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**RISK ANALYSES
IN PLANT PRODUCTION**

THESES OF DOCTORAL (PhD) DISSERTATION

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Mosonmagyaróvár

2007

1. INTRODUCTION, RESEARCH TARGETS

The definition of risk often emerges in everyday life, if decisions must be made in respect to a particular situation. Making decisions in the present concerning the future based on the experiences and knowledge gained and acquired in the past fundamentally characterizes the decision making scenes. Risks concerning plant cultivation can be subject to research in view of two standpoints. One standpoint focuses on risks affecting the plant cultivation process, which fundamentally designate the cultivation structure, its technology and the sales processes on one hand. On the other hand, risks generated by the plant cultivation method itself can also be approached. External effects can impact the status of the natural environment (by environmental pollution and contamination) and the general health status of the population (gene modified plants, food production safety). The research of risks affecting the plant cultivation methods and additionally the earning power and the magnitude of the attainable earnings represents the subject of risk analyses in this thesis.

Yield quantity, sales prices and costs determine the profit of a business. The target of this thesis is to demonstrate the variability and the risky features of these factors by the application of objective and subjective procedures and analyses methods.

Research aims

1. To analyze how the trend of average yield developed between 1960 and 2004 in respect to four plough-land plants, namely wheat, corn, sugar beet and potato having been quite important by virtue of their roles primarily in food supply on a national level and in the Trans-

Danubian region composed of three counties. The target of the analyses is to define a period, when the production circumstances were the most ideal, thus the security to attain the planned yield was the highest.

2. To analyze how the profitability of the four aforementioned plants alters through the analyses of the sales prices, subsidies and production costs.
3. To interview the cultivating entities by questionnaires what they think of the risks implied by plant cultivation and the risk management methods applied. The review concludes whether the plant cultivating entities consider consciously the risks arising in the course of their activity that also affect it.

2. MATERIAL AND METHOD

Both primary and secondary data collection took place in the course of the research. Investigation was conducted on the basis of secondary sources in addition to bibliography processing in concern to the plant cultivation procedure as well as the yield, the sales prices and costs determining the earnings in the Trans-Danubian region.

The variability of the average yield and the sales prices in concern to wheat, corn, sugar beet and potato in the period between 1960 and 2004 was analyzed based on the publications of the Hungarian Central Statistical Office. Graphic illustrations, cyclic and random effect calculations, stochastic dominance and expected value – variation co-efficient efficiency criteria have been applied in the course of the analyses. The relation existing between the yield quantity and the sales price variation has also been analyzed. The research of the production costs and profit variation has been

conducted in respect to the partnership businesses concerning the period between 1990 and 2004 based on the data provided by the Agricultural Economics Research Institute.

The preparation of questionnaires within the primary research methods offered the best solution to survey the management of risk sources and the uncertainty factors. In the summer of 2005, as many as 1.000 questionnaires were distributed by mail to the plant cultivation oriented businesses in Győr-Moson-Sopron, Vas and Zala Counties, out of which as many 267 assessable ones were returned. Closed and selective questions were included in these questionnaires. The interviewees evaluated the risk sources and risk management procedures on a Likert scale (from 1 to 5 according to the school mark scheme). The risk factor sources have been classified into six categories based on the bibliography: production risks, market risks, fiscal risks, technological risks, legal risks and risks implied by human resources. The research contained comparative analyses and furthermore the aware risk management portfolio has been elaborated, which illustrates the significance of risk management in the activity of the given plant cultivation business in correlation with the risk assessment. The model provides data whether a given cultivating entity consciously conducts the management of risks and uncertainty factors.

3. NEW AND LATEST TYPE SCIENTIFIC RESULTS

1. The stochastic dominance and expected value – variation co-efficient efficiency criteria analyses of four plants, namely wheat, corn, sugar beet and potato having been quite important in a food industrial, (dry) feeding and other industrial points of view concluded that the most beneficial periods both in the Trans-Danubian region and on a national level in the term of 45 years between 1960 and 2004 as regards the attainable average yield were as follows:

- between 1980 and 1994 in case of wheat and sugar beet,
- between 1975 and 1989 in case of corn and potato.

It can be unequivocally concluded in respect to the four plough-land plants that the average yield was the most varying between 1990 and 2004; therefore, this period has been considered the most exposed to risks.

2. The variation of the sales prices peaked between 1990 and 2004. It has been confirmed in 86% of the wheat, in 76% of the corn and in 70% of the potato that the yield quantity and the sales prices vary inversely due to the market mechanisms.

