CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE

Faculty of Tropical AgriSciences

Department of Crop Sciences and Agroforestry

USE OF PLANT RESOURCES ON CZECH ORGANIC FARMS WITH SPECIAL REFERENCE TO ETHNOBOTANICAL KNOWLEDGE, GENETIC MATERIAL ACQUISITION AND ORIGIN OF PLANT SPECIES

Master Thesis

Prague 2015

Supervisor:

doc. Ing. Zbyněk Polesný, Ph.D.

Author:

B.Sc. Kateřina Šalková

Declaration

I declare that I have elaborated my thesis independently and quoted only sources listed in the References.

Prague, April 10, 2015

B.Sc. Kateřina Šalková

Acknowledgements

I would like to sincerely thank my supervisor, doc. Ing. Zbyněk Polesný, Ph.D., from the Department of Crop Science and Agroforestry (DCSA) of the Faculty of Tropical AgriSciences (FTA) of the Czech University of Life Sciences Prague (CULS Prague) for his help with the development of this master thesis.

I am grateful for the great help and provision of valuable information and guidance on my thesis to one of the organic farmers with whom I have collaborated, namely to Ing. Zdeněk Ševčík.

I would also like to mention Miloslav Dřevikovsky and the family Kotasova who helped me a lot especially with travel and accommodation arrangements in the White Carpathians.

Last but not least, big thanks to my family and my boyfriend for their enormous help, tolerance and psychological support they all gave me throughout the thesis process.

Abstract

The White Carpathians belong to the protected landscape areas (PLA) in the Czech Republic. Based on the previous studies another study was carried out recently focusing on the region of the White Carpathians and dealing with the problem of high biodiversity on pastures and meadows in the White Carpathians. The question is, whether such diversity of species is to be identified also on organic farms. Even though the current agricultural policy places great emphasis on promoting different environmental functions of agriculture, there is a significant risk that small and medium-sized farms will abandon the organic way of farming. Consequently, a loss of biodiversity may occur.

That is why the emphasis is being put on understanding the range of plant species grown on organic farms. These findings will serve as a basis for the next study that is to be conducted in the future when the abundance of biodiversity on organic farms will be statistically compared and it will be only then that we will be able to say whether it concerns the loss of agrobiodiversity or its development.

Key words: agrobiodiversity, organic farming, seed acquisition

Abstrakt

Bílé Karpaty patří do chráněných krajinných oblastí (CHKO) České republiky. Na základě dřívějších studií v Bílých Karpatech byla provedena studie o vysoké biodiverzitě na pastvinách a loukách v Bílých Karpatech. Otázkou je, zda taková druhová rozmanitost je i na ekologických farmách. I když současná zemědělská politika klade velký důraz na podporu ekologických funkcí zemědělského hospodaření, existuje hrozba, že malé a střední zemědělské podniky upustí od hospodaření na ekologických farmách. Nastane tak ztráta biodiverzity.

Proto je nyní kladen důraz na poznání sortimentu rostlinných druhů pěstovaných na ekologických farmách. Tyto materiály budou sloužit jako podklad pro následující studii za několik let, kdy bude statisticky srovnána hojnost druhové rozmanitosti na ekologických farmách a teprve pak lze říci, jestli jde o ztrátu či rozvoj agrobiodiverzity.

Klíčová slova: agrobiodiverzita, ekologické farmy, získání osiva

LIST OF FIGURES

LIST OF TABLES

Table of contents

1 PREFACE

In a part of the Carpathian Mountains – in the White Mountains (the southeastern part of the Czech Republic, near the border with Slovakia), species abundance and/or the richness of crops on organic farms is reviewed. The species abundance varies substantially on different organic farms in the White Carpathians. The landscape tends to be mountainous near the border with Slovakia. The landscape management is not easy and carries with it certain risks.

In the Czech Republic, grassland communities rich in varieties of species are part of national parks and protected landscape areas conditioned by human activity. Although the current agricultural policy places great emphasis on promoting ecological functions of agriculture, there is a threat that due to difficult conditions small and medium-sized farms in particular will choose to give up farming on meadows and pastures. As a consequence, large protected territories and species-rich grasslands, dependent on sensitive and environmentally sound farming, will degrade (Piro and Wolfová, 2008). To prevent similar degradation on Czech organic farms, we should focus on using plant resources and agrobiodiversity. That is why I am researching the topic in this study.

Organic agriculture is often described as a natural farming system (Lammerts Van Bueren et al., 2002). The natural farming system influences the agricultural biodiversity (agrobiodiversity) and vice versa. The agrobiodiversity depends on the respective form of a land-use (Jungmeier, 1997). The agrobiodiversity is not influenced only by natural farming systems. Another element influencing the agrobiodiversity are people; it means farmers and in this case it concerns organic farmers. Studying the interaction of people and plants has merged in the field called ethnobotany. Considering the subject matter of this scientific discipline, many ethnobotanical research studies, including the topics of agricultural biodiversity, are carried out in the environment inherent to the indigenous people of the developing world (Vogl-Lucasser and Vogl Ch. R., 2002). This research led to interesting results, new insights into seeds or vegetative material acquisition, plant species origin, their importance with respect to agricultural ecosystems and the conservation of agricultural biodiversity.

The cooperation with some of the farmers was not an easy task. Some were arrogant and showed no interest in communicating information related to their production and everything associated with it. Others, on the contrary, were very helpful and willing to cooperate and answered all my questions. Some of them even lent me relevant literature sources and books from their personal libraries, offered me a lodging and were in general fond of the my company as well as the possibility of sharing their experience with me. Some organic farms are located in hardly accessible areas of the White Carpathians and, especially in winter, local people greatly depend on what they have grown during the year. When there is a massive snowfall and large amounts of snow occur, access roads need to be made passable by the local people and most often next-door neighbor cooperate and help each other.

