRENCE OF CHROMOSOME ABERRATIONS IN HETEROSEXUALTWINS OF MERINO SHEEP

Alena SAKALIKOVÁ, Irena ŠUTIAKOVÁ, Svetlana RIMKOVÁ, Emil ŠULÍK, Marián KOSTECKÝ
Research Institute of Veterinary Medicine, Hlinkova 1/A, 040 01 Košice, Slovak Republic

Summary

This study was aimed at the occurrence of chromosome aberrations in heterosexual Merino sheep twins. The occurrence of chromosome aberrations in a healthy ram lamb and his sister have been compared. The sister showed the signs of malformation. The clinical finding revealed slight shift of vulva and small ear lobes. We have recorded 1 % and 4 % occurrence of centric fusions (CF) in ram lamb and in ewe lamb, respectively. There was the high percentage of associations of acrocentric chromosomes as well - i.e. as much as 23 % in ram lamb and 12 % in ewe lamb.

Key words: sheep, chromosome aberrations, heterosexual twins

Introduction

The degree of inter-sexuality in animals affected with developmental abnormalities may be considerably altered in female reproductive organs only slightly reduced (Szatkowska et al., 1993), next to female gonades that are situated in rudimentary scrotum (Jonnson, Gustavsson, 1969; Dain, Tucker, 1970). The literature concerning the extent of masculinizatiom in freemartins presents either bases or the aspects relative to the hermafroditism (Szatkowska et al., 1998). Freemartinism proves to be the common name for developmental anbnormalities of reproductive organs in twins of different sex to be mostly sterile. Freemartinism is not a hereditary abnormality; its occurrence, however, is hereditary conditioned by the fact that it may originate merely with heterosexual twins and the pre-disposition for hatching of twins is usually hereditary conditioned (Vademecum of Veterinary Medicine, 1991).
Sheep caryotype (2n=54) consists of three pairs of long metacentrics and 23 pairs of telocentric autosomes. Chromosome X is big and acrocentric, chromosome Y is small (Long, 1990). In view to the fact that the occurrence of phenotypically different animal - i.e. Merino ewe lamb coming from heterosexual twins was observed we have done the cytogenetic analysis for we have supposed that this may be the case of freemartinism with the possible occurrence of mosaic (XX/XY).

Materials and methods

We have observed the cytogenetic picture of an ewe (mother) and her progeny (twins) of the ewe lamb having anatomical abnormalities (small ear lobes and shifted position of vulva) as well as Merino ram lamb. Heparinised blood (100 IU/ml) taken from *vena jugularis* was used for analysis. Lymphocytes obtained from peripheral blood were treated according to Moorhead et al. (1960). 0.5 ml of heparinised blood was added into the medium supplemented with phytohaemagglutinin. In addition, antibiotics – i.e. penicillin (100 IU/ml) and streptomycin (100 µg/ml) were added. Lymphocytes were cultured for 72 hrs at 37.5 ^{o}C. Two hours prior to the end of cultivation, colchicin (10 µg/ml) was added. The preparations were stained with 10 % Giemsa-Romanowski solution in the phosphate buffer ($2.5.10^{-2}$ $mol.l^{-1}$) pH 7.0. To determine structure aberrations, we have used the Atlas of Chromosome Aberrations by Klen and Srb (1982) as well as the studies of Savage (1975) and Carran and Natarajan (1988).

Results

The results of conventional chromosome analysis are presented in Table 1. Three Merino sheep were included in the study - i.e. mother and heterosexual twins. The ewe was not possible to be assessed due to the mitotic index. This is why it was possible to compare only the progeny namely phenotypically normal ram lamb and ewe lamb that was slightly malformed in the zone of vulva (slight shift) and in the size of ear lobes (small). Cytogenetically, the occurrence of CF was recorded in ram lamb and in ewe lamb (1 % and 4 %, respectively). We have also recorded rather high occurrence of the associations of acrocentric chromosomes in ram lamb and in ewe lamb (23 % and 12 %, respectively). In addition, chromatide breaks as well as gaps were recorded.

