REVIEW ON AGRICULTURE AND RURAL DEVELOPMENT

SCIENTIFIC JOURNAL OF THE UNIVERSITY OF SZEGED, FACULTY OF AGRICULTURE
2013. Vol. 2. (1)

2013/1.

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SCIENTIFIC JOURNAL OF THE UNIVERSITY OF SZEGED, FACULTY OF AGRICULTURE

Volume 2. (1)

Hódmezővásárhely

2013

Published by:
University of Szeged
Faculty of Agriculture
6800 Hódmezővásárhely
Andrássy u. 15.

Responsible publisher:
Károly Bodnár dean

Executive editor:
József Horváth
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ISSN 2063-4803

Printed in 300 copies

Typography:
Generál Ltd.
Szeged

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WITH CD-ROM SUPPLEMENT

Review on Agriculture and Rural Development 2013. vol. 2. (1) ISSN 2063-4803

WHAT IS ANIMAL WELFARE AND HOW CAN WE MEASURE IT?

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ABSTRACT
Animal welfare can be defined as an individual animal's subjective experience of its mental and physical state as regards its attempt to cope with its environment. The mental state (feelings and emotions) of an animal cannot be measured directly, but has to be inferred from the behaviour, physiology, health and productivity of an animal. Various choice tests can be used to assess the behavioural priorities of animals. These tests provide insight into what animals regard as preferable or aversive. Unsuitable housing environments and management may lead to movement difficulties, abnormal responsiveness and abnormal behaviour. Also, a variety of responses of the neuroendocrine, autonomic nervous and immune systems can indicate coping difficulties and stress experienced by animals. Long-term stress may finally result in health problems and reduced productivity. Diseases and injuries themselves are naturally often coupled with suffering. Good productivity does not necessarily equal with good welfare while genetic selection for productivity, for example, may have negative welfare effects. Animal welfare is not only the absence of suffering, but also the animals' possibility to have positive mental states should be considered. Positive mental states can be interpreted from the behaviour and physiology of animals. Since the welfare state results from the complicated interaction of an animal with its environment, it is highly recommended that a diverse range of measures are used in animal welfare studies.

Keywords: animal welfare, behaviour, physiology, health, productivity

DEFINING ANIMAL WELFARE

Animal welfare is a multidimensional scientific and societal concept, and there is no single generally accepted scientific definition of animal welfare (FRASER, 2008: pp 72-78). Probably the most cited definition of animal welfare is: 'The welfare of an individual is its state as regards its attempts to cope with its environment' (e.g. BROOM & JOHNSON, 1993: p 74). This definition has later been modified, and for example NORGES FORSKNINGSRÅD (2005: pp. 30-31) emphasizes that 'state' refers to not only physical (or physiological) but also mental (or psychological) state. WEBSTER's (2005: p. 10) definition 'Fit and happy', expresses the same in the shortest possible way, with 'fit' referring to the physical welfare and 'happy' referring to the mental welfare.
Mental welfare does not refer only to states related to poor physical health (e.g. pain, disease or injury), but also includes more subtle negative feelings (e.g. boredom and frustration) as well as positive feelings (e.g. pleasure) (RUSHEN ET AL., 2008). It is worth noting that in the European Union's Treaty of Lisbon animals are recognised as sentient beings, and that this has to be accounted for during policy formulation, for example EU's Common Agricultural Policy (EC, 2012). 'A sentient animal is one for whom feelings

matter' (WEBSTER, 2005: p. 10-11), and our traditional mammalian and avian farm animals, for example, belong to this group of sentient animals.
The definitions of animal welfare based on physical and mental state still lack one important aspect of animal welfare. Natural living as a prerequisite for good welfare has been emphasised upon, particularly by social commentators and ethicists (FRASER, 2008: pp. 65-72,), and the consumers (MIELE & KJÆRNES, 2009). However, life in nature is full of suffering (DAWKINS, 1980: pp. 51-54), and the relationship between natural living and animal welfare is complicated (WEBSTER, 2008: pp. 188-190).
Accordingly, there are three approaches to animal welfare: feelings, biological functioning and naturalness (RUSHEN ET AL., 2008: pp. 6-9). The final conclusions of the animal welfare studies may depend on how these three are weighed (e.g. FRASER, 2008: pp. 242-247). This reflects the fact that the science of animal welfare is not free from value or ethical considerations.

EXPLAINING ANIMAL WELFARE

Despite the difficulties of defining animal welfare, basically the welfare of an animal depends on how well the adaptations possessed by the animal fit the challenges it encounters in its environment (FRASER, 2008: pp. 226-229). *Figure 1.* illustrates the interaction of an animal with its environment and the putative ways to measure animal welfare. *Figure 1.* is the framework for all discussions that follow, but to keep things brief, will be referred to only this once.

Animal

Genes are the basis of the adaptations of an animal, but developmental factors also affect an individual's ability to adapt to its environment. In fact, domestication includes both genotypic and phenotypic adaptation (PRICE, 2003). Evolution has shaped the genes of animals in the course of millions of years during which animal species adapted to living in their natural environments. Domestication of most farm animal species began thousands of years ago, but living for thousands of generations in a close relationship with man has not had any dramatic effects on the behavioural repertoire or behavioural needs of farm animals (JENSEN, 2009). Rather, only the thresholds to manifest certain behaviour patterns has changed, most notably fear reactions towards man. On the other hand, the development of modern intensive farming started less than 100 hundred years ago, and therefore the massive welfare problems of farm animals in many of the current housing systems have not come as a great surprise.
During the last decades, selective breeding has been an essential tool to improve the productivity of farm animals (RAUW ET AL., 1998). Unfortunately, increasing productivity has also had some undesirable welfare-related side-effects that are reflected in animals behaviour (e.g. suppression of oestrus behaviour in dairy cows), physiology (e.g. immunosuppression in poultry) and health (e.g. leg problems in pigs and poultry). Selective breeding can be, however, used also to promote animal health and welfare (LAWRENCE ET AL., 2004; POTTINGER, 2008).

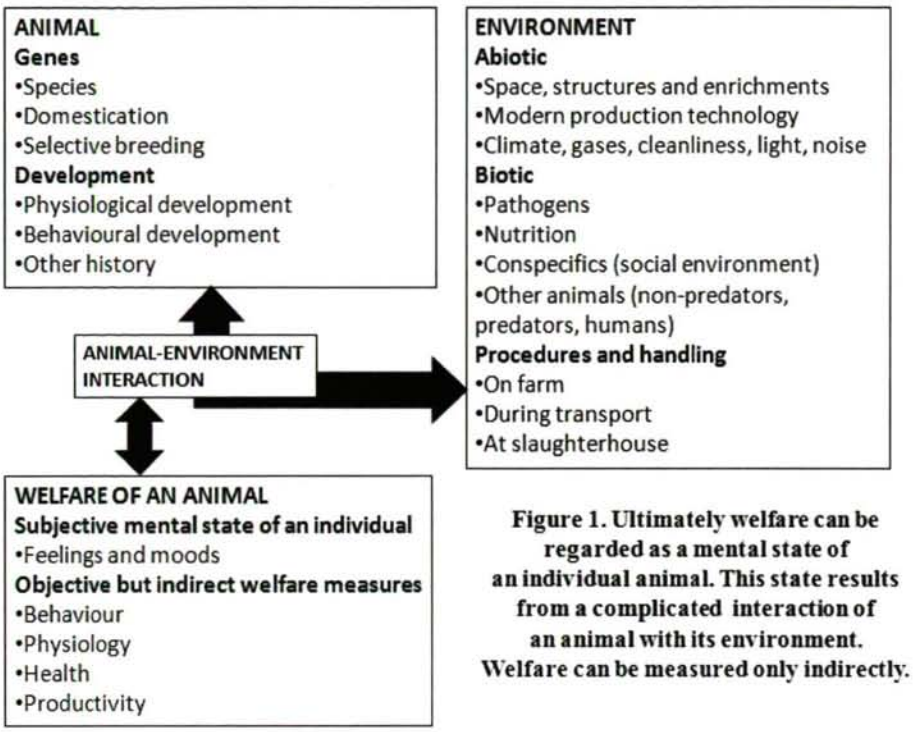

Figure 1. Ultimately welfare can be regarded as a mental state of an individual animal. This state results from a complicated interaction of an animal with its environment. Welfare can be measured only indirectly.

Developmental processes affect the phenotype of an animal all through its live. Stress hormones produced by a gestating female affect the development of the neuroendocrine system of its offspring ('prenatal stress'; LAY, 2000). Also, the experiences in the neonatal phase ('neonatal stress') possibly modify the neuroendocrine system and later reactivity of the animals. Learning, in particular, affects the behaviour of animals after these early phases of life, as they try to cope with their environment (EWING ET AL., 1999: pp 101-107). Successes and failures in these behavioural attempts to cope are crucial to the welfare of animals. Controllability and predictability of life promote coping and good welfare (KEELING & JENSEN, 2009). However, life is not affected only by physiology and behaviour. Injuries and mutilations, for example, may have long term effects on the welfare of animals (EFSA 2009).

Environment

In modern intensive farming systems, the space provided for the animals is limited, which may prohibit even very basic movements (BROOM & JOHNSON, 1993: pp. 131-134). Although it is impossible to bring 'all of nature' into intensive housing systems, environmental enrichment may be used to fulfil species-specific behavioural needs of animals (BROOM & JOHNSON, 1993: pp 145-149): for example rooting material for pigs (ŠPINKA, 2009) or dust-bathing substrate for laying hens (MENCH, 2009). Methods for early detection of sickness illustrate the opportunities that modern technology can offer to enhance animal welfare (WATHES, 2008).

Climate (e.g. temperature and draught), gases (e.g. ammonia) and cleanliness are in concert with pathogens important factors that may affect the welfare of animals (e.g. EFSA, 2009). Low light intensities may, for example, reduce the motion confidence of dairy cows, and light regime probably affects their productivity. Noise, in turn, can induce fear reactions or disturb sleep.

The fulfilment of an animal's nutritional needs is crucial for its welfare (EWING ET AL., 1999), but feeding practices also affect welfare (EFSA, 2009). In cattle, the development of stereotypic tongue rolling may be enhanced by unfulfilled feeding motivation (although the animals' nutritional requirements are met), and rumen acidosis is more common, if concentrates and roughage are provided separately as compared to 'total mixed ration' feeding (RUSHEN ET AL., 2008: pp. 106-109).

Most farm animal species are gregarious and usually kept in groups (WEARY & FRASER 2009). Despite the evolutionary adaptations for living in groups, in many cases the combination of the physical and social environment that we provide, jeopardises the normal development and welfare of animals. Aggression in pigs, for example, is typically related to time limitations in food availability, limited space, and mixing of animals unfamiliar to each other (ŠPINKA, 2009). Other animal species can also pose a threat to animals farmed extensively, particularly predators (e.g. sheep and goats: DWYER, 2009).

A good human-animal relationship is of paramount importance for animal welfare. Fear of stockpersons leads to long-term stress that is reflected in the behaviour, physiology and production of the animals (HEMSWORTH & BARNETT, 2000). Fear of humans is usually a learned response in farm animals, and can be counteracted by the manifestation of appropriate behaviour by the animal caretakers. Farm animals also encounter various procedures that may cause not only fear, but also pain, and in many cases both (e.g. disbudding and tail-docking in cattle: EFSA, 2009).

Animals may be transported several times during the course their lives and most animals are transported at least once, i.e. to the slaughterhouse. Although both transportation (including loading at both ends of the journey) and time at the slaughter house are a short part of the animals lives, in relation to their whole lifespan, these operations may be very stressful to animals (BROOM & JOHNSON, 1993: pp 87-88). Scientific research has, however, aided the development of more animal-friendly handling methods and vehicles, as well as stunning methods (WEBSTER, 2005: pp 169-176).

MEASURING ANIMAL WELFARE

General approaches to, and more detailed descriptions of the methods for measuring animal welfare have been presented in several text books (e.g. BROOM & JOHNSON, 1993; FRASER, 2008). Animal behaviour, physiology, health and productivity can be used for measuring welfare. However, since welfare results from a multifaceted interaction of the animal and its environment, final conclusions of the effects of the housing environment or procedures, for example, on animal welfare should always be based on several studies with several welfare assessment methods.

The natural behaviour of an animal species is an important starting point for designing housing environment, but preference studies are needed to extract the key features of the environment that are most crucial for the welfare of each species (FRASER, 2009: pp. 190-216). Preferences of animals can be measured either in free choice situations or in situations where animals' have to work to gain for access to a resource. Choices made by animals can also be used also to assess the aversiveness of certain procedures to the animals.

Abnormal behaviour, such as stereotypic behaviour or self-mutilation, may stem from restrictive and stimulus-poor environment (FRASER, 2008: pp. 125-145; KEELING & JENSEN, 2009). The motivation to perform some behaviour patterns may be so strong that animals perform them without the normal key stimuli, for instance, dust bathing by laying hens (MENCH, 2009). The effects on welfare of this kind of 'sham' or 'vacuum'

behaviours are not very well understood. Also, poor structural design may hinder normal behaviour, for example lying and rising actions of dairy cows in cubicles (BROOM & JOHNSON, 1993: 131-133).
The signs of physiological attempts to cope can also be used to assess animal welfare. Activation of the autonomic nervous system and the hypothalamic-pituitary-adrenal axis indicate that an animal is perceiving stress (MOBERG, 2000). If stress is strong or prolonged, it affects the immune system, and consequently the health of the animals. Finally, stress may have effects on reproduction, longevity and productivity of animals (BROOM & JOHNSON, 1993: pp. 76-80).

CONCLUSIONS

Ultimately welfare can be regarded as a mental state of an individual animal. This state results from a complicated interaction of an animal with its environment. Welfare can be measured only indirectly using behavioural, physiological, health and productivity measures. A diverse range of measures should be used in animal welfare studies.
This paper intentionally uses a limited number of references and focuses on text book references to facilitate an easy start for anyone who wishes to deepen his or her understanding of the science of animal welfare.

ACKNOWLEDGEMENTS

I thank the organisers of the XII Wellmann Conference for the opportunity to participate in the conference and present this plenary paper. Ms. Roseanna Avento is acknowledged for helping with the language of the manuscript.

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Review on Agriculture and Rural Development 2013. vol. 2. (1) ISSN 2063-4803

FOOD SECURITY AND SUSTAINABILITY – CHANCES AND LIMITATIONS OF AGRICULTURE

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ABSTRACT
The increasing population of the world may induce various problems. There are two major fields; food security and adequate fresh water supply, which are predominant for all Global economic structures. On the other hand all activities implemented in favour of meeting the demand of the population, increase the ecological footprint and may risk sustainability of both mankind and its environment. The present study deals with an assessment of future trends on the basis of the present state of alimentation.
Agriculture has a basic role in providing food for the human race. All sort of activities of that are in relation with the environment and at the same time they are driven by economic and social aspects. Sustainable agriculture can only be implemented if agricultural production can be run in an environment which is socially bearable, and economically viable. The scheme has to take into consideration that the society has to be equitable economically continuously. Whenever any of these interrelations cannot be manifested, the whole system may turn to be non-sustainable, or inefficient regarding food security.

Keywords: sustainability, food security, water scarcity, social equality

INTRODUCTION

Sustainability is the capacity to endure. In ecology the word describes how biological systems remain diverse and productive over time. Healthy ecological systems on a long term represent sustainability. Regarding the human society, sustainability is the potential for long-term maintenance of wellbeing, which has environmental, economic, and social dimensions (JOLÁNKAI ET AL., 2008).

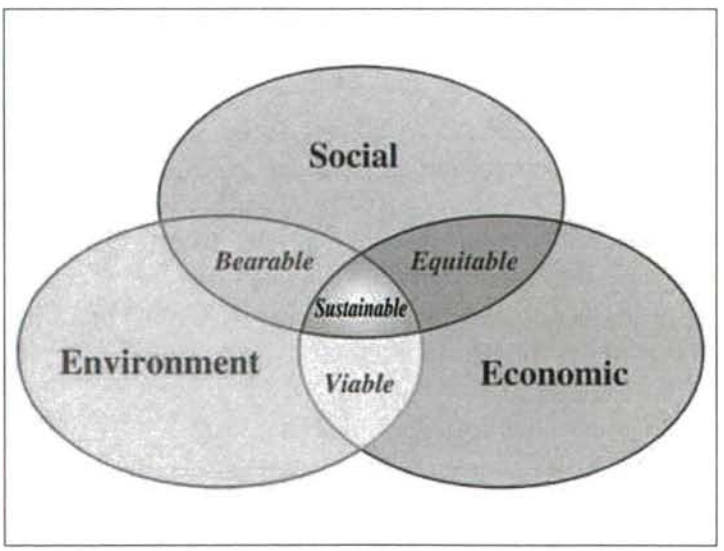

Figure 1. The interactions of sustainability
(Source: FAO 1990)

Sustainability as a term was developed upon the initiation of the United Nations by the Brundtland Committee. After the 1972 Stockholm Conference on the Human Environment

and the 1980 World Conservation Strategy of the International Union for the Conservation of Nature, the leaders of the world realized that there was a need to create an organization whose sole purpose was to raise awareness of the need for sustainable development (UN, 1987a). During this time period, people in developed countries were starting to become more aware about environmental issues stemming from industrialization and growth. Developed countries wanted to reduce the environmental impact of their growth. On the other hand, developing countries were becoming discouraged because they were not at and could not reach the higher levels of economic growth that industrialized countries had. Because of this need for growth, developing countries were desperate to use cheap methods with high environmental impact and unethical labour practices in their push to industrialize. The United Nations saw a growing need for an organization to address these environmental challenges which were intertwined with economic and social conditions as well (UN, 1987b).

The Brundtland Report was a response to the conflict between the nascent order promoting globalized economic growth and the emerging ecological disaster on a global scale. The challenge posed in the 1980s was to harmonize prosperity with ecology.

MATERIAL AND METHOD

The study has been focusing on three aspects of sustainability: economic growth, environmental protection and social equality. In the evaluation assessment public databases and statistics of the United Nations, within that the FAO (FAO, 2013) have been used.

RESULTS

Economic Growth is a crucial point when attempting to attain more sustainable efforts and development. In trying to build their economies, many countries focus their efforts on resource extraction, which leads to unsustainable efforts for environmental protection as well as economic growth sustainability. While the international scientific community was able to help to change the association between economic growth and resource extraction, the total worldwide consumption of resources is projected to increase in the future. So much of the natural world has already been converted into human use that the focus cannot simply remain on economic growth and neglect the continuously increasing problem of environmental sustainability. Agenda 21 of the United Nations reinforces the importance of finding ways to generate economic growth without hurting the environment. Through various trade negotiations such as improving access to markets for exports of developing countries, Agenda 21 looks to increase economic growth sustainability in countries that need it most. The key tasks for sustainable agriculture and rural development are as follows:

- Support for national policies and strategies;
- Promoting farmer-centred research and extension;
- Improving rural infrastructure;
- Strengthening local resource management;
- Providing entitlements for food security;
- Establishing fair and secure land tenure; and
- Reinforcing farmers' organisations and users' groups.

The seven tasks listed above may be divided into two fields; namely the responsibility of the governments and the desirable activities of the local stakeholders.

Environmental Protection has become an important issue regarding politics and businesses over the past decades, leading to great improvements in the number of people willing to invest in green technologies. Healthy ecosystems provide vital goods and services to humans and other organisms. There are two major ways of reducing negative human impact and enhancing ecosystem services. The first of these is environmental management. This direct approach is based largely on information gained from earth and environmental sciences as well as conservation biology. However, this is management at the end of a long series of indirect causal factors that are initiated by human consumption. In accordance with that a second approach is needed through demand management of human resource use.

Management of human consumption of resources is an indirect approach based largely on information gained from economics. There are three broad criteria for ecological sustainability: renewable resources should provide a sustainable yield (the rate of harvest should not exceed the rate of regeneration); for non-renewable resources there should be equivalent development of renewable substitutes; waste generation should not exceed the assimilative capacity of the environment (DALY AND FARLEY, 2004).

The focus on environmental protection has transpired globally as well, including a great deal of investment in renewable energy power capacity. Sustainable development occurring around the world helps to develop and implement water conservation, encourages the use of renewable energy sources, up to date electricity and energy efficient building. The consumption gap remains, consisting of the fact that "roughly 80 per cent of the natural resources used each year are consumed by about 20 per cent of the world's population". This figure is a sort of an evidence of imbalance, and furthermore, the vulnerability of the system. The increasing number of the world's population induces an increment in agricultural activities in favour of providing food security. This may influence two fields of environment; the decrement of natural ecosystems and the water scarcity. Figure 2 shows the dynamics of food production in relation with growth of population.

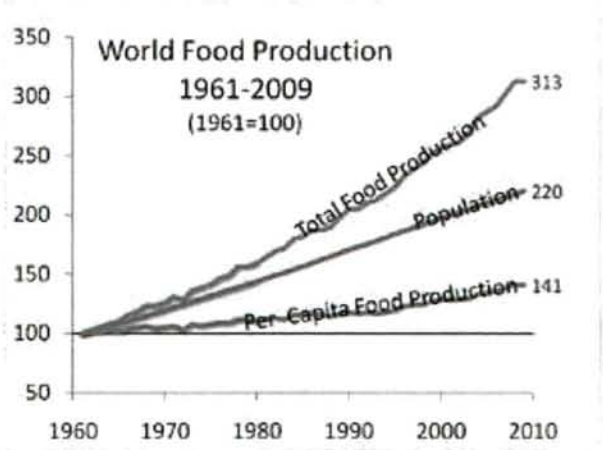

Figure 2. Trends of human population and food production of the world
(Source: FAO, 2013)

Social Equality. A major topic in achieving sustainability is the alleviation of poverty. It has been widely acknowledged that poverty is one source of environmental degradation. The social equality pillar of sustainable development focuses on the social well-being of people. The growing gap between incomes of rich and poor is evident throughout the

world with the incomes of richer households increasing relative to the incomes of middle- or lower-class households. Global inequality has been declining, but the world is still extremely unequal, with the richest 1 per cent of the world's population owning 40 per cent of the world's wealth and the poorest 50 per cent owning around 1 per cent. The Brundtland Commission has made an impact in helping to reduce the number of people living on less than a dollar a day to just half of what it used to be, but this can also be attributed to growth in BRIC countries.

Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life. Figure 3 gives information on food availability. Countries of the world are labelled with colours – green: food surpluses, yellow: balanced state, red: food supply insufficiency.

Figure 3. Alimentation of the world
(Source: FAO, 2013)

In 1996 the World Food Summit (WFS) set the target of "eradicating hunger in all countries, with an immediate view to reducing the number of undernourished people to half their present level no later than 2015". In 2000, the Millennium Declaration (MD) promoted the target to "halve, between 1990 and 2015, the proportion of people who suffer from hunger" (LÁNG, 2003).

FAO received the mandate of monitoring progress towards the objectives set by the WFS and the MDGs. For this reason, the FAO statistics division rigorously and continuously works on the methodology and the parameters needed for estimating the prevalence of undernourishment.

Fresh water supply of the world is closely related to alimentation. In this case the situation is more sophisticated, since water availability if often influenced by physical and economic factors. Figure 4 provides information on water availability. Almost 40 per cent of the world's population is facing physical or economic water scarcity of various extent.

Sustainable agriculture integrates three main goals; environmental health, economic profitability, and social and economic equity. A variety of philosophies, policies and practices have contributed to these goals. People in many different capacities, from farmers to consumers, have shared this vision and contributed to it. Despite the diversity of people and perspectives, the following themes commonly weave through definitions of sustainable agriculture.

Sustainability rests on the principle that we must meet the needs of the present without compromising the ability of future generations to meet their own needs. Therefore, stewardship of both natural and human resources is of prime importance. Stewardship of human resources includes consideration of social responsibilities such as working and living conditions of labourers, the needs of rural communities, and consumer health and safety both in the present and the future. Stewardship of land and natural resources involves maintaining or enhancing this vital resource base for the long term.

A systems perspective is essential to understanding sustainability. The system is envisioned in its broadest sense, from the individual farm, to the local ecosystem, and to communities affected by this farming system both locally and globally. An emphasis on the system allows a larger and more thorough view of the consequences of farming practices on both human communities and the environment. A systems approach gives us the tools to explore the interconnections between farming and other aspects of our environment.

A systems approach also implies interdisciplinary efforts in research and education. This requires not only the input of researchers from various disciplines, but also farmers, farmworkers, consumers, policymakers and others.

For a sustainable agricultural production, apart from theoretical and practical knowledge and the necessary technical support for its implementation, quality of human resources should be considered as an essential basis. Nowadays green movements often do more harm to environment than any other people involved in regular agricultural production.

Politicians speak of agriculture, as if it was some kind of hobby farming. Actually it is an economic necessity in most countries. Green movements often manipulate the public with arguments of no scientific value.

Agriculture and environment are bound together. There are several problems in their inter-relation, however these problems should never be placed in the field of politics.

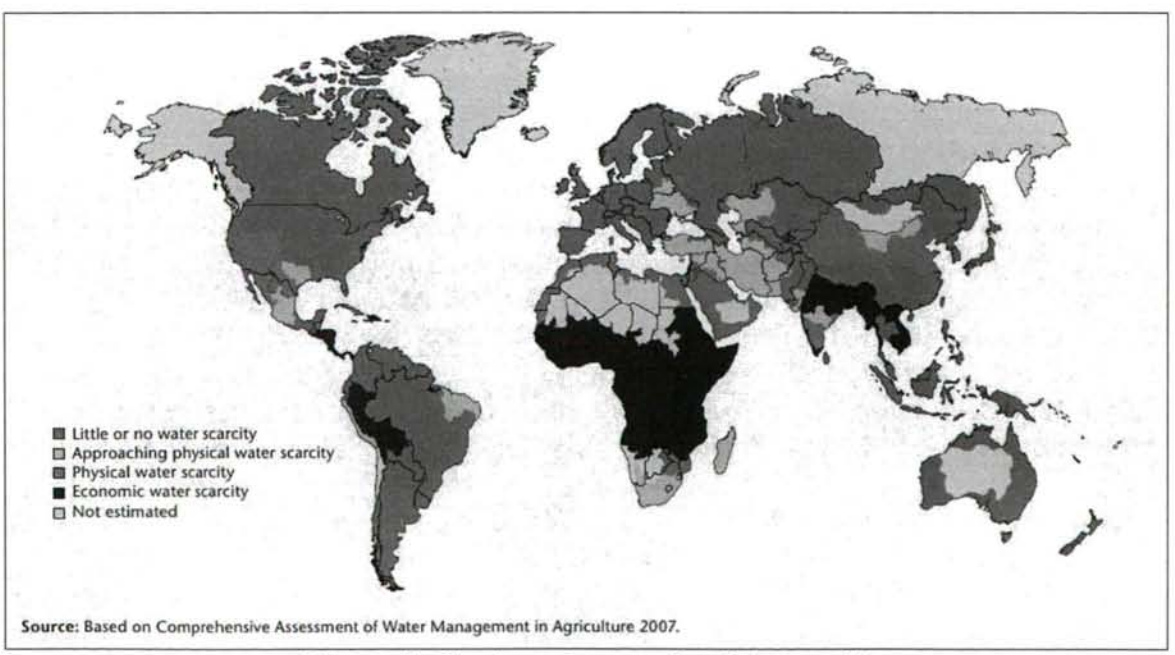

Figure 4. Fresh water supply of the world
(Source: FAO, 2013)

CONCLUSIONS

This brief overview does not give enough bases to draw general conclusions. May be the definition of sustainable agriculture (GOLD, 2009) is giving some suggestions for future tasks, mainly in relation with sustainable rural development. According to that sustainability should be "an integrated system of plant and animal production practices having a site-specific application that will last over the long term:

- Satisfy human food and fibre needs
- Enhance environmental quality and the natural resource base upon which the agricultural economy depends
- Make the most efficient use of non-renewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls
- Sustain the economic viability of farm operations
- Enhance the quality of life for farmers and society as a whole."

Professor S. Cserháti a renowned Hungarian scholar has written in 1905 (*cit in* JOLÁNKAI ET AL., 2002): „Crop production is not an empirical craftsmanship anymore, but rather an art based on a wide range of knowledge". Let us be keen on to encourage knowledge-farming versus eco-anarchism.

ACKNOWLEDGEMENT

The authors are indebted receiving support from the TÁMOP research funding system.

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Review on Agriculture and Rural Development 2013. vol. 2. (1) ISSN 2063-4803

URBAN WILDLIFE: CONFLICT OR COEXISTENCE?

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ABSTRACT
Urban wildlife management is a specific discipline within wildlife biology, focusing on management and research of species in inhabited areas. Urban wildlife management has become business. Numerous companies operate in this field all around the world, while the growing number of conflicts also demonstrates the urgent need to establish such enterprises in Hungary as well. In agriculture, and more specifically, in wildlife management, each and every new opportunity is important and has to be taken advantages of. Urban wildlife management provides such opportunities principally for well-educated wildlife management professionals. In Hungary we first of all need to establish and clarify the legal background. In this process responsibility should be removed from the game managers working outside the inhabited areas. Legal instruments should be offered for the management, and even for the trapping of both the game- and the protected species. Possibilities for protection have to be provided for the aggrieved parties. Nevertheless, the residents affected by these conflicts have to understand that they are the ones to defend their own private properties.

Keywords: urban wildlife, conflict, coexistence, wildlife management

INTRODUCTION

The growing direct and indirect effects of mankind on natural habitats and communities have been known for a long time. The general belief is that there is not much chance for their survival given the proximity of humans. However, this general opinion does not take into account the importance of natural adaptability of species (DARWIN, 2003), and most importantly the fact that those species that are able to adapt to changes in the environment dominated by humans, are also able to proliferate there, as long as the environment is stable (CROOK AND SOULE, 1999). One form of adaptation is that certain species can find all their life conditions even in the near proximity of humans (ADAMS ET AL., 2006). Moreover, new species (or more precisely species new to inhabited areas) have often been reported to appear in inhabited areas. This process has been accelerated by the urban sprawl, which is the disproportionately greater growth of built up areas compared to the increasing number of inhabitants. This in return means faster decrease in size of natural habitats in the proximity of urban areas (WRIGHT, 2004)

Apart from the adaptability, urban areas offer a few further advantages too, which makes it easier for certain species to settle (ADAMS ET AL., 2006; HELTAI AND SZŐCS, 2008):

- beneficial microclimate, especially in the winter: the higher than average winter temperatures help quite a few songbird species to survive;
- suitable shelters: attics, spires, abandoned buildings offer a suitable shelter for several species like pigeons or bats, for example;
- availability of nutrition: apart from the general waste containing a lot of organic

waste (edible for animals) and humans directly or indirectly feeding the animals, invertebrate species collected in the traps of urban living (proximity of street lamps, puddles) also count as food resource;
- lack of predators: this especially helps the settling of small-sized prey species.