Other farms are located near cities or nearby villages and organic farmers are not therefore so cut off from the civilization. The fundamental characteristics of these farms is that they tend to focus more likely on selling grown crops rather than using them for personal needs only. In other words, they are not dependent solely on themselves. They keep a close eye on current trends and monitor a customer demand in order to produce organic products that are most likely to meet both these aspects linked with the consumption of their products.

From its very modest beginnings in the first half of the twentieth century, the importance of the organic farming has grown dramatically and it has been constantly gaining worldwide influence (Kruize et al., 2013).

Attractive properties of new species available in the market, changing diets and culinary habits, latest developments in processing and storage, new information and knowledge on gardening, curiosity and pleasure in experimentation have led to the introduction of species new to the region. All of these examples influence planting crops on organic farms, not only in the White Carpathians.

The use of agrobiodiversity in agricultural systems is under pressure in global context. The loss of crop genetic diversity and its declining use has generated much concern about food security and environmental sustainability.

According to the research by Weatherell Ch. et al. (2003) consumers indicated the “origin” of the crops to be the third most important aspect when considering the purchase of a specific product and the “image” of a crop proved to be even the second most relevant aspect when it comes to their choice in supermarkets and the other places where these products are available. That is the reason implying the necessity to study agricultural biodiversity of plant resources and genetic material acquisition along with their implementation in the market and the local use of common people. If there is more information about its origin, customer demand will increase, organic farmers will have bigger output and they will have more financial resources to provide more information about their product or increase their production of crop species.

The aim of the study can be based on the following hypotheses:

Organic farmers have switched from growing wide biodiversity of crop species in order to grow staple crops important only for their own livelihood as regards the opportunities of government subsidies.

2 OBJECTIVE

The aim of this thesis is to investigate the biodiversity of crops on organic farms in the White Carpathians (Czech Republic).

In an effort to achieve the relevant findings, I am trying to get a comprehensive overview of the genetic material (seeds, seedlings) used on organic farms, its origin, or possibly the material which does not come from any exotic regions.

This study serves to the basis for statistical comparison of the development of agricultural biodiversity on organic farms in White Carpathians in the next ten years.

3 THESIS BACKGROUND

3.1 Study area

The Carpathians are an extensive mountain range of the Central and Eastern Europe. The area on which it is located interferes with Austria, Czech Republic, Slovakia, Hungary, Poland, Ukraine, Romania, and Serbia.

The Carpathian Mountains extending into the Czech Republic are called the Moravian Carpathians. The Moravian Carpathians are divided into several areas. These include: White Carpathians, "Hostýn" hills, Moravian-Silesian Beskydy, "Chřiby", Sub-Beskydian Upland, "Jablunkov´s" Mountains, Silesian Beskydy and Javorníky. (In Czech language it is called: Bílé Karpaty, Hostýnské vrchy, Moravskoslezké Beskydy, Chřiby, Podbeskydská pahorkatina, Jablunkovské mezihoří, Slezské Beskydy a Javorníky.) The White Carpathians are a large area stretching on the surface of about 15,302 ha.

A multi-functional and organic farming system should, besides quality production, fulfill the economic, social and ecological functions of the landscape. These challenges are particularly felt by the enterprises operating in disadvantaged areas LFA (Less Favoured Area), i.e. in the particular area of mountain foothills and mountains (Kouřilová J., 2007).

In 2013, a number of organic farms from the whole Czech Republic was investigated (Offermann et al., 2007). The White Carpathians Figure 1 was established the 3 November 1980. The total area of protected area is 715 square kilometers and it lies at an altitude of 175-970 m. Protected Landscape Areas (PLA) spreads out partly in Hodonín, Uherské Hradiště and Zlín. In 1996, it was included in the UNESCO list of the World Network of Biosphere Reserves (AOPKČRa).

The White Carpathians form a geomorphological unit and mountains located on the Czech-Slovak border, south-east of the Czech Republic. Geographically, it is a part of the Outer Western Carpathians. The emergence of the mountain range was prompted by the folding of marine sediments (AOPKČRa).

The PLA Beskydy Mountains and the Carpathian Mountains are part of the Western Carpathian flysch zone, which was the result of a seismic activity known as Alpine folding.

The mountains comprise the Lower and Upper Moravian Carpathians that were still in the late Tertiary (Neogene) embedded sea. The described area is mostly made from sedimentary rocks of the Magura Nappe. Flysch referes to multiple alternating layers of claystone, siltstone, sandstone, and conglomerates. The thickness of the layers is strongly varying from a few centimeters to several tens of meters. Flysch in the Carpathian Mountains is well-characterized by the content of limestone grains in sandstones, which is reflected primarily in numerous sedimentary calcareous tufa in species' composition of the vegetation. The only location where to find igneous (Neovolcanic) rocks is the Carpathian Mountains in places called Nezdenický Fault System (Piro, 2008).

The data collected in the survey will identify the most commonly found organic farm species. With the data collected in the species inventory, it will be possible to develop a plant community ideotype (Watson and Eyzaguirre, 2001).

Figure 1 Map of the area of the White Carpathians in the Czech Republic (Žmolík, 2008).

3.2 Quality of organic farming

3.2.1 Socio-economic conditions

Organic farming (hereinafter referred to as OF) and organic foods production have a long tradition in the Czech Republic of more than 20 years. The existence of the oldest organic farms has proven that this precisely-defined agricultural system is viable even with no need to use synthetic pesticides, fertilizers or other intensification methods (Action Plan for Organic Farming, 2011-2015).

