

PROFITABILITY POTENTIAL OF THE CROP PRODUCTION IN SLOVAK REGIONS

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Abstract: This report states particular potential rates of solids production and profitability of the production for the most occurring soil types, categories of steepness, skeletalness, soil depth and granularity. The calculation confirms the high correlation of profitability and natural yield of the crop production. Sustainable positive profitability in the crop production is expectable only in the regions with Mollic Fluvisols, Chernozems, Haplic Luvisols, Fluvisols, Albic Luvisols and Planosols contribution. The other regions depend on the subsidiary economic impulses. The analysis of the chosen soil parameters has generally shown that under recent economic conditions is the crop production without subsidiary impulse profitable only in lowlands and slopes to 7°, in deep soils, without skeleton, as to granularity medium heavy soils. This finding does not have to refer to a particular crop. Heterogeneity of the Slovak soils and their characteristics implicitly brings different productive and economic potentials of individual regions. Positive potential of the profitability rate of the crop production can be expected in Bratislava, Trnava, Nitra and Trenčín municipality. According to the classification of the regions into the agricultural productive areas profitability potential is positive only in maize and beet production region. According to the dividing of the Slovak territory into so called LFA (less favoured areas) profitable regions are not included into this system, or the regions with specific disadvantages as well. This report analyses in detail both the text and the graphic form above mentioned differences in potentials of producing the biomass as well as profitability of its production regarding the soil characteristics and agricultural relevant regions.

Key words: profitability of the crop production, solids biomass production, soils parameters, Slovak regions

INTRODUCTION

Economic and social development of any territory is closely associated with the utilization of its natural and human resources. The degree of successfulness of the individual regions depends on their management abilities to utilize effectively existing potentials on the behalf of the country and its inhabitants.

Agricultural landscape is one of the mostly extended natural potential of the country in Slovakia. The method of its utilization concerns almost the half of the republic area. Different agrarian activities which directly or indirectly influence the environment and are also able to bear immediate economic effect are enacted on this acreage. On the other hand, improperly selected structure of the agricultural landscape utilization can negatively influence ecological stability and economic standard of the region. Regarding the dislocation of the agrarian activities it is inevitable to know the potential of the country

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and its individual components, among which the soil is dominant. Soils characteristics and parameters can significantly differentiate the character of the country structure and its utilization. From that point of view, this report, analysing dominant soil characteristics, is dealing with potential effectivity of the crop production in Slovak regions.

MATERIAL AND METHODS

The problem solution results from the soil investigation research observations and the informative system on the soils of Slovakia. This informative system represents the rich initial database of their characteristics, areal differentiation, utilization and protection as well. The following methods and information were specifically used:

- site qualification bank on soils of Slovakia (Soil science and conservation research institute Bratislava),
- updated collection of the BSEU – bonited soil-ecological units (M 1:5000) maps in digital form (GIS ARC INFO), and following information databases (SSCRI Bratislava),
- areal and soil-ecological regionalization of agricultural landscape of Slovakia into so called less favoured areas (Less favoured areas - LFA) (Research Institute of Agricultural and Food Economics, Bratislava),
- potential economic parameters of the soil units (Vilček, 1999) a.o.

Production of the biomass expressed in the solids was defined for each BSEU on the basis of the potential yields of the agricultural crops namely of the main crop yield as well as the minor products and the root remainders. The crop representation resulted from so called typological structure of the agricultural crops seeding in 2000-2004. The rates of potential biomass production were assigned to the particular BSEU and they were decoded into the individual categories of evaluating parameters in GIS background and thus it was possible to differentiate and specify coefficients selected by us.

Similar approach was used to characterize the profitability rate. It was defined as a share of potential profit and costs of crop growing on the level of BSEU.

The methods of operating analyses, data collection in the landscape (particularly spotted localities) and inquiry (agricultural establishments), the soil sampling methods, methods of processing and evaluation of the soil samples, statistic correlation methods (polynomial regression relativities), mathematical simulation of the relations as well as the current software programmes (in particular geographic informative systems – GIS) and their applications were used while the partial problems solving.