Discussion

The results presented show an interesting occurrence of centric fusions and also high occurrence of associations of acrocentric chromosomes that may represent a ˝pre-degree„ with the originating of centric fusions. Originating of these fusions is connected with the alteration of chromosome material in such a manner that the part of the little arms of a chromosome will be translocated and connected with either the arms or the centromer (CF) of another chromosome. The carrier, however, may pass so abnormally altered chromosomes to its embryonal cells where after the fertilization with a

cell with normal chromosomes the defect is not compensed and a part of chromosome is either missing or additional in the progeny of carriers (Kučerová et al., 1981).

Table 1 Chromosome aberrations in heterosexual sheep twins.

Breed: Merino	Ram lamb	Ewe lamb
Number of assessed	100 mitoses	50 mitoses
Hyposomie	11 (%)	4 (8 %)
Polypliodie	1 (%)	0
Chromatid breaks	4 (%)	1 (2 %)
Chromatid gaps	2 (%)	0
centromeric fusion	1 (%)	2 (4 %)
Association	23 (%)	6 (12 %)
2 Associations	1 (%)	0
Centromere separation of metacentric	14 (%)	3 (6 %)
Centromere separation	3 (%)	0
Fragment	0 (%)	1 (2 %)
Double minute	0 (%)	1 (2 %)

The occurrence of a mosaic (XX/XY) testifying for freemartinism was not recorded. This indicated to the fact that in sheep only 5 to 10 % of twins are being born with vascular anastomoses. On the other hand, the chimerism of red blood cells represents merely 5 % of this amount. In cattle, however, it is occurring almost regularly in heterosexual twins (as much as in 92 %) (Vademecum of Veterinary Medicine, 1991).

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ELECTROPHORETIC CHARACTERISTIC OF PLASMA PROTEINASE INHIBITORS IN IMPROVED VALACHIAN SHEEP

Emil ŠULÍK, Irena ŠUTIAKOVÁ, [1]Václav ŠUTIAK
Research Institute of Veterinary Medicine, Hlinkova 1/A, 040 01 Košice, Slovak Republic
[1]University of Veterinary Medicine, Komenského 73, 041 81 Košice, Slovak Republic

Summary

α_1-proteinase inhibitor in blood plasma of Improved Valachian sheep has been studied by isoelectric focusing in a mixture of ampholytes pH 4.2 – 4.9; pH 4.5 – 5.4, and pH 3.5 – 9.3. Altogether, 16 – 17 fractions of proteinase inhibitors – i.e. trypsin were recorded in the blood plasma of breeding rams. Strong activity inhibitors in rams ranged within isoelectric points pH 3.75 – 6.0. Fractions with lower inhibitory activity were in the zone of pH 3.5 - 3.75. The lowest activity fractions were detected within pH 6.55 - 6.85 and in alkaline zone of pH 7.35 – 8.15. In ewes, 4 majority fractions were detected within pH 3.75 – 6.0 as well. In alkaline zone of pH 7.35 – 8.15 no proteinase trypsin inhibitors were detected. Altogether 12 to 13 fractions were detected in ewes. Both in males and females the esterolytic inhibition against chymotrypsin was determined. Fractions of P.I. trypsin following the charge electrophoresis covered the zone from post-γ-globulin up to the prealbumin one.

***Key words**:* Proteinase inhibitors, Improved Valachian sheep, Electrophoresis

Introduction

According to the activity spectrum, proteinase inhibitors (P.I.) can be divided to the group of nonspecific P.I. (including e.g. α-macroglobulin or human α_2-macroglobulin (α_2- antiplasmin) and specific ones including aspartate P.I. (pepstatin), cysteine P.I. (cystatin), tissue inhibitors of metaloproteinases (collagenase. inhibitor, antithrombin III), and serine P.I. (Elliott et al. 1996). Of most frequent specific serine P.I., α_1-proteinase inhibitor was investigated in more detail also referred to as α_1-antitrypsin. The above inhibitor inactivates pancreatic enzymes - i.e. elastase, neutrophilic elastase (catepsin of G neutrophils), trypsin, chymotrypsin, plasmin, thrombin, and acrosin (Wu Foreman, 1991; Molnárová, 1991).
Normally serine P.I. produce almost 90 % of the all antiprotease activity in serum. This activity ensures enzyme-inhibitory balance in an organism and are superior to locally synthesising inhibitors in tissues (Rubin, 1996).
For needs of practice, neither genetic and biochemical characteristic nor polymorphism of serine P.I. under physiological conditions have been fully explored yet. To date, such characteristics in farm animals were most investigated in horses and in swine. In sheep and cattle, however, there are only sporadic data (Juneja, Anderson, 1994; Suzuki, Stormont, 1994; Šutiaková et al., 1995).