Farmers' traditional knowledge and their awareness of ecological and of social affairs became the main base for the development of organic farming (Kruize et al., 2013). A configuration of various tools, applications, and variable rate implements, is required within each farm enterprise (Fountas et al., 2006).

However, there are also unsolved problems when it comes to the necessities of global harmonization and the local adaptability of the standards to organic farming (Kruize et al., 2013). Nowadays, organic food is becoming still more and more popular. Moreover, organic products can be sold for much higher prices than conventional products (Kilcher, 2006). These products are grown on large, specialized farms (organic farms), factories or other facilities (Potravinářská Revue, 2009).

The material of “Action Plan for Organic Farming” describes the strategy for the development of OF in the Czech Republic (CZ) until 2015. It shows that the areas of OF development guaranteed by the Czech Government are sufficiently ensured (legislation, government grants, system of inspection and certification, labeling of organic food). On the other hand, there are areas in OF which are not yet sufficiently advanced and it is necessary to encourage their further development. For example the education of farmers and substantial research are not sufficiently developed and it is simultaneously necessary to support the Czech organic product market and make consumers better informed about organic products.

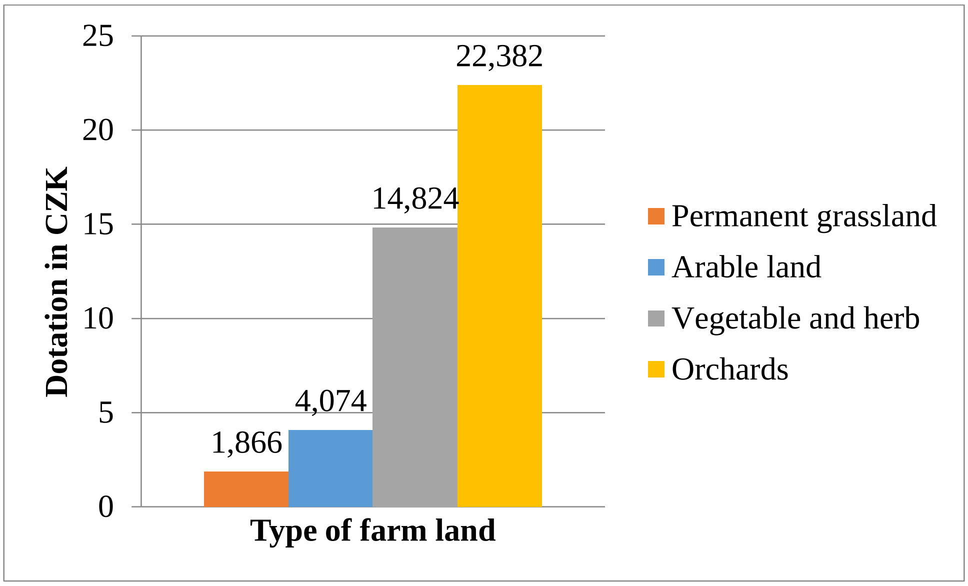

Figure 2 Overview of grants allotted with respect to land resources (Action Plan for Organic Farming, 2011- 2015).

The main driving forces in the development of the Czech OF seem to be government subsidies paid within the frame of the agroenvironmental measures and, not insignificantly, the interest of consumers and traders in Czech organic raw materials as well as the development of the domestic organic market. Recently, approximately 483,176 hectares of land in the Czech Republic are farmed organically; Figure 2 represents 11.4% of total agricultural acreage. From this point of view, the Czech Republic is above the EU average. There are about 4,022 farms varying significantly in size, with a predominant focus on grassland, although the number of cash crop producers has been increasing. There are small organic farms e.g. of just 5 ha acreage but also whole former cooperatives or state farms with acreage of over 1,000 ha. The Czech Republic is the leader in the field of organic farming among new EU member countries. Every year 1 billion CZK (40 million EUR) is paid in the form of subsidies to Czech organic farmers (Action Plan for Organic Farming, 2011-2015). In the Figure 2 the Czech Republic has the different funds according to the different type of land culture like permanent grassland, arable land, vegetable and herb and also orchards.

3.2.2 Field management

The kind of field management style that takes into account in-field variability of soil and crop, also known as precision agriculture, aims to increase the profitability of crop production while simultaneously reducing the negative environmental impact by adjusting applications rates of agricultural inputs according to local needs (Pierce et al., 1999). For example, in the tropics, growing legumes for soil fertilization was almost non-existent there. Organic-fertilizer made from crop residues and molasses was the second most popular organic fertilizer in the central part of the White Carpathians (Thapa and Rattanasuteerakul, 2011). Organic farming shares similarities with other agricultural technologies in terms of the adoption and diffusion process (Lapple and Rensburg, 2011). A comparative study of organically and integrated grown vegetables showed that the organic crops had 2.9 % higher dry matter content than the integrated crops (Fjelkner-Modig et al., 2000) which require different regulatory treatment, it means different types of crops, e.g. field crops or vegetables (Tripp and Louwaars, 1997).

Recently, the priority is not to strive for the highest possible number of organic farmers and largest possible organic acreage. Supportive stimulus and control mechanisms for this area have been set (support for organic farmers, organic food producers, and consumer demand) and these will increase the number of organic farmers and producers in the future. There is now an apparent need to emphasize the quality of the whole established system (Action Plan for Organic Farming, 2011-2015) instead of emphasizing the quantity as much.