Evaluating of the pedogeographic soil characteristics (climate, steepness, depth, skeletalness, granularity, etc.), from their productive and economic possibilities point of view, was based on heretofore elaborated databases on supposed natural and economic parameters of BSEU (Vilček, 2005), which were thoroughly updated and modified during the process of evaluation to receive the recent level. Predominantly, these are economic parameters (prices, costs etc.) which are subjected to the time changes and thus the original databases from 1990-1998 were innovated by the growth index.

By this method objective informative databases on soil units in all Slovakia were originated and these are possible to apply in any region where are data on bonited soil –ecological units known.

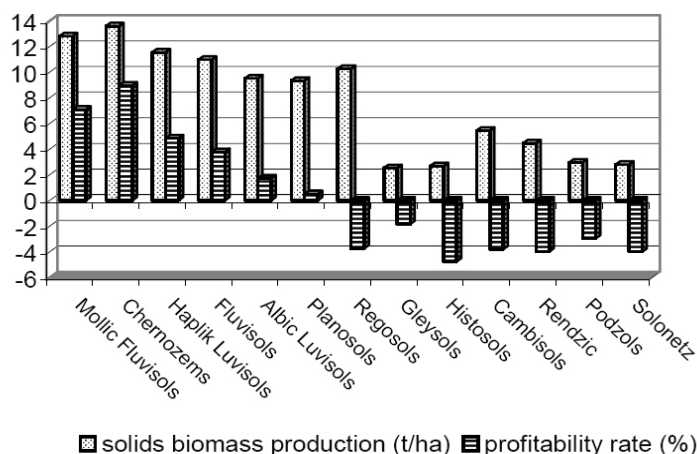
RESULTS AND DISCUSSION

Economic effectivity of the crop production makes a very important role in forming of the landscape structure, its utilization and further development. From this point of view, predominantly, in the heterogeneous natural conditions of Slovakia, the important role is maintained by the environmental quality, in particular the soil quality. The existing soil conditions significantly limit, differentiate and predestinate individual regions for specific patterns (forms) of farming. Diametrically different structures of the crop production are applied in the lowland regions, submountains or mountains areas. There are different structures in quality soils and the different ones in the poor quality soils. Structure heterogeneity of the soil utilization is reflected in the economy of the crop production. In particular, it is intensively perceived by the producers of unsuitably selected crop commodities. In this case, if there is an incompatibility of the environment and the crop needs, financial lost and thus incorrectly invested capital cost is occurred. The profitability of the crop production represents an indicator of the country and regions suitability for the crop production.

The soil parameters influence on the crop production profitability

The effectivity and profitability of the crop production predominantly depends on the soil characteristics. There are significant differences obvious in the classification of the soil types concerning the potential production of the biomass among the following soil types Mollic Fluvisols, Chernozems, Haplic Luvisols, Fluvisols, Albic Luvisols, Planosols and Regosols and soil types Gleysols, Histosols, Cambisols, Rendzic, Podzols a Solonetz (Figure 1). The similar situation except Regosols is observed also in the potentials of the crop production profitability. According to our calculation the crop production in the soil types Regosols, Gleysols, Histosols, Cambisols, Rendzic, Podzols and Solonetz is not profitable without subsidiary economic impulses.

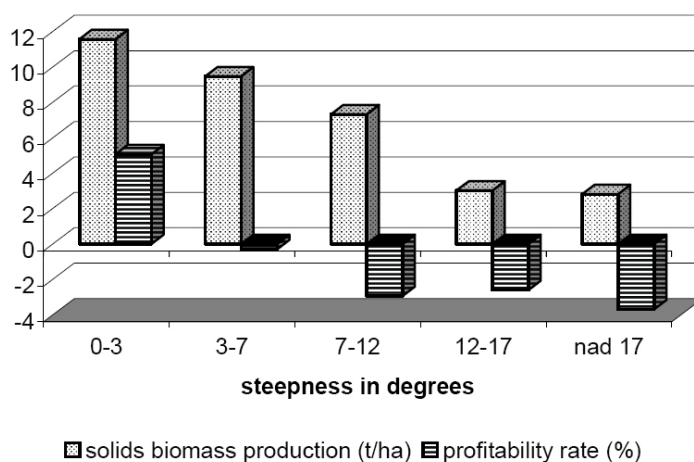
Fig. 1: *Potential profitability of the crop production and the biomass production according to the soil types*



Source: author

Productive and economic potential of the crop production depends on the landscape configuration as well. This is predominantly steepness and connected obstructed production conditions which directly influence the effectivity of the crop growing. The most of the agricultural landscape is situated in the lowlands (44.3 %), and medium hills (19.9 %). The soils in the lowlands show four times higher fertility potential in comparison to hilly soils above 12°. Admittedly significant information is the negative prediction of the crop production profitability in the soils situated in the hills above 7° (Figure 2).