Materials and methods

Animals - Sampling: The examination of trypsin (T), P.I. in blood plasma examination was carried out in 31 rams and in 14 Improved Valachian ewes coming from the breeding farm in L. After blood collection from *v. jugularis* into heparin (15 m.u./ml – Léčiva Praha, Czech Republic) blood plasma was stored for maximum a fortnight at –18 °C. Prior to the electrophoresis, plasma was incubated for 24 hrs/25 °C using neurominidase (fy Sigma).
Electrophoresis: Both charge and IEF electrophoresis in PAG were performed by modified method according to Junej and Gahne (1980). The condition optimization of the detection of proteinase PAG inhibitors was done according to Šutiaková (1989). Detection of P.I. trypsin in PAG was done by the modified method of Estomba et al. (1996).

Results and discussion

Proteinase trypsin inhibitors: In healthy rams, the number of P.I. fractions did not differ, however, the intensity of some fractions was different. Altogether, 16 to 17 fractions of P.I. trypsin were detected in rams (Table 1). The dominant fractions of P.I. trypsin in ewes have positions similar to those in rams. Fractions of P.I. trypsin with lower inhibitory activity (+) at anodic pole were beginning from pH 3.75 and not from pH 3.5 like in rams (++) and the number was lower. Likewise in the alkaline zone of pH 6.55 - 6.85 up to pH 7.35 the lower inhibition as well as lower number of fractions were determined (Table 1 and Fig 1). In our previous studies we have been observing Merino sheep (utiakovα et al, 1995).
According to the intensity, the activities of P.I. trypsin in the above animals were similar to those of Improved Valachian sheep within the fractions with very strong inhibitory activity of pH 4.5 - 5.85 as well as fractions within pH 3.8 - 4.1 frequently with lower intensity. The differences in both intensity and number were recorded in other fractions as well. Similarly to our results, Estomba et al (1993) detected P.I.1 of trypsin in blood plasma of Latxa and Karrantzar sheep particularly within cathodic zone of pH around 5.0. The above authors stated that accoding to the personal statement of Juneja, polymorphic Pi-2 system belonged to the group P.I.1. The authors supported the hypothesis that this is the case of a codominant heritability of an autosomal locus with allelas P.I. 1 A, B, C, and D. Later on, Estomba et al. (1996) detected other D_0 , D_1 and A_0 variants by the modification of previously used IEF method (by increasing the concentration of ampholine pH 4.5 - 5.4 in a mixture of ampholines pH 4.2 - 4.9 and 4.5 - 5.4). Unlike the above authors, we have found the fractions of P.I. trypsin in the alkaline zone in both Improved Valachian and Merino rams using the triple mixture of ampholines. Pelegrinni (1994) reports that P.I. of animals can be divided into separate Pi-1 and Pi-2 systems also according to the ability to inhibit some of serine proteinases. For instance, in horses of Pi-1 group they inhibit both trypsin and α-chymotrypsin. On the other hand, P.I. of group Pi-2 inhibit merely trypsin.
Proteinase inhibitors of α-chymotrypsin: α-chymotrypsin has been studied in Improved Valachian sheep as well. Using three enzymes from other firms, however, no satisfying results were obtained to be good for documentation. Previously, using α-AchT A_4 (fy Boehringer, Mennheim) to be good also for kinetic measurements (Šutiaková, 1998), unlike Estomba et al. (1993) and Estomba et al.(1996) good results were obtained in Merino sheep concerning the esterolytic inhibition against α-chymotrypsin. In Improved Valachian sheep, P.I. of α-chymotrypsin were found ranging from pH 4.5 to pH 5.8 up to pH 6 and similarly to those of Merino sheep they formed always four fractions. Ac concerns position, these fractions agreed with fractions of P.I. trypsin. The occurrence of the four fractions as well as the fact that the positions are similar to P.1 trypsin may indicate for the existence of two-centric inhibitors. It was also possible to prove the occurrence of P.I α-AchT fractions within other pH positions (Table 1). Based on both the above and previous studies we suggest that from genetic and biochemical viewpoints, this system proves to be considerably polymorphic. In addition to the existing inter-species differences to be typical for each animal type, the differences by breed, sex and age dynamics can be detected in the electrophoretic P.I. spectrum (Mattová et al., 1998).

