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## **QUALITY OF AGRICULTURAL PRODUCTION IN ECOLOGICAL AND CONVENTIONAL FARMING SYSTEM**

Two model enterprises served as a basic for the research the results of which are presented in the given paper. The enterprises are situated in the marginal areas of Slovakia and they use an ecological system of soil management (picture 1). Making use of common methods nutritious and hygienic indicators and the content of heavy metals were observed in the selected agricultural produces. From the research results it is possible to conclude that the observed ecological produces had higher nutritious values but from the hygienic point of view the content of nitrates was higher in the selected ecological produces (picture 2, 3). The higher content of heavy metals meadow hay was influenced by the position (picture 1, table 2) where we found over-limit values of risk elements (Cr, Ni). The mobilisation of these elements and consecutive increased contamination in production were significantly affected by soil reaction which was between 4,41 - 4,78 pH in the investigating period.

**Key words:** ecological production, heavy metals, nutrients, proteins, nitrates

### **1. INTRODUCTION**

Quality is a top priority in sustainable systems. Special importance is given to qualitative features of products (such as their size, shape, colour, technological features, nutrient content, etc). In addition, the concept of quality encompasses the whole process of production, i.e. even the moral and ethical aspects of raising farm animals, exploitation of natural resources and the impact of the whole agricultural system on consumers. The quality of produce is regarded as the outcome of the whole agricultural system. Special importance is also given to the absence of heterogeneous and harmful elements (residues), freshness, naturalness, nutrition and physiological characteristics (PRUGAR, 2000).

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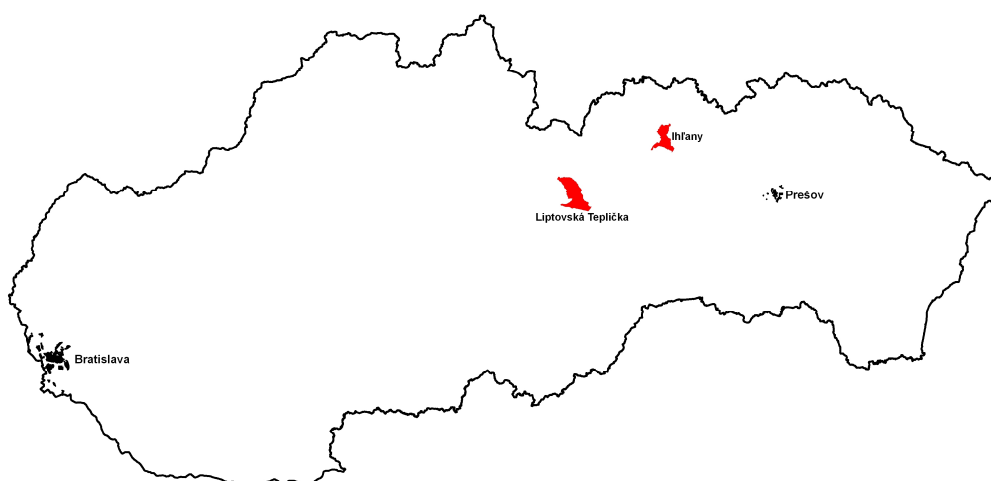
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Table 1 Conventional and ecological treatment of quality (PETR and DLOUHÝ et al., 1992)

Conventional	Ecological
Mechanical assessment	Holistic treatment of quality
Preference for quantity over quality	Preference for quality over quantity
Preference for technological quality	Quality of produce results from quality of all the system

## 2. METHODS AND MATERIALS

Research has been carried out on two model enterprises, which are situated in marginal areas of North-East Slovakia and apply the principles of ecological farming (picture 1). Crop samples have been collected after harvest in order to show the nutrition and hygiene indicators and the amount of heavy metals. An average sample consisted of 10 partial samples. Nutrient content (Na, K, Ca and Mg) and occurrence of heavy metals (Cu, Pb, Cr, Ni, Cd) in accordance with the Slovak Technical Norm No. 730540, occurrence of proteins with the application of solution of pufrum and pigment combining with proteins (Ponceau S), and occurrence of nitrates has been stated with the application of comparative colorimeter produced by Lovibond.