Fig. 2: Profitability of the crop production and the biomass production according to the soil steepness the soil types

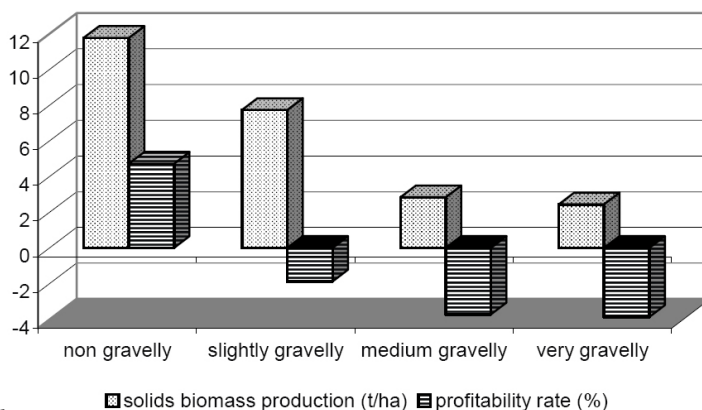


Source: author

As well as the steepness also the skeleton contents in the soils and their depth influence the production of the grown crops biomass. There are 52.8 % soils without skeleton,

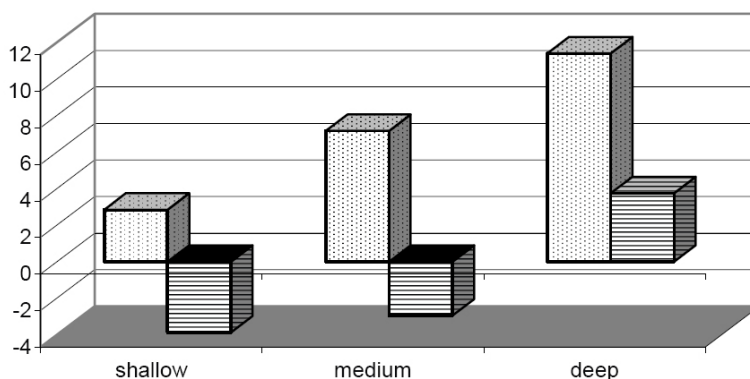
16.1 % slightly skeletal, 8.7 % medium skeletal and almost 22.4 % heavy skeletal. 62.0 % present deep soils, 15.6 % medium deep and 22.4 % shallow soils in Slovakia. There is an assumption that the phytomass production which is produced in heavy skeletal soils can reach only 21 % of the amount produced in the soils without the skeleton. In the shallow soils it presents 25 % of the amount produced in the deep soils. Regarding the financial point of view the slight skeletal and the medium deep soils are not profitable for the classic crop production (Figure 3 and 4).

Fig. 3: *Potential profitability of the crop production and the biomass production according to the soil skeletalilty*



Source: author

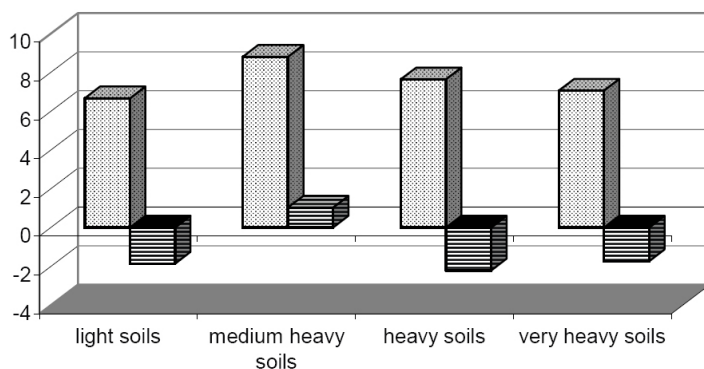
Fig. 4: *Potential profitability of the crop production and the biomass production according to the soil depth*



Source: author

Production parameters of the soils are closely associated with their texture (granularity composition). There are 6.4 % light agricultural landscape as to granularity, 73.1 % medium heavy, 17.1 % heavy and 3.3 % very heavy. There is an assumption that the production of the phytomass can be decreased in 25 % in light soils and very heavy soils in comparison to medium heavy soils. This fact is reflected in the economy of the crop production. The profitability potential without the subsidiary impulses is positive only in medium heavy soils. The crop production in light and heavy soils is not profitable in Slovakia at current economic parameters. The lower lost of very heavy soils opposite the heavy soils and light ones is a result of lower costs related to use of these soils predominantly as permanent grasslands.

