CICISVILI, G.V. - ANDRONKAŠVILI, T.G.: Primenenije prirodnych ceolitov v rastenijevodstve. In: Primenenije klinoptilolitsoderžaščich tufov v rastenijevodstve. Mecniereba, Tbilisi, 1988, s.5-33
KOTVAS, F.: Nové prístupy k optimalizácii výživy rastlín v SSR. In: Zborník referátov, 12. Slovenský seminár o racionálnom používaní priemyselných hnojív, Chemko k.p. Strážske, 1990, s.215-222
KOVANDA, F. - RUŽEK, P.: Rychlost uvolňování amonných iontu ze zeolitu obohacených amonným dusíkem v pudním prostředí. In: Rostlinná výroba, roč. 42, č.4, 1996, s.149-154
PETR, J. - DLOUHY, J. et al.: Ekologické zemědělství, ZN Brazda, Praha, 1992, 312 s.
RINÍK, E.: Proekologické agrotechnológie v rastllinnej výrobe determinujúce biologicky princíp a efektívnosť hospodárenia na pôde. In: Trvalo udržateľné hospodárenie v kultúrnej krajine. DT Nitra, 1995, s. 87 -90
RINÍK, E.: Uplatnenie prípravku BIOSIL v rastlinnej výrobe. In: Poľnohospodárska výroba a skúšobníctvo, roč. 5, č. (1-2), 1997, s.57-58
SOPKOVÁ, A., et al.: Hnojivá s vyššou účinnosťou využívajúce prírodné zeolity. Chemický prumysl, roč. 43, č.5, 1993, s.145-149
TORMA,S.: Využitie prírodného zeolitu pri hnojení zeleniny. In: Zborník referátov z vedeckej konferencie s medzinárodnou účasťou. Michalovce: OVÚA, 1998, s.43-48, 2.diel
TÓTH, Š. - RINÍK, E.: Možnosti použitia prípravku AGROBIOPER v rôznych systémoch hospodárenia. In: Trvale udržateľné systémy rastlinnej výroby a kvalita produkcie. VŠP, Nitra, 1996, s.135-138

## THE CROP ROTATION AND FLUVISOL PROPERTIES ON THE EAST-SLOVAKIAN LOWLAND

**Dana KOTOROVÁ – Božena ŠOLTYSOVÁ**
Research Institute of Agroecology Michalovce, Špitalska 1273, 07101 Michalovce

### *Summary*

The field stacionary trials were carried out during 1994 – 1998. Two soil types Eutric Fluvisol and Fluvi-Eutric Gleysol were observed. Testing field crops were arranged to crop rotation as follows: sugar beet – spring barley – fodder plant 1st crop year – fodder plant 2nd crop year – fodder plant 3rd crop year. Physical and chemical soil parameters were compared with starting values from 1993. The manure in the dose of 40 $t.ha^{-1}$ and limy materials in the dose of 6 $t.ha^{-1}$ were applied to the first crop in the whole crop rotation. Other crops in crop rotation were fertilized with mineral fertilizers rationally by analytical determined contents of available nutrients in soil. Soil were taken from soil profile 0 – 0,3 m from variant with traditional tillage without irrigation after harvesting. The soil bulk density, total porosity, maximum capillary water from physical properties and content of phosphorus, potassium, magnesium and soil reaction were determined. The starting values of available nutrients were ascertained from soil sampling after harvesting of winter wheat. The highest bulk density and the lowest total porosity were when crop rotation ended. Higher bulk density values were observed for fodder plants. At rationally fertilization were not determined significant differences in content of macro-nutrients. Differences between followed soil types were statistically significant.

***Key words***: crop rotation, physical and chemical soil properties, Eutric Fluvisol, Fluvi-Eutric Gleysol

### *Introduction*

The soil in relation to cultivated crops is environment which arrange the rooting of plants and sufficient supply of water and mineral substances to roots. The soil has physical, chemical and biological properties which are in mutual interaction and have significant influence on the soil fertility.

The physical properties are stable future and their changes are caused by modification of ecological conditions for field crops. The structure of crops rotation has important place in the cultivation on soil. Chosen crop rotation influence the changes of physical soil properties, the balance of organic matter in soil and total accessibility of nutrients (Ivanov, 1989; Riník, 1991).

The aim of this work was to determine the changes of physical and chemical properties for soil of the East-Slovakian Lowland by influence of crop rotation with higher presence of fodder plants.

### *Material and methods*

This study includes data obtained from experimental places of Research Institute of Agroecology in Michalovce, Slovak Republic. Field experiments were carried out on Eutric Fluvisol (EF) and on Fluvi-Eutric Gleysol (FEG) in 1994 – 1998. Soil type EF is situated in Vysoká above river Uh and FEG in Milhostov. The values of physical and chemical soil parameters ascertained during field experiments were compared with starting year 1993.