The municipal structure and the changes in architecture also help the migration of certain species to the urban areas. Highways and train tracks leading to the city centres offer a green corridor to a number of species. Many people feeling deprived of nature try to reconnect with it by keeping pets. Pets that escape, or are let go by their human companion, often find their living conditions away from their natural habitats, too, even if it means being continents away (ADAMS 2005; ADAMS ET AL. 2008; HELTAI AND SZŐCS 2008). Species living around humans in the cities are evaluated rather differently. This depends on several things: for how long a certain species has been living with us, how dangerous it is commonly considered and what damages it is capable of making (HELTAI AND SZŐCS, 2008). Being unknown to people, (rightfully or unrightfully) being regarded as dangerous and damages directly caused to humans all lead to more and more significant conflicts between urban wildlife and human societies. This was first noticed in North America in 1967, where the first conference focusing exclusively on managing species living in the cities was held for wildlife management professionals (HADIDIAN, 2003). In the history of urban wildlife management, this is considered the first milestone. In Europe – especially in the UK, Holland, Germany and Poland – the first projects relating to urban wildlife management began in the early '90s (ADAMS, 2005).
Urban wildlife management is a specific discipline within wildlife biology, focusing on management and research of species in inhabited areas. Among the studied species we can find all the vertebrate ones that have always lived around human communities, and those habitat- and trophy generalist species that newly appeared in this peculiar environment during the last centuries. This means that animals regarded as pests (rat, house mouse), as game (wild boar, red fox), as protected (bats, reptiles) or as desirable curiosities (songbird species) all are the subjects of this particular discipline (HELTAI AND SZŐCS, 2008). Urban wildlife managers thus work primarily for the survival of species appearing in cities and urban areas, and for easing conflict between wildlife and humans (ADAMS ET AL., 2006). Urban wildlife management becomes especially important if (VANDRUFF ET AL., 1994):
- the species settling in proliferate;
- exotic species turn up;
- appearing animals prove to be dangerous directly or indirectly to humans;
- the level and volume, or the location, or the type of the damage they make is not tolerable to humans.

Urban wildlife management – as a profession – has become business. Numerous companies operate in this field all around the world, while the growing number of conflicts also demonstrates the urgent need to establish such enterprises in Hungary as well. In agriculture, and more specifically, in wildlife management, each and every new opportunity is important and has to be taken advantages of. Urban wildlife management provides such opportunities principally for well-educated wildlife management professionals. My purpose is to show the most frequent conflicts arising in Hungary, and on the basis of these, to present the opportunities urban wildlife management has in store.

RESULTS

In the case of many potentially problematic species living in urban areas several solutions have been known – or have evolved, in order to ease conflicts - for a long time. In the case of animals considered as pests (e. g. mice, rats), various traps, poisons, or even pest controlling companies are available for everyone needing help. As for bats, usually causing fear, annoyance or minor inconvenience, civil organisations, national parks and zoos are capable of giving assistance (http://www.zoobudapest.com/denevermentes; http://www.natura-alapitvany.joomlaportal.hu/index.php/deneveres-zold-szam). Against the colonies of the rook, however, several local governments have applied definitely questionable methods. The reason for this is the garbage and noise these protected, but colonially nesting birds cause and make. People used water cannons in Kecskemét (http://www.edenkert.hu/vilagos-zold/termeszet/vetesi-varju-kecskemet--vizagyu/1958/), while in Pécs they tried to prevent nesting with sawing machines (http://hvg.hu/tudomany.termeszet/20120229_pecs_varjak). Both solutions display the escalation of the conflict. It is a protected species, thus no such solutions should be allowed in the case of agricultural damage. The woodpecker – capable of destroying the insulation of houses – is lucky enough to avoid such dramatic, and actually illegal, interventions, probably due to the rarity and peculiarity of the damage they make. The recommended solutions, however, prove to be rather ineffective (http://mme.hu/napi-madarvedelem/problemak-madarakkal/harkalyok-rombolasa.html). This is partly true in the case of the most frequently suggested ways of protection against pigeons in the cities as well. The acidity of their droppings can destroy buildings and metal structures to a great extent. But in the case of the stone marten, and of the wild boar, we have even less possibilities.

Living together with the stone marten

Stone martens have long been living in the villages and the buildings of the countryside, as easily available food resources (domesticated animals, various fruits) and warm attics are fairly attractive factors for this species. Its appearance in urban areas started in the 20th century, when massive urbanization of human societies also began. The urban presence of the stone marten is widely known and observed everywhere within its European occurrence area (Tóth et al., 2010), and so it is in Hungary. We have a lot of collected data on the damage it makes and has made in Budapest, Gödöllő, Sopron, Érd, Pécs and many other Hungarian cities. Plenty of scientific articles and news have been published (Heltai et al., 2005; Szőcs and Heltai, 2007; Tóth, 1998; Tóth, 1999; Tóth, 2003; Tóth and Szenczi, 2004; Tóth et al., 2007a; Tóth et al., 2007b; Bárány et al., 2008; Tóth et al., 2009).
Most of the damage it makes derives from curiosity: the marten chews everything it is interested in. There are basically three reasons of this kind of damage (Heltai and Szőcs, 2008):

- Chewing for acquiring information: the reason of chewing is getting to know more of the object of their interest. Humans take unknown objects in their hands out of the same curiosity, touching it to get information about it; martens do the same by chewing.
- Playing: young animals perform chewing also as a play, and to strengthen their jaw, their teeth and their muscles while practising.
- Territorial behaviour: especially true to territorial males. These animals may chew anything that has the smell of another male. This is probably the origin of most of

the damages in cars. It is enough to have the car parked in another street, which happens to be inside the territory of another stone marten. Some cars are reported to have been destroyed by martens eight times in six weeks (SCHUSTER 2004, HERR ET AL. 2009).

Martens can cause damage, disturbance or inconvenience even by their everyday presence, their moving and normal daily activities. They can, for instance, push aside tiles on the roof while playing or running, and thus causing wet walls and mouldiness in the house. They very much like using insulation materials for their nests, by which they destroy the insulation of the house. They make unpleasant and loud noises when they are chasing each other around in their mating season, which can mean sleepless nights for the human residents. Playing of the cubs is again a very noisy activity, performed mainly at night. Their droppings piling in the attic, the rotten remains of their preys and urine flowing down on the walls are not only aesthetic-, but also financial and health problems.
Protection against stone martens can be built on the four pillars of prevention, alerting, excluding and trapping. We cannot, however, just arbitrary choose one solution most appealing to us from these four activities (with the logical exception of the process of prevention). Once the marten's appearance is observed, everything has to be done in order to succeed. The basis of protection is to notice its presence as soon as possible. Most of the times it is its typical dropping, or the noises it makes that shows its being around. In this case all the openings and holes, and all the ways it can get into the house have to be closed or blocked. Branches of trees hanging onto the roof need to be cut so that the marten could not jump over to the top of the house. "Collars" or umbrella-shaped equipments are advised to be put along the trunks of lonely big trees likely to be used for climbing up and down. It is important to terminate the availability of all the attractants for the marten (food, undisturbed shelter). The best solution would certainly be trapping and then translocating them from the area. The efficiency of trapping, however, is low, it most of the times works just as alerting.

Living together with the wild boar

The wild boar is known predominantly for its agricultural damage (BLEIER ET AL., 2012), but its occasional appearance in rural settlements is not rare, either. In recent years conflicts have risen in Budapest, too, residents of the capital feel helpless rage towards the uninvited guests (http://vadmalacok.blog.hu/). This phenomenon, however, is only new in Hungary. In 2003 Cahil et al. reported that a considerable wild boar population lived in the surrounding areas of Barcelona with 3 million residents. Wild boars living in Berlin do not only destroy private gardens, but also football grounds and city parks (KOTULSKI AND KÖNIG 2008). Their evaluation is also rather contradictory. 59 % of the people with negative attitude towards the presence of wild boar consider the species as "modern plague", 44 % demand population decrease, and 41 % are definitely afraid of these animals. According to the majority of the people accepting the presence of wild boar, this species does not cause any trouble (52 %), its presence can and should be tolerated (86 %), it is a positive thing to see wild boar in a city (77 %), though 67 % are also aware that population decrease should be carried out even with guns, if necessary. 9 % of the respondents even feed the animals. They would probably have given different answers, should they know that 18 % of the wild boar living in Berlin is infected with leptospirosis (JANSEN ET AL., 2007). At the 8th Vertebrate Pest Management Conference held in 2011 (JACOB AND ESTHER ED., 2011) an entire symposium was dedicated to the problems caused

by wild boar. At the symposium BOBEK ET AL. (2011) reported damages made in urban areas of Poland.

In the case of the wild boar, protection and the possibilities of management are sharply different from the ones with the stone marten. The marten does not make damages in public areas, contrary to private houses, which are very difficult to protect. Considering the wild boar, it is just the opposite: protecting private gardens is simple and easy, while its presence in public areas is a source of continuous conflicts. Actually it means that suitable and sufficiently strong fences can protect private gardens from wild boar. But public places or an entire city itself cannot be fenced around. Significant decrease or extirpation of the species from the urban areas is practically impossible.

Legal problems of urban wildlife management

In Hungary the species causing conflicts in inhabited areas belong to three legal categories: pests (e.g. rat, mouse); protected species (e.g. woodpecker, bats) (Act No. LIII. of 1996 – Nature Conservation Act); and game species (e.g. wild boar, stone marten) (Act No. LV. of 1996 – Hunting Act). These legal categories also define the potentials and possibilities of management and treatment. Practically anyone can use any instrument against the species regarded as pests. In the case of the damages made by protected species, however, owners are almost helpless, because the only way it is possible to disturb, trap, or maybe even kill the individual of a protected species causing damage is by getting the permission of the locally responsible Nature Conservation Authority. Protection therefore is strongly limited; moreover, according to the Hungarian legislation it is not possible even to claim for compensation in these cases. As for game species, in the sense of the Hunting Law, one can claim for compensation in the case of the wild boar, but not in the case of the stone marten, as the category of "damages caused by carnivore species" does not exist in the Hungarian Hunting Act. Their shooting can only be carried out with the permission of the police (Implementing regulation No. 253 of 2004. (31st of August)), and the legal possibilities of their trapping is also controversial and unexplained. The compensation defined by the law is rather questionable as well, because according to the law the game managers responsible for the damage are not allowed to hunt or to manage in inhabited areas. Moreover, they cannot even affect the most important factors attracting wild boar (shelter, food resources) in human settlements.

CONCLUSIONS

Urban wildlife management provides inexpensive solutions to questions, problems, necessities and opportunities concerning the management of certain wild animal species, taking into consideration the interests of all the affected parties involved as much as possible. In our case it means decreasing the abovementioned problems, while at the same time giving a chance for the conflict-species to survive in urban habitats, but making sure that their damages remain at a manageable level. This issue emerges in the case of a growing number of species moving into urban areas, or already proliferating there. Suitable solutions are being developed and worked out with the help of urban wildlife management (ADAMS 1994; ADAMS ET AL, 2005). Urban wildlife management is a specific discipline within wildlife biology, focusing on management and research of wild animal species in inhabited areas (ADAMS, 2005; HELTAI AND SZŐCS, 2008). Its primary field of research is managing and possibly improving the urban habitats of these species, reducing or preventing the damages they make, and taking part in creating or developing the necessary

legal regulations (McIvor and Conover, 1994; Decker and Chase 1997). Managing populations, occasional rescuing, increasing the density of some highly valuable species and decreasing the populations of others are all among the most crucial goals of urban wildlife management.

In Hungary we first of all need to establish and clarify the legal background. In this process responsibility should be removed from the game managers working outside the inhabited areas. Legal instruments should be offered for the management, and even for the trapping of both the game- and the protected species. Possibilities for protection have to be provided for the aggrieved parties. Nevertheless, the residents affected by these conflicts have to understand that they are the ones to defend their own private properties. It is their duty and their expense, too. They cannot expect and demand compensation from organisations that are not responsible for this situation.

These conditions all need to be fulfilled for the establishment of urban wildlife management companies. Because the conflict has already arisen...

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Review on Agriculture and Rural Development 2013. vol. 2. (1) ISSN 2063-4803

ANTIOXIDANT AND ANTIMICROBIAL ACTIVITY OF HERBAL TEAS MADE FROM HUNGARIAN MEDICINAL PLANTS

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ABSTRACT
Total phenol content and antioxidant activity of herbal teas made from different Hungarian medicinal plants, chamomile (*Matricaria recutita*), rose hip (*Rosa canina*), stinging nettle (*Urtica dioica*) and yarrow (*Achillea millefolium*) were determined. Total phenol content and ferric reducing power was highest in rose hip samples (6216 mg GAE/100 g and 1984 mg AE/100 g) followed by yarrow, chamomile and stinging nettle. Radical scavenging activity of some rose hip and yarrow samples were very similar (78.5 and 77.8%). There were significant differences in the measured values of the same teas from different producers. We found strong correlation between total phenol content and ferric reducing power, and also good correlation between phenol content and DPPH radical scavenging activity, indicating that heat resistant phenolics were mainly responsible for the antioxidant activity of herbal teas. According to our results, herb teas with the highest phytochemical content and antioxidant activity were purchased from the same producer indicating the importance of adequate handling of the herbs.

Keywords: chamomile, rose hip, stinging nettle, yarrow, antioxidant

INTRODUCTION

Medicinal plants have been used in the treatment of various diseases since ancient times. Nowadays, the consumption of herbal teas is associated with a healthy lifestyle and fitness. Teas from medicinal plants are thought to prevent disorders arising from oxidative stress. The antioxidative activity of these beverages is attributed to their polyphenolic content which in turn depends on the growing conditions of the plant. Most medicinal plants growing in Hungary are common in whole Central Europe but the wild chamomile flower of Hungary's Great Plain received "protected designation of origin" status from the European Commission. This flower is "strong, aromatic, sweet-smelling, slightly bitter-tasting and, during processing, does not disintegrate, is less powdery and its essential oil preserves better than the herbal medicine made from cultivated chamomile", according to the application for the protected status. On the other hand, not only the origin but the time of harvest, and processing and packaging can all influence the amount and effect of phytochemicals found in medicinal plants. Our aim was to investigate the polyphenol content and antioxidant activity of herbal teas made from rose hip, chamomile, yarrow and stinging nettle produced and packaged by different companies.

Rose hip is known for its high ascorbic acid content but it is also rich in other, phenolic type antioxidants like flavonoids, tannins, phenolic acids, and non-phenolics like carotenoids and essential oils (ERCISLI, 2007). Rose hip tea with hibiscus is a popular beverage and it is often consumed to substitute black tea. It is used for strengthening the immune system. Chamomile tea is used to cure cold and to soothe inflammation in the gastrointestinal tract. Its pharmacological activity is associated with the essential oil and flavonoid content. The main components in the essential oil are α-bisabolol and bisabolol

oxids. Major phenolic compounds are chlorogenic acids, ferulic acid glycosides, dicaffeoyl quinic acids and apigenin glycosides (RAAL ET AL., 2012). *Achillea millefolium* (yarrow) is used in traditional medicine to treat ailments of the kidney and bladder. It also contains essential oils and phenolic compounds, like chlorogenic acids, dicaffeoyl quinic acid derivatives, luteolin and apigenin glycosids (VITALINI ET AL., 2011). Nettle tea is used as a diuretic, in joint diseases and against rheumatic pain. Main phenolic compounds in stinging nettle are chlorogenic and caffeic acid and their derivatives (KOMES ET AL., 2011).

MATERIALS AND METHODS

Teas from medicinal plants

Chamomile *(Matricaria recutita)*
Rose hip (*Rosa canina*)
Stinging nettle (*Urtica dioica*)
Yarrow (*Achillea millefolium*)

All teas were purchased from the same three companies.

Brewing teas

100 ml boiling distilled water was added to 1 g of each herb, and was left to brew for 20 min. Teas were filtered and after cooling to room temperature were used for the measurements.

Determination of total phenol content

The Folin-Ciocalteu method was used. Teas were diluted before measurement as necessary. The measuring solution contained: 0.2 ml diluted tea, 0.2 ml ethanol (95%), 1ml distilled water, 0.1 ml reagent. After 5 minutes, 0.2 ml sodium carbonate was added to the mixture and was incubated for 60 min at room temperature. Absorption was measured at 725 nm in a Beckman DU-65 spectrophotometer. Total phenolics were expressed as mg gallic acid equivalent (GAE)/100 g weight of the herb.

Determination of ferric reducing power with a modified FRAP method

Reagent solutions: 0.2% of iron (III) chloride, and 0.5% of α,α'-dipyridyl solutions in absolute ethanol. Measuring solution: 2.00 ml of diluted tea sample + 6.00 ml of absolute ethanol + 1.00 ml of α,α'-dipyridyl + 1.00 ml of iron (III). Absorption was measured at 520 nm, strictly 2 min after mixing the ingredients. Ferric reducing capacity was expressed as mg ascorbic acid equivalent (AAE)/100 g herb.

Determination of radical scavenging activity by the DPPH method

1,1-diphenyl-2-picryl-hydrazil (DPPH•) was solved in absolute ethanol (100 μM). Then, 1 ml of this solution was added to 5 ml diluted tea sample. The discoloration of DPPH• was measured at 517 nm after incubation in dark at room temperature for 30 min. DPPH radical scavenging activity was calculated using the following equation:

$$\text{DPPH• scavenging effect (\%)} = (A_c - A_s)/A_c \times 100,$$

where A_c was the absorbance of the control and A_s was the absorbance in the presence of the sample.

RESULTS AND DISCUSSION

The highest total phenol content was measured in rose hip samples followed by yarrow, chamomile and stinging nettle (*Fig. 1*). There were significant differences in phenol content of the herbal teas from different producers. According to the data by ERCISLI ET AL. (2007), total phenolics in lyophilized samples of *Rosa canina* hips had the concentration of

9600 mg GAE/100 g. Our best result was about 6000 mg GAE/100 g showing that during tea making we have lost some ingredients.

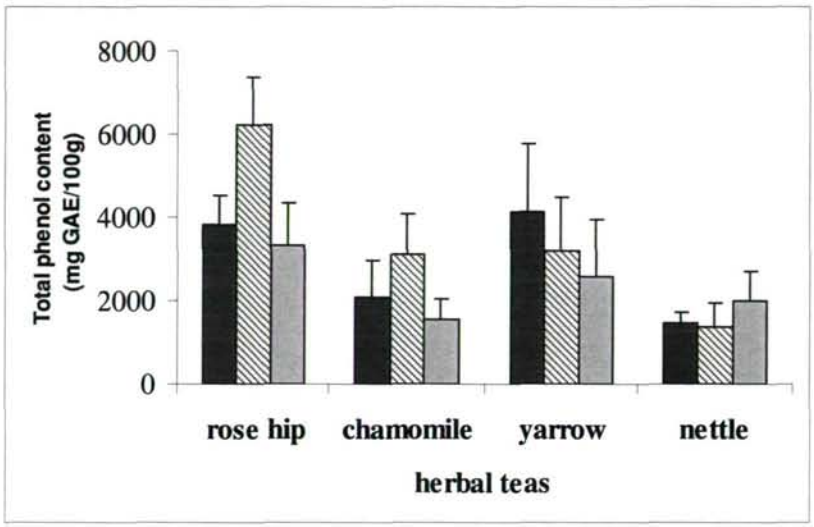


Figure 1. Total phenol content in herbal teas. Samples from different producers are indicated by the column filling pattern

Antioxidant capacities determined as ferric reducing power or free radical scavenging activity showed a similar picture to total phenol content, with rose hip having the highest value: 1984 mg AAE/100g and 78.5%, respectively. AOSHIMA ET AL. (2007) had similar results for DPPH radical scavenging activity of rose hip (82.5%), but obtained a very low value for chamomile (6.7%). Our results for chamomile ranged from 9 to 47% similar to the data of MILIAUSKAS ET AL. (2004) who measured values of 6.4% to 44.7% depending on the extraction method. These differences indicate that chamomile samples have highly variable content of active ingredients.

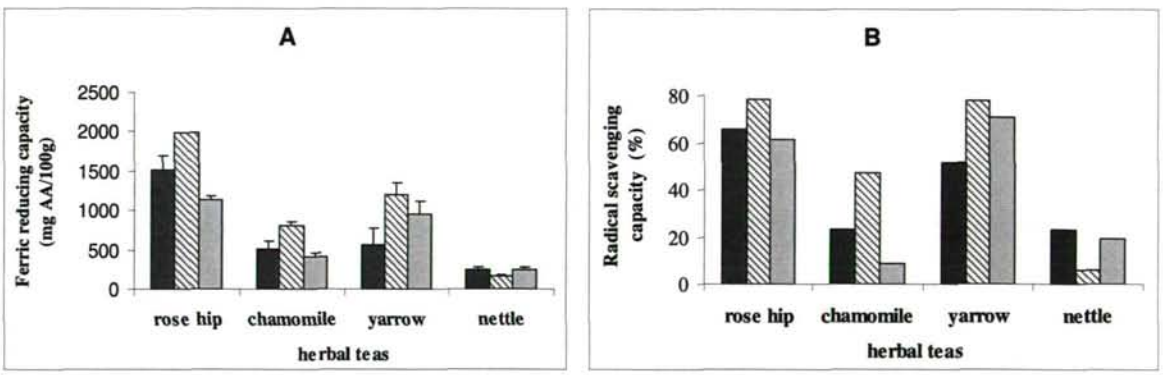
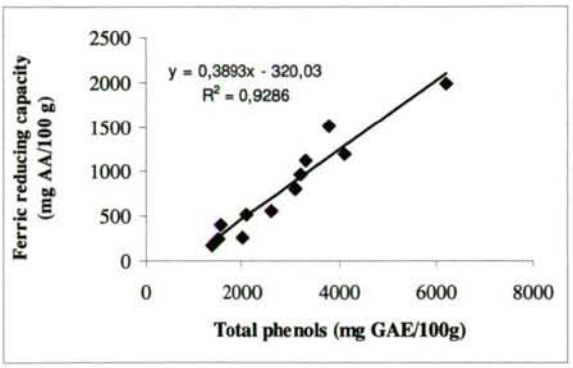


Figure 2. Antioxidant capacity determined as ferric reducing power (FRAP) (A) or radical scavenging activity (B) in herbal teas of different producers

We found strong correlation between total phenol content and FRAP (*Fig. 3*) and also good correlation between phenol content and DPPH radical scavenging activity (*Fig. 4*), indicating that mainly heat resistant phenolics are responsible for the antioxidant activity of herbal teas.



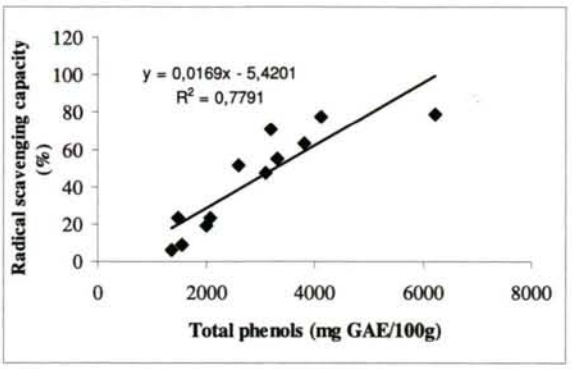


Figure 3. Correlation between total phenol content and FRAP
Figure 4. Correlation between total phenol content and DPPH radical scavenging activity

CONCLUSION

Herbal teas from Hungarian medicinal plants have good antioxidant properties but this varies greatly according to the producer company. It raises the necessity of standardizing the growing, harvesting and drying conditions for the herbs to achieve a more unique quality.

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Review on Agriculture and Rural Development 2013. vol. 2. (1) ISSN 2063-4803

EFFECT OF CULTIVATION SYSTEMS ON MAIZE PRODUCTIVITY AND PRODUCTION PROFITABILITY

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ABSTRACT
In the past decades maize was produced on the largest scale in Hungary. The extreme weather conditions and the rising energy prices of the last years forced the farmers to produce with the least input and with the highest yield stability possible.
Our research was carried out on the land of Vásárhelyi Róna Kft. where a 9-hectare area was partitioned for three equal parcels. The three parcels were cultivated with different basic cultivating methods: ploughing, loosening and strip tillage. Nine-nine different maize hybrids were sowed in each cultivated parcels. In the course of the research we examined the moisture content of the soil, the morphologic features of the hybrids and average yield by hectares. We calculated the total cost, theoretical incomings and earnings by growing maize per hectare.
According to our one-year research we came to the result that the most productive method was tilling proceeding even though it had the highest cost. On the other hand we found that the hybrids reacted differently to the various cultivation procedures. Realizing the results we suggest farmers should take notice of rational tilling and the importance of choosing hybrids.

Keywords: ploughing, ripping, strip tillage, maize hybrid, profitability

INTRODUCTION

Maize is grown in the largest area of Hungary for decades, its production area is 1.17 million hectares on average and the average yield is 6.96 million tons per hectare (HTTP1.). The extreme weather conditions of the last years in Hungary pointed out that the farmers need to adapt to changing terms by the help of agrotechnical factors. Farmers cannot influence the weather factors, but they can make some steps to prevent and repair weather losses. The soil, which suffers from tillage defects (compaction, texture run-down, gather dust, soil crusting) cannot reduce the losses which were caused by weather extremities. Mankind cultivates the land since ancient times, ploughing was the most widespread cultivation method until the 70's, when they started to think about the disadvantages of the ploughing and started to make steps to replace this cultivation method. It has to be promoted to leave out the traditional cultivation methods in the interest of the reduction of soil compaction, organic matter decrease, gather dust, carbon dioxide issue, soil vaporization (BIRKÁS 2000, GYURICA 2000, HAKANSSSON ÉS VOORHEES 1997, HOLLAND 2004, TÓTH 2005), and because it is more economical and more energy efficient (BIRKÁS 1993). The modernization of cultivation is necessary because of growing environmental burden, cost increase, climate changes and soil degradation. So today we are trying to cultivate our land with fewer turns, lower energy input and with sustainable solutions. There are several possibilities among the available cultivation methods which are suitable to save the moisture of the soil and decrease the number of turns (BIRKÁS 2001). Land use affects the soil in all respects, so it is necessary for the farmers to have specialized knowledge to understand the relationships from the context of soil attribute (GYURICZA 2001) so that they can select more suitable cultivation machines.

The goal of our research is to get practicable, realistic and economic results from the effects of three soil cultivation method (ploughing, ripping, strip tillage) on maize hybrids.

MATERIAL AND METHOD

Our research was carried out in 2012, in the area of the Vásárhelyi Róna Kft., the soil parameters are presented in *Table 1.*, and moisture specifics in *Figure 1.* We split the 9 hectare experimental area into 3 equal parts. The cultivation methods were different on the plots: ploughing, ripping and strip tillage. We sowed 9 maize hybrids (P9528, P9494, PR37N01, PR36V52, PR36V74, DKC4995, DKC5007, NK Lucius, NK Octet) on 25th April 2012 with 77000 seed/ha^{-1} seed densities.

During our field test, in 9 replications, we determined height of plant, area unit (2 running meter) of number of plant and number of corn-cob, length of corn-cob, fertility of corn-cob, number of grains per corn-cob and the yield.

The results were estimated with SPSS 18 program, two-factor analysis of variance. We calculated the requirement of fuel (l ha^{-1}) and work time (minute ha^{-1}) of soil cultivation methods, as well as we reviewed all charges of maize production. We calculated the return of three cultivation systems and all hybrids, than we received the profitability of maize production.

Table 1. Data of soil investigation of experimental area

Soil analysis parameters	Value
pH (KCl)	7.27
K_A	44
$CaCO_3$ (m/m%)	3.51
Humus (m/m%)	3.00
P_2O_5 (mg/kg)	177
K_2O (mg/kg)	581.33

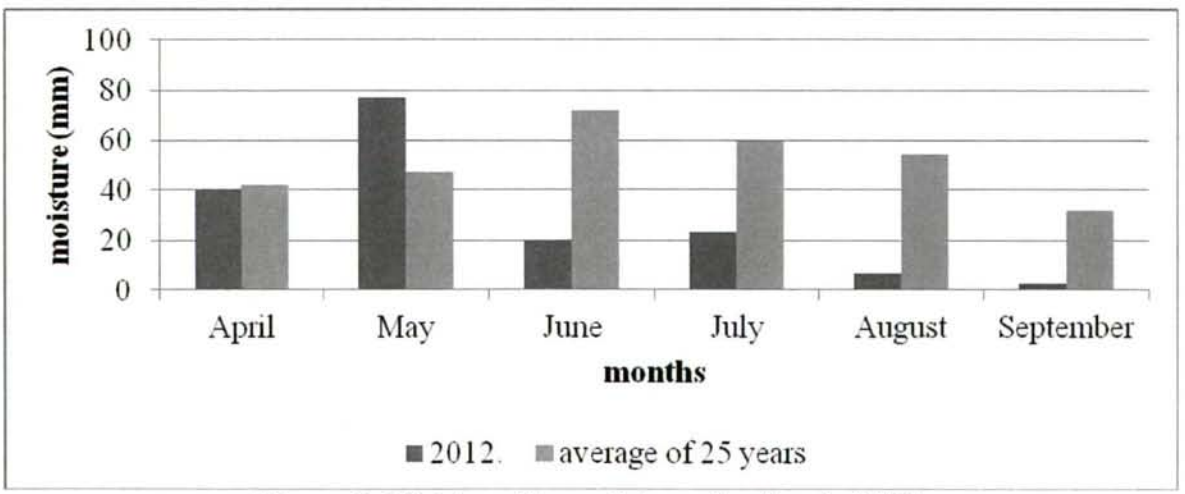

Figure 1. Moisture through investigation in 2012

RESULTS

Table 2. Comparison of soil cultivation systems on the basis of maize productivity parameters

parameters	soil cultivation systems	P9528	P9494	PR37N01	PR36V52	PR36V74	DKC4995	DKC5007	NK Lucius	NK Octet	Average
height of plant (cm)	ploughing	225.78	228.89	233.67	231.00	221.56	227.78	225.67	226.56	241.89	**229.20^a**
	ripping	222.33	219.11	225.22	220.44	222.56	226.89	223.22	229.67	198.67	**220.90^b**
	strip tillage	202.00	191.11	200.33	209.00	194.44	207.89	205.33	180.56	198.67	**198.81^c**
number of plant (piece per 2 running meter)	ploughing	11.56	9.89	11.56	11.78	11.11	11.33	12.11	12.44	11.56	**11.48^a**
	ripping	10.22	12.11	11.89	11.56	11.22	11.00	11.00	12.11	11.89	**11.44^a**
	strip tillage	10.78	10.00	11.56	11.11	10.78	11.33	12.00	11.22	10.89	**11.07^b**
number of corn-cob (piece per 2 running meter)	ploughing	11.00	9.00	9.67	6.89	5.33	8.00	11.11	11.89	8.67	**9.06^a**
	ripping	4.00	7.67	5.22	5.56	5.78	7.56	7.56	10.78	3.89	**6.44^b**
	strip tillage	11.44	6.00	8.11	8.89	3.44	6.11	5.89	10.22	3.89	**7.11^b**
length of corn-cob (cm)	ploughing	12.89	14.43	13.39	12.50	13.00	14.44	13.06	13.39	13.94	**13.45^a**
	ripping	10.33	11.89	11.28	10.17	10.56	13.39	11.89	14.78	9.06	**11.48^b**
	strip tillage	1.61	9.59	10.72	11.44	12.00	13.67	13.00	9.94	10.28	**11.36^b**
fertility of corn-cob (percentage)	ploughing	96.96	94.78	89.73	84.99	88.61	92.64	89.43	89.72	88.67	**90.61^a**
	ripping	82.08	82.09	80.49	66.40	66.08	80.68	68.27	89.15	87.63	**78.10^b**
	strip tillage	95.24	82.09	84.19	88.56	65.26	96.50	92.77	90.40	90.54	**87.28^a**
number of grains (piece per corn-cob)	ploughing	408.67	466.06	344.78	344.39	372.39	457.28	348.67	390.00	404.56	**392.98^a**
	ripping	175.72	201.39	163.89	142.33	145.00	201.56	156.33	268.22	203.56	**184.22^b**
	strip tillage	350.78	203.78	197.22	267.94	169.78	321.39	248.83	275.83	267.72	**255.92^c**
yield (t ha^{-1})	ploughing	4.67	2.72	3.58	3.25	2.21	3.60	3.17	5.57	4.18	**3.66^a**
	ripping	2.40	4.96	3.62	3.72	2.40	1.62	1.98	2.27	2.17	**2.79^b**
	strip tillage	2.66	1.60	1.96	1.29	0.82	1.39	1.27	2.90	2.79	**1.85^c**

On the average of hybrids significant difference showed between the soil cultivation systems considering the height of plant. The highest plants developed in the plough plots, followed by the ripping area and we measured the smallest plants in the strip tillage parcels (*Table 2*).

