C	9,81	4,52	12,28	12,20	12,66	12,70	11,58	9,81
x	10,39	6,80	12,86	11,99	12,79	13,73	12,01	10,84

(0) with following differences (a significant influence): to cattle FYM + 0.93 % rel. 8.52 %, to Ekofert + 0.93 % rel. 8.52 % and to Mikrobion application + 1.04 % rel. 9.63 %. The higher refined sugar yield was found out in case of the lower seed spacing 157 mm, too (+ 0.73 % relatively 6.8 %).

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THE INFLUENCE OF ZEOMIX N FERTILIZER ON THE WINTER RAPE YIELDS

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Summary

The experiments with winter rape were carried out on the Experimental place in Vysoká above river Uh during 1997 – 1999. The winter rape grown at the Luvisol. The ecological fertilizer ZEOMIX N was applied at 2nd additional fertilizing by nitrogen in dose 200 kg N .ha^{-1}. On this variant but was lower average thousand-kernel weight (4,9 g) than variant with calcium nitrate (5,0 g). The ecological fertilizer ZEOMIX N may be used as carrier of mineral nutrients for winter rape plants. Their application in soil decrease consumption of nutrients and costs on import of row materials are lower. Because less nutrients are leaching into groundwater the environment is protection, too.

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

Introduction

The winter rape is very interesting field crop in this time. Using of ecological fertilizer has serious role at its cultivation in field conditions.
The aim of this article is to determine effect of ecological fertilizer ZEOMIX N on the winter rape yields in the East-Slovakian Lowland conditions.

Material and methods

The field treatments were carried out on Albic Luvisol during 1996 – 1999. The experimental place is located in Vysoká above river Uh in central part of the East-Slovakian Lowland. Winter wheat was forecrop for winter rape.
Fertilization was realized by balance method and nutrients from manure were accepted, too. The placement of mineral fertilizers – superphosphate (21 % P) and potassium chloride (50 % K) – were realized before sowing. In spring the basic dose of 50 kg N.ha^{-1} as ammonium nitrate (27 % N) was applied. Further doses of nitrogen were applied during vegetation of winter rape (table 1). Chemical control of winter rape was made by suitable pesticides.
Each variant was three-times repeated and rape seeds were harvested from 10 m^2 experimental areas. The obtained data were tested by the analysis of variance.

Table 1: Nitrogen fertilizers and doses used in field treatment

Variant	Fertilizer	Dose of fertilizer (kg.ha^{-1})
1.	ZEOMIX N (ZEO, 10,4 % N)	100
2.	ZEOMIX N (ZEO, 10,4 % N)	200
3.	Ammonium nitrate (LAV, 27 %N)	100

4.	Ammonium nitrate (LAV, 27 %N)	200
5.	Control (K)	0

Results and discussion

ZEOMIX N is characterised as ecological fertilizer and help to decrease using of chemical preparations in plant production.
The application of ecological fertilizer ZEOMIX N in winter rape stand was not observed phytotoxicity in comparison to LAV variant (27 % N). Similarly influence of ZEOMIX N on growth phases of winter rape from flowering to harvesting was no-significant.
The year of growth was statistically significant at evaluation the effect of used fertilizers on winter rape yield. Higher rape seed yields were ascertained in 1997 and 1998 than in 1999 (table 2).

Table 2: The multiple LSD-test of yield comparison (95 % significance)

Year	Interactions yield x crop year			Difference
	Average yield (t.ha^{-1})	Homogenous groups		
1997	3,378		x	- 0,0768
1998	3,454		x	0,1540
1999	3,224	x		0,2308

Significantly higher winter rape yield were determined on variant with nitrogen fertilization than on variant without nitrogen. For fertilized variants were yields in average higher about 1,69 t.ha^{-1} (+ 46 %).
From results of variance analysis influenced no-significant increase of yield for variant ZEO 100 (3,340 t.ha^{-1}) in comparison with variant LAV 100 (3,291 t.ha^{-1}).
The highest rape winter yield – 4,208 t.ha^{-1} – were obtained from variant ZEO 200 and this yield was about 0,282 t.ha^{-1} higher in comparison with yield for variant LAV 200 (3,926 t.ha^{-1}). Results are situated in table 3**.**

Table 3: The multiple LSD-test of yield comparison (95 % significance)

Variant	Yield (t.ha^{-1})	Homogenous groups			
K	1,994	x			
ZEO 100	3,340		x		
LAV 100	3,291		x		
ZEO 200	3,926			x	
LAV 200	4,208				x

Obtained results are similarly as published TÓTH – RINÍK (1996), RINÍK (1997), KOVANDA – RŮŽEK (1996) and SOPKOVÁ et al. (1993).

Table 4: The multiple LSD-test of yield comparison (95 % significance)

Interaction: yield x variant	Differences ±	Limit
ZEO 100 - ZEO 200	-0,86800	0,00000*
ZEO 100 - LAV 100	0,04900	0,00000*
ZEO 100 - LAV 200	-0,58633	0,00000*
ZEO 100 - K	1,34567	0,00000*
ZEO 200 - LAV 100	0,91700	0,00000*
ZEO 200 - LAV 200	0,28167	0,00000*
ZEO 200 - K	2,21367	0,00000*
LAV 100 - LAV 200	-0,63533	0,00000*

Higher dose of ZEOMIX N (variant ZEO 200) increased the winter rape yield about 0,89 t.ha^{-1} in comparison with yield on variant ZEO 100. This conclusion corresponding with results by TORMA (1990, 1998) and CICIŠVILI – ANDRONKAŠVILI (1988). These authors determined increase of yield by application the ecological fertilizer on base of zeolite.
Increase of efficiency of nutrients in soil and nutrients in fertilizers is possible also of application of ZEOMIX N. This fertilizer has possibility to fix the nutrients in its structure and then these to loosen for field crops. In this way damages of mineral nutrition elements in root range of plant is decreased. Similar conclusions published also KOTVAS (1990), PETR – DLOUHÝ et al. (1992) and RINÍK (1995).

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

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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.