The studied crops on both observed soil types were arranged into stabile crop rotation: sugar beet – spring barley – fodder plant the 1st crop year – fodder plant the 2nd crop year – fodder plant the 3rd crop year. The manure in the dose of 40 $t.ha^{-1}$ and limy materials in the dose of 6 $t.ha^{-1}$ were applied to the first crop in the whole crop rotation. Other crops in crop rotation were fertilized with mineral fertilizers rationally by analytical determined contents of available nutrients in soil.

The changes of physical and chemical properties of EF and FEG were searched during experiments. Soil samples for determination of physical properties were taken from the soil profile 0 – 0,3 m from variant with traditional tillage without irrigation after harvesting. The soil bulk density ($\rho_d$, kg.m$^{-3}$), total porosity (P, %), maximum capillary water capacity ($\Theta_{KMK}$, %) were determined. Soil samples for determination of chemical parameters were taken from depth 0 – 0,3 m, too. The starting values were ascertained from soil sampling after harvesting of winter wheat. Content of phosphorus, potassium, magnesium and soil reaction were determined. The obtained data were tested by the regression analysis by Grofik et al. (1990).

***Results and discussion***

The values of bulk density are changed by influence of cultivated field crops that by crop rotation, too. The results in table 1 show gradual increase of bulk density during experimental season at comparison with starting values. This trend was observed on both soil types though between concrete values of bulk density for EF and FEG were ascertained differences for individual field crop. The positive reaction of bulk density on cultivated forecrop were determined on both soil types at spring barley which followed after sugar beet.
The total porosity corresponded with bulk density values at both soil types and all field crops arranged into crop rotation. From point of view of cultivated fodder plants influenced that if cultivate these plants during three crop years, irrespective of their species and sowing date, attend to significant increase of bulk density and decrease of total porosity. Is possible that effect of crop and soil tillage expressed in changes of soil physical properties of Fluvisol and Fluvi-Eutric Gleysol, too.
Hydro-physical soil properties are significantly influenced of content of clay particles in soil profile and their total surface. Fulajtár (1986) published that for Eutric Fluvisols are characteristic high values of maximum capillary water capacity. Similar results were obtained also in conditions of the East-Slovakian Lowland. Values of ΘKMK were higher on Fluvi-Eutric Gleysol than on Eutric Fluvisol.
The content of macro-nutrients in middle till good supply and neutral soil reaction are characteristics of agrochemical soil profile. Average contents of available nutrients and soil reaction in crop rotation are showed in table 2.

Table 1: The changes of physical soil properties during experimental season

| Crop rotation | $\rho_d$ (kg.m$^{-3}$) | | P (%) | | $\Theta_{KMK}$ (%) | |
|---|---|---|---|---|---|---|
| Soil type | FM | FMG | FM | FMG | FM | FMG |
| Starting values | 1 440 | 1 381 | 45,64 | 46,82 | 35,62 | 38,96 |
| Sugar beet | 1 469 | 1 430 | 45,10 | 45,84 | 35,23 | 37,08 |
| Spring barley | 1 456 | 1 425 | 45,68 | 46,28 | 37,17 | 39,50 |
| Fodder plant 1st crop year | 1 508 | 1 438 | 44,13 | 44,92 | 38,06 | 39,90 |
| Fodder plant 2nd crop year | 1 526 | 1 472 | 43,56 | 44,13 | 37,37 | 37,20 |
| Fodder plant 3rd crop year | 1 559 | 1 524 | 42,28 | 42,77 | 36,73 | 36,83 |

Table 2: Chemical soil parameters in crop rotation

| Crop rotation | P (mg.kg$^{-1}$) | | K (mg.kg$^{-1}$) | | Mg (mg.kg$^{-1}$) | | pH/KCl | |
|---|---|---|---|---|---|---|---|---|
| Soil type | FM | FMG | FM | FMG | FM | FMG | FM | FMG |
| Starting values | 51,8 | 47,0 | 140,7 | 155,3 | 107,0 | 267,1 | 6,91 | 6,57 |
| Sugar beet | 53,0 | 52,4 | 133,2 | 161,4 | 111,2 | 268,0 | 6,96 | 6,73 |
| Spring barley | 56,0 | 56,2 | 138,6 | 159,5 | 105,8 | 287,5 | 6,88 | 6,63 |
| Fodder plant 1st crop year | 52,9 | 51,6 | 140,3 | 176,2 | 110,3 | 282,1 | 6,90 | 6,60 |
| Fodder plant 2nd crop year | 49,3 | 53,6 | 148,9 | 163,3 | 107,8 | 270,3 | 6,81 | 6,65 |
| Fodder plant 3rd crop year | 47,8 | 49,8 | 138,5 | 165,9 | 113,8 | 266,8 | 6,83 | 6,56 |

The contents of macro-nutrients in followed crop rotation were in proportionally close large. In the crop rotation the differences between maximum and minimum value were as follows: $\Delta$ P = 7,35 mg.kg$^{-1}$, $\Delta$ K = 10,94 mg.kg$^{-1}$, $\Delta$ Mg = 9,62 mg.kg$^{-1}$. Interest differences were ascertained between soil types. For Fluvi-Eutric Gleysol the average content of available K was significantly higher than for Fluvisol ($\Delta$ K = 23,59 mg.kg$^{-1}$). Similarly average difference of magnesium between soil types ($\Delta$ Mg = 164,3 mg.kg$^{-1}$) was statistically significant. The highest values of soil reaction were determined after harvest of sugar beet. The manuring and liming under first field crop in crop rotation effected increasing soil reaction value at experiment ended.