By studying the effect of soil cultivation systems on the average of hybrids we can claim that significantly bigger number of plant per area unit developed by the ploughing and by the ripping system compared to the strip tillage area (*Table 2*).

On the average of different hybrids, studying the effect of soil cultivation systems we found that those plants developed significantly bigger number of corn-cob per area unit, which came from ploughing primary tillage compared to the ones from ripping or strip tillage (*Table 2*).

By investigating the effect of cultivation systems on the length of corn-cob, significantly higher length values can be observed on the plants, which come from plough cultivation, than by ripping and strip tillage (*Table 2.*).

On the average of the studied hybrids the poorest fertilisation occurred in the case of plants in ripping tillage, while fertility was significantly better on corn-cob of plants from plough tillage and strip tillage parcels (*Table 2*).

We can confirm statistically 5% difference in the number of grain of corn-cob between the soil cultivation systems. The highest number of grains per corn-cob (392.98 grain per corn-

cob) developed in ploughed plots and the fewest grain per corn-cob (184.22 grain per corn-cob) in the area of ripping tillage (*Table 2*).
On the average of 9 hybrids to consider the effect of soil cultivation systems we can claim that there are differences in yields which can be statistically confirmed. The highest yield was in ploughed plots, the lowest yields weighed in the area of strip tillage (*Table 2.*).
We experienced the biggest expense of fuel (53.5 l ha^{-1}) and work time (90 minute ha^{-1}) in plough tillage (*Table 3*). This followed by the ripping with use of fuel (40.5 l ha^{-1}) and work time (71 minute ha^{-1}). We used the fewest fuel (22 l ha^{-1}) on strip tillage, and the strip tillage was the best expenditure of work time (70 minute ha^{-1}).

Table 3. Expense of fuel (l ha-1) and work time (minute ha-1) of soil cultivation methods

	Ploughing		Ripping		Strip tillage	
	l ha^{-1}	minute ha^{-1}	l ha^{-1}	minute ha^{-1}	l ha^{-1}	minute ha^{-1}
Stubble stripping	4	10	4	10	4	10
Fertilization	1.5	6	1.5	6	0	10
Primary tillage	34	42	17	20	14	30
Secondary tillage	10	12	14	15	-	-
Sowing	4	20	4	20	4	20
All	**53.5**	**90**	**40.5**	**71**	**22**	**70**

We studied the profitability of maize production by hybrids and also by soil cultivation systems (*Table 4*). On the average of hybrids the highest cost was on the ploughing tillage system, this was 237230 HUF per hectare expense. The friendliest charge was the strip tillage; its average expense was 221659 HUF per hectare.
By calculating with the maize prices of the Budapest stock exchange at the end of September (*Table 4*) – due to deviation of yield – the ploughed area produced the most return (305512 HUF per hectare), followed by ripping parcels (256361 HUF per hectare), and we could register the fewest return on the strip tillage (188007 HUF per hectare).

Table 4. Profitability calculations (HUF ha-1)

	expense			return			profit		
Hybrids	**ploughing**	**ripping**	**strip tillage**	**ploughing**	**ripping**	**strip tillage**	**ploughing**	**ripping**	**strip tillage**
P9528	238515	234245	262935	371090	223540	240440	132575	-10705	-22495
P9494	239427	235157	218857	244340	389940	171540	4913	154783	-47317
PR37N01	235782	231512	215212	300240	302840	194940	64458	71328	-20272
PR36V52	239427	235157	218857	278790	309340	151390	39363	74183	-67467
PR36V74	239427	235157	218857	211190	223540	120840	-28237	-11617	-98017
DKC4995	237094	232794	216524	301540	238126	157890	64446	5332	-58634
DKC5007	238942	234672	218372	273590	196240	150090	34648	-38432	-68282
NK Lucius	233229	228959	212659	429590	215090	256040	196361	-13869	43381
NK Octet	233229	228959	212659	339240	208590	248890	106011	-20369	36231
Average	**237230**	**232957**	**221659**	**305512**	**256361**	**188007**	**68282**	**23404**	**-33652**

On the basis of our results of one year investigation on 3 soil tillage systems and 9 hybrids we can say that the most effective cultivation system is the ploughing, followed by the ripping and in the end there is strip till, where there was loss in maize production (*Table 4*).
Finally we can conclude that the investigated parameters were influenced by not only the soil cultivation systems, but significantly by the maize hybrids as well

CONCLUSIONS

On the basis of our research, which was carried out in 2012, under extremely dry conditions we can conclude that the height of the plant, the area unit of number of plant and number of corn-cob, length of corn-cob, fertility of corn-cob, number of grains per corn-cob and the final yield are significantly affected by the soil tillage system.
The statement of BIRKÁS (1993) was confirmed, because biggest expense of fuel (53.5 l ha^{-1}) and work time (90 minute ha^{-1}) was in plough tillage. At the same time the two saving tillage methods resulted in fewer yield than the plough, it fundamentally determined the profitability. So our trial shows that we are not able to leave out completely the ploughing from the Hungarian maize production and we can determine that it is very important to compare the cultivation systems in the point of economical view.
Regarding to our field test, we can notice that the speciality of hybrids shows up in the development parameters of plant, in the yield and the result of economic calculations. So the investigated parameters are significantly influenced by not only the soil tillage systems, but also the maize hybrids. This fact drew our attention to take into account not only the parameters of soil and climatic primary tillage, but we mustn't forget the plant central soil tillage (BIRKÁS, 2010), which predicts the effect of hybrid specific tillage.

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Review on Agriculture and Rural Development 2013. vol. 2. (1) ISSN 2063-4803

OBSERVATION OF SURFACE ISOCYANATE FORMATION ON THE CEO_2 AND ON RH SUPPORTED BY CEO_2

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ABSTRACT
Infrared spectroscopic studies showed the formation of isocyanate surface complex in the NO + CO reaction on supported noble metal catalysts. As this surface complex plays decisive role in the undersived side reaction of the catalytic transformation of the auto exhaust gases, great attention should be payed to its properties and to the mechanism of its formation. For this purpose the interaction of NO + CO gas mixture with supported gold, palladium and rhodium catalysts was investigated.When the adsorption and reaction of NO with CO two absorption bands appeared in the FTIR spectra of Rh/CeO_2 at 2180 and 2210 cm^{-1}, which were not observed following the adsorption of reactants and products. Adsorption of isocyanate acid on pure CeO_2 yielded the same spectral features suggesting that these bands belong to adsorbed isocyanate, NCO, species bonded to the CeO_2. These results suggest that spillover process of NCO from the Rh onto support proceeds even in the case of CeO_2 used as a solid oxidizer in the three-way catalyst. NCO attached to ceria reacts with H_2O resulting in the release of NH_3.

Keywords: Rh/CeO_2 catalyst, support, adsorption, NO + CO reaction, isocyanate formation,

INTRODUCTION

In the elucidation of the reaction mechanism of a catalytic process it is important to establish the reaction intermediates and their possible role in the reaction. In most cases, however, this is not an easy task as a real reaction intermediate exists only transitorily and in a very low concentration on the catalysts.
One of the most important areas of the environmental protection is decreasing air pollution. Converting the produced materials in catalyst way has great part in removing the toxic materials emitted by chemical factories and cars. A possible way of removing NO of the exhaust is a catalytic reaction with reduced gases, especially CO.
Infrared spectroscopic studies showed the formation of isocyanate surface complex in the NO + CO reaction on supported noble metal catalysts. As this surface complex plays decisive role in the undesired side reaction of the catalytic transformation of the auto exhaust gases, great attention should be paid to its properties and to the mechanism of its formation. This features seems to confirm the original assumption of Unland namely that NCO is responsible for the undesired formation of NH_3 in automobile exhaust catalysis (UNLAND, 1973). Recent studies performed on supported Rh confirmed both the formation of NCO, in the catalytic reduction of NO with CO and hydrocarbons and its migration from the Rh onto the support (KONDARIDES ET AL., 2000).

MATERIAL AND METHOD

Rh/CeO_2 catalyst was made impregnation of CeO_2 (ALFA AESAR, surface area: 50 m^2/g) in the solution of $RhCl_3 \cdot 3H_2O$. The dried suspension was pressed into self-supporting wafers using a Ta mesh oxidized in the IR cell at 573 K for 30 min and reduced at 673 K in

the presence of 100 Torr H_2 for 60 min. The gases used were of commercial purity (Linde), CO (99.97%), NO (99%). The isocyanic acid was prepared by the reaction of H_3PO_4 and KOCN (SOLYMOSI ET AL., 1979). NO and HNCO was purified by fractional distillation.

Infrared spectra were recorded with a Biorad (Digilab. Div. FTS 155) instrument with a wave number accuracy of ±4 cm^{-1} (*Fig. 1*). Typically 128 scans were collected. All of the spectra were taken without the use of a scaling factor (f = 1.0). Catalytic studies have been performed in a closed circulation system. In this case the reaction was followed by analyzing the composition of the gas phase with a Quadrupole mass spectrometer.

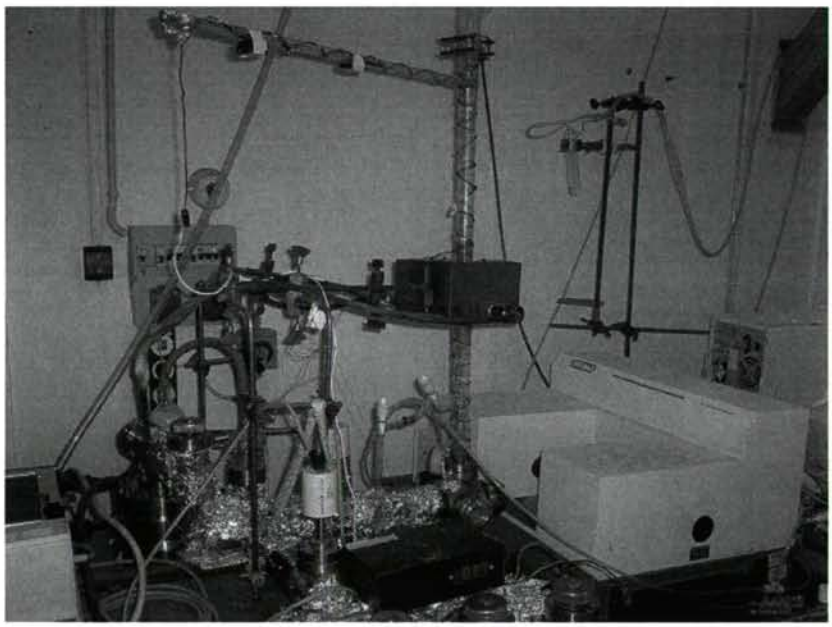

Figure 1. FTIR 155 set

RESULTS AND DISCUSSION

Co-adsorption of NO + CO (1:2) gas mixture on 5% Rh/CeO_2 at 300 K produced intensive absorption bands at 1750 and 1922 cm^{-1} due NO, and pair of band at 2105 and 2037 cm^{-1} corresponding to $Rh^+(CO)_2$. Heating the sample to 373 K, caused only a slight shift of the position of NO and CO bands. New spectral feature peaking at 2180 cm^{-1} was detected first at 473 K, which became larger and winder at 573 K, and attenuated only at 673 K (*Fig. 2A*). Deconvolution of the broad band showed that it consists of two components absorbing at 2210 and 2171 cm^{-1}. Note that these spectral features were not detected on FTIR (*Fig. 1.*) spectra of pure CeO_2 (T_R = 673 K) exposed to NO + CO gas mixture at 373-573 K.

Mass spectrometric analysis f the gas phase during gradual heating of the sample (6.5 K/min) in the presence of reacting gas mixture indicated that the reaction between NO and CO on 5% Rh/CeO_2 starts at ~423 K producing N_2, CO_2 and a small amount of N_2O.

The reaction was completed at 573-583 K. In the following experiments I examined the stability of the new bands produced at 573 K under continuous evacuation. I found that both bands remained practically intact up to 473 K. At higher temperature first the feature at 2210 cm^{-1} disappeared followed by the band at 2171 cm^{-1}. As neither the adsorption of the reacting gases (NO, CO), nor that of the products (N_2O, N_2, CO_2) gave such bands, I tentatively attribute them to the vibration of isocyanate species formed in the reaction.

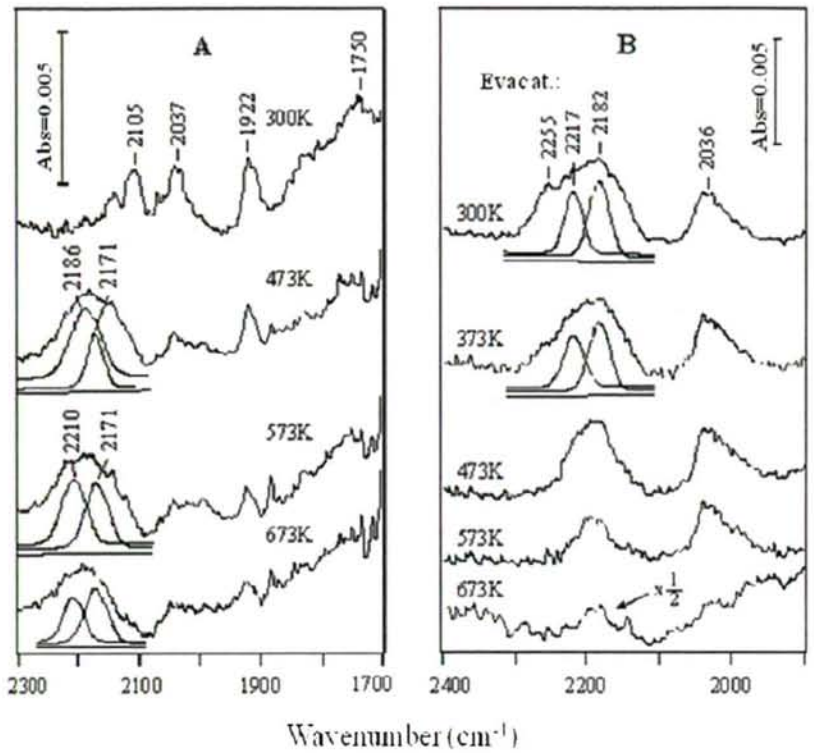

Figure 2. (A) Effect of temperature on the FTIR spectra of 5% Rh/CeO_2 in the presence of 20 Torr NO + 40 Torr CO. Sample was degassed at 300 K before registering of any spectra. (B) Effects of temperature on the FTIR spectra of adsorbed NCO produced by HNCO adsorption on 5% Rh/CeO_2. The sample was kept for 15 min at the given temperature.

In order to ascertain further the nature of absorption bands formed in the NO + CO reaction, I undertook the study of the adsorption of HNCO on samples used, which provides the easiest way to determine the position of NCO on the support and on the metals. First of the results was obtained on pure, metal-free CeO_2 (T_R = 673 K). Exposure of this sample to a very low pressure of HNCO at 300 K produced a weak band at 2180 cm^{-1}, the intensity of which increased with the rise of HNCO pressure and slightly shifted to higher wavenumbers (*Fig. 3A*). At higher HNCO pressure the band became wider clearly composed of two features at 2207-2210 and 2180-2184 cm^{-1}. Further increase of the pressure led to the appearance of absorption bands at 2254 cm^{-1} (not shown), which belong to the molecularly isocyanic acid (HERZBERG AND REID, 1950).

Degassing the sample at 300 K eliminated these spectral features and attenuated the band at 2210 and 2184 cm^{-1}. Gradual heating of the sample under continuous degassing caused further weakening of these bands. The 2210 cm^{-1} bands disappeared first above 473 K and then the 2184 cm^{-1} band moving to 2176 cm^{-1} did it at 673 K after several hours (*Fig. 3B*). During the heating the appearance of new bands were not experienced. Taking into account the previous results obtained on different oxides both bands at 2210 and 2180-2184 cm^{-1} are attributed to the asymmetric stretch of NCO species attached to CeO_2. The appearance of two bands suggests the presence of two adsorption sites, perhaps Ce^{4+} and Ce^{3+}. The stability of NCO on ceria is similar to that observed on titania and alumina (SOLYMOSI AND BÁNSÁGI, 1979).

Similar experiments were performed with 1% Rh/CeO_2 (T_R = 673 K). At very low HNCO pressure we obtained a weak band at 2182 cm-1 and three others at 2103, 2053 and 2036 cm^{-1}. These latter ones clearly belong to the adsorbed CO formed in the decomposition of NCO. On 5% Rh/CeO_2 only one CO band appeared at 2036 cm^{-1}. On the increase of the HNCO pressure the 2182 cm^{-1} band broadened and a high frequency band at ~2217 cm^{-1} clearly developed. A spectral feature at 2255 cm^{-1} due to molecularly bonded HNCO also appeared. This is shown in Fig. 2B. Annealing the adsorbed layer during continuous degassing caused an attenuation of the band above 373 K. The disappearance of the 2217 cm-1 band occurred above ~473 K and that of the 2182 cm-1 band at 673 K.

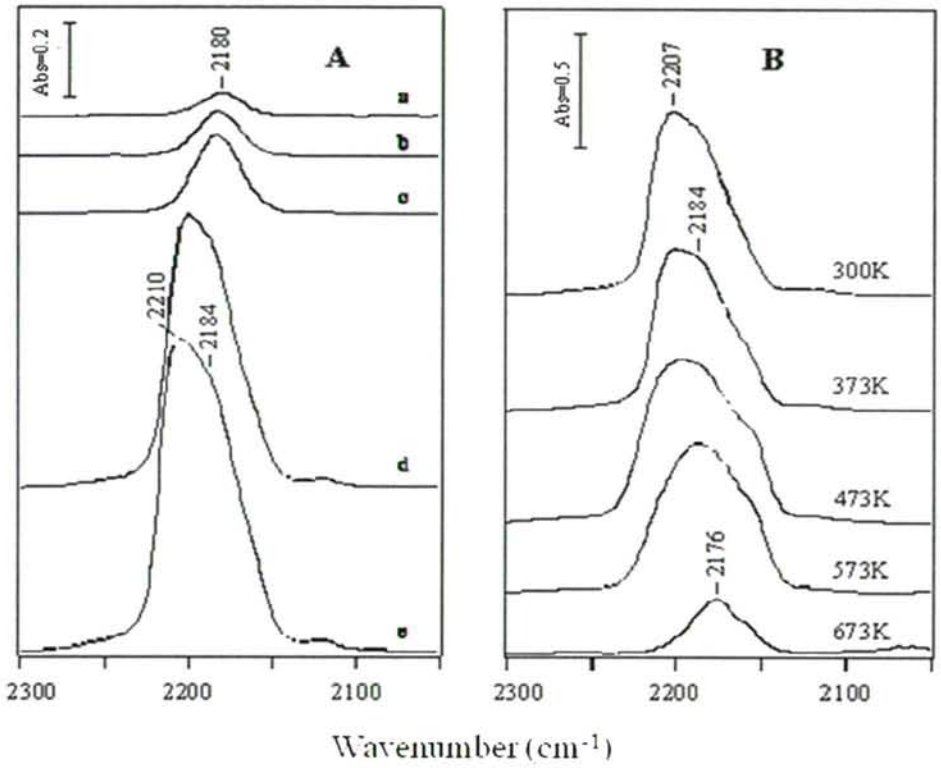

Figure 3. (A) FTIR spectra of CeO_2 (TR = 673 K) as a function of isocyanic acid exposure at 300 K. The pressure of HNCO was (in Torr) (a) 2.8 x 10^{-3}, (b) 8.2 x 10^{-3}, (c) 1.1 x 10^{-2}, (d) 3.0 x 10^{-2}, (e) 6.0 x 10^{-2}. (B) Effect of degassing temperature on the stability of adsorbed NCO produced by HNCO adsorption on CeO_2. The sample was kept for 15 min at the given temperature.

Some measurements have been carried out concerning the reaction of NCO produced by HNCO adsorption over CeO_2 and Rh/CeO_2 at 300 K. Isocyanate species on ceria decomposed to N_2 and CO above 473 K. A small amount of CO_2 also evolved indicating the oxidation of NCO or CO by the reactive oxygen of CeO_2. Same products were found when Rh was deposited on CeO_2, but the evolution of gases started at somewhat lower temperature. The product distribution basically changed when H_2O was admitted in the IR cell. In this case NH_3 became the major product indicating that a fraction of NCO reacted with H_2O. The presence of Rh was advantageous for the NH_3 formation. Mass spectrometric data are presented in *Figure 4*.

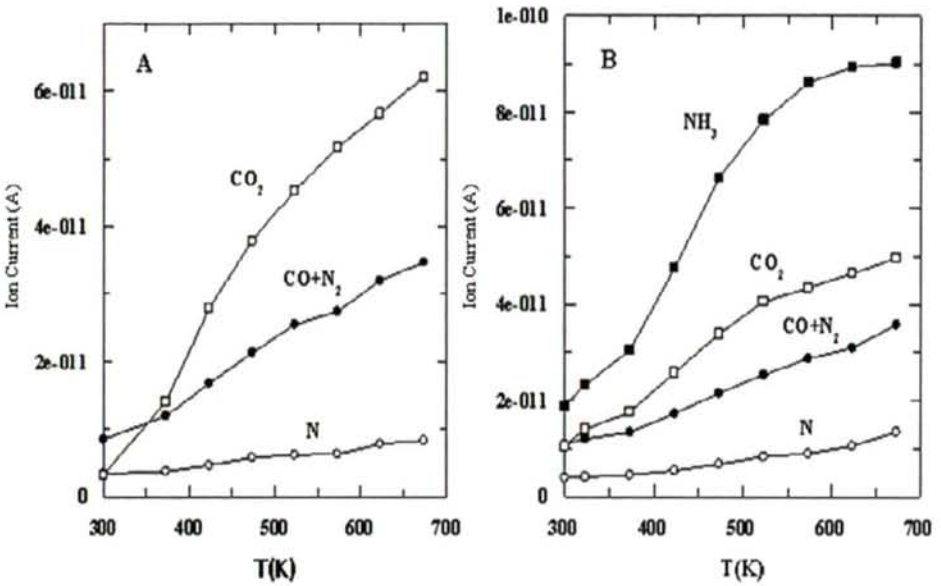

Figure 4. Effects of temperature on the reaction products of adsorbed NCO on CeO_2 in the absence of H_2O (A) and in the presence of 2.0 Torr of H_2O (B). Surface NCO was produced by HNCO adsorption at 300 K.

CONCLUSIONS

The formation of isocyanate in the NO + CO reaction and in the HNCO adsorption has been established on Rh supported by CeO_2 used as an oxidizer in the three-way catalyst.
As in other cases NCO formed on the Rh spill over onto the CeO_2, where it is accumulated and stabilized.
Although NCO is residing on the CeO_2, it reacts with H_2O above 473 K yielding NH_3.

ACKNOWLEDGEMENT

A loan of rhodium chloride from Johnson-Matthey PLC and the financial support of OTKA (Contracts T 38233 and T 43251) are gratefully acknowledged.

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Review on Agriculture and Rural Development 2013. vol. 2. (1) ISSN 2063-4803

THE EFFECT OF MINERAL FERTILIZATION ON HEAVY METALS CONTENT IN TOMATO FRUIT

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ABSTRACT

The goal of our study was to investigate the effect of different mineral fertilization doses on the heavy metals content (Fe, Mn, Cu, Zn, Ni, Co, Cr, Pb and Cd) in tomato fruit grown in uncontaminated area. The heavy metals bioaccumulation rates have also been investigated.

The experience was done in a cambric cernosium soil, with low acidity reaction, very good content in nitrogen, phosphorus and potassium and the high natural fertility potential favorable vegetables cultivation in Romanian Western Plain area. Also, this soil is very rich in iron, zinc, cooper and cobalt but fall below acceptable parameters under the laws of our country.

The study was performed on control soil samples (without fertilizers) and soil samples after differentiated NPK fertilization in variable dozes: $N_{30}P_{30}K_{30}$, $N_{45}P_{45}K_{45}$, $N_{60}P_{60}K_{60}$ and $N_{120}P_{60}K_{60}$.

Although the soil analyses showed the presence of cobalt, chromium and lead in certain concentrations, except for cadmium which is not detectable, in tomatoes grown in the investigated area these heavy metals not found. Other micronutrients were very low values, well below the legal maximum allowed in vegetables cultivated in Romania. These results suggest that this area is favorable to ecological vegetables crops.

Keywords: mineral fertilization, heavy metals, bioaccumulation rates, tomatoes

INTRODUCTION

Tomato (*Lycopersicum esculentum*) is the most popular and widely cultivated seasonal fruit vegetable crop; it is grown in the backyard of most people's home (SAINJU, 2003).

Heavy metals occur naturally in soils, and some of these, such as copper (Cu), zinc (Zn), and cobalt (Co), play an important role in the nutrition of plants and animals, while others, such as cadmium (Cd), lead (Pb), and arsenic (As), have deleterious effects on various components of the biosphere. Normally, these elements are present in the soil at concentrations or forms that do not pose a risk to the environment, but their levels can be altered by different anthropogenic routes (LIMA, 2009).

Depending on the physical and chemical properties of the soil (particularly pH and redox potential), heavy metals are mobilised in the soil solution and are adsorbed by the plants. Some heavy metals reach the soil directly, under the form of fertilisers used as a supplement for plant nutrition or indirectly, as a result of amendaments or other chemical substance applications (herbicides, insecticides) (GOGOASA, 2004) and industrial emissions, transportation, harvesting process, storage and sale (NORMALIZA, 2009). Heavy metals may impair plant physiology by reducing respiration and growth, interfering with photosynthetic processes and inhibiting fundamental enzymatic reactions if accumulated at high concentrations. When these toxic metals are present in soil at a low concentration, plants continue to grow uniformly despite accumulating these metals. The ability of plants to accumulate heavy metals into their organs may hence be used to monitor soil pollution, and in particular the amount of heavy metal (MALIZIA, 2012).

During the last few decades, the toxicity of heavy metals has drawn attention of many environmental scientists. Heavy metal accumulation leads to the loss of agricultural yield and hazardous health effect. Food chain contamination by heavy metals has become a burning issue in recent years because of their potential accumulation in biosystem through contaminated water, soil and air (LOKESHWARI, 2006).

MATERIAL AND METHOD

Soil samples were taken 0-25cm depth and were collected before the establishment of tomato crop. The fertilization was applied in spring, with four weeks before tomatoes plantation. Were use dry/granulated fertilizers NPK 15:15:15 and the nitrogen high dose supply with urea application (MAIA, 1983). No herbicides were used.

Analytical method of soil samples: The soil samples were analyzed by method recomanded by SR ISO: 11047 based on the measuring of heavy metals absorbance in aqua regia extracts and were determined by atomic absorption spectrometry in air/acetylene flame using Atomic Absorption Spectrometer contrAA®300 by Analytik Jena, using standard work conditions and the wavelength dominate (λ) for each chemical element. The correlation coefficient for the calibration curves (r^2) its: Fe - 0.9988, Mn - 0.9959, Cu - 0.9942, Zn - 0.9873, Ni - 0.9952, Co - 0.9998, Cr - 0.9761, Pb - 0.9975 and Cd - 0.9928. For iron, manganese, cooper and zinc determination were using diluted samples of 1:10 in deionized water; nickel and lead were using work solution. Concentrations have been reported as mean values of three replicates.

Analytical method of tomato samples: Tomatoes samples were collected on June-July at thoroughly fruit maturity. 20.00 g fresh tomatoes were dried at 105^0C to 3 hours, calcinated at 650^0C for 3 hours; added 10.00 mL pure HNO_3 0.5N solution and to run dry. The mineral residue were solubility in 25.00 mL pure HNO_3 0.5N (MAIA, 1983). This solution was used for heavy metals determination under similar conditions of soil samples. All chemicals used in this study were analytical reagent grade (Merck); deionized water.

Heavy metals **bioaccumulation rate (BR)** in the tomato fruit, which represents the percentage of the element present in the tomatoes in relation to total content in the soil (VYSLOUZILOVA, 2003), was calculated according the formula:

$$BR = \frac{Me_{plant}}{Me_{soil}} \cdot 100 \ (\%)$$

where: Me_{plant} = concentration of metal in the tomatoes (mg/kg); Me_{soil} = concentration of metal in the soil (mg/kg).

RESULTS

A fertilizer is said to be complete when is contain nitrogen, phosphorus and potassium. Nitrogen (N), phosphorus (P) and potassium (K) are in quantitative terms the most important minerals for the tomato fruit as they account for more than 90% of the mineral content (SAINJU, 2003). Of these three nutrients, nitrogen and phosphorus are more important for tomato plant. Phosphorus it has low mobility and availability in soils. Phosphorus availability in the soil is generally improved by the addition of N to the K (HABY, 2011).