3.2.3 Crop production

According to Kilcher (2006), Lampkin & Padel (1994) and Henning et al. (1991), organic agriculture, which is an agriculture entirely relying on organic inputs, is synonymous with sustainable agriculture. Organic farming is characterized by the prohibition of a majority of synthesis chemicals in crop production (Lampkin, 2002). Organic products are not harmed with chemical substances, neither before nor after harvest during storage (Lammerts Van Bueren and Van Den Broek, 2002). Organic agriculture regards biodiversity as an irreplaceable production factor and as an instrument for preventing pests, disease and weeds (Geier, 2000). This is for instance the case with potatoes and onion where varieties with good long-term storage potential without the use of chemical sprouting inhibitors are much in demand (Lammerts Van Bueren and Van Den Broek, 2002). We can conserve or store different plant species or varieties. Attractive properties of new species from the market, changing diets and culinary habits, latest developments in processing and storage, new information and knowledge on gardening, curiosity and the pleasure in experimentation have led to the introduction of species new to the region (Vogl-Lukasser and Vogl, 2002).

Activities that directly support farmers from the perspective of *in situ* conservation are as follows: community seed banks, local germplasm collections, and the reintroduction of local varieties (Almekinders, 2001). *In situ* (on-farm) conservation is the maintenance of species populations in their natural habitats either as uncultivated plant communities or in farmers' fields as a part of existing agro-ecosystems (Jarvis et al., 1997). On-farm conservation, on Figure 3, is a process, which generates diversity (Sthapit and Jarvis, 1999). The convention on biological diversity has recognized the continued maintenance of traditional varieties *in situ* as an essential component of sustainable agricultural development (Sthapit and Jarvis, 1999).

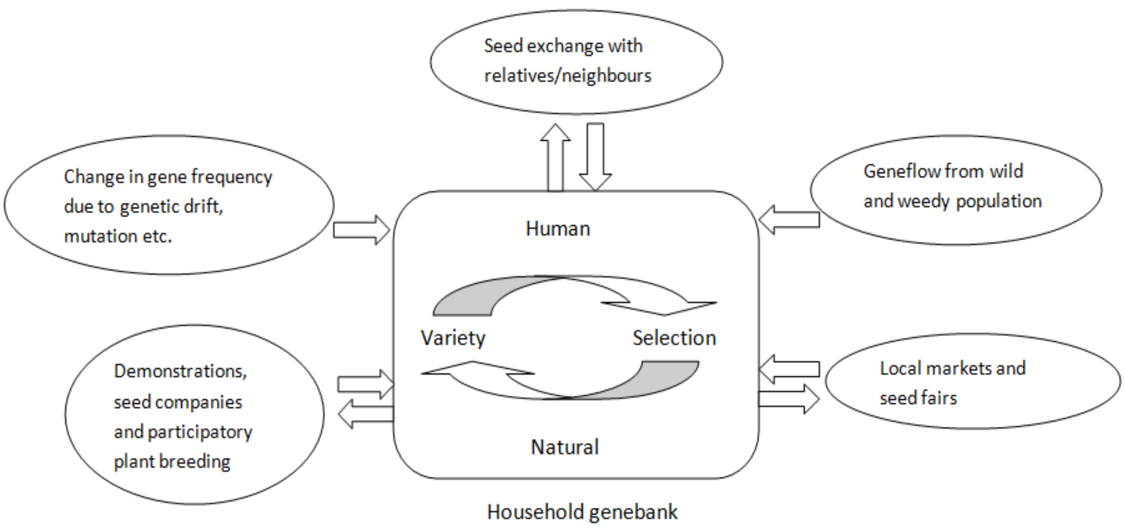

Figure 3 Informal seed supply systems in informal farming systems (Sthapit and Jarvis, 1999).

3.3 Relationship between environment and organic farming

3.3.1 Landscape protection

The aim of the Action Plan for Organic Farming, 2011-2015, is to achieve a 15% proportion of the total agricultural acreage along with a concurrent increase in the organic food proportion in the food market to 3%. The disproportion is the result of the non-production functions of organic farming. Approximately 80% of organic acreage is represented by permanent grassland. For the comparison with other countries, see the Figure 2. At the same time it is a crucial resource for global agricultural and environmental sustainability (Almekinders, 2001). The reason for this is mainly the high proportion of less favorable areas in the Czech Republic, including especially mountainous regions and uplands, where landscape maintenance is very important due to a high number of areas with restricted systems of management (Action Plan for Organic Farming, 2011-2015). Organic agriculture can actually provide better income than conventional agriculture (Rasul and Thapa, 2004). Jaffee and Strivastava (1994) divide their analysis into plant breeding, seed production and processing and seed distribution, marketing and quality control. The challenge is to understand, for any given crop and environment, the optimum mix of public and private (commercial or voluntary) contributions to these various elements of the seed provision process. During the next 50 years, global agricultural expansion threatens to impact worldwide biodiversity on an unprecedented scale that may rival climate change in its significance for the persistence of a panoply of species (Tilman et al., 2001).

Organic farming is growing rapidly in its potential for producing healthy food and in decreasing environmental harm caused by farming practices (Woese et al., 1997; Healton, 2001). It has been adopted in a wide range of climate and soil types (Dorado et al., 2011). The perception among consumers is that organically produced crops possess higher nutritional quality (Woese et al., 1997; Healton, 2001). The loss of biodiversity on this scale has fulfilled the debate over the sustainability of current intensive farming practices that includes fears over water pollution, soil erosion, landscape quality and food safety (DEFRA, 2002; EU, 2002).