3. Based on the primary research it can be concluded that the plant cultivating entities define the price variation of the main product, the delay in subsidy payments, the agronomy policy of the state administration, the variation of the resource prices and the fluctuating quantity of the annual precipitation to be the most crucial risk sources affecting their activities. The typical risk management methods applied by the plant cultivating entities are as follows: obtaining market information, creating financial

reserves, settling contractual yield sales and cultivating several plant species.

4. The aware risk management portfolio is capable for classifying a plant cultivating entity into one of the four segments and to conclude whether such entity consciously manages the risk factors affecting its profit earning activity.

4. EXTRAPOLATIONS AND PROPOSALS

The following extrapolations can be derived from the factors affecting the profit generated by plant cultivation and the research of the risk sources and risk management methods.

The average yield of wheat, corn, sugar beet and potato between 1960 and 2004 in the Trans-Danubian region and on a national level was analyzed in the initiative phase of the research in order to state the variability of said average yields. By the graphic illustration and the designation of the cyclic effect free of polynomial trend it can be concluded in case of all examined plants that the period started with a declining phase. This decline started after the reorganization of the large agricultural production entities and lasted until the middle 1960s', when it reached its nadir. The second half of the 1960s' brought increase in cultivation. Spectacular boom launched from the middle 1960s' after the introduction of the new economical scheme and in the 1970s' as a consequence of the powerful technical development in agriculture, so that high standard production stabilized in the 1980s'. The yield of the plants subject to research declined again owing to the socio-economical changes occurring in the beginning of the 1990s'. The bad income circumstances of the plant cultivating businesses and the constrained

use of the sources (e.g.: artificial fertilizers and herbicides) were the reasons for such a phenomenon.

However, it can also be concluded that agriculture is unequivocally weather dependent despite the technical evolution and that the weather conditions and the natural capabilities exert direct impacts on the yield in plant cultivation, of which effects appear in the annual yield fluctuation independently from the economical conditions; this is confirmed by the graph of random effects.

By totaling the stochastic dominance and expected value – variation coefficient efficiency criteria effects, such time periods could have been separated in case of each plant, which were both the most beneficial and the most disadvantageous in view of the chance of average yield intended to have been attained. The highest and the safest average yield in case of wheat and sugar beet could have been attained between 1975 and 1989, whilst such a tendency evolved in case of corn and potato between 1975 and 1989. It can be concluded unequivocally in case of the four plough-land plants that the average yields were the most variegated between 1990 and 2004; therefore, this period can be considered the most exposed to risks.

As regards income, yield loss causes the majority of the problems in most cases because of the income loss, but exceedingly high yield can also imply difficulties, since it must be stored (that implies significant costs) and the oversupply negatively affect the sales prices.

The effect of price uncertainty emerges through the product prices on one hand and through the expenses on the other hand. While the product prices are uncertain in most cases, the expenses are not based on the types of the plant cultivation procedures. Following the political changes, the variability of the sales prices significantly grew, which made the cultivating entities exposed. Following the accession to the European Community, the income

of the eligible cultivating entities became more calculable, which has made the planning process of the cultivation activity more reliable as a result of the simplified land based subsidies and the national supplementary supports. The price applied in the course of the intervention purchase procedure provides an option for the cultivating entities to opt for secure solutions in lieu of the lower sales prices emerging due to the oversupply, if the requirements are properly met.

In the course of the primary research, analyses was conducted amongst the plant cultivating entities to survey the significance of the risk sources affecting their profit earning activity and the risk management methods applied. The plant cultivating farming entities define the price variation of the main product, the delay in subsidy payments, the agronomy policy of the state administration, the variation of the resource prices and the fluctuating quantity of the annual precipitation to be the most crucial risk sources affecting their profit earning activities. They attribute less significance to seed quantity, environmental burden and the risks implied by the assumed climate change.

Of the risk management methods, 89% of the interviewees cultivate several plant species, which also attribute high priority to information, hence to weather forecast survey and to market information.

The aware risk management portfolio was completed in the course of the questionnaire analyses, in which the average risk assessment of a given cultivating entity and the assessment of the significance of the risk management methods in the profit earning activity can be compared. The hypothesis pointing out that risk management would be highlighted in the cultivating activity, if the cultivating entity attributed high priority to the affecting role of the risk sources can partly be verified based on the analyses. 62% of the interviewees belong in Segment I. (low risk assessment

and management) and Segment IV. (high risk assessment and management), which means that risk management takes place in their economical and business activity consciously according to their subjective consideration of the affecting influences of the risk sources. The interviewees assessed the significance of the risk sources highly as regards Segment II.; however, they scarcely apply any risk management method. Making a risky decision in the latter case combines with a far higher or lower opportunity of profit earning or loss. Those classified in Segment III. over insure themselves. They assessed the role of the risk sources lower than the average based on their subjective risk assessment. Therefore, they would be able to reduce the application of the risk management methods in their business activities, because these imply either costs or profit loss in every case, thus impeding the attainment of a higher income. The request for consultancy services listed in the risk management methods was given a very low mark, of which increase could eliminate the errors in Segments II. and III.