Tomatoes need moderate to high levels of P and K (ARSHAD, 1999). From total content of metals in soil, only a small part is available. Metal availability strongly depends on pH, which is influenced by the level of mineral fertilization (SAINJU, 2003).

The soil properties also influence the uptake of heavy metals (MEDIOUNI, 2006). The cernosium soils have normal heavy metals content. The mean concentrations of heavy metals in this soil is: Mn - 200-2000 mg/kg (GOIAN, 2000), Cu mobile forms - 5-11 mg/kg, Co - 12-29 mg/kg, Pb - < 20 mg/kg, Cd – 1.2-1.5 mg/kg, Zn - 25-70 mg/kg and Co- in trace (IANOS, 1995).

The experimental data of heavy metal contents in soil are presented in *Table 1*. The studied area presented normal levels of heavy metals. Our experimental data are in agreement with data from the literature (GOIAN, 2000; BORDEAN, 2011) for soil and regional condition. The order of accumulation of heavy metals in soil samples was: Fe > Mn > Zn > Ni > Pb > Cu > Cr > Co > Cd. The heavy metals distributions in researched soil were lowest content values that the WHO/FAO maximum permissive limits: Pb – 100, Cd - 3, Ni – 75, Cr - 400 mg/kg.

Table 1. Heavy metals concentrations in soil

	Heavy metals content (mg/kg dry matter)								
	Fe	**Mn**	**Cu**	**Zn**	**Ni**	**Co**	**Cr**	**Pb**	**Cd**
Soil samples*	4340.78	231.92	7.68	47.87	12.87	5.03	6.08	11.51	-
Normal values**	-	900	20	100	20	15	30	20	1
Warning threshold**	-	1500	100	300	75	30	100	50	3
Intervention threshold**	-	2500	200	600	150	50	300	100	5

Source: *own research; **Ordinance 756/1997.

Although the soil analysis showed that is very rich in iron, zinc, copper and cobalt but fall below acceptable parameters under the laws of our country (ORDINANCE 756/1997), in tomato fruit samples these quantities are very low, well below the legal maximum allowed in vegetables. Maximum limits accept in Romanian legislation for heavy metals content in vegetables: Cu - 5.0 mg/kg fresh matter, Zn - 15.0 mg/kg, Pb - 0.5 mg/kg and Cd - 0.1 mg/kg (ORDINANCE 975/1998). The concentrations of heavy metals in vegetables were in according with the WHO/FAO maximum permissive limits: Pb - 0.3, Cd - 0.2, Ni - 10, Cr - 2.3 mg/kg. The mean values of Fe, Mn, Cu, Zn and Ni concentrations in tomato are given in *Table 2*.

Table 2. Micronutrients in tomato fruit

Fertilization doses	**Heavy metals content (mg/kg dry matter)**				
	Fe	**Mn**	**Cu**	**Zn**	**Ni**
Control	4.49	0.815	0.860	2.460	0.106
$N_{30}P_{30}K_{30}$	4.84	0.831	0.878	2.489	0.139
$N_{45}P_{45}K_{45}$	6.20	1.010	1.107	2.496	0.165
$N_{60}P_{60}K_{60}$	4.56	0.663	0.564	1.621	0.107
$N_{120}P_{60}K_{60}$	5.87	1.041	0.564	2.823	0.186

Source: own research

Iron is the abundant metal; is a link element between macro and microelements. Fe has the highest content in tomatoes by $N_{45}P_{45}K_{45}$ fertilization doses (6.20 mg/kg) and the lowest content in Fe was identified a control samples (4.49 mg/kg). Mn highest accumulation (1.041 mg/kg) is observed a $N_{120}P_{60}K_{60}$ fertilization doses. The Zn level was higher everything to the maximum fertilization doses studied. The concentration of cooper content ranged from 0.564-1.107 mg/kg. Ni is present only in trace at 0.106-0.186 mg/kg.

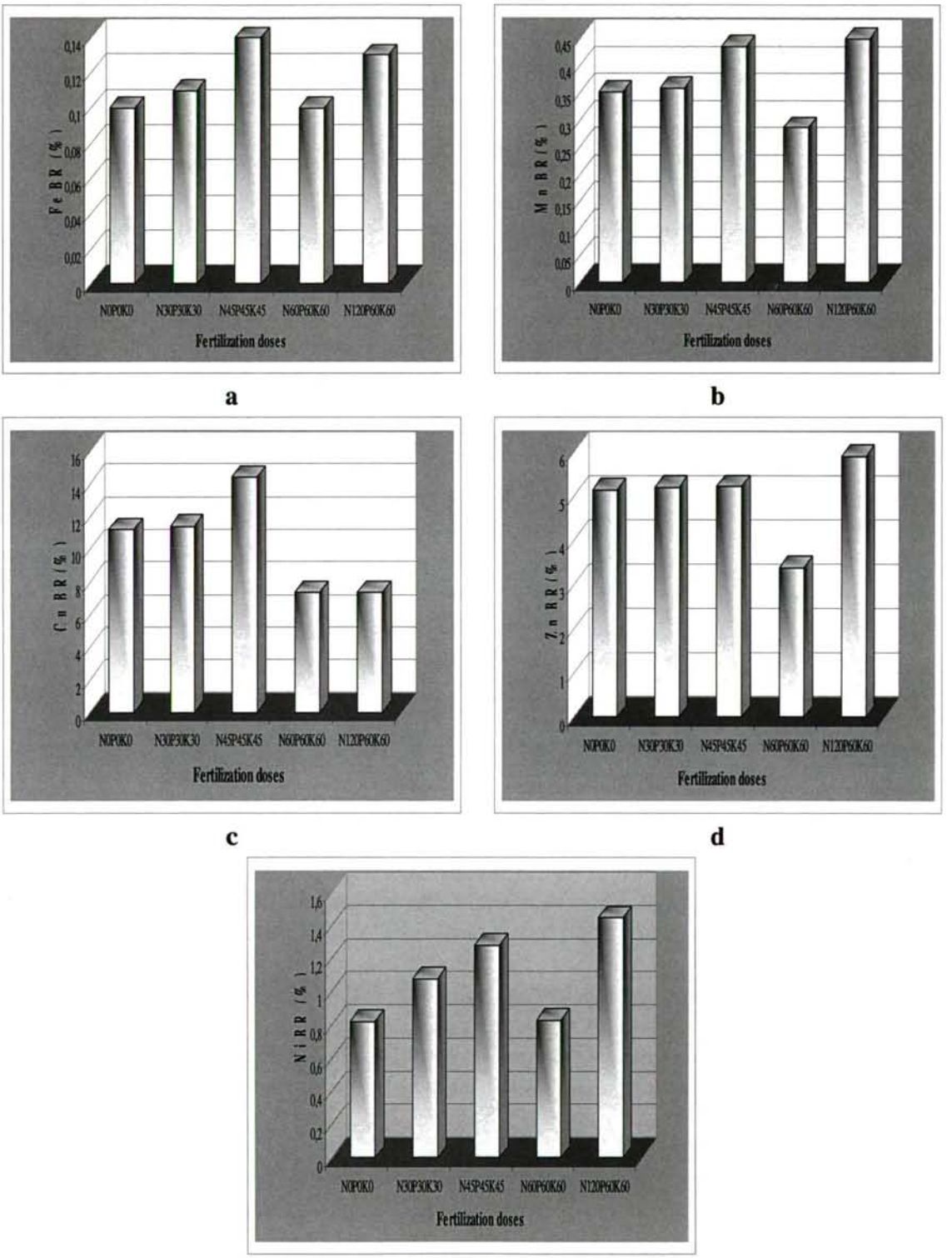

Figure 1. Bioaccumulation rate of iron (a), manganese (b), cooper (c), zinc (d) and nickel (e) in tomato fruit

Source: own research

The order of heavy metals content in tomato fruit samples was: Fe > Zn > Cu > Mn > Ni.

In general, plants do not absorb or accumulate lead. However, in soils testing high in lead, it is possible for some lead to be taken up. Higher concentrations are more likely to be found in leafy vegetables and on the surface of root (GOGOASA, 2004).

Although the soil analyses showed the presence of cobalt, chromium and lead in certain concentrations, except for cadmium which is not detectable, in tomatoes grown in the investigated area these heavy metals not found.

Heavy metals and nutritive contents of tomatoes depend on growing conditions (MITEVA, 2001). OLSEN (1972) found that phosphorus fertilisation at high rates caused an increase in Zn deficiency in plant and PATRA et al. (1982) found that an application of P increased Fe content of the plant with a decrease in Zn, Cu and Mn content. Excess level of P in the soil can decrease the solubility of Fe and its translocation in tomato, thereby increasing its deficiency. The toxicity in tomato appears when Mn concentration in the soil is >80 mg/kg and in the plant >1000 mg/kg. The toxicity can be reduced by applying water soluble P fertilizer, such as triple superphosphate, which reduces Mn availability. High P level in the soil can also reduce Zn availability to tomato and results deficiency (SAINJU, 2003). In their similar studies, ATAOGLU and SEZEN (2004) were found that N application increases the Zn content of the plant parts while Zn content goes down with P application. K fertilization has no effect on Zn content. Their results show broad agreement with our study.

Figure 1 illustrates the bioaccumulation rates values for some heavy metals in tomato fruit grown in uncontaminated soil.

BR increases to $N_{45}P_{45}K_{45}$ fertilization doses and decreases sharply a $N_{60}P_{60}K_{60}$ fertilization doses and then increases again. The higher BR value of manganese (0.44), nickel (1.44) and zinc (5.89) is observed a $N_{120}P_{60}K_{60}$ fertilization doses and a $N_{45}P_{45}K_{45}$ fertilization doses for iron (0.14) and cooper (14.41). Of all the heavy metals the iron content in soil and in tomato fruit is high but the BR value is very low.

CONCLUSIONS

The experience was done in a cambric cernosium soil very rich in iron, zinc, cooper and cobalt but fall below acceptable parameters under the laws of our country.

The order of accumulation of heavy metals in soil samples was: Fe > Mn > Zn > Ni > Pb > Cu > Cr > Co > Cd.

The order of heavy metals content in tomato fruit samples was: Fe > Zn > Cu > Mn > Ni. The other elements (Co, Cr, Pb and Cd) are not found.

Metal availability in soil is influenced by the level of mineral fertilization. Phosphorus fertilisation increased Fe and decrease Zn, Cu and Mn content of tomatoes; N application increases the Zn content of the plant, and K fertilization has no effect on Zn content.

In conclusion, different doses of N, P and K fertilizers were applied to tomato crop soil determined different bioaccumulation rate in tomato fruit. We can even say that this uncontaminated area is favorable to ecological vegetables crops, mainly tomatoes.

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Review on Agriculture and Rural Development 2013. vol. 2. (1) ISSN 2063-4803

EFFECT OF SUBSTRATES AND ENHANCERS ON THE ROOTING OF SOME ROSE VARIETIES OF THE TEA GROUP UNDER GREENHOUSE CONDITIONS

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ABSTRACT

A rose assortment changes so much in time that, until something is published about it in a book, other new rose varieties are on the market. It is estimated that 150 million roses are cultivated each year in the world – both as cut flowers and as flowering plants for the decoration of green areas. They can be planted on slots along the road, in round and irregular flowerbeds (short roses), isolated or in groups, supported by fences, planted in pots or in flowerdisplays. The rose has always been the badge of many countries. East Mediteranean Sea and subtropical areas of East Asia are the place of origin of roses. The research was carried out at the Didactic Station in Timisoara in the conditions of a modern greenhouse of the Gothic 800 type and aimed at studying the rooting rate of rose cuttings in five rose varieties of the Tea group on different substrates. Multiplication through cuttings is among the first methods used to multiply roses and its advantage is that the plants obtained this way maintain all the features of the mother-plant and do not produce runners that require supplementary removal work.

Keywords: rose, cutting, variety, substrate, rooting enhancer

INTRODUCTION

Palaeontologists claim that roses date back to the Tertiary Era, 70 million years ago. Old writings show that roses have been known ever since 2350 BC. Around 2200 BC, King Sargon of Sumer became renowned for bringing home from one of his campaigns vine, fig and rose.

The first writings on rose cultivation and on winter cuttings belong to the Greek philosopher Theophrastus (382-287 BC). It seems that the surname "Queen of Flowers" was given by the Greek Achilles Tatios towards the end of the 2nd century AD.

The Genus *Rosa* has about 140 species, of which 95 originate in Asia, 18 in North America and the rest in Europe and North Africa. There is no rose coming from places south from the Equator (GRANT, 2004).

Some rose varieties have strong scents and have been intensely cultivated – therefore, their cultivation has turned into a good business. For instance, the Damascus rose and the Alba rose are the most used in the manufacturing of rose oil. The large flowered Hybrid Tea varieties produce the most fragrant roses and the best roses for cutting, although they generally bloom less frequently than the Floribunda (DE VLEESCHOUWER, 2004).

Between the two World Wars, most of the cultivated roses belonged to the Tea group. Since then, other roses such as covering roses, rose varieties from the groups Polyanthus, Floribunda and Patio, creeping and covering roses, roses from the David Austin group, and miniature roses were added to the Tea group roses to decorate green areas.

The main cut rose producing countries are Holland, Denmark, Israel, Kenya, Zimbabwe, the USA and Columbia. Roses find their place in all landscaping styles. Many of the great landscape and garden designers of the 20th century used roses in their schemes (COURT, 2004).

Our research consisted of determining the rooting rate in some rose varieties from the Tea group on different rooting substrates and with different rooting enhancers. The goal was to establish which of these rose varieties suited the best for multiplication through cuttings.

MATERIALS AND METHODS

To carry out our research, we studied the following rose varieties from the Thea group: Prima Donna, Double Delight, Ambasador, Imperatrice Farah, Doamna în Mov, Pascali, Golden Elegance, Acapella, Madonna, and Mainzer Fastnacht.
Cutting was done in August. From the mother-plants, we took cuttings with 3-4 buds. We left 1-2 leaves above 2 basic leaflets. The cuttings were stuck in the rooting substrate about 3 cm deep. Row distance was 8 cm and plant distance was 5 cm (WAGNER, 2002).
The substrates used were sand, perlite and a mixture of peat, perlite and sand (in equal amounts). The rooting enhancer we used was Radifarm, a complex vegetal product, 100% natural that ensures the development of a vigorous root system. Measurements were made 6 weeks after the planting of cuttings
(HTTP://WWW.BLONDYROMANIA.RO/PHARMA/156.PDF).

RESULTS

Based on data presented in *Table 1* below, we can see that both rose varieties and rooting substrates had a real distinctly significant impact on the rooting of rose cuttings on the background of homogeneity of environmental conditions of the experiment. The rose variety had the highest impact (26.00%) on rose cuttings rooting, followed by the rooting substrate (11.96%), while the treatment with Radistim had a lower impact (0.21%), i.e. insignificant.
We can also see that the combined effects of the different factors had considerable impacts, statistically ensured, on the rooting of rose cuttings: thus, the highest impact was in the interaction between rose varieties and substrates (24.80%), and the lowest one was in the interaction between substrates and rooting enhancers (1.36%).

Table 1. Analysis of the variance for the effect of variety, rooting substrate and rooting enhancer on rose cuttings rooting

Source of variation	SP	GL	S^2	F-test
Total	96044.2	179		
Repetitions variety	55.1	2	27.5	F=0.10
Variety	16890.0	9	1876.7	F= 7.14**
Substrat	7769.8	2	3884.9	F= 14.77**
Stimulator	137.2	1	137.2	F= 0.52
Variety x Substrat	16107.5	18	894.9	F= 3.40**
Variety x Stimulator	7765.3	9	862.8	F= 3.28**
Substrat x Stimulator	882.6	2	441.3	F= 1.68**
Variety x Substrat x Stimulator	15400.6	18	855.6	F= 3.25**
Error	31036.1	118	263.0	

On the background of different rooting substrates, we can see that rose varieties had amplitudes of the cuttings rooting percentages ranging between 56% when using perlite as

a rooting substrate and 36% when using the mixture of perlite, sand and peat as a rooting substrate. Thus, on the sand rooting substrate, the rose varieties Ambasador and Acapella had a significantly higher rooting percentage compared to the other rose varieties, except for the rose variety Madonna. The rose varieties Pascali and Golden Elegance valorised in the most effective way the rooting substrate of perlite, with significant 20-56% increases in rose cuttings rooting compared to most other rose varieties (except for the rose varieties Imperatrice Farah and Madonna). The rooting substrate made of perlite, sand and peat was the most favourable for the rooting of the rose cuttings in the rose varieties Imperatrice Farah, Pascali and Golden Elegance, which recorded maximum values of this process, significantly higher than the rose varieties Prima Donna, Double Delight, Doamna în Mov and Madonna.

In the case of the rose varieties Double Delight, Ambasador, Doamna în Mov, Madona and Mainzner Fastnacht, the composition of the rooting substrate had no significant impact on the rooting of rose cuttings. In the rose varieties Pascali and Golden Elegance, the sand rooting substrate resulted in a significantly lower rooting compared to the other rooting substrates which resulted in maximum values. In the Prima Donna rose variety, the rooting substrate made of perlite, sand and peat was significantly more effective than the other two rooting substrates. In the case of the rose variety Acapella, the rooting substrate made of perlite, sand and peat was more favourable to the rooting of rose cuttings than the perlite rooting substrate.

As for the combined effect of the rose varieties and of the rooting enhancer on rose cuttings rooting (*Table 2*), we can see a higher amplitude between the rose varieties when we did not apply any rooting enhancer (44.44%) compared to the results obtained on the background on which we applied Radifarm (28.57%).

When no rooting enhancer was applied, the highest rooting percentage was in the rose varieties Golden Elegance and Imperatrice Farah which resulted in statistically ensured increases compared to the rose varieties Prima Donna, Double Delight, Acapella and Madonna. The rose varieties Pascali, Acapella and Ambasador better valorised the treatment with the rooting enhancer Radifarm, resulting in significantly superior cuttings rooting percentages compared to the rose varieties Prima Donna, Double Delight, Doamna în Mov, Madonna and Mainzer Fastnacht.

Table 2. The variety and stimulator effect on rooting of rose cuttings

Nr.	Variety	Stimulator	
		Untreated	Radifarm
1	Prima Donna	y48.89d	x66.67d
2	Double Delight	x73.33bc	x68.89d
3	Ambasador	x82.22abc	x93.33ab
4	Imperatrice Farah	x93.33a	x80.00bcd
5	Doamna în Mov	x82.22abc	y66.67d
6	Pascali	x85.71ab	x95.24a
7	Golden Elegance	x93.33a	x86.67abc
8	Acapella	y67.78c	x94.44ab
9	Madonna	x77.14bc	x74.29cd
10	Mainzer Fastnacht	x80.00abc	x75.24cd

$DL_{5\%}$=15.14 $DL_{1\%}$=20.02 $DL_{0,1\%}$=25.80

The differences between the combinations noted with different letters: a, b, c – for vertical comparisons; x, y, z – for horizontal comparisons are considered significant

The treatment with Radifarm had a major, statistically ensured impact on the rooting of rose cuttings in the rose varieties Prima Donna and Acapella, determining increases between 17.78 and 26.66%. In the case of the rose variety Doamna în Mov, the treatment with the root enhancer Radifarm determined a significant diminution of 15.55% of the cuttings rooting percentage. In the other rose varieties, applying the rooting enhancer Radifarm had no impact whatsoever on rose cuttings rooting.
As for the combined impact of the rooting substrate and that of the rooting enhancer on the rooting of rose cuttings, we can see that, no matter the type of rooting substrate, the treatment with the rooting enhancer Radifarm had no significant impact on the rooting process: despite the increases of 4.23-5.48% on the rooting substrates of perlite and of perlite, sand and peat, these increases never reached the level of statistical insurance.

Table 3. The substrate and stimulator effect on rooting of rose cuttings

No.	Substrate	Stimulator	
		Untreated	Radifarm
1	Sand	x73.71b	x69.24c
2	Perlite	x76.67ab	x80.90b
3	Perlit+Sand+Peat	x84.81a	x90.29a

$DL_{5\%}$=8.29 $DL_{1\%}$=10.96 $DL_{0,1\%}$=14.13

The differences between the combinations noted with different letters: a, b, c – for vertical comparisons; x, y, z – for horizontal comparisons are considered significant

Taking into account the impact of the treatment with the rooting enhancer Radifarm on the rooting of rose cuttings on the three rooting substrates, we can see really significant differences between the rooting substrates (*Table 3*). When we did not apply any treatment, the mixture of perlite, sand and peat allowed a significantly superior increase in the rooting rate of the rose cuttings compared to the simple substrate made of sand alone.
The treatment with the rooting enhancer Radifarm allowed the best results in rose cuttings rooting on the complex rooting substrate, perlite, peat and sand, significantly 9.39-21.05% higher than the other rooting substrates. On the sand rooting substratum, the efficacy of its use was significantly, 11.66% lower compared to the perlite rooting substrate.
Taking into account the combined effect of the rooting substrate and that of the treatment with the rooting enhancer Radifarm on rooting, the rose varieties recorded, on the sand rooting substrate, variation amplitudes ranging between 60% in the control variant and 73.3% when applying the rooting enhancer Radifarm. On this rooting substrate, without applying any rooting enhancer, the rose variety Double Delight showed a cuttings rooting percentage significantly superior to that of the rose varieties Prima Donna, Pascali and Mainzer Fastnacht. Applying the rooting enhancer Radifarm on a sand rooting substrate was valorised at a very high level by the rose varieties Ambasador and Acapella which yielded maximum rooting percentages, significantly higher than those of the other rose varieties except the rose varieties Pascali and Madonna.
On the sand rooting substrate, the treatment with Radifarm had a significant effect only on the rooting of the cuttings of the rose variety Pascali, where it resulted in an increase of 28.57%. In the case of the rose variety Double Delight, the rooting enhancer Radifarm caused a significant decrease of about 73% of the rose cuttings rooting.

Table 4. The effect of variety, rooting substrate and stimulator on the rooting of rose cuttings

Rooting substrate : Sand			
Nr.	Variety	Stimulator	
		Untreated	Radifarm
1	Prima Donna	x40.00c	x60.00b
2	Double Delight	x100,00a	y26.67c
3	Ambasador	x80.00ab	x100.00a
4	Imperatrice Farah	x80.00ab	x60.00b
5	Doamna în Mov	x80.00ab	x60.00b
6	Pascali	y57.14bc	x85.71ab
7	Golden Elegance	x80.00ab	x60.00b
8	Acapella	x80.00ab	x100.00a
9	Madonna	x80.00ab	x80.00ab
10	Mainzer Fastnacht	x60.00bc	x60.00b
Rooting substrate: Perlite			
Nr.	Variety	Stimulator	
		Untreated	Radifarm
1	Prima Donna	x46.67c	x40.00b
2	Double Delight	x60.00bc	x80.00a
3	Ambasador	x80.00ab	x80.00a
4	Imperatrice Farah	x100.00a	x80.00a
5	Doamna în Mov	x80.00ab	x80.00a
6	Pascali	x100.00a	x100.00a
7	Golden Elegance	x100.00a	x100.00a
8	Acapella	y40.00c	x83.33a
9	Madonna	x80.00ab	x85.71a
10	Mainzer Fastnacht	x80.00ab	x80.00a
Rooting substrate: Perlite+Sand+Peat			
Nr.	Variety	Stimulator	
		Untreated	Radifarm
1	Prima Donna	y60.00c	x100.00a
2	Double Delight	y60.00c	x100.00a
3	Ambasador	x86.67ab	x100.00a
4	Imperatrice Farah	x100.00a	x100.00a
5	Doamna în Mov	x86.67ab	y60.00bc
6	Pascali	x100.00a	x100.00a
7	Golden Elegance	x100.00a	x100.00a
8	Acapella	x83.33abc	x100.00a
9	Madonna	x71.43bc	x57.14c
10	Mainzer Fastnacht	x100.00a	x85.71ab

$DL_{5\%}$=26.22 $DL_{1\%}$=34.67 $DL_{0,1\%}$=44.69

The differences between the combinations noted with different letters: a, b, c – for vertical comparisons; x, y, z – for horizontal comparisons are considered significant

As for the perlite rooting substrate (*Table 4*), the rose varieties we studied presented amplitudes of the rooting percentage of 60%. On the background without the rooting enhancer Radifarm, the rose varieties Imperatrice Farah, Pascali and Golden Elegance yielded maximum yields of rooting, significantly superior to those of the rose varieties Prima Donna, Acapella and Double Delight. The treatment with the rooting enhancer Radifarm on this rooting substrate was valorised at maximum level by the rose varieties Pascali and Golden Elegance, while in the rose variety Prima Donna, the effect was significantly lower.

When using the perlite rooting substrate, applying the rooting enhancer Radifarm resulted in a significant increase of about 43% of the rose cuttings rooting only in the rose variety Acapella, while in the rest of the rose varieties, the rooting enhancer had a lower impact that was not statistically ensured on the rooting process.

On the rooting substrate of complex composition – perlite, sand and peat – without any treatment whatsoever, we could see that the rose varieties Imperatrice Farah, Pascali, Golden Elegance and Mainzer Fastnacht recorded maximum values of rooting that were significantly superior to those of the rose varieties Madonna, Double Delight and Prima Donna. The treatment with the rooting enhancer Radifarm was valorised at maximum level by most rose varieties, except for the rose varieties Madonna and Doamna în Mov, where the rooting percentage in these conditions was significantly lower. On the background of this complex substrate, the rooting enhancer Radifarm had a high impact on the rose cuttings rooting only in the rose varieties Prima Donna and Double Delight, where it generated significant increases of 40%. In the rose variety Doamna în Mov, applying this rooting enhancer resulted in a significant 26.7% decrease of rooting percentage, as it did on the sand rooting substrate.

CONCLUSIONS

Analysing the data processed, we can recommend the multiplication through cuttings of the rose varieties Pascali and Golden Elegance as well as of the rose varieties Ambasador, Imperatrice Farah and Acapella.

We recommend cutting multiplication on a sand rooting substrate in the rose varieties Ambasador and Acapella, on a perlite rooting substrate for the rose varieties Pascali and Golden Elegance, and on a mixture of peat, perlite and sand rooting substrate for the rose varieties Imperatrice Farah and Golden Elegance.

The rose varieties Golden Elegance and Imperatrice Farah are recommended to be multiplied through cuttings but with no rooting bio-enhancer application.

Using the rooting bio-enhancer Radifarm is recommended in the rose varieties Pascali, Acapella and Ambasador, which yield significantly superior cuttings rooting percentages compared to the rose varieties Prima Donna, Double Delight, Doamna în Mov and Mainzer Fastnacht.

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Review on Agriculture and Rural Development 2013. vol. 2. (1) ISSN 2063-4803

IN VITRO ANTHER CULTURE UTILIZATION IN HUNGARIAN TRITICALE BREEDING PROGRAM

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ABSTRACT
The doubled haploid plants can play a key role in applied research to map the agronomically, botanically important traits and acceleration of the breeding process in crop plants. The efficiency of triticale anther culture was tested by two field- and greenhouse grown winter triticale varieties (GK Idus and GK Szemes). The effect of growing conditions and genotype and their interaction were tested on four androgenic parameters (number of embryo-like structures, total, green and albino plantlets). The androgenesis was induced in each treatment of the two tested genotypes. Cultivar GK Szemes produced more embryo-like structures, total and albino plantlets, while the field grown GK Idus produced the most green plantlets/Petri dish. In the experiments of growing conditions, the efficiency of this tested method was higher in anther culture of field grown materials if compare to greenhouse origin materials. Based on this promising data, we can suggest the using of this method in applied research (production of mapping population) and practical breeding.

Keywords: androgenesis, anther culture, cereal breeding, genotype x environment interaction, triticale

INTRODUCTION

The doubled haploid (DH) plants can play a key role in i) applied research to map the agronomically, botanically important traits and ii) acceleration of the breeding process. Three different methods are known for the production of triticale DH plants; maize mediated haploid production, anther- and isolated microspore culture. The first one is an expensive technology because of parallel growing of two different species (maize and triticale); while albinism and genotype dependency reduce the practical efficiency of isolated microspore culture (PAUK ET AL. 2000, 2003 EUDES AND AMUNDSEN 2005, LANTOS ET AL. 2005, EUDES AND CHUG 2009). In 1973, the regeneration of the first anther culture derived plantlets was published (WANG ET AL. 1973, SUN ET AL. 1973). Despite of many efforts on androgenesis, some published data are available which mentioned the application of anther culture in practical breeding (THOMAS ET AL. 2003, OLESZCZUK ET AL. 2011). The main bottlenecks of triticale anther culture are genotype dependency, albinism and colchicine treatment of haploid regenerants because of low spontaneous rediploidization.
Genotype dependency is a well-known phenomenon in androgenesis of cereals including triticale. Many chromosomes and QTLs in the triticale genome were detected in connection with androgenic parameters such as number of embryo like structures (ELS), total and green plant regeneration (BALATERO ET AL. 1995, GONZÁLEZ ET AL. 2005, KRZEWSKA ET AL. 2012). Thus, significant differences were observed among the green

plant production of different triticale breeding materials (TUVESSON ET AL. 2000, 2003, WEDZONY 2003).

The phenomenon of albinism is another critical factor which hinders the production of large number of green plantlets for breeding (TUVESSON ET AL. 2000, 2003, WEDZONY 2003). Furthermore, the colchicine treatment of the regenerants is also an important step because of low spontaneous rediploidisation rate (OLESZCZUK ET AL. 2011).

The efficiency of anther culture is influenced by genotype (G) and environmental (E) factors such as growing conditions of donor materials, collection time of donor tillers, stress treatment, induction and regeneration media etc (CHIEN AND KAO 1983, HASSAWI ET AL. 1990, KARSAI ET AL. 1994, KARSAI AND BEDŐ 1997, PONITKA ET AL. 1999; IMMONEN AND ROBINSON 2000). In our experiment, the androgenic response of field- and greenhouse grown triticale genotypes was compared in anther culture based on four androgenic parameters (number of ELS, regenerated plantlets, green and albino plantlets). The effect of growing conditions and genotypes and their interaction were analysed (two-way ANOVA).

In this research, the focus was on the important parameters of triticale anther culture and comparison of two different origins of donor tillers for efficiency on the androgenic parameters.

MATERIAL AND METHOD

Plant material and growing conditions

In our experiments, two winter triticale (x *Triticosecale* Wittmack) varieties (GK Idus and GK Szemes) were used to test the efficiency of anther culture.