Ethnobotany is the study of these plant-human interrelationships and embeds in dynamic ecosystems of natural and social components (Alcorn, 1997). Sensory qualities like taste are not only the result of environmental but also of genetic influences (Simon et al., 1982; Simon, 1993). Farmers use crop genetic diversity to cope with soil and climatic variations, and to reduce production risks (Almekinders, 2001). Farmers shape the diversity of their crops through decisions affecting biological, social, economic processes, and land use (King, 1999). A genuine organic agriculture creates "integrated, humane, environmentally and economically sustainable production systems, which maximize the reliance on farm-derived renewable resources and the management of ecological and biological processes and interactions, in order to obtain acceptable levels of crop, livestock and human nutrition, protection from pest and diseases, and an appropriate return to the human and other resources" (Lampkin and Padel, 1994). Conservation of existing biodiversity in agricultural landscapes and the adoption of biodiversity-based practices have been proposed as a way of improving the sustainability of agricultural production through greater reliance on ecological goods and services, with less damaging effects on environmental quality and biodiversity (Collins and Qualset, 1999; McNeely and Scherr, 2003).

Due to the need for an institutionalized solution to this issue, the Ministry of the Environment (MoE) appointed a work group "Organic Farming in Nature and Landscape Protection". The work group was appointed by a MoE Deputy Minister and was also a MoE advisory body in terms of organic farming. The work group consisted of experts from universities, researchers, organic farmers' associations and representatives of practitioners (Action Plan for Organic Farming, 2011-2015).

Farm managers, as a result, have to address new requirements, for example those related to the improvement of quantity and quality while reducing environmental impact. Therefore, they will need more control over their production system (Kruize et al., 2013). There are three influencing factors, namely:

a) The amount of organic fertilizers such as farm yard manure and compost procedures produced by farmers themselves,
b) Perception of the harmful effect of inorganic pesticides, and
c) The length of experience in growing vegetables (Thapa and Rattanasuteerakul, 2011).

Given that agricultural landscapes are prone to disturbance, succession can be more rapid when some indigenous plants remain, seed banks exist, and/or neighboring intact biodiversity-rich vegetation still serves as a source of dispersing organisms (Lamb et al., 2005).

Main outputs of the Action Plan for Organic Farming, 2011-2015: The work group especially focused on providing more and better information for the specialist public; with the financial and organizational support of the MoE the following titles were published:

- “Diversity and Organic Farming” - a study exploring the literary background of this topic and also focusing on the topic of grassland in organic farming,
- Organic farming bulletin on the theme of grassland, dealing not only with its production aspect but also analyzing scientific approach with the aim of enhancing the species diversity of grassland communities,
- A publication issued in 2005 by the former Institute for Agricultural and Food Information: Considerate forms of farm management in the landscape, including a description of up-to-date subsidy organs of the Ministry of Agriculture (MoA) and MoE in the field of nature conservation,
- A MoA publication “Organic Farming and Biodiversity”, part of which was a presentation of findings on the effect of organic farming on biodiversity and the landscape.

Table 1 Perspective for the development of the structure of agricultural land under organic management between 2010 and 2015 (Action Plan for Organic Farming, 2011-2015).

Indicator	**Austria**	**Germany**	**Poland**	**Slovakia**	**Czech Rep.**
Number of organic farms	20 000	20 000	15 000	1 000	2 689
Organic farmland acreage	493 000	908 000	314 000	141 000	398 407
Proportion of organic farmland (%)	15.5	5.4	2	7.3	9.38
Arable land acreage	18.3	29.7	25.8	12.2	11.38
Permanent grassland acreage	68.7	49.7	37.6	69.1	82.63

3.3.2 Benefits of organic farming

There is a worldwide trend towards the promotion of organic agriculture in view of its environmental, social and economic benefits (Thapa and Rattanasuteerakul, 2011). Organic agriculture bases its sustainable self-regulating production system on the concept of a farm as an agroecosystem. An agroecosystem, defined as an ecological system within the agricultural context (i.e. with inputs, withdrawal of products and interference by a farmer), is shaped by the strong interaction between the (variations in) biotic and abiotic environment, the genetic composition of species involved and the management resources available to the farmer (Swift and Anderson, 1993; Almekinders et al, 1995; Vandermeer, 1995).

Agrobiodiversity is most likely to enhance agroecosystem functioning when assemblages of species are added since their presence results in unique or complementary effects on the ecosystem functioning, e.g., by planting genotypes with genes for higher yield or pest resistance, mixing specific genotypes of crops, or including functional groups that increase nutrient inputs and cycling (Jackson et al., 2007) The influence of organic farming on the environment has not yet been assessed to a sufficient extent in the Czech Republic; therefore there is a lack of regionally specific information in this field. However, some research projects have proven a positive effect of organically managed land on biodiversity and stability of surrounding biotopes. The maintenance of ecosystem functions and protection of elements of the environment, which OF can offer to society, are not yet provided at a sufficient level. No indicators have been put into practice which would adequately enable the evaluation and reward of the positive effect of the OF system on the environment. At the same time there are no tools available, within subsidy support, which would allow a complex approach to be taken into account and would respect both production and non-production functions of organic farming (Action Plan for Organic Farming, 2011-2015).

Currently, organic farmers largely depend on varieties supplied by conventional plant breeders and developed for farming systems in which artificial fertilizers and agrochemicals are widely used. The organic farming system differs fundamentally in soil fertility, weed, pest and disease management, and makes higher demands on product quality and yield stability than conventional farming (Lammerts Van Buern et al., 2002). On the basis of research carried out so far we can assume that the structure of organic production, the prohibition of easily soluble N-based mineral fertilizers and synthetic plant protection, among other measures, are a significant OF contribution to the protection of surface-water and groundwater. Farming land organically requires the renewal of the natural processes in the soil, which is an important factor in terms of the protection of soil as a non-renewable resource. The majority of research studies (mostly foreign) proves a higher level of biological diversity on organically managed land (in the Czech Republic this has been studied e.g. in vineyards) (Action Plan for Organic Farming, 2011-2015).