Fig. 5: *Potential profitability of the crop production and the biomass production according to the soil granularity*



Source: author ■ solids biomass production (t/ha) ■ profitability rate (%)

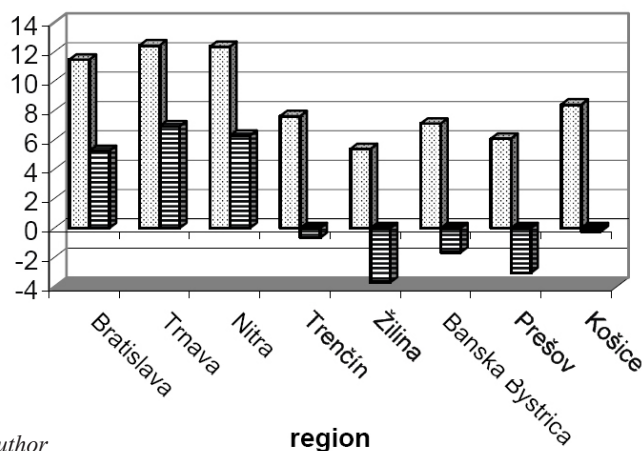
Above mentioned pedological aspects in mutual interactivity with climate as well as with another natural and human influences differentiate the agricultural landscape from economic effectiveness of the crop production point of view. This fact significantly affects developing possibilities of individual regions. It is impossible for the regional policy to do without the knowledge of productive and economic potential of the agricultural landscape. From this aspect it is suitable to analyse and know productive and economic potential of the agricultural landscape according to the classification into the traditional regions. This knowledge can significantly influence the direction of the regional developing policy.

Profitability of the crop production according to the regional-administrative division

The regional-administrative division of Slovakia represents basic, generally comprehensible categorisations of the territory, in which the weather condition is taken into consideration only a little. In spite of this the analysis of the potential effectiveness of the crop production according to the districts or regions is a significant indicator mostly for efficient areal distribution of individual activities or for designing of the state subsidiary policy in the agricultural department. Our calculations have confirmed that only regions with the soils of the highest point value – Trenčín (70 points), Nitra (69 points) and Bratislava (62 points) are able to profit from the crop production, too (Figure 6). The level of the produced phytomass per one hectare range on the level of about 11-12 t of solids. The less profitable, as to this indicator concerns, are regions of Žilina and Prešov with the soil of the point value 26 or 27 points, where only 6 – 7t of phytomass solids are produced by one hectare, that is only one half if compared to the most productive regions in Slovakia.

A new question is arising from this analysis, what way the given regions should follow in agrarian production and as well the question concerning EU subsidies which support mostly environmental development of the countryside.

Fig. 6: *Potential profitability of the crop production and the biomass production according to the regions of Slovakia*



Source: author

Profitability of the crop production according to the production areas

The classificatory criteria for the agricultural landscape differentiation have been elaborated in the past. The agricultural landscape was divided into so called production types according to the crop growing successfulness. There are well known maize, beet, potato or mountain production areas. Quantitative and qualitative analysis of the natural and economic potentials using geographical informative systems specified present characteristics of these areas.

The maize production area takes 37% of the agricultural landscape, predominant soil type is Chernozem (32%), soils are mostly in the slopes to 3°, without skeleton, deep, as to the granularity medium heavy and their quality is evaluated in point value 74 points.