In the middle of October 2011, the genotypes were sown in nursery of Cereal Research Ltd. (Szeged). The fertilization of donor plants were carried out by an artificial manure of nitrogen, phosphorus and potassium (1:1:1) in autumn, in 60 kg/ha dose. The genotypes were also grown under greenhouse conditions where 16 h photoperiod and 20/15 ºC (day/night) was ensured for donor plants. In the greenhouse, the donor plants were fertilised once every two weeks with Volldünger (N:P:K:Mg/14:7:21:1, plus 1% microelements: B, Cu, Fe, Mn and Zn; Magyar Kwizda Ltd., Budapest, Hungary).

The donor plants were grown in the field and greenhouse until the collection of donor tillers.

Collection and pre-treatment of donor materials

Donor tillers containing early and mid uninucleated microspores were collected for anther culture. The harvested tillers were put into Erlenmeyer flask containing tap water and covered by PVC bags. The cool pre-treatment period was approximately two weeks at 3-4 °C.

Anther culture

The anthers of donor materials were isolated into 90 mm diameter glass Petri dish (250 anthers/Petri dish) containing modified W14 medium (OUYANG ET AL. 1989), namely W14mf (LANTOS ET AL. 2013). Three day heat shock was applied in the beginning of the culture, after the heat shock the Petri dishes were kept at 28 °C in dark thermostat.

Plant regeneration of microspore derived ELS

The microspore derived ELS with 2 mm diameter size were transferred onto 190-2Cu regeneration medium (PAUK ET AL. 2003). Approximately 40-50 ELS were placed on the

90 mm diameter plastic Petri dish (Sarstedt Ltd., Newton, Massachusetts, USA) containing the regeneration medium. The regenerated green plantlet with 20-30 mm length leaves were transferred individually into glass tubes containing the same regeneration medium.

Data collection and statistical analysis

The experiments were carried out at least five replications. Data of four androgenic parameters (number of ELS, total, green and albino plantlets) were collected from each treatment of anther cultures. The data were analysed by two-way ANOVA. The statistical analyses were carried out by Microsoft® Excel 2002 statistical software developed by Microsoft Ltd., Redmond, Washington, USA.

RESULTS

In triticale anther culture experiments, the effect of genotype and growing conditions were tested based on four androgenic parameters. The growing condition influenced all of tested parameters while the genotype influenced the ELS, total and albino plantlets production (*Table 1*). The statistical analysis revealed the interaction in connection with total, green and albino plantlets production.

Table 1. Statistical analysis of androgenic parameters based on data of anther culture of field grown and greenhouse grown triticale genotypes

Two-way ANOVA	*df*	*MS-ELS*	*MS-total plantlets*	*MS-green plantlets*	*MS-albinos*
E	1	15792.2***	3328.2***	369.8**	1479.2***
G	1	7683.2**	1008.2**	105.8	1767.2***
GxE Interaction	1	39.2	404.9*	245.0*	1280,0***
Error	16	612.65	67.15	30,225	25,05

*,**,*** Significant at the 0.05, 0.01 and 0.001 probability level, respectively

Androgenesis was induced in anther culture of each treatment and genotype. ELS were visible to the naked eye on the fifth week of culture (*Figure 1A*) which were transferred onto the regeneration medium. The ELS from each treatment produced green plantlets (*Figure 1B* and *Figure 1*C).

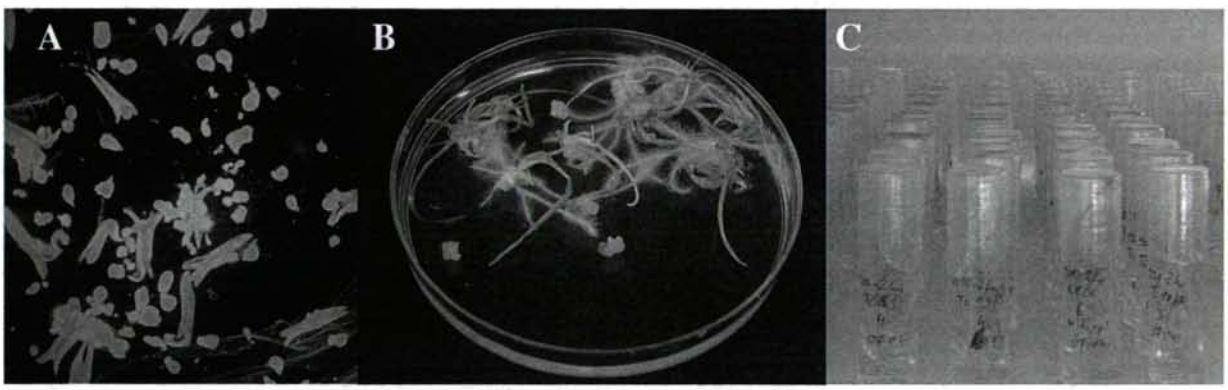

Figure 1. Important steps of anther culture in triticale. (A) The microspore derived ELS can be visible on the fifth week of anther culture. (B) The ELS regenerated plantlets on the first week of regeneration period. (C) The green plantlets were grown in individually glass tubes.

Based on the statistical analysis of data, significant differences were obtained between the two genotypes (*Table 2*). The ELS production and the number of total and albino plantlets was higher in anther culture of GK Szemes while the anther culture of field grown GK Idus achieved the highest green plantlets production (17.8 green plantlets/Petri dish).
In comparison of growing condition of donor materials, the field grown materials produced more ELS, total, green and albino plantlets in anther culture of the two tested genotype (*Table 2*). The differences of ELS production and total plant regeneration were significantly higher in anther culture of field grown genotypes. The ratio of green and albino plantlets ranged from 0.17 to 12.71 depending on genotype and origin of donor materials.

Table 2. Efficiency of triticale anther culture of field and greenhouse grown genotypes

Genotype	Origin of donor materials	ELS production/ Petri dish	Regenerated plantlets/ Petri dish	Green plantlets / Petri dish	Albino plantlets/ Petri dish	Ratio of green and albino plantlets
GK Szemes	field	102.6	42.4	6.2	36.2	0.17
GK Szemes	greenhouse	43.6	7.6	4.6	3.0	1.53
GK Idus	field	60.6	19.2	17.8	1.4	12.71
GK Idus	greenhouse	7.2	2.4	2.2	0.2	11
LSD5%=	-	23.467	7.769	14.84	33.92	-

DISCUSSION

Haploid plant production methods offer a good chance for breeding to accelerate the breeding process; these methods were used successful in the breeding of more crop plants (THOMAS ET AL. 2003). In our experiments, androgenesis was induced in anther culture of triticale genotypes to test the effect of growing conditions and genotype on androgenic response.
Our observation was in harmony with some published data that the genotype influenced the efficiency of anther culture response (BALATERO ET AL. 1995, IMMONEN AND ROBINSON 2000, TUVESSON ET AL. 2000, 2003, GONZÁLEZ ET AL. 2005, KRZEWSKA ET AL. 2012). These differences were enhanced among the numbers of ELS and mitigated among numbers of green and albino plantlets. So, other environmental factors (conditions of anther culture and plant regeneration) influenced also the regeneration of green and albino plantlets.
The origin of donor materials had a significant effect on response of triticale genotypes. The all tested androgenic parameters were higher in anther culture of field grown genotypes than data of greenhouse derived anther cultures. These results are in contrast with the earlier investigation of IMMONEN AND ROBINSON (2000). Based on this phenomenon, field grown materials are preferred in our anther culture protocol.
The production of green plantlets is the most critical and important parameter in DH plant production methods; regeneration of green plantlets is influenced not only by G but also the growing and culture conditions (CHIEN AND KAO 1983, HASSAWI ET AL. 1990, KARSAI ET AL. 1994, KARSAI AND BEDŐ 1997, PONITKA ET AL. 1999; IMMONEN AND ROBINSON 2000). In our investigations, the ratio of green and albino plantlets was also influenced by genotype and growing condition. Furthermore, strong G x E interaction was measured on

the number of albino plantlets. More experiments are required to clarify this phenomenon in triticale androgenesis.

Based on this promising data, we can suggest the using of this method in applied research (production of mapping population) and practical breeding. Following experiments should focus on the increasing the number of green plantlets among the regenerants and decreasing the effects of environmental factors.

ACKNOWLEDGEMENT

The authors thank the conscientious work for Szilvia Palaticki, Ferenc Markó and Dorina Márta. Experiments were supported by the Hungarian Res. Grant of GOP-1.1.1-11-2012-0044.

This research was realized in the frames of TÁMOP 4.2.4. A/1-11-1-2012-0001 „National Excellence Program – Elaborating and operating an inland student and researcher personal support system" The project was subsidized by the European Union and co-financed by the European Social Fund (project number: A1-MZPD-12-0070).

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Review on Agriculture and Rural Development 2013. vol. 2. (1) ISSN 2063-4803

THE IMPACT OF ORGANIC AND MINERAL FERTILIZATION ON SUGAR CONTENT IN GRAPES

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ABSTRACT
The sugar content in grapes is a specific characteristic for each variety, and it is influenced within certain variation limits by soil and climate factors and by technological factors. Grape vine nutrition represents an important factor for ensuring good quality of wine products. We conducted research in order to comparatively assess the influence of two fertilization systems, organic and mineral, on the sugar content of grapes, varieties *Burgund* and *Silvana*. Organic fertilization was made with manure in doses of 30, 40 and 50 t/ha. For the mineral fertilization we used a complex fertilizer of the type NPK (S), zinc fertilizer [15/15/15(+3+Zn)], in doses NPK_{50}, NPK_{100} and NPK_{150} kg s.a./ha. Different plant nutrition ensured by the two fertilization systems led to different accumulation of sugars in each variety. *Burgund* variety accumulated sugars from 234.88 to 256.42 g/l, variation amplitude being between 14.33 – 21.54 g/l. For *Silvana* variety, the sugar content ranged between 158.07 and 196.68 g/l, with differences of 10.71 – 38.61 g/l.

Keywords: sugars, grape vine, *Burgund*, *Silvana*, organic and mineral fertilization

INTRODUCTION

Quality in viticultural production is the result of several soil, climate and technological factors that are differently valorised by grape varieties. Sugar content is an essential quality element for both table grapes and wine grapes.
Among bio-chemical components of grapes, sugars rank among the first ones with values between 120 and 250 g/l. Upon grape full maturity, the ratio between glucose and fructose, main components of sugars, is 0.82.
Together with soil and climate factors of major importance for grapevine (RANKINE *ET AL.* 1971; JONES & DAVIS 2000; PEUKE, 2009), technological elements can also substantially contribute to the increase of grape quality. Among technological factors, nutrition plays a very important role (BERTONI & MORARD 1982; CONRADIE & SAAYMAN, 1989).
Numerous researches have monitored and emphasised the impact of macro- and micro-nutrients on grape production and quality (NEILSEN *ET AL.* 1989, JACKSON & LOMBARD 1993, SPAYD *ET AL.* 1994, WADE *ET AL.* 2005, COLAPIETRA & ALEXANDER 2006, DOBREI *ET AL.*, 2009).
CONRADIE & SAAYMAN (1989) have presented the results of long-term researches on the impact of mineral NPK fertilisation on white wine composition and quality. Making petiole tests, they assessed the nutrition state and identified certain antagonistic relations between the nutrition ions in the plant (petiole) as well as the correlations between the nutrition elements and must quality. An important role is that of potassium ion in the diminution of nitrogen in the mist and of the acidity.
The effect of the combinations of macro- (N, Mg, and K) and micro-elements (Fe, Zn) in the guidance of nutrition in grapevine allowed the identification of some positive and negative correlations between grape production, grape quality, and grapevine nutrition state (AMIRI & FALLAHI, 2007).
The increased interest in biodynamic and organic productions in viticulture have determined the development of research to assess the importance of soil as a nutrition

environment, of organic fertilisers as a source of nutrients and the adaptation of grapevine cultivation technologies to the new concepts (REEVE *ET AL.*, 2005).

Taking into account the general context of research in the field of viticultural production quality through the guidance of technological factors among which nutrition is one of the most important factors, we have studied the impact of two types of fertilisation – organic and mineral – on grape production quality in the varieties *Burgund* and *Silvana*, from the point of view of sugar content.

MATERIAL AND METHOD

Research was carried out at the Didactic Station in Timişoara, on the fruit tree and grapevine plantation. Soil and climate conditions are favourable to grapevine culture. The soil is a chernozem with physical and chemical features that make it a medium-fertility soil: $pH_{H_2O} = 6.71$, H = 2.76%.

Climate conditions are characterised by mean annual precipitations of 630 mm and by mean temperatures of 11.3^{0}C. The mean annual duration of sunshine is 2,100-2,200 hours, the variation of the annual duration being described by the relation $y = 1.9769x + 2108.3$ (Source: Meteorological Station of Timişoara).

The biological material was represented by two varieties of grapevine – *Burgund* and *Silvana*. The experimental variants were based on two types of fertilisers – organic and mineral – at different rates: animal manure at three rates (M_{30}, M_{40}, and M_{50} t/ha); complex NPK fertilisers, and zinc fertilisers [15/15/15(+3+Zn)] at three rates NPK_{50}, NPK_{100}, and NPK_{150} kg a.s./ha. We have assessed sugar content in grapes upon harvesting, after fertilising with both organic and mineral fertilisers. Measuring sugar content was done with the refractometric method. Data were processed statistically with the variance analysis. To interpret results statistically, we calculated the standard error and we assessed the impact level of the factor fertilisers on sugar content in grapes and the significance degree of the differences.

RESULTS AND DISCUSSIONS

Results of research concerning grape quality from the point of view of sugar content after fertilising with organic and mineral fertilisers (nutrition factor) are presented in Table 1 and Table 2.

Table 1. Sugar content of grapes in the variety *Burgund* under the impact of organic and mineral fertilisation at the Didactic Station of Timişoara (mean values, 2010-2011)

Experimental variants		Sugar content (g/l)	Relative values (%)	Differences	Significance
Mt		234.88±8.14	100.00	-	
Manure	30 t/ha	249.21±2.14	106.10	14.33	*
	40 t/ha	253.06±2.76	107.74	18.18	**
	50 t/ha	254.03±4.19	108.15	19.15	**
NPK	50 kg a.s./ha	241.45±2.97	102.79	6.56	
	100 kg a.s./ha	251.28±4.15	106.98	16.40	**
	150 kg a.s./ha	256.42±6.10	109.17	21.54	**

DL 5% 13.684
DL1% 18.200
DL 0.1% 23.673

Table 2. Sugar content of grapes in the variety *Silvana* under the impact of organic and mineral fertilisation at the Didactic Station of Timişoara (mean values, 2010-2011)

Experimental variants		Sugar content (g/l)	Relative values (%)	Differences	Significance
Mt		158.07±5.34	100.00	-	-
Manure	30 t/ha	180.07±7.58	113.91	22.00	*
	40 t/ha	183.78±8.00	116.27	25.71	**
	50 t/ha	174.75±3.95	110.55	16.68	-
NPK	50 kg a.s./ha	168.78±4.35	106.78	10.71	-
	100 kg a.s./ha	196.68±5.53	124.42	38.61	***
	150 kg a.s./ha	188.83±3.04	119.46	30.76	***

DL5% 16.701
DL1% 22.213
DL 0.1% 28.894

The two types of fertilisers and the rates applied had different impacts on sugar accumulation in grapes. The biological material, i.e. the grape varieties we studied, also responded in different ways to fertilisation: the highest sugar content was in the grape variety *Burgund* (256.42 g/l) and the highest increases in sugar accumulation after nutrition correction through fertilisation were in the grape variety *Silvana* (38.61 g/l in the variant NPK_{100} kg a.s./ha).

The comparative analysis of data show differences of sugar content generated by both fertilisation types and grape varieties because of the different biological potential of valorising vegetation factors, i.e. fertilisers (nutrients).

Sugar content in the grape variety *Burgund* ranged between 234.88±8.14 g/l in the control variant and 256.42±6.10 g/l in the variant NPK_{150} kg/ha a.s. Natural soil fertility ensured a sugar content of 234.88±8.14 g/l, figure 1, figure 2.

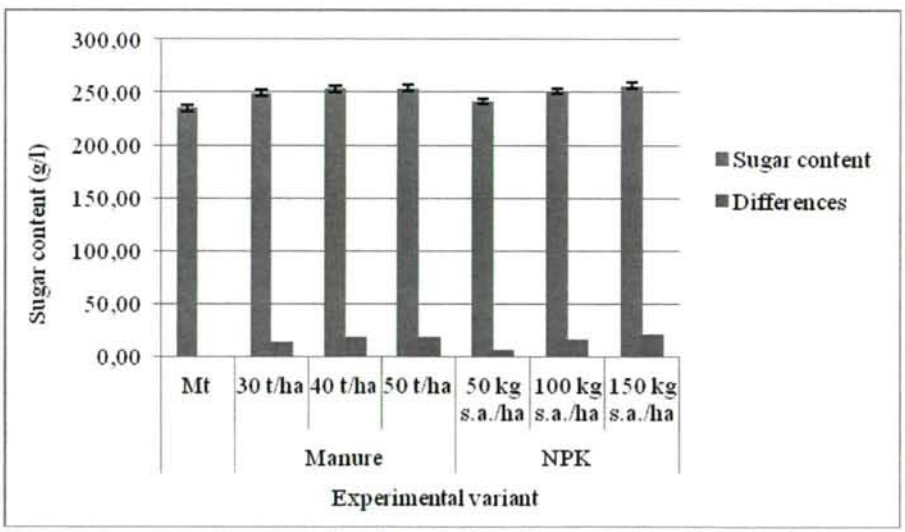

Figure 1. Sugar content of grapes in the variety *Burgund* under the impact of organic and mineral fertilisation at the Didactic Station of Timişoara (mean values, 2010-2011)

The grape variety *Silvana* valorised the fertilisers applied by accumulating a sugar content between 168.78±4.35 g/l in the variant NPK_{50} kg/ha a.s. and 196.68±5.53 g/l in the variant NPK_{100} kg/ha a.s. Natural soil fertility ensured a sugar content of 158.07±5.34 g/l.

Organic fertilisation determined a variation of sugar content between 174.75±3.95 g/l (M_{50}

t/ha) and 183.78±8.00 g/l (M_{40} t/ha) in the *Silvana* grape variety and a variation of sugar content between 249.21±2.14 g/l (M_{30} t/ha) and 254.03±4.19 (M_{50} t/ha) in the *Burgund* grape variety.

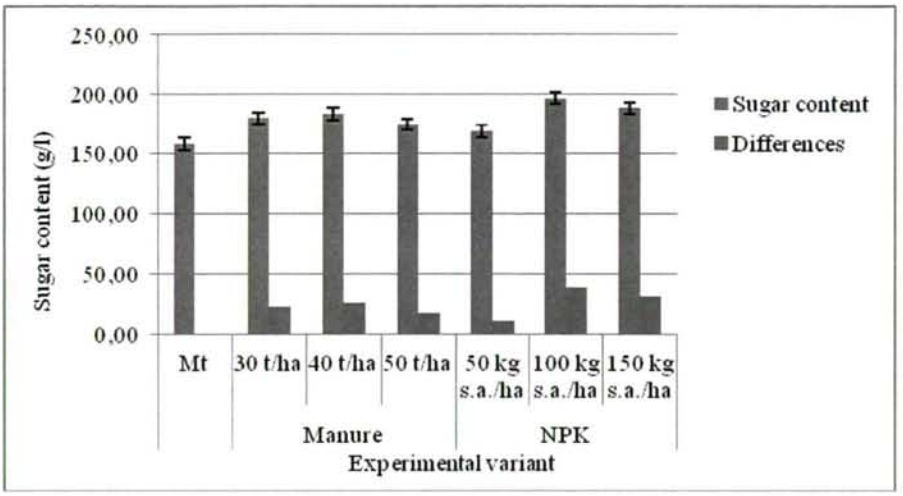

Figure 2. Sugar content of grapes in the variety *Silvana* under the impact of organic and mineral fertilisation at the Didactic Station of Timişoara (mean values, 2010-2011)

In the case of mineral fertilisation, sugar content ranged between 168.78±4.35 g/l (NPK_{50} kg a.s./ha) and 196.68±5.53 g/l (NPK_{100} kg/ha a.s.) in the *Silvana* grape variety and between 241.45±2.97 g/l (NPK_{50} kg a.s./ha) and 256.42±6.10 g/l (NPK_{150} kg a.s./ha) in the *Burgund* grape variety.

Organic fertilisation ensured an increase in sugar content between 14.33 and 19.15 g/l in the *Burgund* grape variety and between 16.68 and 25.71 g/l in the *Silvana* grape variety (figure 3).

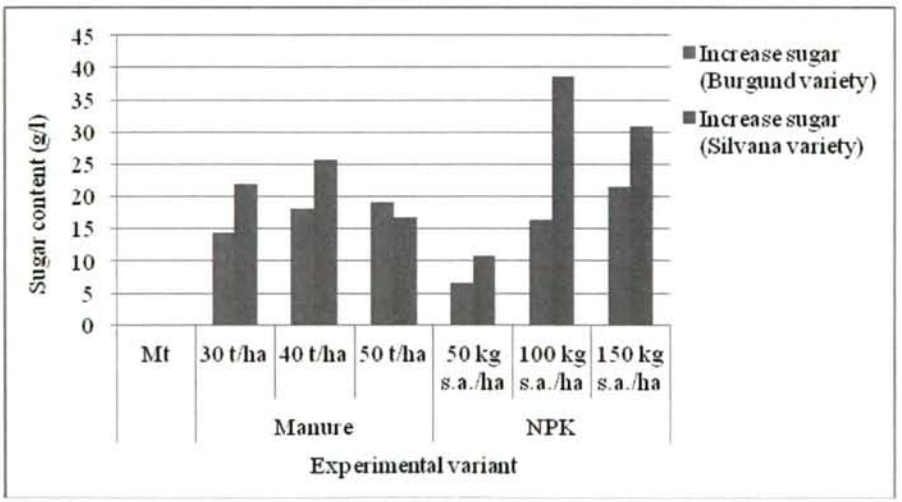

Figure 3. Sugar content increase in the *Burgund* and *Silvana* grape varieties under the impact of organic and mineral fertilisation at the Didactic Station of Timişoara (mean values, 2010-2011)

Mineral fertilisation determined increases of sugar content between 6.56 and 21.54 g/l in the *Burgund* grape variety and between 10.71 and 38.61 g/l in the *Silvana* grape variety.

CONCLUSIONS

Sugar content in grapes is determined by fertiliser type – organic or mineral – and rate of active substance applied.

Fertilisers are valorised in a different way depending on the type of grape variety. According to our own research, the *Burgund* grape variety yielded a higher content of sugars for the same rates of fertilisers compared to the *Silvana* grape variety, though the latter one yielded more sugars per rate of nutrient.

Organic fertilisation with animal manure determined increases of the sugar content between 6.10 and 8.15% in the *Burgund* grape variety and between 10.55 and 16.27% in the *Silvana* grape variety.

Mineral fertilisation determined increases of the sugar accumulation rate between 2.79 and 9.17% in the *Burgund* grape variety and between 6.78 and 24.42% in the *Silvana* grape variety.

The *Silvana* grape variety better valorised both organic and mineral fertilisation: the increase of the amount of accumulated sugar is higher compared to the *Burgund* grape variety but the rate of specific sugar content is lower.

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Review on Agriculture and Rural Development 2013. vol. 2. (1) ISSN 2063-4803

METHOD FOR THE RAPID DETERMINATION OF SOIL PHYSICAL PARAMETERS OF EXTENSIVE GREEN ROOFS

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ABSTRACT
Optimization of soil mixes used for extensive green roofs is essential in a long-term, well-functioning system design and implementation. One of the key elements of this is determining the soil physical characteristics of the used components with the following critical elements: rock mass, rock volume, space between particles, water absorption and water retention capacity, surface water retention. In our research we developed a new method for rapid identification of soil physical performance characteristics of extensive green roofs. The performance indicators were divided into three groups: 1. density-related indicators: loose density, wet loose density, rock material density, wet density of the rock, crystal structure density, rock mass per unit rock volume; rock volume per unit rock volume, rock mass per unit wet rock volume, rock mass per unit wet rock mass. 2. Water content related indicators: water content (porosity) per unit mass of wet rock, water content (porosity) per unit wet rock volume, water content per unit volume of wet granules, surface water per unit volume of granules, surface water per unit mass of granules. 3. Indicators related to space between particles: space between grains per unit volume of granules, space between grains per unit mass of granules. During the development of the procedure and method it was important for us that the parameters should have been determined simply and easily. Further advantages of the developed method are that they are fast, cheap and reasonably accurate and help rock/soil mixture characterization and quantitative comparability. We illustrate the method and the system of performance indicators on examples of growing media mixes for extensive use.

Keywords: soil physics parameter, performance indicators, extensive green roof, rapid identification

INTRODUCTION

In general, green roofs are defined as flat or slightly sloped roof with a waterproofing membrane, a load carrier layer, and a soil layer of a certain thickness to provide the vegetation to be planted with an environment to live in. From the static, heat and humidity control point of view, green roofs are sized and installed with insulation for rainwater; with the vegetation and insulating layers constituting an integrated system (FLL, 2002; WERTHMANN, 2007).

In technical literature, there is a distinction between extensive green roofs and intensive green roofs, categories from agriculture. An extensive green roof is basically a roof with an ecologically active vegetation protective layer, typically unsuitable for regular access. The design is close to nature, relying on undemanding plant material corresponding to the natural cycles and processes. Taxa are drought-tolerant, rockery succulents and other plant materials well-adapted to extreme conditions. The other category is that of intensive green roofs, or roof gardens, which require a high level of maintenance, regular replenishment of

nutrients, typically with irrigation systems installed, with selectively bred taxa and a higher proportion of covered surfaces. Hybrid solutions of the two categories are rare in practice as the planned use of the green roof determines the type to be implemented. The decision between an extensive or an intensive green roof is influenced by the designated use, maintenance needs, irrigation, the acceptable load, the depth and the species to be used (HIDY et al., 1995). *Table 1* provides a comparison between extensive and intensive green roofs.

Table 1. A comparison of extensive and intensive green roofs

	Extensive	Intensive
Use	no access, ecological protective layer	suitable for regular access
Maintenance	low maintenance costs	requires care
Irrigation	usually not used	not installed without irrigation
Weight	1.6-24 kN/m^2	2.0-15.0 kN/m^2
Structural depth	10-15 cm	25-100 cm
Plant material	stonecrop, wildflowers, grass	perennial ornamental plants, woody plants, herbaceous plants

Source: HIDY et al., (1995)

The growing medium on extensive green roofs is to meet special requirements. Intensive roofs do not get regular maintenance, no pesticides are used, even irrigation is not available, and therefore the composition of the low-depth mix must take these factors into account. The composition, the physical and chemical parameters of substrate mixes used on extensive roofs are determined by the local climate (exposure, humidity, wind uplift etc.) and by the planted vegetation. Nevertheless, the mixes for extensive roofs need to comply with multiple requirements. A layer with a depth of only a few centimeters is to provide, at the same time, a balanced nutrient supply, a stable heat system, good water management, it is to have the appropriate, not too heavy weight, while it is supposed to retain water but also control storm-water runoff. Low volumetric weight (0.2-0.8 g/cm^3) biomass materials are often used in growth media as they provide not only good water management but are also excellent for improving soil life and biological activity. Examples of such materials are peat, wood chips, sawdust etc. (FORRÓ, 1998; FORRÓ, 2001).

The weight of the growth media is important for the load of the roof structure, for the compaction factor and erosive processes. The water retention, water drainage capacity, the nutrient retention and supply features etc. of growth the media are much more important for the vegetation to be planted. Several substrate types have been developed for extensive green roofs (DEUTSCHER, 1995).

In the construction practice for extensive roofs, single-component substrates of mineral origins are common for their short-term structural characteristics and relative low cost, but in the long run their use may result in increased acidity and the build-up of toxic materials. Acidity increases the risk of pathogens and pests, while the buffer capacity of those substrates is minimal. The humus materials and clay-humus complexes used in the mixes provide sufficient nutrient reserves for the plants. The nutrient release rate protects the plants from overconsumption (FORRÓ, 2002).

The optimization of substrate mixes used on extensive green roofs is essential for the design and implementation of system well-functioning in the long run. A key component in that effort is to determine the soil mechanics characteristics of components used, with the

following critical items: unit weight, unit volume, pore space, water absorption and water retention capacity, water retention on the surface.
The main objective of this study is to develop a new method/procedure for prompt determination of performance characteristics for extensive green roofs. A subsidiary objective of the study is closely related to the first objective, to illustrate the procedure through examples of extensive media mixes.

MATERIAL AND METHOD

The conceptual procedure for determining the parameters is as follows. The rock sample is gently dried at 70 °C for 24 hours in a drying cabinet. Then the sample is cracked to particle sizes in the 0.5-1.0 mm range and graded. Required equipment: graduated cylinder, scales, water, dry, fine quartz sand or corundum of known particle size. For accuracy, preciseness and reliability of measurements, 10 parallel measurements are conducted at the same time.
The procedure for the measurement is as follows: Determine the tare weight of the empty graduated cylinder. Place some sample material into the cylinder and measure the net weight (loose/m). Read the volume (loose/v). Pour the sample onto a sheet of paper. Place some quartz sand into the cylinder, measure the net weight (por/m), and read the volume (por/v). Add the previous sample from the paper, and shake with the quartz sand. Knock on the cylinder and if the particles are not covered in sand, while continuously knocking the cylinder, add more sand so that the sample particles are covered. Measure the combined net weight (mix/m) and read the combined volume (mix/v). Pour the material from the cylinder and fill with a certain amount water (of known volume), measure the net weight of the water (for accuracy, water.m = water.v). Add some sample material to the water and measure the net weight of the suspension (susp/m).Wait for 10 minutes for the suspension to settle, than read the combined volume for the suspension (susp/v). Remove the excess water from the rock particles, close the opening of the cylinder, turn it upside down and wait for the remaining water to trickle away (0.5-1 hour).Turn the cylinder back to its normal position and measure the weight again (wet/m). As the last step, compact the wet material by gently hitting against a hard surface, then read the wet volume (wet.v). Table 2 explains the calculation of the parameters.
The results are statistically evaluated in several steps. Based on the 10 parallel measurements, the arithmetical average and variation for each physical performance indicator is determined for the media. Using the averages, profile diagrams are created for the media for visual representation. Using single-factor variation analysis, it is determined whether there are two samples significantly different for the given characteristic. Where there is a significant difference, the least significant difference (LSD) approach is used for comparison in pairs in the post hoc test.