The desired variety traits include the adaption to organic soil fertility management, implying low (lower) and organic inputs, a better root system and the ability to interact with beneficial soil microorganisms, ability to suppress weeds, contributing to soil, crop and seed health, good product quality, high yield level and high yield stability (Lammerts Van Bueren et al., 2002). It is fundamental to evaluate these benefits and prepare new settings for OF subsidy conditions after 2013. The new settings must enable further development of the OF system, although not primarily the quantitative increase in organic acreage but rather the improvement in the quality of the whole system (Action Plan for Organic Farming, 2011-2015).

Organic farming will be a fully developed sector of agriculture with all appropriate characteristics such as a stable market, services and a State policy – support for providing public goods including aspects related to the environment and animal welfare (Action Plan for Organic Farming, 2011-2015).

The limited area of organic agriculture will be the bottleneck for economic interest in establishing specific breeding programmes for organic farming systems. The proposed organic crop ideotypes may mean a benefit not only for organic farming systems, but in the future also for conventional systems that move away from high inputs of nutrients and chemical pesticides (Lammerts Van Bueren et al., 2002). Partial aims and activities mentioned in the Action Plan for Organic Farming (2011-2015) proposed to achieve a 3% organic food share of the total amount of processed foods; increase the proportion of Czech organic food to 60 % in the organic market: increase the transparency of origin in purchasing organic foods, support regional sale and establishment of new types of sales points, and enhance the awareness of the benefits of organic farming for the environment in the Czech agriculture. You can see the perspective for the development of the structure of agricultural land under organic management between 2010 and 2015 on the next Table 2.

Table 2 Perspective for the development of the structure of agricultural land under organic management between 2010 and 2015 (Action Plan for Organic Farming, 2011-2015).

	2008	**2009**	**2010**	**2011**	**2013**	**2015**
Number of organic food producers	410	497	660	730	810	920
Number of organic farms	1,802	2,689	3,800	4,200	5,200	5,800
Organic arable acreage	338,722	398,407	464,000	511,000	571,000	650,000
OF share of total farmland acreage (%)	7.97	9.38	10.9	12	13.4	15.3
Arable land (ha)	34,990	44,906	58,000	68,000	80,000	94,500
Permanent grassland acreage (ha)	278,913	329,232	381,690	418,888	467,286	532,784
Permanent culture acreage (orchards) (ha)	2,777	3,678	5,200	5,800	6,200	6,500
Permanent culture acreage (vineyards) (ha)	408	645	1,100	1,300	1,500	1,700
Permanent culture acreage (hop-fields) (ha)	0	8	10	12	14	16
Other areas (ha)	21,634	19,890	18,000	17,000	16,000	15,000

For organic farming, there are also some significant threats. The most common example is as follows: unclear ownership of land, low purchasing power of the population, low accessibility of loans in the common financial market, WTO (removal of subsidies, changes in policy etc.), low stability of the economic environment; unstable market, deceptive labeling of organic products, introduction of GMO’s within EU and worldwide, negative natural and climatic phenomena, and the ecological consciousness of the population still at a low level (Action Plan for Organic Farming, 2011-2015).

Farmers will continue maintaining landraces as long as they see benefits, but they may choose to replace them with modern varieties for the following reasons: poor yields of local landraces; lack of market for local varieties; disease and pest susceptibility; poor economic returns; unwanted traits such as taste; access to seed of modern varieties, input and credit facilities and technical support (Sthapit and Jarvis, 1999).

3.4 Species diversity

3.4.1 Agrobiodiversity management

Agrobiodiversity refers to the variety and variability of living organisms that contribute to food and agriculture in the broadest sense, and that are associated with cultivating crops within ecological complexes (Kruize et al., 2013). It controls undesirable quantities of crop associates by stimulating the self-regulating capacity of agro ecosystem as much as possible, for example by using agrobiodiversity at different levels of management (farm, crop species, variety) within the farming system (Anonymous, 1991; 2002). Organic farming has less impact on hedge bottom vegetation, with hedges on organic farms displaying significantly higher species diversity than those to be identified on conventional farms (Aude et al., 2003). In addition to understanding the basis for farmer decision-making and management of diversity, there are a number of additional reasons for the use of participatory methodologies in the research on genetic diversity (Godbole and Eyzaguirre, 1997). Evaluating the value associated with agrobiodiversity or the opportunity costs that would result from conserving it, is an undertaking complex (Gollin and Smale, 1999). There is a lack of adequate knowledge of how the ecological functions that are provided by agrobiodiversity translate into tangible benefits for society (Jackson et al., 2007).

An important point to remember is that crop diversity, according to Long et al. (2000), is to a greater or lesser extent created and maintained with active human intervention. This means: agricultural ecosystems are disturbed environments, usually managed by farmers in order to maintain early stages of ecological succession, many aspects of crop diversity would not survive without this human interference; agricultural ecosystems rely on a large extent of alien species: the majority of economically important crop species have been introduced into many countries beyond their original area of origin – this means there is a very great interdependence between countries for the genetic resources on which our food systems are based; much crop diversity is held *ex-situ* (off-farm) in gene banks and other reserves, and not on-farm in the farming system.