Table 1 Differences in number and intensity of P.I. fractions of trypsin and chymotrypsin in Improved Valachian sheep according to sex. IEF in PAG (T = 7.5; C = 3); visual assessment.

Proteinase trypsin inhibitors							
Rams				**Ewes**			
Fraction intensity	**pH range**	**fraction number**	**Note**	**Fraction intensity**	**pH range**	**fraction number**	**Note**
++	3.5 - 3.75	4 -5	constant intensity	+	3.5 - 3.75	3-4	Lower intensity than in rams
+++	3.75-6.0	4	constant number of fractions	+++	3.76 - 6.0		Position of fraction within pH 5.8 constant number of fractions
+	6.55-6.85 až 7.0	5	Intensity of inhibitory activity in particular animals different except for fractions pH 6.85	+ (±)	6.55-7.35	3-4	tracer amount of fraction pH 6.85 in the position like in rams
++	6.85	1		±	6.85	1	
+	7.35-8.15	2-3	In some animals a fraction is missing		7.35-8.15	0	No inhibitory activity
Fractions altogether		**16-17**		**Fractions altogether**		**12-13**	
Proteinase inhibitors of α-chymotrypsin							
Rams				**Ewes**			
±	4.5-5.8	4	In positions corresponding to dominant P.I. trypsin∗	±	4.5-5.8	4	In positions corresponding to dominant P.I. trypsin∗
	7.0-7.5	0 ?	Visually undetectable		7.0-7.5	0 ?	Visually undetectable
±	> 4.5	1-2	Non sharp	±	4.5	0-1	Non sharp

Legend: +++ - very strong inhibitory activity (dominant fractions) - phenotypic fractions; ++ - lower inhibitory activity, clear and intensive fractions; + - low inhibitory activity – clear fractions; ± - distinguishability of tracer amounts of fractions; ∗ - proved: 1. α-AchT of bovine pancreas (fy Koch Light); 2. α-AchT from bovine pancreas - 68.6 U/mg (fy Fluka); 3. α-AchT TLCK Treated - 55.6 U/mg (fy Fluka);

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Acta fytotechnica et zootechnica, Vol. 4, 2001, No 5
Proceedings of the International Scientific Conference on the Occasion of the 55th Anniversary of the Slovak Agricultural University in Nitra

THE FREQUENCY OF MICRONUCLEI IN THE PERIPHERAL LYMPHOCYTES OF SHEEP IN CONVENTIONAL AND ECOLOGICAL FARMING

Irena ŠUTIAKOVÁ, Emil ŠULÍK, Alena SAKALIKOVÁ, Svetlana RIMKOVÁ, [1]Václav ŠUTIAK
Reserach Institute of eterinary Medicine, Hlinkova 1/A, 040 01 Košice
[1]University of Veterinary Medicine, Komenského 73, 041 81 Košice

Summary

In this work the occurrence of micronuclei in the peripheral lymphocytes during the autumn period was studied in ecologically and conventionally farmed Improved Wallachian sheep. In the above groups of 1-4-year-old sheep a frequency of 14.4 ± 6.13 and 17.5 ± 14.01 micronuclei per 1000 binucleated cells was observed, respectively. In rams, 34.11 ± 14.62 and 20.33 ± 6.44 micronuclei were stated for the conventional and ecological farm, respectively, the results revealing significance at the level of P = 0.02.