The procedure and the evaluation is illustrated using the following mix:

Mix No. 1: zeolite 17 %, clay granulate 17%, river sand 20%, Florasca 'A' substrate 40 %, Hanság peat 5%.
Mix No. 2: ground brick 25 %, ground ytong blocks 25 %, Hanság peat 15%, zeolite 20 %, meliorite 15%.
Mix No. 3: Florasca 'A' substrate 50%, Hanság peat 20%, sand 15%, meliorite 15%.

Table 2. Calculation of parameters in the procedure

Loose density	$\rho_{loose} = m_{loose} \div V_{loose}$
Wet, loose density	$\rho_{wet\ loose} = m_{wet} \div (m_{susp} - m_{water}) \times \rho_{loose}$
Rock density	$\rho_{rock} = m_{mix} - \rho_{por} \times V_{por}) \div (V_{mix} - V_{por})$
Rock density, wet	$\rho_{wet\ rock} = m_{wet} \div (m_{susp} - m_{water}) \times \rho_{rock}$
Crystal structure density	$\rho_{crystal\ structure} = (m_{susp} - \rho_{water} \times V_{water}) \div (V_{susp} - V_{water})$
Rock weight, in unit volume	$m_{rock/V} = \rho_{rock}$
Rock volume, in unit volume	$V_{rock\ /Vrock} = \rho_{rock} \div \rho_{rock}$
Rock weight, in unit wet volume	$m_{rock/Vwet\ rock} = \rho_{rock}$
Rock weight, in unit wet weight	$m_{rock/mwet\ rock} = (1 \div \rho_{wet}) \times \rho_{rock}$
Water content (porosity), in unit wet weight	$m_{water/mwet} = 1 - (1 \div \rho_{wet}) \times \rho_{rock}$
Water content (porosity), in unit wet volume	$m_{water/Vwet} = (\rho_{wet} - \rho_{rock})$
Water content, in unit wet granulate volume	$m_{water/V\ unit\ wet\ granulate} = \rho_{wet\ loose} - \rho_{loose}$
Surface water, in unit granulate volume	$V_{surface\ water/V\ granulate} = \rho_{loose} \div \rho_{rock} + m_{water/Vunit\ wet\ granulate}) - 1$
Surface water, in unit granulate weight	$V_{surface\ water/m} = V_{surface\ water/V} \div \rho_{wet}$
Pore space, in unit granulate volume	$P_{space/Vunit\ granulate} = 1 - (\rho_{loose} \div \rho_{rock})$
Pore space, in unit granulate weight	$P_{space/munit\ granulate} = P_{space/Vunit\ granulate} \div \rho_{loose}$

Source: own construction based on KOCH et al. (1966)

RESULTS

The procedure can be used to simply and rapidly determine those parameters of the rock sample/substrate mix that are required most often for design and implementation efforts on the technical side: density, the volume of cavities in the volumetric unit of the rock, the density of the crystal structure constituting the rock etc.

As a result of length limitations, the results presented herein are only highlights from the substrate mixes. For the accuracy, preciseness and reliability of the measurements, averages are calculated from 10 parallel measurements.

The results indicate that the substrates represent a typical pattern. Every density parameter (loose density; wet loose density, rock density, wet; crystal structure density) resulted in a series of descending values for Mix 1, Mix 3 and Mix 2. *Figure 1* shows parameters directly corresponding to density, while *Table 3* presents the results of the post hoc test for the density parameters of the mixes.

This summary table evidences corroborates that Mix 1, then Mix 3, then Mix 2 took the highest values for every density parameter for every mix, at least to 95 %.

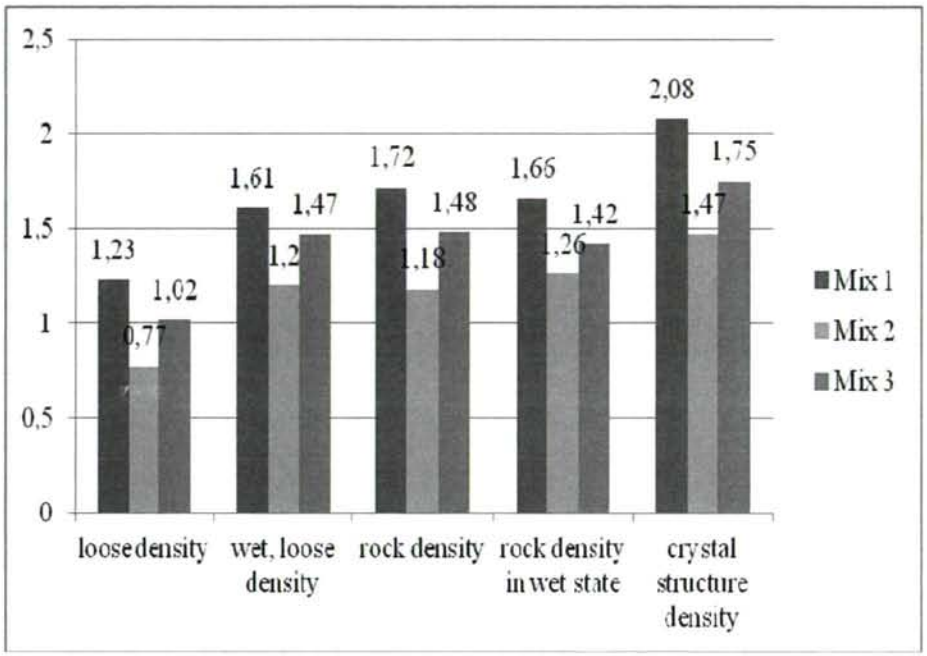

Figure 1. Density Parameters of the Mixes Tested

Table 3. Matrix for Significant Differences in Density Parameters for the Mixes Examined

loose density wet, loose density rock density rock density in wet state crystal structure density	**Mix 1**	**Mix 2**	**Mix 3**
Mix 1	–	99% 99% 99% 99% 99%	99% 95% 99% 99% 99%
Mix 2	0.46 0.47 0.54 0.40 0.61	–	99% 99% 99% 95% 99%
Mix 3	0.20 0.14 0.24 0.24 0.33	0.25 0.27 0.30 0.16 0.28	–

CONCLUSIONS AND DISCUSSION

Currently, a number of Hungarian National Standards cover testing for soil quality and soil mechanics characteristics: MSZ-08-0205:1978 – Determination of physical and hydro-physical properties of soils; MSZ-08-0480-1:1981 – Horticultural soil mixtures. Qualitative requirements; MSZ-08-0480-2:1982 – Horticultural soil mixtures. Laboratory analyses; MSZ-08-1788:1984 – Field measurement of hydraulic conductivity of soil. One must note that these standards were primarily developed for soil and not substrate mixes to

be used under special extensive conditions. It is also known that detailed and lengthy tests should be carried out primarily in accredited laboratories, relying on the appropriate skillest and equipment.

The procedure is designed in a manner that would provide as many parameters as possible through a few very simple and interlinked weight and volume measurement. The entire system models the scenario of rainwater falling onto the extensive green roof, so the particles absorb as much water as the hydration shell around them, the rest drains away. These measurements are often required, and they are carried out without being comprehensive, however, with much more effort invested in the process than it would be necessary. The lack of a system and the incomprehensive nature of the process would very often renders the comparison of samples tested for different parameters at different times impossible, and the result is the loss of valuable information. The procedure described here is designed to prevent that loss of information, while at the same time it is a useful tool to better understand the behaviour of a substrate, rock material, or filtering particles. A disadvantage of the procedure is that it is of limited use with fine grains. Profiling physical parameters of mixes has the primary advantage that it provides the comparability of samples through a detailed, almost comprehensive description of the materials.

The profiles can be considered as fingerprints for rock/medium features, very characteristic to the samples tested. The profile polygon is unambiguously determined by the area/perimeter (A/P) ratio and the profile polygon centre of gravity (GC). It would be a useful step to adapt that methodology to extend the procedure described (KOLLÁR-HUNEK et al., 2008).

ACKNOWLEDGEMENTS

This project was supported by TÁMOP 4.2.1./B-09/1/KMR/2010-0005

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Review on Agriculture and Rural Development 2013. vol. 2. (1) ISSN 2063-4803

A BIO-ECONOMIC ANALYSIS MODEL IN TETRA H HYBRID RAISED IN ORGANIC SYSTEM

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ABSTRACT
This paper shows a bio-economic analysis model in Tetra H hybrid, raised in organic system, in line with the protein intake and of the body weight registered during the experimental period. The mathematic model y=a/(1+bx+cx2) allows the assessment of the expenses recorded with chicken feeding depending on crude protein intake. The model also validates the possibility to simplify the chickens' nutrition technology (starting from a triphase fodder feeding to a diphase fodder feeding) and at nutritional (protein) levels adapted to the desired body weight. The indices of correlation between the expenses registered with fodder feeding and crude protein intake show us that between them there is a strongly positive correlation, thus: 0.958 (in T1), 0.980 (in T2) and 0.972 (in T3). The indices of determination (R2) corresponding to the three experimental variants are higher, with values over 0.963, and the error percentage of the mathematical model is reduced (below 6%). Based on the results obtained in Tetra H chickens, it may be recommended a diphase fodder feeding (with starter fodder between 1-21 days and grower-finisher fodder between 22-112 days) with concentrates mixtures (CM) by 22% and 17,5% CP and 2971 and 3160 kcal ME/kg.

Keywords: bio-economic analysis, protein, mathematical model, costs of feeding, organic poultry Tetra H

INTRODUCTION

Ecologic agriculture is thought to be a viable solution, which solves the negative impact of an intensive agriculture, through which are satisfied the requests of some advised consumers, contributing to the protection of the environment, to the welfare of the animals, as well as to the rural development (Regulation CE 889/2008).
The ecological poultry egg and meat production registers a special dynamics through an increase in the number of operators in this sector, but due to the low level of the productive performances, the internal intake needs can still not be provided.
The indices most utilized in assessing the economic efficiency of aviculture and organic system can be: live growth achieved at the sacrifice age (min 81 days), the cost per poultry and per unit of product, the feed/day/bird expenses and per unit of product, the energy intake per bird, the hours-individual activities per unit of product, the profit per bird (simiz et al. 2012).
From the influence factors on the costs of an organic product, are cut off the expenses with fodder feeding, which, according to different authors, (Scahaw, 2000; Weersink et al. 2002) may oscillate 40% and 60%.
Failing some complete control values of feed for poultry youth raised organically, we hereby propose a bio-economic analysis model of the results achieved in Tetra H hybrid depending on the administered crude protein intake and of the body weight registered at the end of the experimental period.
The high degree of correlation of protein level with weight gains and the feed conversion rate (Mendes and Cury, 1986; D'alfonso, 2003; Balevi and Coskun, 2000; Zhan et al. 2007; dairi et al. 2010) as well as the high costs of protein feeds, has stayed at the basis of the elaboration of bio-economic analysis model in Tetra H hybrid, raised in organic system.

MATERIAL AND METHODS

The experiment that led to the elaboration of bio-economic analysis model has been performed on a number of 102 one day old of mixed sex Tetra H. These birds were again randomly divided into three equal treatment groups of 34 birds each. In the experiment, dietary treatments were as follows: chickens in T_1 were triphase fed with starter (1 to 21 d), grower (22 to 56 d) and finisher (57 d to slaughter, 112 d) with 22.00, 19.03 and 17,5% crude protein (CP) and 2971, 3136 and 3160 kcal (metabolizable energy) ME, chickens in T_2 were diphase fed with starter (1 to21 d) and grower-finisher (22 to 112 d) with a nutritional value similar to that of chickens in T_1, and the chickens in T_3 diphase fed with starter and grower-finisher with protein level minimized by approx. 10p% and energetic level by 5.5-8% (19,73, respectively 15,75% CP and 2809, respectively 2910 kcal ME). Feed and water was provided *ad libitum*. Daily mortality was recorded for each group.
Bird and feed were weighed every two weeks to determine body weight and feed intake, and to calculate the protein and energy intake.
Economic traits:
a. Cost of feed (CF) consumed for one kg of weight gain was calculated as follows:
CF=(C1F1+C2F2+C3F3)/(WG1+WG2+WG3), where:
C1, C2, C3: Price of one kg feed at starter, grower and finisher, respectively.
F1, F2, F3: Feed intake at starter, grower and finisher, respectively.
WG1, WG2, WG3: Weight gain at starter, grower and finisher, respectively.
The fodder feed costs analysis has been set during the entire growing period based on the purchase price of the fodders and based on the concentrated mixture (CM) structure in the phases of growth.
b. Estimation of feed costs based on protein intake with the help of a mathematic model using the Data fit 9 softhware.
Data were processed by one-way ANOVA (IBM SPSS Statistics 19). When appropriate, differences among system means were compared with Turkeys multiple-range test and were considered significant at $P<0.05$.

RESULTS AND DISCUSSIONS

Data on body mass, total growth rate, CM and CP intake, and ME as well, set for the entire experimental period in Tetra H hybrid are shown in *Table 1*.

Table 1. Body weight, feed, protein and energy intake of chickens belonging to different experimental groups

	T_1	T_2	T_3
Body weight at 112 d (g)	2150.00±41.539[a]	2070.00±40.06[a]	1700.00±33.485[b]
Average daily gain (g)	18.84±0.538[a]	18.13±0.612[a]	14.82±0.500[b]
Feed intake (kg)	5.850±0.265[a]	5.840±0.115[a]	5.020±0.282[a]
CP intake (g)	9.57±0.435[a]	9.31±0.177[a]	7.22±0.397[b]
ME kcal	163.91±7.458[a]	164.00±3.291[a]	130.03±7.351[b]

[a-a] $P>0.05$; [a-b] $P<0.05$.

The data on body mass at the end of experimental period show that the experimental variant T1 obtains higher weights (2150.00 ± 41.539 g) compared to variants T2 and T3. Chickens in T2 weighing 2070.00 ± 40.06 g at the end of experiment follow closely the body mass of chickens in T1 with an insignificant difference ($p>0.05$). Chickens in T3 registered the most reduced body weight (1700.00 ± 33.485 g) with a significant difference from T1 as well as from T2 ($P<0.05$).

The total rate of growth listed in table 1 reconfirms the findings on body mass evolution of chickens i.e. chickens in T2 fed according to the diphase model, fed with two CM common structures for 85 days from the total of 112 days plus the total of chickens in T1 (fed according to triphase model) registers an decrease of only 3.77% lower, which allows the simplification of fodder feed technology to two phases. The decrease of energetic rate by 5.5-8% and of the protein rate by approx. 10% for CM given to chickens in T3 significantly reduces, by 18.23%, the increases in growth compared to chickens in T2, which shows the necessity to keep a proper nutritional contribution and under the conditions of a slow growth of poultry youth.

It turns out that in T3 it has been registered the lowest total CM intake (5.020 kg/chicken) during the total experimental period, followed by T2 with a higher total intake of 14.20%. In T1 it has been registered the highest total CM intake (5.850 kg/chicken) by 0.17% compared to T_2 and by 16.53% compared to T_3. Although there are differences on CM ingestion, they are statistically insignificant ($P>0.05$).

Regarding the crude protein intake, it turns out that the values are close in T_1 and T_2, 9.57±0.435 g, respectively 9.31±0.177 g, a statistically insignificant difference ($P>0.05$), which could lead to the possibility of applying a diphase fodder feed. CP intake in T_3 registers significantly lower values (7.22±0.397 g) due to the fact that in this variant the CP has been reduced in both CM used structures.

As for the energy metabolized intake in chickens from the three experimental variants, according to data in *Table 1*, it turns out that between T_1 and T_2 the percentage differences are only of 0.06 %. By feeding chickens in T_3 with some CM with energetic levels lower by 162-250 kcal ME/kg, there is not recorded a compensatory energy intake (ZHAN et al. 2007), the ME intake during the entire experimental period being by 20.72% lower than T_2 ($P<0.05$).

The results of the economic analysis become decisive when selecting the feed technique (biphase and triphase) of the duration of these phases as well as on the protein level and the structure of concentrated mixtures.

Table 2. Expenses recorded of feeding chicken

	CF/chicken			CF/kg live weight		
	T_1	T_2	T_3	T_1	T_2	T_3
Euro	3.159	3.088	2.223	1.469	1.492	1.307
%	100	97.75	70.35	100	101.52	87.64

As expected, according to the data in Table 2, the highest expenses are made with feeders for chickens in T_1 with 3.159 euro/chicken, but expressing the costs reported to live weight kg, it turns out that chickens in T_2 (*Figure 1*) these costs are only with 1.52% higher, which allows recommend an application of a diphase diet and with nutritional CM values provided in protocol.

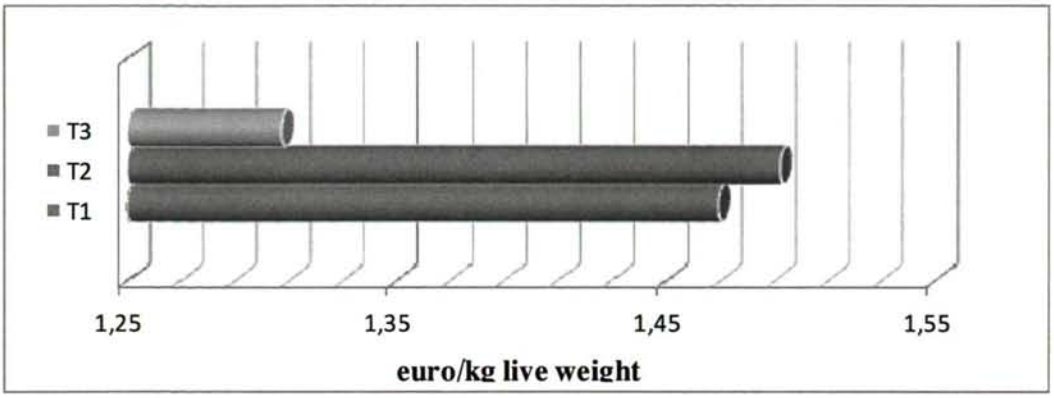

Figure 1. Representation of fodder intake of chickens from the experiment

Although for chickens in T_3 the costs of feed reported to live weight kg are the lowest (1.307 euro/kg live weight), the technological solution can be taken into consideration only under the conditions of accepting some modest productive indicators for Tetra H hybrid.
The indices of correlation between the expenses registered with fodder feeding (y) and crude protein intake (x), presented in Table 3, show us that between them there is a strongly positive correlation, thus: 0.958 (in T_1), 0.980 (in T_2) and 0.972 (in T_3). Starting from this premise, it has been set a mathematic model valid for the three experimental variants which can assess the expenses recorded with chickens fodder feed according to crude protein intake. The model: $y = a/(1+bx+cx^2)$, is shown in *Table 3*.

Tablel 3. Feeding cost estimates according CP intake (g)

Model Definition: $y = a/(1+bx+cx^2)$,
were: $y=CF$, $x=$ *CP intake (g)*

Variance Analysis

Source	DF	Sum of Squares	Mean Square	F Ratio	Prob(F)
Regression	2	8.1768856	4.08844	87.2748	**0.0001**
Error	5	0.2342281	0.06845		
Total	7	8.4111138			

Regression Variable Results

Variable		Value	Standard Error	t-ratio	Prob(t)
T_1	*a*	0.097655	2.924868	3.33880	**0.020**
$R^2=0.972$	*b*	-0.195656	9.068764	-21.5747	**0.000**
$r=0.958$	*c*	9.894671	8.512789	11.62330	**0.000**
T_2	*a*	0.115788	0.028855	4.0126923	**0.010**
$R^2=0.976$	*b*	-0.198663	0.008142	-24.399118	**0.000**
$r=0.980$	*c*	0.010273	0.000766	13.403427	**0.000**
T_3	*a*	0.075582	0.025637	2.9481113	**0.031**
$R^2=0.963$	*b*	-0.252680	0.015126	-16.704766	**0.000**
$r=0.972$	*c*	0.016559	0.001858	8.9108727	**0.0003**

Following the application of this mathematic equation, there can be assessed the expenses for fodder feeding in Tetra H hybrid, performed organically under conditions similar to the development of this experiment, based on the determination of crude protein intake.

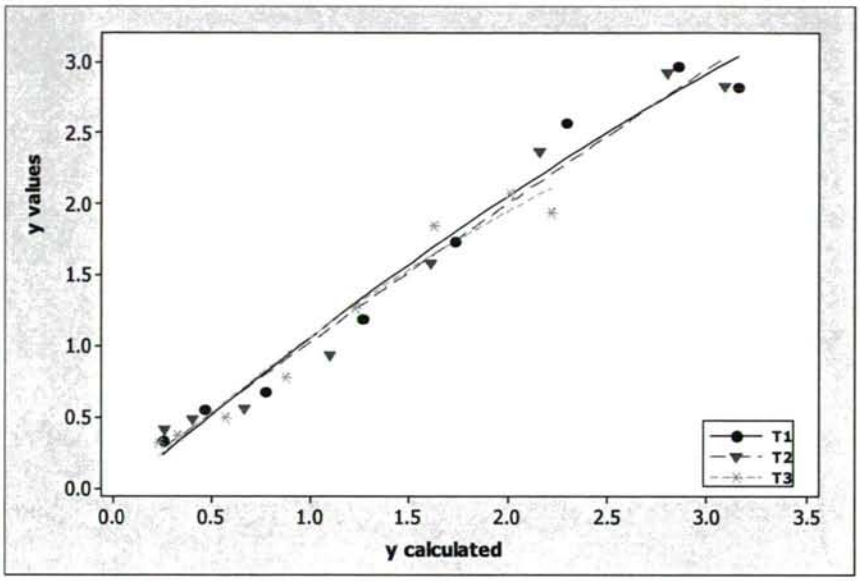

Figure 2. Fodder feeding cost for chickens in experimental variants

The analysis of data shown in *Table 3* results that the values calculated (the predicted price) is close to the analysis experimentally obtained during the 12 weeks of growth. The indices of determination (R^2) corresponding to the three experimental variants are higher, with values over 0.963, and the error percentage of the mathematic model is reduced (below 6%).

CONCLUSIONS

The chickens in T_2 fed by the diphase model record growth performance similar to variant T_1, with insignificant differences, but the costs recorded with fodder feeding are lower by renouncing the CM intermediary structure.

As for the crude protein intake, but also metabolized energy, it turns out that the values are closed in T_1 and T_2, which might lead to the possibility of applying a diphase fodder feeding. The intake CP to T_3 registers significantly lower values.

Costs registered with fodder feeding of Tetra H hybrid maintained in organic system, according to the gross protein intake, can be estimated with the help of the following mathematic model $y=a/(1+bx+cx^2)$ with an error below 6%. The mathematic model selected has registered a high determination index, over 0.958.

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Review on Agriculture and Rural Development 2013. vol. 2. (1) ISSN 2063-4803

RELATIONSHIP BETWEEN THE NUMBER OF LACTATION AND MILK YIELD ON SAANEN GOAT FARMS

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ABSTRACT
The authors examined the milk production, on five Saanen-goat farms at the time of the monthly milk-recordings. In their present study they endeavoured to examine the connection between lactation number and milk production. They tried to find out how the increase in the lactation number of the mother goats affect the milk yield; in which lactation these values are the highest and until which lactation it is worth keeping the mothers in production. There were 37 ewes on farm No. 1, 17 on farm No. 2, 45 on farm No. 3, 17 on farm No. 4 and 80-90 on farm No. 5. On farm No 1-4 the daily milk yield was measured five times a month from May to September. On farm No. 5 the examinations were continued for three years. The data were processed by Microsoft Excel 5.1 and analysed by SPSS for Windows 15.0 programmes. To determine the relationship between the data univariate variance analysis and Pearson' correlations were applied. The highest milk yield was observed in lactation 3 and 4. The most milk was produced by the does on farm 5 in lactation 4 (2.75 milk kg/day/doe; $r = 0.31$; $P < 0.01$), while the least yield was given by the ewes on farm 4 (lactation 7; 0.52 milk kg/day/doe). Based on the evaluation in the end the peak of the mild yield was in lactation 4. (2.46 milk kg/day/doe; $r = 0.16$; $P < 0.01$), and in lactation 7 the milk yield of the ewes was the same as that of the ewes in lactation 1. Based on these findings it was concluded that the mothers could be kept in production until their 7^{th} - 8^{th} lactation. When considering milk yield a value of $h^2 = 0.22$ ($P<0.05$) was found in the given stock, which means the heritability of this parameter indicated a poor heritability, according to their results. The farm effect proved to be significant in case of the milk yield.

Keywords: Saanen goat, milk yield, lactation number

INTRODUCTION

The main benefits of goat milk production. The influence of the quantity of milk nutrition, and age significantly affected. The Hungarian domestic varieties give an average of around 300 liters, while foreign dairy breeds from 6000 to 1200 liters of milk. The good dairy goats produced milk 15 to 20 times their body weight during a lactation (SCHANDL, 1971). KUKOVICS-NÉMETH (2008) found that the goat's body weight compared to a maximum of 9.31 times the capability of producing a lactation, when the mother's average weight is 50-60kg goat, the amount of milk they produce can be 500-600kg.

According to SCHANDL (1971) the best age for the animals to start breeding is 7-8 months however in case of the less-developed animals he suggests the 1 1/2 years of age. The animals are at top capacity at the age of 3-5, but he notes that in some cases, even at the age of 12-16 they can be satisfactory for milk yield. The 1-2 year old mothers give less than 100 to 200 liters per year less than the older goats. The 5 to7 year-old goats produce the most milk, then there is a decrease in their milk yield.

The 1-2 year old mothers give 20-30% less milk than the 3-5 years old, who are in their prime breeding. The goats are usually taken out of milk production at the age of 7 to 9 years, but sometimes 12 to 16-year-old animals can produce at an acceptable level (VÁRKONYI-ÁTS, 1982).

MOLNÁR - MOLNÁR (2000) found that the goats are at the top of their milk production during their fourth lactation period. In comparison, their production is 95%, in the third lactation 90% in the second one, while in the first one it is only 70%. The mothers reach their peak performance from 4 to 8 years old. According to NÉMETH ET AL. (2010), milking should be started as soon as possible after calving, while they suggest the end of the milking, the so-called dry period, should start from 200th day of lactation. From this point on there is a greatly reduced milk yield, although studies have shown that milk fat and milk protein content might increase.

CREPALDI ET AL. (1998) Alpine goats were tested and found to affect on milk yield the calving period ($R^2 = 0.4$), number of calving ($R^2 = 0.03$) and litter size. Most of the calving was wintertime (60%) and 40% in spring. There are several authors demonstrating the positive effect of winter calving on the milk yield: STEINEN, 1975; ALDERSON AND POLLAK, 1980; MONTALDO ET AL., 1981; BOULOC, 1992; MUORAD, 1992; VECEROVA AND KRIZ, 1993; NIZNIKOWSKI ET AL, 1994.

The one-year milk production will be best if the mother calves in winter (SCHANDL, 1947), so it will give a lot of milk in spring again, due to the green fodder, while mothers calving in summer dry up soon (their milk production stops).

An increase in the milk production of mothers more than 5-year-old is rare, but it might happen. VECEROVA - KRIZEK (1993) examined 809 goats, Czech, white short-haired goats, which were in the10th lactation and in case of 248 animals they found an increasing production. However FINLEY ET AL (1984) think, the maximum milk yield can be achieved between 24 and 50 months of age; Alpine, Saanen and Toggenburg goats were examined. RAATS ET AL. (1983) carried out experiment with, Boer goats and found that the milk production increases from the second lactation to the fifth one.

In this study authors endeavoured to examine the connection between lactation number and milk production. They tried to find out how the increase in the lactation number of the mother goats affect the milk yield; in which lactation these values are the highest and until which lactation it is worth keeping the ewes in production.

MATERIAL AND METHODS

The examinations were performed on five Saanen goat farms. Grazing was the basis for nutrition, which was supplemented with feed mix (corn, wheat, barley, and triticale) at the milking in the morning and in the evening. But the quality and quantity of the grasslands and feed mix were different. The animals could graze on burned out, sparse-grass field except in May, the rainy month, on Farm 2 and Farm 4. We examined 56 mother goats on Farm 1, 17 mothers were on Farm 2, 45 animals on Farm 3 and 17 on Farm 4. The examinations were carried out on Farms 1, 2, 3 and 4 from the beginning of May until the end of September, 2008, for five months, monthly. On Farm 5, where there were 80-90 mother goats, the examinations were continued for three years (2005-2007). The quantity of goat milk was measured with Berango type ewe-milk measuring equipment in the morning and in the evening- monthly. Based on the daily (morning and evening) measured milk production data I calculated the daily milk yield of each lactating goat and the average values of lactating goats were made up from these data. The mother goats were grouped according to lactation number on each farm and then the average daily lactation milk yield values were lactation for each group. The data were analysed with a single-factor analysis of variance method. The relationship between the variables was examined with correlation analysis (Pearson's phenotypic correlation coefficient). The results were illustrated in table or in chart. The examinations were carried out from the combined data of the five farms altogether.

The figures were uploaded and systematized on computer with Microsoft Excel 5.1 programme. For data processing SPSS for Windows 15.0 programme was used.

RESULTS

The assessment of individual farms

On Farm 1 mothers in third lactation reached the highest milk yield (2,67 kg/ mother/ day), while there was no significant difference between the average milk yield from second to sixth lactation only a minor fluctuations were observed. The milk yield was significantly less, compared to the peak production in the 8th lactation but almost the same as in the first one.

On Farm 2 the milk yields were little in every lactation; the higher values were due to three calvings. However, the milk production fluctuated - e.g. second lactating mothers produced less than the first. The animals could not produce more milk due to poor nutrition.

On Farm 3 the fourth lactation mother goats produced most milk (2.45 kg/mother/day), although this value is not significantly different between the neighboring third and fifth lactation values. However, the milk production at 6th lactation mother goats has been significantly reduced. Mothers were at their peak power of 3-5 lactation.

On Farm 4 lactation milk yield was very low in each group. The animals were in very poor condition due to incomplete nutrition. The 5-lactating mothers produced the most milk, but the average lactation milk yield was1.70 kg milk/day/mother, which is the lowest of all farms.

On Farm 5 the production significantly increased until the fourth lactation (2.75 milk kg / mother / day). In this period, the animals produced the most milk on this farm.

Is noteworthy that milk production was high (2.37 kg) even in the sixth lactation, it was significantly more than the 2nd lactation mother goats and did not differ significantly from the production of the 3.-4.- 5. lactation mothers (*Table 1*).