Genetic and population diversity provides the essential basis for continuing crop improvement. Breeding programmes have exploited landraces and crop wild relatives for genes for increased pest resistance, yield and quality (Briggs and Knowles, 1967; Cooper et al., 2001; Tisdell, 2003). The use of agrobiodiversity in agricultural systems tends to be under pressure worldwide. The loss of crop genetic diversity and its continuous declining use has generated much concern about food security and environmental sustainability (Almekinders, 2001). Farmers have been involved in various stages of formal research processes from the initial documentation of genetic diversity and indigenous knowledge associated with plant genetic resources in the field (Sandoval, 1994) to the identification of methods enabling us to assist the continued selection and maintenance of local cultivars (Sperling and Berkowitz, 1994; Mowbray, 1995). This is focused on the value of landraces (traditional and local crop varieties) to farmers in centers of agricultural diversity (Brush and Meng, 1998) of the Carpathian Mountains on the north-east of the Czech Republic in Zlín Region.

Biodiversity refers to all living things and the interaction between them: a vast array of organisms with an almost infinite complexity of relationships (Lenné and Wood, 2011). The agrobiodiversity in small-scale farming systems in developing countries is recognized to be a threatened resource of great value. Farmers are the principal managers of this diversity (Almekinders, 2001). Agricultural biodiversity, that is, 'agrobiodiversity', is an exceptionally important subset of biodiversity. Agrobiodiversity has been defined by Qualset *et al.* (1995) as including all crops and livestock and their wild relatives, and all interacting species of pollinators, symbionts, pests, parasites, predators and competitors (Lenné and Wood, 2011).

Agrobiodiversity through agriculture, that is management of the interactions between crops and domestic animals and their associated biodiversity and the environment, provides most of our food with less than 5% from the wild (Prescott-Allen and Prescott-Allen, 1986). This study is aimed only at crops associated with the biodiversity and the environment. Traditionally, the farmers in the humid tropics used organic fertilizers regularly to manage soil fertility that contributed to make agriculture both environmentally and economically sustainable (Charlton, 1987).

Agrobiodiversity is the part of biodiversity that is directly relevant for agricultural production. It includes the genetic diversity within and between crops and animals used for agricultural production (Almekinders, 2001).

Most of our food is also derived directly or indirectly form plants. It has been estimated that more than 80% of our calories and edible dry weight comes from crop plants (Evans, 2003).

Most information on the management of crop genetic diversity at the community level relates to the major seed-propagated annual grain crops, which are in general the most important group of crops for small-scale farmers. Minor grain, root and tuber crops are, however, locally very important food and cash crops (Almekinders, 2001). The biodiversity benefits are likely to derive from the specific management practices employed within organic systems (Gardner and Brown, 1998).

Agriculture is a large global user of biodiversity (Wood and Lenné, 1999). Agriculture has selected and added value to wild biodiversity for more than 10,000 years of managing agrobiodiversity. Agriculture has conserved biodiversity on the hoof and as seed and planting materials over this long period.

Biodiversity that closely interacts with crops is usually considered a part of agrobiodiversity. It includes pests, diseases, soil organisms, pollinating insects, etc. (Almekinders, 2001).

The management of agrobiodiversity will be determining our future, both in cities and the countryside. Agroecosystems – mediated through agrobiodiversity – have always provided the essential ecosystem service of food production (Lenné and Wood, 2011). The function of agrobiodiversity in agricultural systems is still poorly understood. The objective to increase agrobiodiversity for more sustainable agriculture is still largely based on assumptions and unofficial information, rather than on solid ecological and socio-economic evidence (Almekinders, 2001).

Present knowledge extends from a greater appreciation of traditional agriculture and the needs of farmers, through classical agricultural research in genetics, statistics, replicated experiments, plant breeding, agronomy, crop protection, rural sociology, information management and many more through to biotechnology (Lenné and Wood, 2011). Participatory methods in agricultural research and their use on crop diversity is to strengthen the ability of researchers to identify, understand, and better serve all those whose decisions influence agricultural diversity (King, 1999).

The prime candidate in the search for the relevant wild ecosystem in the 'Near Eastern' centre of crops origins – the arc stretching from Palestine, Jordan and Israel, through Syria, southern Turkey, Iraq and south-western Iran. As the source of important cereals and pulse crops (wheat, barley, pea, lentil, faba bean and others) this region has been the focus of extensive botanical, genetic and, to a lesser extent, ecological research, which has resulted in a multiplicity of theories on the origins of plant domestication (Lenné and Wood, 1999).

It is believed believe that a greater appreciation of the obvious success of the independent and multiple crop´s domestication is a valuable resource for the future as well as for the sustainability of agriculture (Lenné and Wood, 1999).

Lenné and Wood (1999) wish to refocus the debate to other facets of agricultural origins perhaps on diversity management and our food security than current academic controversies over the origin of agriculture.

A key concept of wild ecology is the idea of plant succession. Simply put, bare ground will be colonized by smaller, annual plants with easily dispersed seed. But, as with many ideas in ecology, concepts of succession have changed over time (Tansley, 1935).

At present, international socio-economic developments, including market conditions and, in particular, advances in the field of biotechnology, are negatively affecting the conditions for farmers' access and use of agrobiodiversity (Almekinders, 2001).

3.4.2 Conservation of plants

Crops originated from their wild relatives through a single, or at the most, few events of domestication in limited regions (Lenné and Wood, 1999).

In organic agriculture the basis of sound crop production is the care for building-up soil fertility, which is based on three inextricably interrelated components of soil management: the physical (water-holding capacity, structure, etc.), chemical (nutrient dynamics, pH), and biological (soil biota) component (Vandermeer, 1995). Soil fertility in organic farming means: well-managed soil organic matter, good soil structure, diverse soil biota, and a high nutrient and water-holding capacity by using compost and stable manure (Koopmans and Bokhorst, 2000). Agrobiodiversity is necessarily based on farmers' needs and priorities. Only when addressing farmers' needs communities can be expected to utilize and maintain agrobiodiversity in a sustainable way (Almenkinders, 2001). Information about specific variety characteristics that the farmer finds important will provide insight on household preferences and behavior (Brush and Meng, 1998). Improving the articulation of farmer perspectives and developing community skills are also important aspects of *in-situ* conservation strategies, which work directly with the genetic resources that farmers value and conserve, and which build off of farmer's own breeding and selection systems (Khon Kaen University, 1987).