Key words: genotoxins, frequency of micronuclei, sheep, ecological and conventional farming

Farm animals are exposed to different substances present in soil, water, air or feeds. The biological effects of these substances, i.e., the response of the organism to the impact of genotoxic substances in different ecosystem can be assessed by different cellular, histological, biochemical and cytogenetic biomarkers (Schramm et al.,1999; De Souza Bueno, 2000). Chromosome aberrations, sister exchange chromatids and micronuclei as cytological biomarkers are used in biomonitoring studies of animals exposed to environmental genotoxins (Hebert, Luiker, 1996). According to Di Bernardino et al. (1997), environmental genotoxin monitoring with cytogenetic biomarkers is especially important with respect to bioproducts since farm areas are polluted with pesticides, mycotoxins, heavy metals and the like.
Breeding animals under specific conditions are an integrated part of the ecological farming system (Fazekašová, Poráčová, 1999). Kováč (1996) pointed at differences in animal breeding in the conventional and ecological farming systems.
This work aimed at assessing the occurrence of micronuclei in the peripheral lymphocytes of sheep under conventional and ecological farming practices.

Materials and methods

In the autumn, Improved Wallachian sheep aged 1 – 4 years (10 males, 9 females) were examined on an ecologically operating farm (Anonymous, 1995). Sheep of the same breed aged 2 – 5 years and coming from a conventional farm (9 males, 8 females) were also subjected to analysis.
Biological material – blood – was obtained from the v. jugularis into heparin (100 IU/ml of blood). Heparinized blood (0.4 ml) was cultured in 0.6 ml of Panserin 702-Chromosome Medium-S-chromo-cell with FBS, PHA-L and L-glutamine (PAN Systems GmbH, Biotechnologische Produkte ™, Germany) for 72 hours at 37.5 °C. Antibiotics (100 IU/ml penicillin G and 100 µg/ml streptomycine) and 7.5% $NaHCO_3$ were added to the culturing medium.
Micronucleus test: After 44 h of culturing cytochalasin B (2 mg/ml in DMSO, Sigma, USA) was added to the medium at a final concentration of 6 µg/ml. The preparations were evaluated in a Nikon microscope using Animal and Photostyler software at a magnification of 400x and 1000x. Micronuclei were identified according to the criteria of Countryman and Heddle (1976). The frequency of micronuclei was determined per 1000 binucleated cells for each animal. The results were statistically evaluated using the Sigma stat (Jandel Scientific®) t-test.

Table 1 Frequency of micronuclei in the peripheral lymphocytes of ecologically and conventionally farmed sheep in the autumn period

Donor Sex	Statistical values	MN frequency per 1000 cells	
		Conventional farm	Ecological farm
F	x ―	17,5	14,4
n=8	Std Dev	14,01	6,13
n=10 (E)	SEM	4,95	1,94
	P=0,05		
M	x ―	34,11	20,33
n=9	Std Dev	14,62	6,44
n=9(E)	SEM	4,88	2,15
	P=0,02		

Note: If more micronuclei occurred wich binucleated cells, their number was included in the total. F =female, M=male, E=ecological farm.

Results

In autumn, the peripheral lymphocytes of female sheep in the conventional and ecological system revealed a frequency of 17.5 ± 14.01 and 14.4 ± 6.13 micronuclei per 1000 binucleated cells, respectively, however, without statistical significance (P = 0.05; Table 1).
As can be seen from the table, significant results (P = 0.02) concerning micronucleus frequency in the peripheral lymphocytes were obtained in the male sheep of both systems.

Discussion

The micronucleus test is used in biomonitoring studies in both human and veterinary medicine dealing with environmental load (Dianovský, 1994; Kovalkovičová et al., 2001; Šutiaková et al., 2001; Bonassi et al., 2001). According to Fenech (1998) the frequency of micronuclei can be affected by several factors (age, life style, sex, individual mutagen sensitivity, etc.) which therefore need to be studied step by step. In earlier studies the spontaneous frequency of micronuclei in the lymphocytes of conventionally and ecologically bred sheep was assessed during the spring period (Šutiaková et al., 2000). Since these cytogenetic analyses characterized the response of the organism to genotoxins of the preceding period of 3-4 months, we took interest in the factor of seasonality. In autumn, the frequency of micronuclei in the peripheral lymphocytes of females presented 17.5 ± 14.1 and 14.4 ± 6.13 per 1000 binucleated cells in the conventional and ecological system, respectively. Similar results were obtained in spring, however, on the conventional farm both sexes were taken into account for frequency assessment. In the lymphocytes of rams a frequency of 34.11 ± 14.62 and 20.33 ± 6.44 micronuclei per 1000 binucleated cells was stated on the conventional and the ecological farm, respectively, These figures revealed significance. In connection with the beforesaid a specific feature of sheep breeding has to be pointed out: breeding rams usually come from other localities (market purchase) then the ewes under investigation and thus the results may be „distorted„ (Kvokačka, personal communication). This fact needs to be recalled when considering the high frequency of micronuclei (60 – 70 per 1000 binucleated cells) in two of the breeding rams. In peripheral lymphocytes of dairy cows Scarfi et al. (1993) reported a spontaneous frequency of 12.3 ±4.1 micronuclei per 500 binucleated cells and observed it to be 3x higher than in man. This fact was attributed to sensitivity to cytochalasin B, the number of chromosomes in cattle (2n = 60) and sensitivity to genotoxic pollutants.
Vith view to the continuing presence of different genotoxic substances in the environment the importance of using cytogenetic biomarkers to prevent health disturbances and produce ecological food is still increasing.