Table 1. The relationship of the average daily lactation milk yield and the number of lactation by farms (milk kg/mother goat/year)

Lactation	Farm 1		Farm 2		Farm 3		Farm 4		Farm 5	
No	$\bar{x} \pm s$	n	$\bar{x} \pm s$	n	$\bar{x} \pm s$	n	$\bar{x} \pm s$	n	$\bar{x} \pm s$	n
1	2.06±0.62a	50	1.93±0.86	30	-	-	-	-	1.67±0.47c	140
2	2.53±0.66b	65	1.85±0.89	15	-	-	-	-	2.00±0.66b	175
3	**2.67**±0.69b	35	**2.20**±0.93	20	2.20±0.50a	105	0.86±0.48	10	2.15±0.85b	205
4	2.54±0.71b	10	1.60±0.87	10	**2.45**±0.54a	65	0.76±0.42	25	**2.75**±0.56a	205
5	2.29±0.89b	40	2.56±1.15	5	2.07±0.48a	25	**1.70**±0.62	30	2.20±0.68b	100
6	2.45±0.38b	15	-	-	1.39±0.78b	15	-	-	2.37±0.44a	20
7	-	-	2.65±1.12	10	1.18±0.16b	5	0.52±0.35	5	-	-
8	2.15±0.96a	10	1.30±0.54	5	3.16±0.61c	5	0.69±0.36	15	-	-
9	-	-	-	-	1.63±0.10b	5	-	-	-	-
Average	2.35	-	1.91		2.20		0.86		2.19	

n = number of measurements

The means with the different letters are significantly different, within farms ($P < 0.05$)

The combined evaluation of farms

The total assessment of the data of all five farms covers the individual differences of the farms. The milk production tendency in the successive lactations was performed as expected (*Figure 1.*). The milk production increased until the fourth lactation (2.46 kg milk/day/mother goat) and then a decrease followed. MOLNÁR - MOLNÁR (2000) concluded the same results.

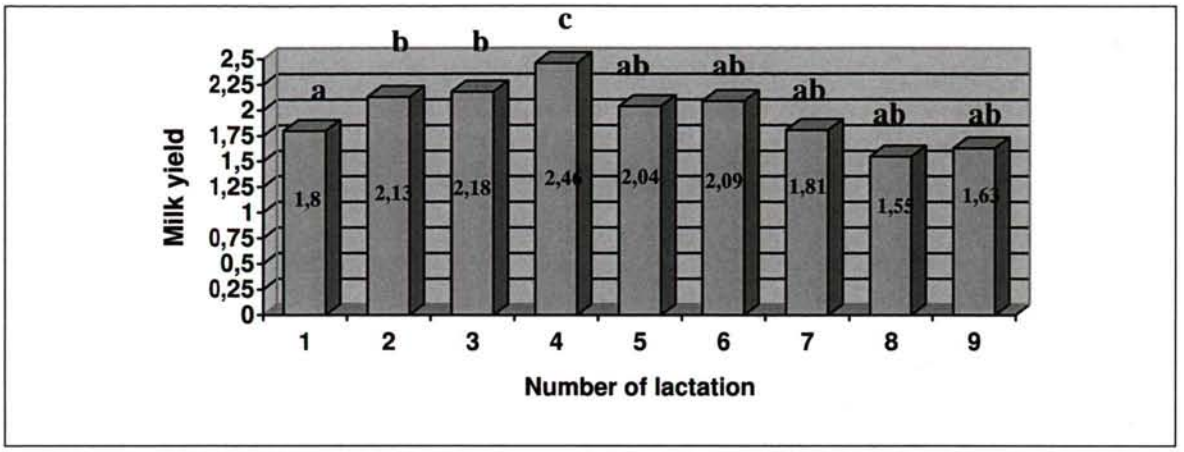

Figure 1. The relationship of the average daily milk yield and the lactation number on all five farms (milk kg/day/mother goat)

The values marked with various letters are significantly different (P<0.05)

The peak production was significantly higher than the neighbouring values. Milk production decreased from the fifth lactation without significant differences. The milk production of mother goats in their seventh lactation was the same as that of the first-lactation mothers. The milk yield produced by mothers in their ninth lactation was hardly less than that of the firs-lactation mother goats. Base on that we can conclude that it is worth keeping the 7.-8.-9.-lactation mother goats in production when they perform these values. It must be noted though, that the rate of such animals was not high. Because of their high life-expectancy I suggest keeping their offspring in production as well. The correlation examination of the milk yield and the lactation number indicated a weakly intermediate, positive relationship from the first to the fourth lactation. ($r = 0.26$; $P<0.01$), while the milk yield was growing. Later, together with the increase of the lactation number, the milk yield decreased and the relationship became negative ($r = -0.16$; $P<0.01$).

CONCLUSIONS

The milk yield increased in all examined farms with lactation number, but there were significant differences in values. The highest amount of milk was produced in the third, fourth and fifth lactation of the goats, then their production fell back. The goats on Farm 3 had the highest milk yield (2.75 kg milk/mother/day; $r = 0.31$, $P <0.01$) in fourth lactation. The least milk was produced on Farm 4, during their peak production, in the fifth lactation period: 1.70 kg milk/mother/day. The production of the animals due to poor nutrition fell back to far behind that of the animals with well-fed and the production was unbalanced. They were not able to fulfil the production that can be expected from them because of their genetic endowments and the lactation number (Farm 4: the peak production of the fifth lactation was only 1.70 kg milk/day/mother goat).

When looking at the analysis carried out by the combined results of the five farms it can be observed that the animals produced the largest quantity milk in the fourth lactation period (2.46 kg milk/mother/day). This result is the same as MOLNÁR-MOLNÁR (2000) found. In comparison, the mothers in fifth lactation produced significantly less milk (2.04 kg/day). The milk yield of mothers in the seventh lactation did not differ significantly from that of the mothers in their second lactation.

According to the results found that the influence of the number of lactation milk yield.

The animals should be kept in production for seventh and eighth lactation as well, if they achieve results like mothers on Farm 1 and 3.
The animals are capable of high production for many years, if their nutrition is adequate (Farm 1: From lactation No.2- to No.6).

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Review on Agriculture and Rural Development 2013. vol. 2. (1) ISSN 2063-4803

BURROW DENSITIES OF EURASIAN BADGER (*MELES MELES*) AND RED FOX (*VULPES VULPES*) IN BÖRZSÖNY MOUNTAINS

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ABSTRACT
Due to their common spread in Hungary, Eurasian badger (*Meles meles*) and red fox (*Vulpes vulpes*) play key role in most Hungarian communities' life, and have decisive importance in both of wildlife management and nature conservation. Thus, development of a biologically well based carnivore management for these species is a relevant task that requires to getting to know their population statuses and to tracking the changes of these statuses. Our study aim was to verify the accuracy of stripe transect method that is commonly used for estimating burrow densities of carnivores, in a hilly area, that has always been a habitat for both of these two species. We were looking for answer to how the estimated burrow densities of the study area are related to data of countywide questionnaires, and to results of other, similarly detailed surveys. Burrow estimation was done in February 2011, and complete counting in January, February, and March of 2012. Our results showed 20.0% underestimation of Eurasian badger, and 2.2% overestimation of red fox burrows. Comparing to similarly detailed surveys, burrow density of badger in Börzsöny is equivalent to results from hilly areas, whilst definitely exceeds the level of densities on plain habitats. Red fox burrow density of the study area is multiple of the countrywide mean value that may refer to a remarkable systematic underestimation by wildlife managers. Our data, which are based on detailed assessment, show reliable burrow density values and offer a feasible method for practitioners.

Keywords: Eurasian badger, red fox, burrow, Börzsöny Mountains, density

INTRODUCTION

Eurasian badger *(Meles meles)* and red fox *(Vulpes vulpes)* are widespread, middle sized carnivores in most of the European countries, just like in Hungary, too (NEAL AND CHEESEMAN, 1996; MITCHELL-JONES ET AL., 1999; HELTAI, 2010). The key of their high population densities is the excellent adaptability both in habitat selection and feeding (KRUUK, 1989; LANSZKI ET AL., 1999; HELTAI, 2010). In Hungary Eurasian badger became protected in 1974. Due to its expanding population and range between the late 80's and early 2000's badger was removed from the national list of protected species (13/2001. (V.9.) KöM decree) (HELTAI AND KOZÁK, 2004). Eurasian badger is currently a game species, hunted between 1st of July and the end of February. Red fox has never been protected in the history. Its hunting season includes the whole year. Having broad tolerance and lacking big carnivores let them to be top predators of most of Hungarian natural communities (HELTAI, 2010). Their steadily growing stock may cause further strengthening in their predatory role and other impacts (HELTAI AND KOZÁK, 2004; HELTAI, 2010). This may manifest in stronger impact on species more important for wildlife management (HELTAI, 2010), raising damage on agriculture in case of badger (BÍRÓ et al., 2010), and increasing impacts on animal and human health of illnesses transmitted by both species (SRÉTER et al., 2003; TAKÁCS et al., 2012). Thus, development of a biologically well based carnivore management for these species is a relevant task both for nature conservation and wildlife management that requires knowledge on densities of local carnivores, and their population changes. Our study aim was to verify the accuracy of

band-transect method that is commonly used for estimating burrow densities of these carnivores, and in conservation biology in general with the method of complete counting in a hilly area that has always been a habitat for both of these two species (NEAL AND CHEESEMAN, 1996; HELTAI, 2010). We were looking for answer to how the estimated burrow densities of the study area are related to data of countywide inquiries, and to results of other, similarly detailed surveys.

MATERIAL AND METHOD

Study area

The study area is located in the southern side of Börzsöny Mountains close to Márianosztra villages. The terrain is indented, cut by ditches, hills, streams, and ravines. The lowest point of the area is 140 m. a. s. l., the highest peak reaches 335 m. a. s. l. The main tree species of this highly forested (54.8%) area are Turkey oak *(Quercus cerris),* and sessile oak *(Quercus petraea)* but common hornbeam (*Carpinus betulus*), and Scots pine (*Pinus sylvestris*) have remarkable stands, too (*Figure 1*). The shrub stratum is rich. A part of the opened area (73.9%) is in agricultural use; almost its half is meadow, whilst the other part is for crop production. The other 26.1% is shrubby-grassy, natural-like area.

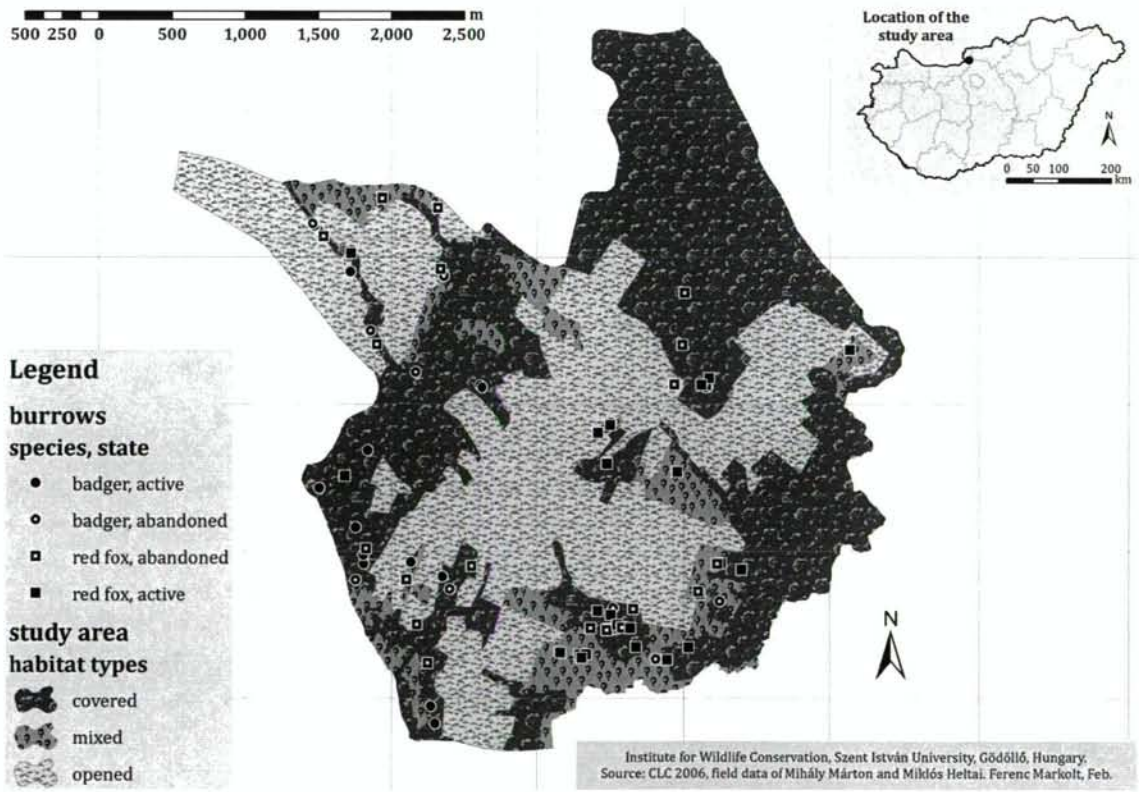

Figure 1. Study area, and burrow locations

Burrow estimation and the calculation of density

Field data were collected on 18th, 19th, 20th, and 25th of February 2011 with stripe transect method (HELTAI AND SZEMETHY, 2010). Nine, north-south oriented parallel lines were delineated, 500 meter between each. Lines were followed in field in order of to the serial numbers by help of compass and GPS. Localisation of burrow sites, marking borders of different vegetation classes, and registering the visible stripe width were done both by

GPS, and on a 1:25000 scale field map. This way, de facto 265 ha area were mapped, that is 21.1% of the whole 1257 ha study site, so the sampling can be considered as representative (HELTAI AND KOZÁK, 2004). HD72/EOV (EPSG code: 23700, Egységes Országos Vetületi Rendszer) was used as spatial reference for the GPS data recording. The following data were noted down during the recording: number of transect, use of burrow (inhabited or abandoned), type of vegetation, number of entrances/exits, and other signs referring to species (odour, footprints, latrine, faeces, prey remains). Statistical evaluations were done by Microsoft Excel and GraphPad InStat software. Random sample of transects were taken for estimating burrow density. Five transects were chosen in each case in order to calculate the mean burrow density. This sampling was repeated seven times and the mean of the resulted seven data was considered as estimator of burrows density of the study area (HELTAI AND KOZÁK, 2004). Welch test was implemented to compare burrow densities of the two species. Use of burrows found in February 2011 was controlled again on the 3rd, and 4th of August, 2011. Accuracy of burrow density estimation was re-checked on the 17th, 23rd, 27th, 30th of January, 2012, 2nd, 25th, 26th of February, 2nd, 3rd, and 4th of March, 2012 via complete counting, when use of burrows found in the previous year was re-investigated. Then, number of burrows found and estimated density of 2011 were descriptively compared. Burrow density of the study area was compared with data of detailed studies found in Hungarian publications and with general national figures, as well (HELTAI AND KOZÁK, 2004; HELTAI, 2010; MÁRTON ET AL., 2012).

RESULTS

Estimation of burrow densities based on the data of 2011 are for Eurasian badger 1.58 ± 0.64 burrow/100 ha, for red fox 3.66 ± 1.75 burrow/100 ha (*Table 1*). Welch-test proved, that, both for active ($t_w = 2.967$, df = 7, p = 0.021, n = 14) and abandoned ($t_w = 2.648$, df = 7, p = 0.033, n = 14) burrows, burrow density of red fox is significantly higher in the study site.

Table 1. Burrow density estimation of the two carnivore species (pcs./100 ha)

Sample	Badger		Red fox	
	Active burrows	All burrows	Active burrows	All burrows
1	1.83	1.83	3.45	3.45
2	0.36	0.73	6.37	6.37
3	1.36	1.36	2.50	2.50
4	2.20	2.56	5.88	5.88
5	1.36	1.36	2.50	2.50
6	2.20	2.56	2.94	2.94
7	1.73	2.09	1.99	1.99
Mean:	1.58	1.79	3.66	3.66
SD:	0.64	0.68	1.75	1.75

When comparing estimation of 2011 to results of the complete counting in 2012 badger seems to be 20.0% underestimated, whilst red fox looks to slightly (2.2%) be overestimated (*Table 2*).

Table 2. Comparison of the interpolation of estimated burrow density to the whole study area ($\bar{x} \pm SD$) and the results of the complete counting

Species	2011	2012
	Burrow density (pcs./1256.7 ha)	All burrows (pcs.)
Badger	22.5 ± 8.6	27
Red fox	46.0 ± 22.0	45

These values of burrow density of Eurasian badger are similar to what was found in studies conducted on hilly areas, but remarkably exceed values found in studies done on plain study areas. Difference between hilly and plain areas' burrow densities is statistically certified ($t = 2.885$, $df = 9$, $p = 0.018$, $n = 11$).

Table 3. Burrow densities of Eurasian badger on different study areas

Sample area	Active burrow (pcs./100 ha)	Difference from Börzsöny (%)
Borsodivánka (1998)	0.000	100.0
Abádszalók (1998)	0.000	100.0
Abádszalók (2001)	0.120	92.4
Egyek (1998)	0.061	96.1
Egyek (2001)	0.220	86.1
Pély (1998)	0.032	98.0
Dévaványa (2001)	0.480	69.6
Erdőspuszták (Nagycsere-Debrecen) (2004)	1.070	32.3
Ágota-puszta-Farkassziget (Hortobágy-Püspökladány) (2004)	0.300	81.0
Pécel-Isaszeg (2006)	1.660	-5.1
Nagyrét (Kiskunság) (2005)	1.490	5.7
Mátyás király vadaskert (Bakony) (2007)	1.070	32.3

Burrow density of red fox found in the Börzsöny (36.6 burrow/1000 ha) is similarly high compare to a figure found in a study from the Bakony (40.8 burrow/1000 ha) (MÁRTON ET AL., 2012). However, in comparison with the general national average figures, our results suggests much higher values, than the data based on the country-wide questionnaires (*Table 4*).

Table 4. Countrywide burrow density of red fox (pcs./1000 ha) (source: HELTAI, 2010)

Year	Transdanubia			Danube to the East		
	Mean	SD	N	Mean	SD	N
1988	2.3	1.7	101	2.0	1.4	144
1990	2.1	1.4	75	2.1	1.6	117
1994	3.1	2.1	129	2.2	1.5	180
1995	3.0	2.1	141	2.6	1.8	215
1997	3.9	2.8	169	4.1	7.4	243
1998	4.3	2.6	215	3.4	2.6	293
2000	4.4	3.4	222	2.6	1.9	333
2001	4.2	2.9	191	2.7	2.0	301
2002	3.74	2.62	197	2.73	2.03	346
2003	3.16	2.28	204	2.76	1.86	328
2004	3.00	5.82	197	2.70	1.98	331
2005	2.99	3.14	193	2.62	1.91	335
2006	2.94	1.97	182	2.41	1.55	256

CONCLUSIONS-DISCUSSION

Based on the number of the explored active burrows, burrow density of red fox is double of Eurasian badger's. This result, however, does not necessarily apply to abundance, since social behaviour of the two species is different. Fox lives solitarily, whilst badger in family groups (clan) (KRUUK, 1989; HELTAI, 2010). Number of active burrows may let us draw conclusions about the size of red fox population, but this is not possible in case of the badger taking into consideration that the size of clans may range from 2-3 to dozen of individuals depending on the food supply (NEAL AND CHEESEMAN, 1996). In order to establish a reliable value of Eurasian badger population density, our presented method should be supplemented by footprint counting and whole-year observation (HELTAI AND KOZÁK, 2004). Comparing the estimation of 2011 and the complete counting of 2012 we can conclude, that estimation was more precise in case of red fox. For Eurasian badger burrows, 20% underestimation was found; however, the result of the complete counting is still within the standard deviation of the estimated value (*Table 2*). Burrow densities of badger statistically differ in plain and hilly habitats. Its background may be the expanding Europe-wide range seen in the last decades (GRIFFITHS, 1993; HELTAI ET AL, 2001). In Hungary, in the recently occupied plain areas, badger abundance has not reached such level yet, as in its original hilly habitat (HELTAI, 2010). In case of red fox, the low value of the general national population density figure may refer to a remarkable systematic underestimation by wildlife managers. Using the method of population-reconstruction, CSÁNYI AND TÓTH (2000) found 200% underestimation for red deer. One may wonder, if in case of such an important, emblematic big game species as red deer, underestimation may be so large, what accuracy we can expect for species with far less economic concerns. Both Eurasian badger and red fox shows raising population trends in Hungary (HELTAI, 2010). Thoughtful management of these species is a more and more often occurring question in fields of both nature conservation and wildlife management; and animal and human health consequences of illnesses transmitted by these species are not negligible sources of threats (SRÉTER ET AL., 2003; TAKÁCS ET AL., 2012). High density found in Börzsöny points out the "storehouse" role of "big-game"-type Game Management Units, meaning that the intensive carnivore rearing only on small game areas is not sufficient alone. In order to reach smaller abundances, carnivore-rearing must be implemented and continued in big game areas, too. Otherwise a source-sink type system is being realised

(CSÁNYI, 2007); carnivore backup will continuously arrive from big game areas to places, where carnivore rearing is properly implemented. The basis of a well designed, feasible, and economically controllable carnivore management is the accurate estimation of population. Our data that are based on detailed assessment, show reliable burrow density values and offer a feasible method for practitioners of wildlife management.

ACKNOWLEDGEMENTS

We would like to express our gratitude to Viktor Gáncs, head of forestry of Ipolyerdő Zrt, and to Róbert Borka, technical leader of forestry and wildlife management, for providing forestry data. Special thanks must be addressed to Mihály Márton, the elder, for his help in the field work at data collection.

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Review on Agriculture and Rural Development 2013. vol. 2. (1) ISSN 2063-4803

FARMS IN THE GREEN CARE CONTEXT

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ABSTRACT
The concept Green Care loosely refers to the utilization of nature and farms to produce social, healthcare and education services. Green Care operations in Europe have grown from small-scale trials based on the initiatives of farmers or needs of healthcare to holistic service models. Green Care is deemed to add value to the service sector in all its sub-sectors, offering customers a low threshold to participate in functional and interactive farm work. The nature based service model combined with social and healthcare services offers completely new instruments that produce more customer-oriented wellbeing services. Green Care is especially suitable for small farms that have original native breeds of production and pet animals. It is hoped that Green Care can enhance the conservation of valuable cultural rural environments and native breeds and through the increase of services support the vitality of rural areas. Many European countries support Green Care on both government and municipality levels. In many countries farmers have networked and organize learning circles to develop Green Care operations.

Keywords: farms, countryside, Green Care, wellbeing, nature, rehabilitation

INTRODUCTION

Green Care is a well-being service-model that activates individuals and utilizes animals, nature, gardens and rural environments, to enhance the quality of life of clients and their ability to function. Green Care is a concept that, on one hand, encompasses nature-based operations, and on the other hand, is also analogous to the concepts of social farming, farming for health and care farming, all which refer to those farms that, as part of their operations, utilize their environment and activities to meet the needs of their target group.(HASSINK & VAN DIJK, 2006; ELINGS & HASSINK, 2008; DI IACOVO & O`CONNOR, 2009; YLI-VIIKARI ET AL., 2009; SEMPIK ET AL., 2010; O´CONNOR ET AL, 2010; www.farmingforhealth.org;). According to Hassink et al (2006), Green Care operations can be roughly divided into rural, animal and garden assisted operations, depending on the environment, nature element used, the objectives and content. What is common to the different Green Care methodologies is the use of nature and natural environments, to support the physical, psychological and social well-being of clients, as part of other social, health and education services. The contributory action of participatory and experiential revival of nature is known to increase well-being. (SEMPIK ET AL, 2010; YLI-VIIKARI ET AL, 2009)

In this paper, Green Care operations refer to a nursing farm or rural environment-assisted activities that produce social well-being. Green Care operations have grown in Europe from very small-scale experiments, based in initiatives of farmers or on health care needs, to established, comprehensive service concepts. Small experiential projects in society are often the only way to investigate how new social innovations work in practice, gather scientific information and knowledge from real, experiential environments and other sources. (TOIKKO & RANTANEN, 2009; GIBBONS ET AL., 1994; HARMAAKORPI, 2008)

Green Care is often describes as a social innovation. Social innovations are associated with complicated dependency relationships between different operating systems in society, thereby their development requires plenty of local adaptations, silent knowledge and face-to-face communication between the different actors. (HÄMÄLÄINEN & HEISKANEN, 2009). Usually the most significant innovations are borne at the interface of different scientific disciplines, thus creating the need for common integrating concepts, terms and a common language to enhance an interactive dialogue. (SEE E.G. HENRY & LECLAIR,1987; CAWSEY, 1997)

Social innovations are often borne from the need to solve practical problems and face challenges in society (TOIKKO & RANTANEN, 2009). However, social innovations are also new ideas or operations, borne from the creative work of individuals, groups or society, that bring value-added to individual, society and well-being service operations. (HÄMÄLÄINEN, 2005)

The effectiveness of Green Care has been publicly investigated in European publications using target focus (SEE E.G. BERGET ET AL., 2008; DE BRUIN ET AL, 2010) or from the value-added it brings to the rural area and the farmer. For the future, all of Europe's common goal is to find solutions to keep scarcely inhabited rural areas dynamic and robust and find solutions to provide new activities for the youth that remain in the rural area to add onto the traditional agriculture based on wildernesses.

(http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=OtaJ:C:2001:262:0153:0156:FI:PDF)

GREEN CARE IN EUROPE

Green Care activities are especially suitable for very small farms where the work is still very much based on craftsmanship. Small farms still have some original native breeds of animals, thus through Green Care the sustenance of nationally valuable traditional environments and genetically important native breeds can be supported. Municipality objectives, in regard to wellbeing services, aim at responding to individualistic demands that have emerged from the changing values, by offering new, customer-based services. Urbanisation has slowly estranged people from nature, though in recent times there has been a deeper interest in nature and the rural areas. Green Care activities build bridges between different sectors as well as between rural and urban areas (DI IACOVO, 1999; SEMPIK ET AL, 2010).

In recent decades, well-being services have diversified and customers have more choices. The development of well-being services has been affected by societal resources, values, needs, legislation and other normative directives. Green Care operations have advance quickly in those European countries where the response to new operation models is open and positive. Country comparisons are useful. KENNETT AND YEATES (2001) emphasize that comparisons are a very mundane way of thinking. Whereas tourists compare their experiences of beaches and food, researchers compare concepts and analytical methods. Comparison research is also based to practical motives. Contrasting one's own country to other countries is an important means to assess the functionality of systems or the need for change (PÖNTINEN 2004). Green Care is quite similar in different European countries, being made up of agricultural and gardening work as well taking care of animals and sceneries, on farms. Clients can come to farms at their own costs (for example on a personal budget, German, Holland) as day-clients or nursing, care and rehabilitation centres can buy Green Care services from farms. In addition to municipalities, the third sector also utilizes Green Care services. Target customers in Green Care are mostly

individuals in rehabilitation due to substance-abuse or mental health problems, the elderly and young people with special needs. Some farms offer services to only certain target groups and small groups, but in Holland and Italy, for example, the customer-base is often more diverse.

Typically farms and institutions draw up a rehabilitation plan together with the customers and Green Care customers mostly dawn from urban centres. In addition to rehabilitation, farms can also offer vocational training and provide a job placement or housing arrangement. In Norway, collaboration between schools and farms has always been active.

The shaping of Green Care activities is affected by social and healthcare attitudes and values, as well as how the government or municipalities support activities. In many Green Care countries farms receive direct financial support from the government (see e.g. Norway in på tunet- system) or different expert centres have been formed for the activities. The activities can be also be funded through sales of farm products. In Italy, co-operative movements for Green Care have been founded, where responsible business has been conceptualized onto farm products, allowing the possibility to receive a better price than normal (HASSINK, 2007, 2008; DI LACOVO ET AL, 2010; SOINI, 2011). With corporate social responsibility (CSR) becoming more commonplace, customer buying decisions are more affected by social, cultural and economic factors (HAANPÄÄ, 2007)

In Finland, Green Care took off from a project in 2004 conducted at the Environmental Research Unit at MTT Agrifood Research Finland, where the aim was to determine whether native breeds of animals, that are friendly in nature, were suitable for nursing and rehabilitation activities. Native breed were deemed important in regard to national-level memories and the sustenance of agricultural history. The conservation of species was addressed by aiming to identify new societal tasks for species. Officially, Finland launched the concept Green Care in 2008. Unlike in other European countries, the Green Care concept was not disseminated on the initiative of actors in agriculture or social and healthcare, but on the initiative of MTT. MTT has been very active in bringing Green Care to general discourse and activities were developed through workshops whose aims were to create a framework for the activities and criteria to measure effectiveness. Green Care has been enthusiastically adopted in Finland. The Green Care Association of Finland was created in 2010, with the aim of coordinating information flows regarding activities and helping the actors network (SOINI, 2011). Several Green Care initiatives have been activated all over the country. Green Care in Finland is for the present, integrated into nursing institutions as nature-assisted activities that are utilized as part of rehabilitation operations. Co-operation with farms is still in the primary stage. Green Care activities are expanding further from the social and healthcare sector to other wellbeing services.

Encounters between the countryside, animals and people, with a wellbeing focus is not a new phenomenon. Regenerating nature, the calm of animals and day-to-day rhythms that shape the farm have, since the beginning of human history, been a part of rehabilitation and pedagogical elements in different social institutions. Nursing institutions were often established in the peaceful countryside in naturally beautiful locations and the inhabitants participated in the chores within the institution according to their own interests and strengths. Green Care emphasizes the feeling of success, achieved through work and activities, that increases the feelings of meaningfulness of life and coherence. People structure themselves according to their experiences and activities. Regular and pleasing routines also support the well-being of those in rehabilitation. Activities and participation help an individual attach themselves to the community and society. Through different activities the individual feels useful to others as well. (MULTANEN, 2007; YLI-VIIKARI, 2009; SEMPIK ET AL, 2010) Social and cognitive skills and therapeutic exchange activities integrate farm assisted activities. (SEE E.G. NORDLING, 2007) Theoretically, Green Care can

also be linked to social exchange theory where the importance of reciprocity in a two-way relationship is emphasized (BLAU, 1986), as it can also be linked to equality theory where an individual is said to face anxiety, if he receives more support than he gives. The feeling of reciprocity correlates to the feeling of wellbeing (ÄYRÄVÄINEN, 2012; WOLFF & AGREE, 2005). In Green Care, caring and nursing are viewed as dualistic- the object becomes the subject or the care-receiver becomes the care-giver. Farm animals, vegetable patches and gardens do not only support the functionality of the target group, but gives the individual a unique opportunity to step into the responsible role of care-giver. Green Care utilises the communal nature of farms and networks for peer support that are created by different clients (SEMPIK ET AL, 2010).