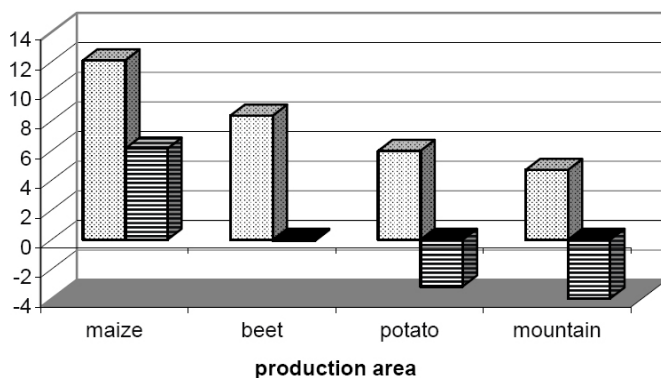
The beet production area takes 22% of the agricultural landscape, predominant soil type is Chernozem (25%), soils are mostly in the slopes to 3°, without skeleton, deep, as to the granularity medium heavy and their quality is evaluated in point value 51 points.

The potato production area takes 27% of the agricultural landscape, predominant soil type are Cambisols (63%), soils are mostly in the slopes to 7-12°, strongly skeletal, shallow, as to the granularity medium heavy and their quality is evaluated in point value 27 points.

The mountain production area takes 14% of the agricultural landscape, predominant soil type are Cambisols (75%), soils are mostly in the slopes to 7-12°, strongly skeletal, shallow, as to the granularity medium heavy and their quality is evaluated in point value 19 points.

At present structure of utilization of these agricultural landscapes and under existing economic conditions (costs, prices) it can be observed that without subsidiary impulses in the crop production only the maize production area is profitable, the beet production area is on the boundary of profitability and the potato and mountain production areas are not profitable for the intensive crop production (Figure 7).

Fig. 7: *Potential profitability of the crop production and the biomass production according to the production areas*



■ solids biomass production (t/ha) ■ profitability rate (%)

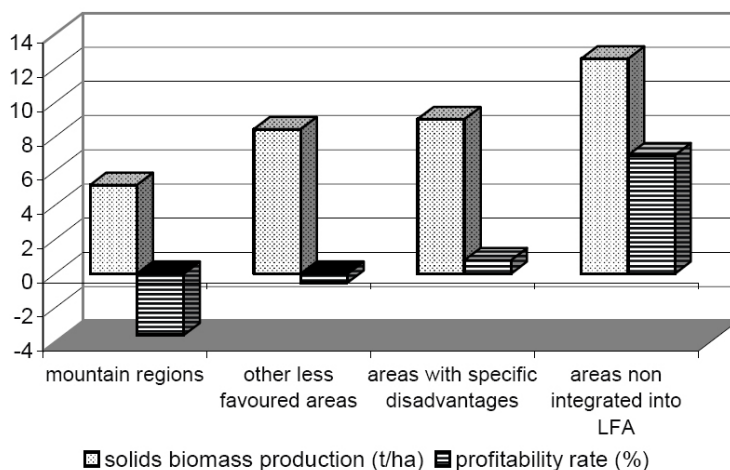
Source: author

Profitability of the crop production according to the less favoured areas (less favoured areas - LFA)

Subsidiary policy of the agricultural department is predominantly coming out the so called less favoured areas. There are mountain areas (20%), other less favoured areas (16 %) and areas with specific disadvantages (14%) in this classification of the landscape. Areas which are not integrated into the less favoured take 50 % of the agricultural landscape. The landscape quality expressed in one hundred scale is the highest in regions which are not integrated into the less favoured areas (78 points), followed by the areas with specific disadvantages (49 points), other less favoured areas (43 points) and mountain areas (22 points).

The results of our investigation indicate that the mountain areas do not reach either the half of the production potential of the areas do not integrated into LFA. The growing of the agricultural crops without subsidies is profitable only in the areas do not integrated into LFA. Specifically less favoured areas are on the boundary of profitability and other less favoured areas and mountains areas are for the agricultural crop growing uneconomic (Figure 8). From this point of view the subsidiary policy applied in Slovak territory by the European Union is rational. It concerns the entrepreneurs on the agricultural landscape and concerns also the support of the less favoured areas. The question is only the degree of specifics, that means regarding local, predominantly soil specifics of individual users of the landscape within the cadastre or municipality.