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Acta fytotechnica et zootechnica, Vol. 4, 2001, No 5
Proceedings of the International Scientific Conference on the Occasion of the 55th Anniversary of the Slovak Agricultural University in Nitra

EVALUATION OF CHLORIDE CONCENTRATIONS IN CATCHMENT OF ŽITAVA RIVER

Jaroslav NOSKOVIČ[1], Lýdia JEDLOVSKÁ[1], Erika TOBIAŠOVÁ[2],
[1]Department of Environmental Protection and Zoology, [2]Department of Pedology and Geology

Summary

In catchment of upper Žitava flow, in 1994-1998, chloride concentrations in Hostiansky stream were studied. Obtained results showed, that seasonal dynamics of chloride concentrations in water flow was not showed in experimental years. In along profile of water flow, increasing tendency of their values was showed from first to last sampling places. The main producers of chloride contaminants in water flow were Mykoprogres (company for mushroom processing and production), Topoľčianky village and Zlaté Moravce town. Accounted Cl^- values (according to STN 757 221), classified all sampling places in along profile into first class of water quality (very clean water).

Key words: chlorides, water flow, sampling place and time

Introduction

Chlorides are the components of natural waters and together with HCO_3^- and SO_4^- anions are dominant (Horáková et al., 1986).
Important chloride sources in surface waters are sewage and some industrial waters, route sprinkling in winter period (Pitter, 1990) and atmospheric waters (Valtýni, Lalkovič, 1995).
In soil, chlorides exist mostly in soluble substances (Ivanič et al, 1988). The highest chloride escapes from soils into water flows are in catchments, where arable soils are in majority from agricultural soils (Noskovič, 1993).
They are hygienically harmless in waters, but in higher concentration, water taste can be affected. They are chemically and biochemically stable in water (Biskupič, 1991).