SENNI: GREEN CARE PROJECT IN NORTH SAVO

The SENNI project started in September 2011 and is co-funded by the European Social Fund and the North Savo social sector employment and product development using Green Care methodology- project, that is co-ordinated by the Department of Biology at the University of Eastern Finland. The Savo Vocational College and Ylä-Savo Vocational College also implement the project. Projects always have a clear starting and ending point and divide into different tasks during their life-cycle. (RUUSKA 2007) The SENNI project moves from the premise of understanding the Green Care phenomena and describing the different project activities into a holistic concept. This common concept was set as multidimensional wellbeing that supports sustainable development and that is projected in this project as the common denominator connecting the customer, the provider and environment.

The SENNI project has three focus areas. The aim of the activities is to increase awareness of Green Care in the Pohjois-Savo region (north Savo), create continuous Green Care training to support incoming Green Care activities and develop and test models in real customer situations and tailor-make them into cost-efficient service wholes.

SENNI Green Care training admitted 30 Green Care entrepreneurs (or entrepreneurs working closely in the field, aspriring Green Care entrepreneurs) of whom 27 had vocation social or healthcare training. The central elements in the training were animals, plants and rural environments as well as their diverse use in multifaceted and rehabilitation in wellbeing services. The basis for training is the vocational competency of the applicants, which in turn was the basis for creating the training programme in collaboration with the vocational colleges implementing the project.

SENNI GREEN CARE animal training was split between small animals and horses, where the focus was the behavior of species and the recognition of special characteristics as well as the safe behavior of animals in producing wellbeing. The garden-assisted module aimed at creative use of the nature and gardens at different times of the year. In training using rural environments, the focus is on the use of farm animals and farms from different customer points of view. The training has also covered business and each module has included a theme on social rehabilitation, to bind animal, rural and nature based themes as part of Green Care.

The SENNI project targets 16-25 year old youth with special needs and over 65 year olds that are still able to live at home. Green Care services targeted to the elderly are divided into themes that maintain functionality, promotion of functionality and balance. Interest in nature has been the premise for acceptance into the groups. Green Care activities that maintain functionality has elderly people that have a dog. The direction has taken the perspective of life-long learning and functionality which has been diversely implemented

using subjects related to dogs. Green Care services that promote functionality tests operation models, based on nature and diverse training activities. Green Care methods for supporting balance are used to support those that suffer from memory loss to improve their quality of life and wellbeing. Using dogs, youth with special needs have been reached. Services targeted to them are still being developed in the spring. The activities utilize SENNI Green Care student services.

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Review on Agriculture and Rural Development 2013. vol. 2. (1) ISSN 2063-4803

CHANGES OF HUMAN RESOURCE CONCENTRATION AND SPECIALISATION IN HUNGARIAN INDUSTRY

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ABSTRACT
On certain areas of Hungary different industry structures evolved and various industries became dominant in each region. The spatial location of certain industries was influenced by several social-economical factors (the historical traditions of production, ownership, available labour force and equipment, resources, etc.). In case of the regionally differentiated industrial structure in some areas different profitability, human-resource usage, technical standards, different risk factors and market opportunities must be calculated. In the years following the regime-change the transformation in Hungarian economy resulted in significant changes in the sectoral and regional structure of the industry in the field of human resources as well. These changes demand to carry out studies that provide answers whether any concentration can be observed at the spatial organization of industry sectors and also if an increase or decrease in the industrial specialization is characteristic of a certain county regarding human resources.

Keywords: industry, specialisation, concentration, human resources, Herfindahl and Dissimilarity index

INTRODUCTION

In the European Union countries, including Hungary, the spatial structure of industry changed significantly in the field of employment. Sometimes the number of employees decreased in certain industrial sectors (mining; food, drink and tobacco production; textile, leather goods and shoe production), while in other industrial sectors the opposite can be observed, i.e. an increase (engineering; Basic metal, metal processing products) (ABONYINÉ PALOTÁS – KOMAREK, 2005). This raises the necessity of examinations, which can help find out if there was an increase or decline in concentration of industries concerning spatial organisation in the past few years and also if there was a characteristic change in the industrial specialisation with regard to employment. In order to monitor the changes of the past few years, it is important to consider the spatial concentration of Hungarian industrial sectors and the sectoral specialization of employees in each area at different times (OLÁH – SZABÓ, 2001; BARTA, 2002; HORVÁTH, 2002; KISS, 2010; ABONYINÉ PALOTÁS – KOMAREK, 2011; BODNÁR, 2011).

MATERIAL AND METHOD

There are several indices to measure the industrial specialisation and the spatial concentration of the industrial sectors (e.g. Concentration index, Hoover-index, Theil-index, Herfindahl index, Dissimilarity index). Out of these indices two were selected to determine the industrial specialisation and the spatial concentration of the industrial sectors of Hungarian counties by employees.
The value of the Herfindahl index (absolute specialisation and concentration) can be between 0 and 1, while that of the Dissimilarity index (relative specialisation and concentration) between 0 and 2.

Herfindahl index (absolute specialisation):

$$H_j^S = \sum_i \left(S_{ij}^S\right)^2$$

Dissimilarity index (relative specialisation):

$$DSR_j = \sum_i \left| S_{ij}^S - S_i \right|$$

where:
i = industry
j = county

S_{ij}^S = i industry of j county share from total employees in j county industry

S_i = i industry share from the total employees in Hungarian industry

Herfindahl index (absolute concentration):

$$H_i^C = \sum_j \left(S_{ij}^C\right)^2$$

Dissimilarity index (relative concentration):

$$DCR_i = \sum_j \left| S_{ij}^C - S_j \right|$$

where:
i = industry
j = county

S_{ij}^C = i industry of j county share from total employees in Hungarian industry

S_j = j county share from the total employees in Hungarian industry

The data provided by the Central Statistical Office (KSH – Központi Statisztikai Hivatal) were the base for my work. The data of industrial employees by the site of employment were examined.
The studied time interval is between 2000 and 2008. There were frequent changes in TEÁOR (Standard Classification System of Industrial Activities) numbers; therefore this is the period that allows the comparison and the analysis of data and drawing conclusions.

RESULTS AND CONCLUSIONS

In the basic period (2000) the highest index values were represented by Fejér, Vas, Győr-Moson-Sopron, Jász-Nagykun-Szolnok and Pest Counties considering **absolute specialisation**. Fejér County is primarily due to the processing industry, including a prominent role of engineering, basic metal and metal processing industry.

The prominent position of Vas County in this field is due to its engineering industry and light industry (textiles, leather products and footwear), while in case of Pest County it is also the engineering industry and the food industry (food, beverages and tobacco). The number of employees in engineering industry indicated a higher concentration in Győr-Moson-Sopron and Jász-Nagykun-Szolnok. In the base year the counties with the lowest absolute specialization were Borsod-Abaúj-Zemplén, Csongrád and Veszprém. In case of these counties, the index is 0.14 or below this value. The reason for that is there were no dominant industry sectors in these counties, which would have a determinative role in employment.

Table 1. The absolute specialisation of Hungarian industry by employees in different territories

Name of territorial unit	2000	2002	2004	2006	2008
	Herfindahl index				
Budapest	0,16	0,16	0,16	0,15	0,15
Pest County	0,24	0,21	0,22	0,20	0,20
Fejér County	0,25	0,27	0,25	0,26	0,25
Komárom-Esztergom County	0,18	0,20	0,26	0,34	0,37
Veszprém county	0,14	0,14	0,14	0,15	0,17
Győr-Moson-Sopron County	0,21	0,21	0,22	0,21	0,21
Vas County	0,25	0,24	0,24	0,23	0,23
Zala County	0,18	0,20	0,24	0,24	0,26
Baranya County	0,15	0,14	0,14	0,14	0,15
Somogy County	0,20	0,19	0,17	0,20	0,22
Tolna County	0,20	0,19	0,18	0,16	0,16
Borsod-Abaúj-Zemplén County	0,13	0,14	0,15	0,17	0,18
Heves County	0,18	0,19	0,19	0,23	0,25
Nógrád County	0,16	0,16	0,16	0,16	0,18
Hajdú-Bihar County	0,17	0,17	0,16	0,16	0,16
Jász-Nagykun-Szolnok County	0,21	0,21	0,20	0,23	0,25
Szabolcs-Szatmár-Bereg County	0,17	0,18	0,17	0,17	0,18
Bács-Kiskun County	0,17	0,17	0,18	0,18	0,18
Békés County	0,17	0,18	0,18	0,16	0,17
Csongrád County	0,14	0,14	0,14	0,14	0,14

Source: author's figures based on KSH data

In 2008 Komárom-Esztergom, Zala and Heves Counties caught up with Fejér County. The processing industry involving machine industry as well as basic metal and metal production play an important role in Fejér County, which takes up significant labour capacity.

The „catching-up" of Komárom-Esztergom County with Fejér County is due to engineering since the number of employees in this sector has almost tripled from 2000 to 2008. Zala and Heves Counties could also improve owing to machine industry. In case of these counties the value of absolute specialisation reached or exceeded 0.25. Pest and Vas Counties lost their previous advantage in this field. By 2008 the index value for Pest County fell back to 0.20, while that of Vas County to 0.23. The setback can be explained

particularly by the fact that the number of industrial sectors (in Vas County it was mainly engineering, as well as textile, leather goods and footwear industry) employing plenty of labour previously was decreasing from 2000-2008. Concerning Pest County it is true that employment improved in terms of the number, but the growth took place not only engineering and food, beverage and tobacco manufacturing typical of the county, but equally distributed among the various industrial sectors. At the same time it is a fact that in other industrial sectors (e.g. wood, paper products and printing, basic metal and fabricated metal products) the growth was higher than in the previous sectors (machinery, food, beverages and tobacco products).

Examining the trend of absolute specialization in employment, we can conclude that comparing 19 counties to the capital city there was an opposite direction. In the capital and in four counties (e.g. Tolna, Hajdú-Bihar) the index of the absolute specialization in the industrial employment decreased from the base year to the current year, while it increased in ten counties (e.g. Szabolcs-Szatmár-Bereg, Somogy) and it stagnated in five counties (e.g. Csongrád, Békés).

The increase was primarily due to the fact that certain industries (such as engineering, basic metal and metal products) the degree of concentration increased in employment and thus the given industry of the given county became dominant in employment (e.g. mechanical engineering in Komárom-Esztergom County). The decrease of the index can be explained by the negative direction of change in the number of employees, as well as a more even distribution of employees by sectors within the county.

In 2000 in the field of employment there was a major difference in the sector structure of Tolna, Fejér, Borsod-Abaúj-Zemplén Counties compared to that of the national structure **(relative specialisation).** The index value reached 0.50 in case of the above mentioned three counties. In Tolna County textiles, leather products and footwear production were relatively high, at the same time engineering was low, while in Fejér County the basic metal and metal processing products manufacture resulted in an industrial structure significantly different from the national one. In County engineering was lower, at the same time basic metal and metal processing products manufacture and the higher share of the chemical industry was the cause of the deviation from the national structure. In 2000 the national sample was particularly represented by Somogy, Győr-Moson-Sopron, Zala and Jász-Nagykun-Szolnok Counties in the sector structure. Most labour was employed in engineering, textile, leather goods and footwear production as well as in food, drink and tobacco production.

In 2008 it was still in Tolna and Fejér Counties, and also in Komárom-Esztergom, Szabolcs-Szatmár-Bereg and Csongrád Counties where a significant difference can be found in the sector structure. In case of Tolna and Komárom-Esztergom Counties the index value also reaches or exceeds 0.5. In Fejér County the low food, drink and tobacco production, at the same time the high basic metal and metal processing products manufacture resulted in an industrial structure different from the national one. Similar difference from the national figures was due to a high rate of engineering and a low rate of food, drink and tobacco production in Komárom-Esztergom County, a low engineering and at the same time high electricity, gas, steam and water supply production in Tolna County, a high rate of food, drink and tobacco production in Csongrád County, while low engineering and higher rate or food, drink and tobacco production in Szabolcs-Szatmár-Bereg County. There was a change in the national pattern. In this field the national pattern was mainly represented by Veszprém, Somogy, Heves, Nógrád, Jász-Nagykun-Szolnok and Pest Counties in 2008. That year it was the engineering, food, drink and tobacco products and also basic metal and metal processing products manufacture sectors where most labour was employed. When examining the tendency of the changes in the research

period we find that from 2000 to 2008 the relative specialisation decreased in 11 counties, it stagnated in 6 counties and in the capital, while in 6 counties it increased. It is important to note that the main feature of the national industrial structure is that engineering and chemical industries have improved somewhat, and the food, beverages and tobacco production fell back. The value of relative specialisation stagnated or decreased in the counties where this trend was characteristic. The most significant changes took place in Komárom-Esztergom County (increase in relative specialisation) and in Pest County (decrease in relative specialisation). The former was the result of the significant improvement of engineering, while the latter was that of the decreasing engineering and chemical industry as well as the food, drink and tobacco sector falling back somewhat.

Table 2. The relative specialisation of Hungarian industry by employees in different territories

Name of territorial unit	2000	2002	2004	2006	2008
	Dissimilarity index				
Budapest	0,30	0,29	0,25	0,24	0,30
Pest County	0,31	0,24	0,20	0,17	0,13
Fejér County	0,52	0,57	0,49	0,48	0,44
Komárom-Esztergom County	0,31	0,30	0,36	0,50	0,55
Veszprém county	0,32	0,34	0,35	0,28	0,23
Győr-Moson-Sopron County	0,24	0,25	0,25	0,19	0,19
Vas County	0,46	0,42	0,40	0,31	0,32
Zala County	0,27	0,30	0,38	0,32	0,33
Baranya County	0,35	0,35	0,30	0,29	0,28
Somogy County	0,22	0,26	0,28	0,23	0,24
Tolna County	0,54	0,61	0,56	0,57	0,54
Borsod-Abaúj-Zemplén County	0,50	0,43	0,32	0,34	0,34
Heves County	0,28	0,30	0,25	0,32	0,31
Nógrád County	0,43	0,34	0,45	0,37	0,35
Hajdú-Bihar County	0,31	0,33	0,29	0,29	0,32
Jász-Nagykun-Szolnok County	0,29	0,26	0,26	0,28	0,29
Szabolcs-Szatmár-Bereg County	0,46	0,49	0,36	0,39	0,38
Bács-Kiskun County	0,35	0,30	0,30	0,33	0,34
Békés County	0,49	0,46	0,44	0,37	0,35
Csongrád County	0,38	0,43	0,44	0,48	0,49

Source: author's figures based on KSH data

Considering the **absolute concentration** of Hungarian industry by employment in 2000 it was mining, wood and paper products, printing and chemical industry that showed the highest concentration values. In 2008, however, the former situation changed somewhat, some sectors declined, while others improved.

That year the highest geographical concentration, concerning employment, was found in wood and paper production and printing activities, in chemical industry and other processing industry. The geographical concentration increased in case of food, drink and tobacco production, leather goods and footwear production as well as wood and paper production and printing, while it fell back in mining and electricity, gas, steam and water supply. Stagnation can be observed in chemical industry, non-metal mineral production,

metal raw material and metal processing as well as in engineering. The lowest values can be seen in case of mining in the period between 2000 and 2008. No significant geographical concentration was seen in employment in Hungarian industry during the examined period.

Table 3. The absolute concentration of Hungarian industrial sectors by employees

Industrial sector	2000	2002	2004	2006	2008
	Herfindahl index				
Mining	0,13	0,10	0,09	0,08	0,08
Food, drink and tobacco production	0,06	0,06	0,07	0,07	0,07
Textile, leather goods and footwear production	0,06	0,06	0,06	0,07	0,07
Wood and paper products, printing activities	0,11	0,12	0,11	0,11	0,14
Chemical industry	0,10	0,11	0,11	0,11	0,10
Non-metal mineral products	0,08	0,07	0,07	0,08	0,08
Basic metal, metal processing products	0,08	0,08	0,08	0,08	0,08
Engineering	0,07	0,07	0,07	0,07	0,07
Other processing industries	0,07	0,07	0,07	0,08	0,10
Electric energy, gas, steam and water supply	0,07	0,07	0,07	0,07	0,06

Source: author's figures based on KSH data

Table 4. The relative concentration of Hungarian industrial sectors by employees

Industrial sector	2000	2002	2004	2006	2008
	Dissimilarity index				
Mining	0,95	0,80	0,49	0,48	0,46
Food, drink and tobacco production	0,28	0,28	0,26	0,30	0,36
Textile, leather goods and footwear production	0,43	0,46	0,44	0,40	0,39
Wood and paper products, printing activities	0,37	0,40	0,35	0,32	0,41
Chemical industry	0,44	0,43	0,40	0,36	0,29
Non-metal mineral products	0,62	0,60	0,56	0,51	0,45
Basic metal, metal processing products	0,34	0,35	0,36	0,32	0,33
Engineering	0,31	0,27	0,25	0,25	0,24
Other processing industries	0,31	0,34	0,35	0,34	0,41
Electric energy, gas, steam and water supply	0,35	0,33	0,31	0,32	0,33

Source: author's figures based on KSH data

When analysing the **relative** geographical **concentration** of employment in industry we can claim the following: The greatest difference from the total industrial geographical distribution can be seen in the field of mining and non-metal mineral product manufacture both in 2000 and in 2008-ban. There were only minor changes in the sectors in 2008 compared to 2000. An increase can be observed in three sectors, while in case of seven there was a decrease. The greatest increase occurred in case of "Other processing industries" (which was due to Budapest), while the greatest decrease happened in mining, despite the fact that both in 2000 and in 2008 it was the mining where the greatest difference showed from the total industrial geographical distribution. In 2000 in mining the high concentration of the sector was the result of the share of Borsod-Abaúj-Zemplén and Veszprém County, which was higher than the national rate. In case of non-metal mineral product manufacture the reason for the high relative concentration is the share of Fejér

County within the sector is rather behind that of the total industry. In 2008 in mining the higher concentration of the sector was due to the higher share of Zala and Bács-Kiskun County, and of Veszprém County in non-metal mineral product manufacture compared to the national rate.

The specialisation and concentration examinations of the industrial employment of Hungarian counties reflect the processes of the industry characteristic of the structural and territorial changes of industrial employment of Hungary in the past few years. Due to these changes the role and importance of certain regions and industrial sectors also changed and resulted in a new employment structure.

Concerning employment, the current changes and transformations in the industry structure have not been completed, since both the regional and the structural transformation of the industry is a result of continuous development, that is the reason why the current production investments in Hungary can create a new situation in the regional specialization and sectoral concentration of our industry (e.g. Mercedes-Benz – Kecskemét) with regard to employment.

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Review on Agriculture and Rural Development 2013. vol. 2. (1) ISSN 2063-4803

THE PARTICIPATIVE CHARACTERISTICS OF LAG-MEMBERS IN HUNGARY

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ABSTRACT
One of the much debated questions in the governance literature is the social participation of local people. According to the majority of experts, the participation of local actors in decision-making process is growing through the partnerships and thus wiser and fairer decisions can be made in development issues affecting them. Therefore, partnerships have become popular instruments of government to deliver policy goals more effectively. This study focuses on the participative characteristics of members of rural development partnerships.
The participative features of local actors are studied in the paper through the example of the LEADER partnerships. Interviews and two countrywide surveys were conducted in the circle of leaders of Management Offices and members of Local Action Groups (LAGs). The so gained data were analysed by different statistical methods. The results concerning the participation and activity of members proved my hypothesis, according to which the work in partnership does not always end in real and meaningful participation of local actors. Most of the partners typically did not exploit all the possibilities of participating in partnership actions.

Keywords: social participation, activity, rural development partnership, Local Action Group (LAG), LEADER programme

INTRODUCTION

Since the 1990s, development thinking has been dominated by 'decentralisation fever' due to the belief that decentralisation and participation makes for better government by bringing government spatially closer to people (SHORTALL, 2004, pp. 109.). To decentralise some responsibilities to address specific local problems and strengthen bottom-up rural development, participation of local actors has been supported in the European Union (WARD - MCNICHOLAS, 1998).
The term 'participation' means different things to different people, for instance it can be a principle, a practice or an end in itself. In this paper the definition of the World Bank Participation Sourcebook is used which think participation as a 'process through which stakeholders influence and share control over development initiatives and the decisions and resources which affect them' (WORLD BANK, 1996, pp. xi.).
Participation is a complex, contested and problematic term (HAYWARD, 2004; STOREY, 1999). Policy makers acknowledged that community involvement has 'a range of benefits, in terms of better decision making and enhanced cost effectiveness' (ATKINSON, 1999, pp. 65.). However, several theorists, for instance MCQUAID (2000) does not believe that the increased participation in decision-making process involves better decision-making in itself, since a larger number of partners may create unclear goals and unequal power relations between the partnership members may lead to social exclusion. KRISHNA (2003) agrees this opinion, according to him it is much more important, that the involved participants how actively participate in the course of partnership working. Since all the

efforts to involve more local actors are in vain, if then their participation is just superfluous.

LEADER method is based on bottom-up approach which involves that local people participate in decision-making about the local rural development 'strategy and in the selection of the priorities to be pursued in their local area' (CEC, 2006). Therefore, according to the rhetoric, the active participation of local public, business and civil actors has been promoted in LEADER in order to reinforce the capacities of local community by involving them (MAUREL, 2008). However, the meaning of community involvement is not clear in LEADER literature, since its degree can be very variable (SHORTALL-SHUCKSMITH, 1998).
Until now only a few case studies (BULLER, 2000; KOVÁCH, 2000; SCOTT, 2004; SHORTALL 2008; SHUCKSMITH, 2000; STOREY, 1999; THUESEN, 2010) have examined who are excluded from partnership membership and among these researches even less is engaged in studying who really take part in decision-making process actively and in a meaningful way. Therefore, the objective of this paper is to reveal whether the current Hungarian LEADER Local Action Groups really fulfil the EU directives concerning the active participation of local actors.

MATERIAL AND METHOD

The LEADER programme is thought to be a successful rural development initiative of the European Union. It is based on the partnership of representatives of the civil, business and public sphere. The LEADER has introduced a new approach to rural development theory and also to practice in the Member States. Within the framework of the initiative, rural development projects have been realised in more than 2000 European micro-regions in the last twenty years. Due to its effectiveness, the LEADER has been integrated as a methodological axis into the rural development policy of the second pillar of Common Agricultural Policy.
Based on the extended literature review a hypothesis was set up: it was assumed that working in partnership often did not result in real participation of partners and most of the LAG-members typically did not exploit all the possibilities of participating in partnership actions. To decide whether this hypothesis can be confirmed or should be rejected first interviews were made with some leaders of project management offices of LEADER LAGs in order to get to know better their organizational problems. These interviews helped what further examination techniques should be employed (see *Figure 1*). First statistical data were collected and then two countrywide surveys were conducted: one in the circle of leaders of management offices and another one in the circle of members of LAGs regarding their activity and participative characteristics in the autumn of 2011. At that time 94 Local Action Groups operated in Hungary. Originally 72% of the LAGs were surveyed, but in this paper only 55% of the LAGs (51 partnerships) are examined, because only those local partnerships were analysed where at least the representatives of two civil organizations, two enterprises and two local governments answered the questionnaire appreciably.
In the research participative characteristics of partners in the drafting of local development strategy, partnership meetings, different events and tenders were examined. Beside participation frequency of members, the activity of partners in partnership actions were studied, because they also determined the efficient operation of partnership, since if too many members are inactive, then the partnership may become inoperative.

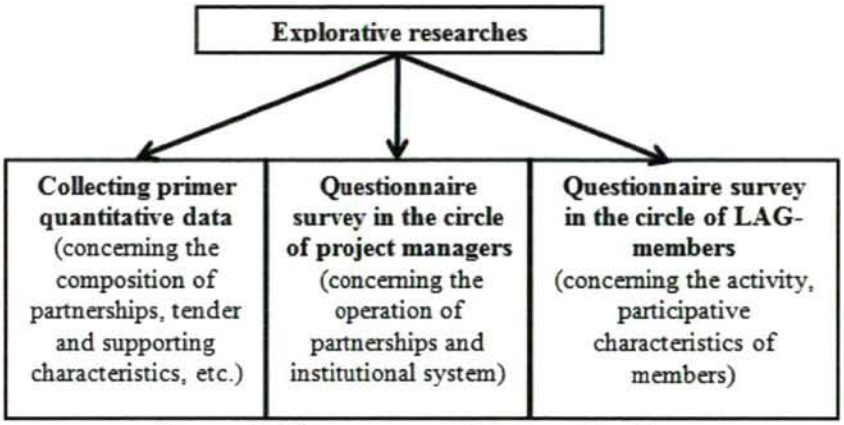

Figure1. The process of data collection
Source: own edition (2013)

The data were analyzed by different statistical methods. First, single variable tests were used to examine the data structure. Then, frequency distribution, different measures of central tendency, dispersion and some other indicators were calculated. While to analyse the relationship among nominal or ordinal variables cross-tabulation was employed, among metric variables correlation-calculation was used.

RESULTS

Prior to the research it was assumed that the participative willingness was higher in the smaller LAGs, because in these partnerships it can be easier to inform the members about the possibilities of participation, find such occasions when the majority of members can be presented at the meetings and support partners in preparing proposals. However, there was no significant relation between the size of partnerships and the participative willingness of members on the basis of correlation analysis.

It is important that more and more partners would contribute with their ideas to the strategy, because if partners do not take part in the drafting of development plans, then its measures and the real development needs of partners may differ significantly. In most of the LAGs, however, the participation willingness in composition of development strategy was quite low. Only every third respondent contributed to the development plan with their ideas or opinions (see *Figure 2*).

Although the majority of LAG-members stated that new tender possibilities played an important role in their accession to the partnership, merely two-fifth of the partners submitted applications in the first two rounds of New Hungary Rural Development Plan (hereinafter called NHRDP) Axis III (see *Figure 2*). The lack of activity in application was explained by three reasons. On the one hand, the lack of time, on the other hand, the changes in financial circumstances of applicants caused their passivity. The third group declared that the local development strategy did not match with the development needs of his region because of the bureaucratic regulations and conventional planning, for this reason he did not write project proposal.

Most of the tender titles were key development target areas for the local governments and they possessed the appropriate human capacity and they own financial resources needed for project proposals. The tenders supported by NHRDP Axis III had relatively large budget, therefore higher amount of own sources were required which could not be ensured by civil organizations with more difficulties than by the local governments. Therefore, the

local governments were much more active in such type of tender submission than the representatives of civil organizations or entrepreneurs.

Hardly more than one-third of the partners submitted proposals in frame of the first round of NHRDP Axis IV (LEADER) (see *Figure 2*). The activity in LEADER proposals had not significant relation to the sphere representation. This feature can be explained by the fact that the budget of proposals in case of Axis IV was smaller. Therefore, smaller own financial sources were required for their implementation, so unlike Axis III, the local people and organizations with less financial sources could submit proposals as well.

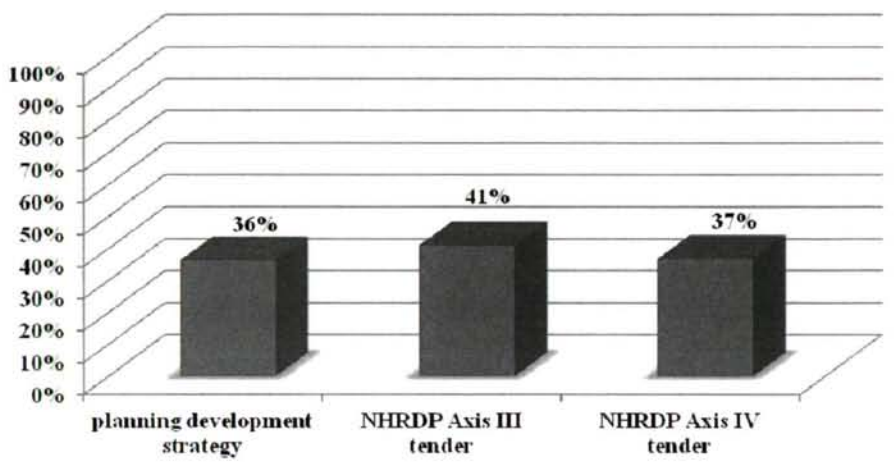

Figure 2. The participation characteristics of LAG-members
Source: own edition (2013)

The participative willingness of partners in meetings and other events was low as well. One-tenth of partners had never attended meetings and one-fifth did it only rarely. The participation at other events – like forums for informing citizens, gatherings and trainings – was even lower than at the meetings.

The survey proved that those members, who had shown larger participative willingness in certain above mentioned activity, took part more intensively in the other fields of partnership actions, too.

Almost one-third of the respondents considered himself explicitly passive participants. Some of them claimed that they were not active because of lack of time, others accounted for apathy. Moreover, several partners felt that only a narrow group's interests were taken into consideration during the decision-making processes. So they considered themselves peripheral members and could not see the point of participating more actively due to their disappointment.

Almost one-tenth of members did not participate in the decision-making of LAGs and the implementation of regional development strategy at all. Most of them did not care the collective interests, had joined the partnership for personal reasons. They just wanted to be well informed regarding on-going events and developments occurring within the regions, but they were not interested in taking part in the collective work.

The representatives of the business sphere were the most passive. The civil sphere took the second place and the local governments were thought to be the most active partners. Slightly more than one-tenth of the respondents from the public sector stated that they were passive observers or they did not participate at all in partnership actions. Almost two-fifth of the partners had the same opinion concerning civil representatives and sixty percent of partners considered the entrepreneurs inactive.

CONCLUSIONS AND DISCUSSION

In most of the LEADER partnerships the participation willingness was low in the course of planning and implementing development strategy, in LAG-meetings and different gatherings, exhibitions, forums and training courses. According to the survey more than one-third of the members were inactive in partnerships. The representatives of the entrepreneurs were the most passive in LAG work out of the three sectors, but the representatives of the other two sectors were not active enough, either. The above results concerning the participation and activity of members prove the hypothesis, according to which the work in partnership does not always end in real and actual involvement of partners.

Manipulative or passive participation were experienced in many LEADER partnerships. While the manipulative participation is simply pretence, in case of passive participation 'people participation by being told what has been decided or has already been happened' (PRETTY, 1995, p.1252.).

The so-called non-participation (see HAYWARD ET AL., 2004) is a typical phenomenon in some of the examined partnerships. In this case the rational decision of members is the reason for the lack of participation. Most of them joined the partnership not in the interest of the community but rather for personal reasons. They often become partners in order to be well-informed concerning the local development and fund-raising possibilities but they do not actually want to participate in the work of the partnership.

In spite of the above mentioned problems, the LEADER programme still has ensured more extended and deeper involvement of local actors than the top-down directed rural development projects but it would be advisable to further deepen and widen the participation. It would be important to define those who totally reject cooperation within the partnership. When the reasons of their passivity are explored, it can be decided whether it is worth working on their activation. In case of those who totally reject cooperation, it is not worth further encouraging their involvement in the partnership. But the participation of those should be facilitated who show at least some minimum willingness to cooperate and have been absent only for the lack of trust or some other personal reasons.

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