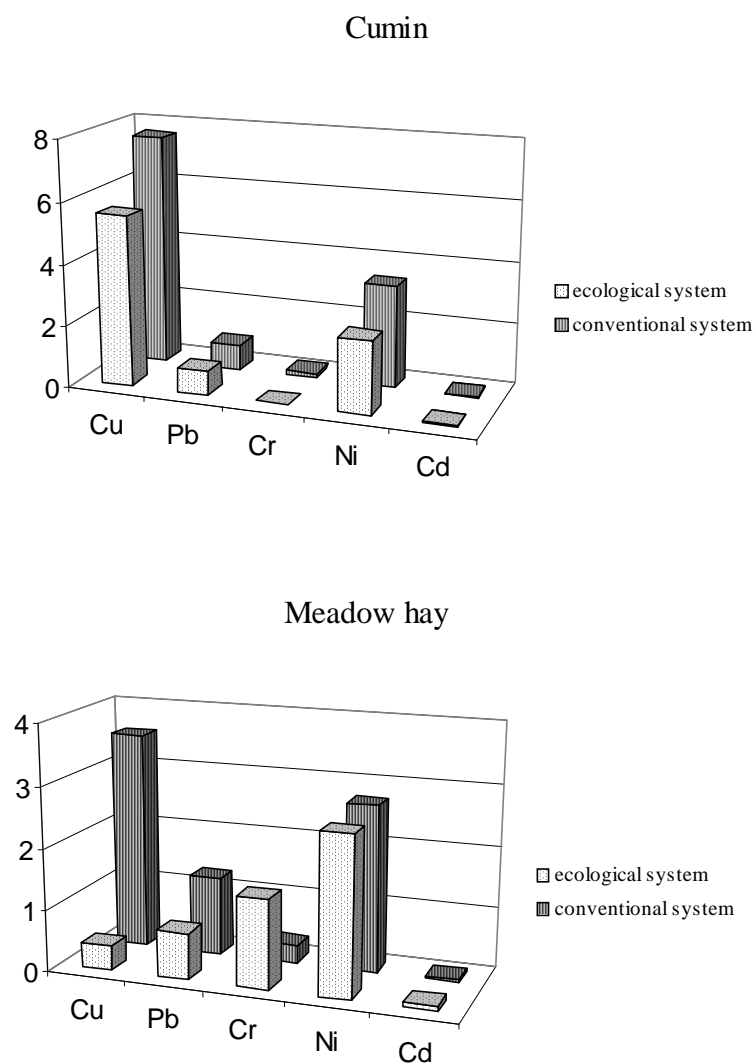


Picture 1 The sites of the research (Liptovská Teplička, Ihľany) in Slovakia

## 3. RESULTS AND DISCUSSION

Ecological farming is responsible for produce having lower content of heavy metals and residues of pesticides. Content of heavy metals has proved to be lower in cumin produced by ecological farming than in the cumin produced by conventional farming. Higher content of Chromium and Cadmium has been found in meadow hay from ecological production (picture 2). Higher content of heavy metals in production has been caused by their occurrence in soil – exceeding maximum amounts of Chromium and Nickel (table 2), mainly as a result geological causes contamination of soils (ŠEFČÍK, PRAMUKA and GLUCH, 2008; KROKUSOVÁ and ČECH, 2007). Higher occurrences of these

elements and the subsequent contamination in final production have resulted from pH of soil (SKALA, VRKOČ and SUŠKEVIČ, 1995), which has ranged between 4.41 and 4.78 in the territory in question.



Picture 2 Content of heavy metals [ $\text{mg.kg}^{-1}$  of dry matter] in crops in conventional and ecological systems

Table 2 Content of heavy metals in soil on model enterprises

Heavy metals [mg.kg <sup>-1</sup> of dry substance]	<b>Cu</b>	<b>Pb</b>	<b>Cr</b>	<b>Ni</b>	<b>Cd</b>
In soil	13,50	13,71	23,05	20,56	0,23
Limit values*	20,00	30,00	10,00	10,00	0,30

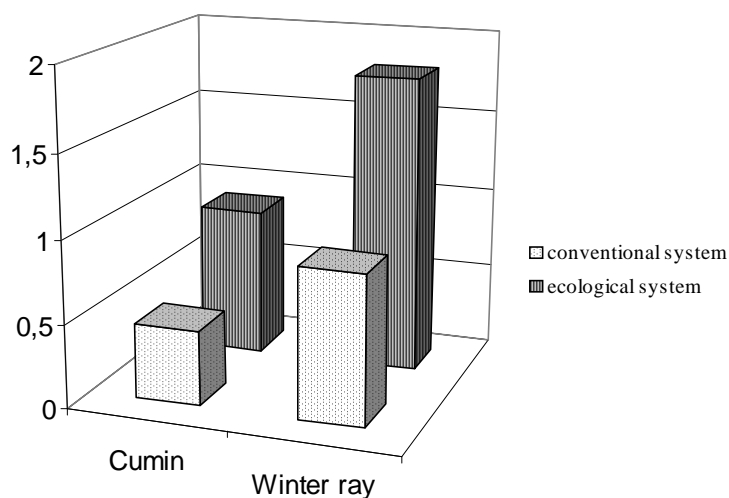
\*Bulletin of the Ministry of Agriculture of SR, 1994