Material and methods

Hostiansky stream,which is in upper part of Žitava river catchment was studied. Water flow springs in Tribeč chain. It flows through Hlboká dolina, Hostie village and Topolčianky and Zlaté Moravce towns. Its issue is under Zlaté Moravce- part of Chyzerovce. The area of water flow catchment is 120 km^2. Its average yearly overflow in issue of Žitava river is 0.94 $m^3.s^{-1}$. Flood flat of water flow is covered with grass clumps, various herbs, bushes and trees.
Water flow catchment is spread on two different geographic units. Upper part of Hostie village is in Tribeč chain and lower part of Hostie village is in Žitavská upland. Tribeč is part of crystallic- mesozoic era zone of Karpaty. From soils, there are Ranker, Rendzina, Calcaric Regosol, Eutric Cambisol, and Albic Luvisol. In forest ecosystems, dominant trees are oak, beech and hornbeam. Characteristic representants of trees in water flow flood are ash and older.
Žitavská upland is amalgamated between chains Tribeč and Pohronský Inovec. From geological point of view, area is part of Zlaté Moravce bay. Dominant part, mainly in lower height levels, is covered with quarternary sediments (loess). In this soil-formation substrate, Orthic Luvisol were created. Besides this soil type, in this catchment area are Eutric Cambisols and in flat of water flow, there are Eutric Fluvisol.
With regard on agricultural production, catchment of water flow is part of beat areas. From agricultural plants, there mainly cereals crop, from which winter wheat is dominant. In 1995- 1998, from fertilizers in dose 54 kg N. $ha^{-1}.y^{-1}$ were only used. Besides of this, farmyard manure in dose 42 t. $ha^{-1}.y^{-1}$ were applicated under root- crops (data from Farm- Topolčianky). In animal production, there cattle and hog breedings are dominant.
Sampling of water from water flow was done regularly in last decades of months in 1994- 1998. Sampling place under Zlaté Moravce town, where samples were taken since March in 1995, was exception. Samples were taken from current in along profile of water flow, following sampling places were determined: 1- Forest ecosystem, 2- Under permanent grass ecosystem on the left side and forest ecosystem on the right side of water flow, 3- Under permanent grass ecosystems on the both sides of water flow, before Hostie village, 4- Under Hostie village, 5- PD Topolčianky- Hostie centre, 6- Under agroecosystem of arable soil on the both sides of water flow, before Mykoprogres, 7- Under Mykoprogres, 8- Under permanent grasses on the left side and tree and bush nurcery on the right side of water flow, before Topolčianky town, 9- Under Topolčianky, 10- Under agroecosystem of arable soil on the both sides of water flow, before Zlaté Moravce town, 11- Under Zlaté Moravce town- part Chyzerovce, in issue of water flow of Žitava river.
Cloride concentrations were determinated according to Mohr. Results are presented in mg $Cl^-.l^{-1}$. Classification of water in sampling places into water quality classes were done according to accounted typical Cl^- values with limits for individual quality classes, which are according to STN 75 7221-classification of surface water quality.

Mean Cl^- value obtained in the Hostiansky Brook depending on sampling time and position during the period 1994 - 1998

Sampling time:

Figure 1

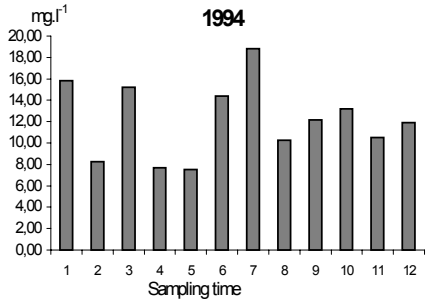


Figure 2

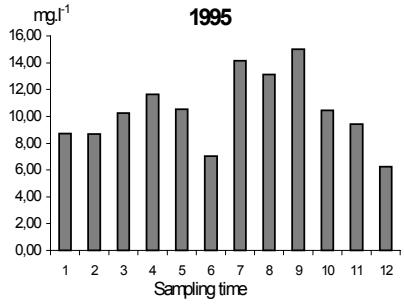


Figure 3

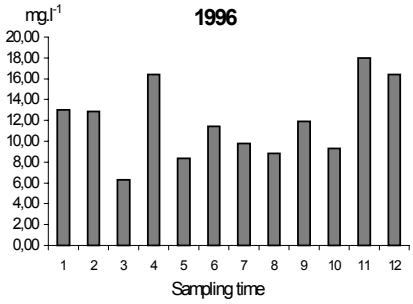


Figure 4

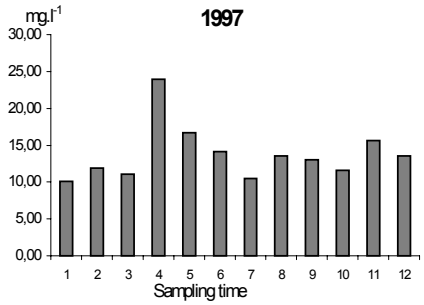


Figure 5

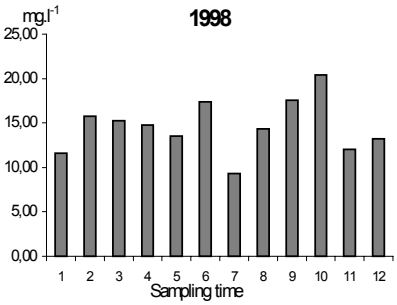
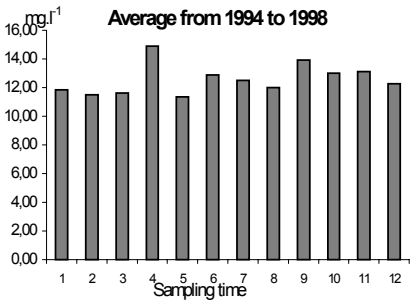