***References***

FULAJTÁR, E.: Fyzikálne vlastnosti pôd Slovenska, ich úprava a využitie. 1. vyd. Bratislava: Veda, 1986. 156 s.
GROFIK, R. - FĽAK, P.: Štatistické metódy v poľnohospodárstve. 1. vyd. Bratislava: Príroda, 1990. 344 s. ISBN 80-07

00018-6
IVANOV, I. A.: Sevooborot, effektivnosť odobrenij i plodorodije počv. In: Agrochimija, 1989, č. 11, s. 35 – 40.
RINÍK, E.: Vplyv štruktúry osevných postupov v rozdielnych agroekologických podmienkach na ich produktívnosť a zmeny pôdnych vlastností. In: Synteza a perspektywa nauki v plodnozmianach. I. časť. Olsztyn, 1991, s. 17 – 23.

## THE EFFECT OF SEEDING RATES ON GRAIN YIELD OF SPRING BARLEY IN SYSTEM WITHOUT TILLAGE

**Martin DANILOVIČ**
Research Institute of Agroecology Michalovce, Špitalska 1273, 07101 Michalovce

***Summary***

The field treatments were carried out on two experimental places of Research Institute of Agroecology Michalovce. The influence of various seeding rates on the spring barley yield was observed in these small – plot field experiments during 1996 – 1997. On the average, the first seeding rate (4 mil. grains per hectare) gave the highest yield production in conditions of Fluvi-eutric Gleysol (5,16 $t.ha^{-1}$) and the second seeding rate (5 mil grains per hectare) gave the highest yield production in conditions of Eutric Fluvisol (5,19 $t.ha^{-1}$). Presented data showed that the highest seeding rate do not assure the highest grain yield production of spring barley.

***Key words:*** spring barley, grain yield, seeding rates

### *Introduction*

For normal growing and development must have each plant own vegetational space. The vegetational space is determined by spacing and by seeding rate. When the stand density is very high the intraspecific competition is very high too and nutritional space for every plants is very small. The weed infestation rate is very intensive in the thin stands and the density of productive culm (ears. $m^{-2}$) is not optimal. Optimal stand density is in interrelation with seeding rate and it is influenced by more factors: sort and variety of plant, soil and climatic conditions, forecrop, depth and time of sowing, quality of sowing and quality of seed. The aim of experiment was to evaluate the influence of seeding rates on spring barley yield production.

### *Material and methods*

The field treatments were carried out on two experimental places of Research Institute of Agroecology Michalovce. The influence of various seeding rates on the spring barley yield was observed in these small – plot field experiments during 1996 - 1997. Spring barley variety Sladko was cultivated on the Eutric Fluvisol (Vysoká nad Uhom) and on the Fluvi – eutric Gleysol (Milhostov) in the climatic conditions of the East-Slovakia Lowland. Spring barley followed after sugar beet in the crop rotation and grown in natural conditions without irrigation. The experiment was conducted to study the effect of two seeding rates (4 million grains per hectare and 5 million grains per hectare) on production of spring barley grown in condition without tillage.

### *Results and discussion*

The quantitative parameters of spring barley were dependent from different seeding rates. The grain yield of spring barley were moved in the range 5,37 – 4,91 $t.ha^{-1}$ (fig 1 and 2).
On the average, the first seeding rate (4 mil. grains per hectare) gave the highest yield production in conditions of Fluvi-eutric Gleysol (5,16 $t.ha^{-1}$) and the second seeding rate (5 mil grains per hectare) gave the highest yield production in conditions of Eutric Fluvisol (5,19 $t.ha^{-1}$). The importance of seeding rates has been reflected in experimental years, in our case, in favour of lower seeding rate by 0,07 $t.ha^{-1}$ on two years average in conditions of Fluvi-eutric Gleysol and in favour of higher seeding rate by 0,1 $t.ha^{-1}$ on two years average in conditions of Eutric Fluvisol.
The results indicated that the seeding rates had not statistically significant effect on grain yield. Higher seeding rate gave the similar grain yield comparing to the lower seeding rate on both of soil types (table 1). The results also indicated that there was not statistically significant difference between both of seeding rates which were compared in field experiment (table 2).
The aim of experiment was to evaluate the influence of seeding rates on spring barley yield production. There were two different seeding rates (4 and 5 mil. grain per hectare) and presented data showed that the highest seeding rate do not assure the highest grain yield production of spring barley. Similarly results published Dudáš (1991), Moustafa, Refay, (1998) and Míša (2001).