5. PUBLICATIONS COMPILED IN THE TOPIC OF THE THESIS

Proofread articles

1. **Lőrincz, Zs.** – Kacz, K. – Kalmár, S.: Risk and risk management in the plant production, *Gazdálkodás*, 2006, L. évfolyam, 17. szám
2. Kacz, K. – **Lőrincz, Zs.**: Formation of land and farm structure at Hungary's western gate, *Gazdálkodás*, 2006, L. évfolyam, 17. szám
3. **Lőrincz, Zs.** – **Salamon, L.**: A kukoricatermesztés jövedelmét befolyásoló tényezők változékonyság-vizsgálata, *Acta Agronomica Óvariensis*, 2007, accepted

Information dissemination articles

1. **Radnics, Zs.** – Kalmár, S. – Salamon, L.: Gazdálkodói vélemények a növénytermesztés kockázatairól, *Agro Napló*, 2006/5, 7-9. old.

International conferences

1. Kalmár, S. – **Radnics, Zs.** – Salamon, L.: A precíziós növénytermesztési technológia bevezetése Magyarországon – a gazdálkodók körében végzett felmérések tükrében, Within the European Union Nemzetközi Konferencia, Mosonmagyaróvár, 2004. május 6-7., (előadás + absztrakt + CD kiadvány)

2. **Radnics, Zs.** – Kalmár, S. – Salamon, L.: Investigation of factors affecting the application of precision plant production technologies, Sustain Life Secure Survival II., Socially and Environmentally Responsible Agribusiness, Prague, 22.-24. sept. 2004, (poster + abstract + CD)

3. **Radnics, Zs.:** Kockázatok a növénytermesztésben

AVA 2 Agrárgazdaság, Vidékfejlesztés, Agrárinformatika Nemzetközi Konferencia, Debrecen, 2005. április 7-8. (előadás)

4. Pusztainé K., J. – **Radnics, Zs.:** Überblick der Agrarinformationssysteme als der Basis der Gemeinsamen Agrarpolitik, Európa-Napi Nemzetközi Konferencia, Mosonmagyaróvár, 2005. május 5-6. (előadás + abstract + CD kiadvány)

5. **Radnics, Zs.:** A növénytermesztés kockázatai, X. Nemzetközi Agrárökonómiai Tudományos Napok, Károly Róbert Főiskola, Gyöngyös, 2006. márc. 30-31. (poszter + abstract + CD kiadvány)

6. Sinka, A. – **Radnics, Zs.:** Untersuchung der Wettbewerbsfähigkeit der Bos-Genetic GmbH, Within the European Union Nemzetközi Konferencia, Mosonmagyaróvár, 2006. április 6-7., (előadás + absztrakt + CD kiadvány)

7. **Radnics, Zs.** – Sinka, A.: Die Bedeutung der Risikofaktoren der Pflanzenzucht in der Entscheidungsfindung, Within the European Union Nemzetközi Konferencia, Mosonmagyaróvár, 2004. május 6-7., (poszter + absztrakt + CD kiadvány)

Hungarian conferences

1. Kalmár S. – **Radnics Zs.** – Salamon L.: A precíziós növénytermesztési technológia bevezetése a humán tényezők függvényében, Óvári Tudományos Napok, Mosonmagyaróvár, 2004. október 7., előadás + absztrakt + CD kiadvány

2. Kalmár S. – **Radnics Zs.** – Salamon L.: A precíziós növénytermesztési technológia humán tényezői a fenntartható fejlődés szolgálatában, 14. Komáromi Napok, Fenntartható fejlődés, fenntartható társadalom és integráció Tudományos Konferencia, 2005. április 28. (teljes anyag nyomtatásban megjelent)

3. **Radnics, Zs.** – Kalmár, S. – Salamon, L.: A Nyugat-dunántúli régió gazdálkodóinak véleménye a növénytermesztés kockázatairól, XLVII. Georgikon Napok, Keszthely, 2005. szeptember 29-30. (előadás + absztrakt + CD kiadvány)

4. **Radnics, Zs.** – Hegyi, J.: A Nyugat-Dunántúli régió gazdálkodóinak jellemzése a növénytermesztés kockázatairól alkotott véleményük alapján, Óvári Tudományos Napok, Mosonmagyaróvár, 2006. október 5., előadás + absztrakt + CD kiadvány