Fig. 8: *Potential profitability of the crop production and the biomass production according to the less favoured areas*



Source: author

CONCLUSION

Soil characteristics significantly influence the productive potential of the crop production and it is reflected in the profitability of the agricultural crops growing. The biomass yield is correlated to the soil quality. Mostly the soils of the following types Mollic Fluvisols, Chernozems, Haplic Luvisols, Fluvisols, Albic Luvisols, Planosols are with regard to the biomass production and the crop production profitability the assurance of effective production. Regarding the prediction of the relation between the soil parameters and the profitability of the crop production it is obvious that agricultural crops growing without subsidiary impulses is profitable only on the slopes below 7°, in the soils without skeleton, deep soils and medium heavy soils.

Heterogeneity of the soil conditions in Slovakia differentiate the level of the crop production in the individual regions, both economically and productively. The crop production as a whole is profitable only in Bratislava, Trnava and Nitra from the regional point of view, then it is the maize production area and so called less favoured areas.

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References

- DŽATKO, M. (2002): Evaluation of the productive potential of the agricultural landscape and the soil-ecologic regions in Slovakia. VÚPOP, Bratislava, 88 s., ISBN 80-85361-94-9 (in Slovak).

- KOVÁČ, K. et al. (2003): General plant production. SPU, Nitra, 335p., ISBN 80-8069-136-3 (in Slovak).
- LINKEŠ, V., PESTÚN, V., DŽATKO, M. (1996): Handbook for using of BSEU. VÚPÚ, Bratislava 43 p. ISBN 80-85361-19-1 (in Slovak).
- MICHAELI, E. (1999): Regional geography of the Slovak Republic. FHPV PU, Prešov, 256 p. ISBN 80-88722-41-1 (in Slovak).
- VILČEK, J. (1999): Pedo-ecological parameters of classification and utilization of the agricultural landscape (Final Report). VÚPOP, Bratislava, 113 p. (in Slovak)
- VILČEK, J., HRONEC, O., BEDRNA, Z. (2005): Environmental pedology. SPU, Nitra, 299 p., ISBN 80-8069-501-6 (in Slovak).
- VILČEK, J. (2005): New principles, rules and parameters of the potential utilization of the landscape in Slovakia (Final Report). VÚPOP, Bratislava, 81 p. (in Slovak)

POTENCIÁL RENTABILITY RASTLINNEJ VÝROBY V REGIÓNOCH SLOVENSKA

Zhrnutie

V príspevku boli stanovené konkrétne potenciálne hodnoty produkcie sušiny i rentability výroby pre najrozšírenejšie pôdne typy, kategórie svahovitosti, skeletovitosti, hĺbky pôd i zrnitosť. Prepočty potvrdzujú vysokú koreláciu rentability a prírodnej výnosovosti pestovania plodín. Udržateľnú pozitívnu rentabilitu v pestovaní plodín je možné očakávať len v regiónoch so zastúpením Mollic Fluvisols, Chernozems, Haplik Luvisols, Fluvisols, Albic Luvisols and Planosols. Ostatné regióny sú v tomto smere závislé od dotačných stimulov. Analýza zvolených pôdnych parametrov ukázala, že vo všeobecnosti je rastlinná výroba pri súčasných ekonomických podmienkach a bez dodatočných stimulov rentabilná len na rovinách a svahoch do 7°, na pôdach hlbokých, bez skeletu a zrnitostne stredne ťažkých. Tieto poznatky nemusia platiť pre konkrétnu plodinu.

Heterogenita pôd a ich vlastnosti na Slovensku zákonite prináša aj rozdielne produkčné i ekonomické potenciály jednotlivých regiónov. Pozitívne hodnoty potenciálu rentability rastlinnej výroby môžeme očakávať v samosprávnom kraji Bratislavskom, Trnavskom, Nitrianskom a Trenčianskom. Podľa zatriedenia území do poľnohospodárskych výrobných oblastí je potenciál rentability kladný len v kukuričnej a repárskej výrobných oblasti. Podľa rozdelenia územia Slovenska do tzv. LFA (less favoured areas) sú v tomto smere rentabilné regióny do tohto systému nezaradené, resp. aj oblasti so špecifickými nevýhodami. Príspevok v textovej i grafickej forme uvedených diferencií v potenciáloch produkcie biomasy i rentability jej výroby podrobne analyzuje a to tak z pohľadu pôdnych vlastností, ako aj pre poľnohospodárstvo relevantných regiónov.

Recenzovali: Prof. h.c. prof. Ing. Ondrej Hronec, DrSc.
Prof. RNDr. Eva Michaeli, PhD.