Figure 6



Sampling position:

Figure 7

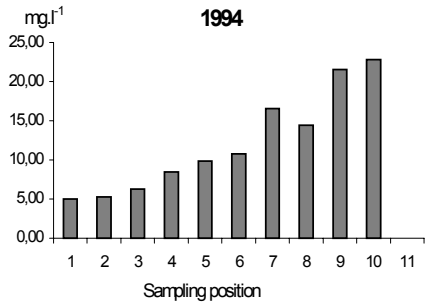


Figure 8

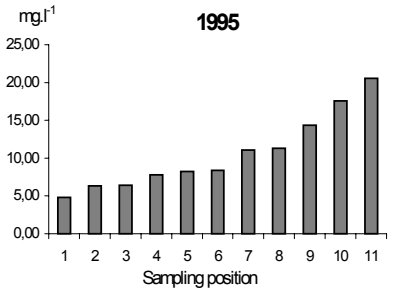


Figure 9

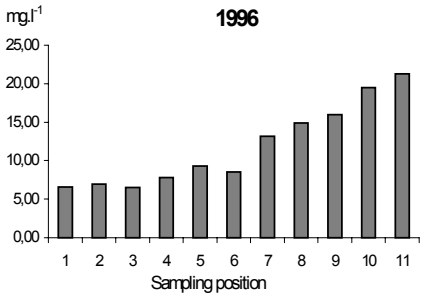


Figure 10

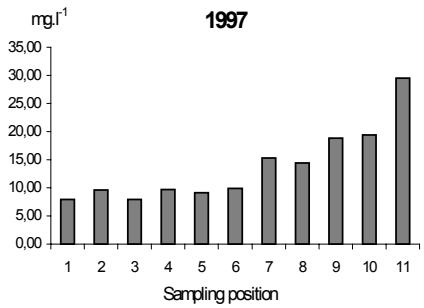


Figure 11

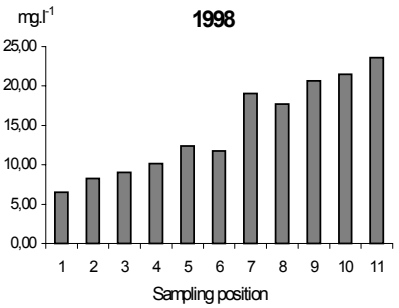
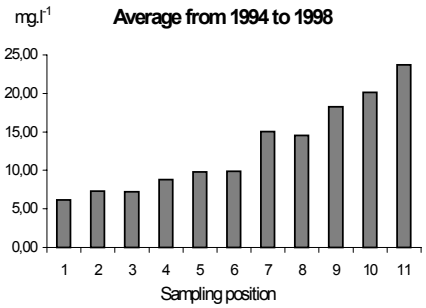


Figure 12



Results and discussion

Average chloride concentrations with dependence on sampling time in experimental years showed (fig. 1-5), that seasonal regularity was not showed. Average chloride concentrations in all experimental period were fluctuated with dependence on sampling time from 11.33 mg.l^{-1} (May) to 14.89 mg.l^{-1} (April) (fig. 6).
Increasing tendency of Cl^- concentrations from first to last sampling place was showed in along profile of water flow in all experimental years (fig. 7-11).
The highest increase during all experimental period was under Mykoprogres (sampling place 7), which processes and produces mushrooms, under Topoľčianky village (sampling place 9) and Zlaté Moravce town (sampling place 11) (fig. 12)
We supposed, that chlorides from Mykoprogres come to water flow by insufficiently treated sewage. Increases under Topoľčianky village and Zlaté Moravce town are in connection with insufficiently treated sewage from households diractly into water flow. Similar conclusions are presented by Biskupič (1991), as well.
Tőlgyessy et al. (1984) showed, that chloride concentrations in sewage waters are in tens mg.l^{-1}. Accounted typical Cl^- values (table 1), according to STN 75 7221, clssified all sampling places in along profile of water flow into first class of water quality (very clean water).

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