Higher content of nutrients (Ca, Mg, Na and K) has been found in ecological production than in conventional production of cumin (except for Na) (picture 3) with corresponds to the work JURČOVÁ and TORMA (1998).



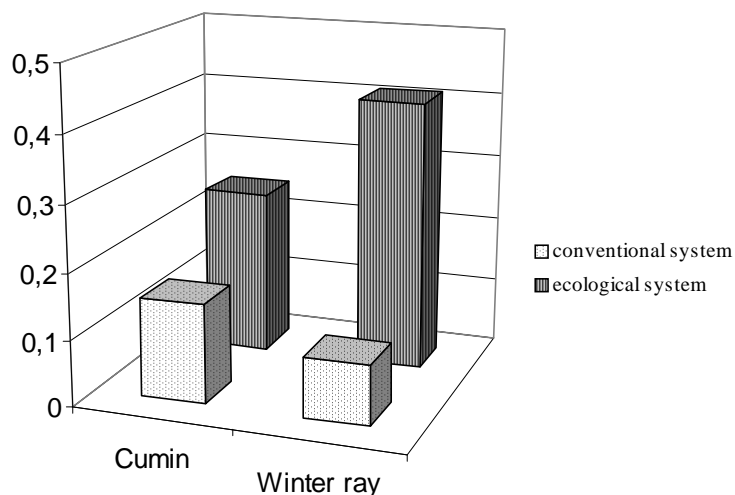
Picture 3 Content of nutrients [mg.kg<sup>-1</sup> of dry matter] in crops in conventional and ecological system

With regard to the content of nitrates, it has been established that if a high dosage of manure is applied, concentration of nitrates in crop tends to be higher under favorable weather conditions. In this research study the content of nitrates in ecological system (picture 4) has been shown to be double in amount. Based on these findings it is possible to assume that the ecological products have a higher nutrition value, however, they have a higher content of nitrates. Similar findings have been shown in PRUGAR'S research studies (1994, 2000).



Picture 4 Content of nitrates [mg.NO<sub>3</sub>.l<sup>-1</sup>] in crops in conventional and ecological system

In comparative studies on various cultivation systems products from ecological agriculture are assessed as better with regard to their nutrition value. In some expert studies, however, ecological products are given a more critical assessment due to a lesser degree of their exploitation potential and due to some of their nutrients and proteins being less digestible. This research study has proved a higher content of proteins in crops from ecological system than in conventional system (picture 5).



Picture 5 Content of proteins [g.l<sup>-1</sup>] in crops in conventional and ecological system

#### 4. CONCLUSION

On the grounds of the research results it is possible to conclude that the observed ecological produces had higher nutritious values but from the hygienic point of view the content of nitrates was higher in the selected ecological produces. The higher content of heavy metals meadow hay was influenced by the position where we found over-limit values of risk elements (Cr, Ni). The mobilisation of these elements and consecutive increased contamination in production were significantly affected by soil reaction which was between 4,41 - 4,78 pH in investigating period.

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#### **JAKOŚĆ PRODUKCJI ROLNICZEJ W SYSTEMIE EKOLOGICZNEGO I KLASYCZNEGO ROLNICTWA**

W badaniach zastosowano dwa modele przedsiębiorstw. Przedsiębiorstwa te usytuowane są w marginalnych obszarach Słowacji i wykorzystywane jako ekologiczne systemy zarządzania glebą. Wykorzystując metody żywienia i higieny, zaobserwowano zawartość ciężkich metali w produkcji wybranych towarów rolniczych. Z badań wynika, że produkty ekologiczne miały większe wartości odżywcze, jednakże zawartość azotanów była w nich wyższa. Zawartość tych związków oraz stopień zanieczyszczenia wpływała na reakcje gleby, która miała pH w przedziale 4,41-4,78 w badanym okresie.