Organized collection, evaluation, and conservation of crop genetic resources have gone on for two hundred years, confirming the fact that politicians, scientists and consumers value these resources. The social value of crop genetic resources has been described anecdotally by examples of the economic contribution of exotic crops and crop varieties (Iltis, 1989). The existence of crop genetic resources in farming systems implicitly suggests that farmers value them as well, a suggestion that is confirmed by research on farmers' knowledge and their use of different crops and crop varieties (Brush, 1995). Diversity of crop genetic resources, according to Almekinders (2001), has two vital functions for farmer households:

a) It serves multiple purposes of consumption, use and marketing.
b) It enables farmers to cope with variable or unpredictable environment and market conditions. These functions are particularly important in complex, diverse and risk-prone environments.

On the other hand, the main drivers of biodiversity loss according to Heywood (2011) are:

a) Habitat loss, degradation, simplification
b) Global change
c) Invasive species
d) Overexploitation of resources
e) Pollution

These are some of a wide variety of possible types, including wind, water and animals. But for crops, the main dispersal mechanism are humans, so much that wild-type dispersal mechanisms may be lost by evaluation – so as in the case of maize, where the seeds are enveloped by bracts (Lenné and Wood, 1999). It is important to find out the factors explaining the variation in the extent of organic vegetable farming from one farm household to another (Thapa and Rattanasuteerakul, 2011). Some authors concentrate on a part of the on farm Plant Genetic Resources (PGR), i.e. crop genetic diversity (Kohler-Rollefson, 2000). Although in general the local PGR system is dynamic and contains a relatively high level of crop genetic diversity, there is also a need for the introduction of exotic genes to improve yields and yield stability in situations where the local varieties are not performing satisfactorily. In other situations, new genes are needed to adapt to changing agro-ecological and socioeconomic conditions (Almekinders, 2001).

Participatory research involves working directly with organic farms and individual farmers in order to understand the variables which influence their patterns of crop management. The use of participatory methodologies strengthens the ability of researchers to locate diversity and identify multiple uses for different crops (King, 1999). Two approaches to describing farmers' variation of landraces and crop genetic resources exist in the literature. Economic analyses of variety choice can be used to impute value, while ethnobotanical description of farmers' uses of and attitudes towards different varieties provides information on value. Some argue that the synthesis of these two approaches is desirable particularly in peasant production systems with missing or imperfect markets where ethnobotany can provide useful information (Brush and Meng, 1998). Crop genetic diversity that is managed by farmers in marginal areas, i.e. areas that are usually characterized by a complex combination of stresses, may in particular provide important genes and gene combinations for future crop improvement (Almerinders, 2001). This could be a gradual process of diffusion, as settlements were established away from the homelands of crops (Lenné and Wood, 1999).

As already mentioned before, farmers are the principal managers of crop genetic diversity. They develop agricultural crops and varieties from wild plants through crop cultivation. They decide which crops and varieties to plant; select and store seeds for the next season; and exchange seeds with other farmers from the same or other communities to obtain new or lost varieties, and to replace degenerated varieties (Almekinders, 2001). The role of farmer knowledge in particular areas has long been recognized, but has become increasingly important within the context of *in situ* conservation and participatory plant breeding (King, 1999). There is ample evidence of local production of quality seed, but there is much difference as for farmers' seed production. In many cases, farmers' seed production and storage are sub–optimal, affecting seed vigor and seed health. Furthermore, seed exchange is not effective under all circumstances. Geographic, cultural, social and gender factors can all be barriers in the flow of seeds between households and communities (Almekinders, 2001). Household crop production and farmer decision-making may be influenced by inter-household factors such as the land tenure system or the size of land holdings. In addition, crop management may be shaped by factors within the given household such as differential access to inputs, responsibility, and control over products (King, 1999).

Collection of materials for *ex situ* storage in gene banks and the distribution of improved varieties are the only intentional points of contact (Almekinders, 2001). Giving support to gene banks for the reintroduction of local varieties into communities and rescuing threatened varieties for storage in gene banks, it establishes a functional link between *ex situ* and *in situ* conservation (Almekinders, 2001).

3.4.3 *Crop varieties*

Much scientific literature shows that some of the comparisons are not experimentally valid due to variation in crop varieties, timing in fertilization, and handling and storage after harvesting (Warman and Harvard, 1997). To obtain varieties adapted to organic farming systems, ideotypes have to be elaborated per crop per market segment (Lammerts Van Buern et al, 2001). Nevertheless, the fact that organic farmers use modern varieties does not mean that these are optimal for their farming system. The current modern varieties are adapted to conventional agriculture that has put in a lot of effort to minimize or simply overrule diversity in the cultivation environment, and breeding has mainly been focused on such relatively standardized farming systems (Jongerden and Ruivenkamp, 1996). For further optimization of organic product quality and yield stability new varieties that are adapted to organic farming systems are required (Lammerts Van Bueren et al., 2002). Organic farmers do not require varieties with a higher yielding capacity in the first place because of risking to lose such profit by (increased) disease susceptibility, but need varieties with a higher yield stability through improved adaption to organic farming systems and because of that yield reduction (Lammerts Van Buern et al., 2002). Performance testing of new varieties is done to ensure that they meet certain standards (such as yield), and is usually accomplished through field trials from a specified number of seasons and locations (Tripp and Louwaars, 1997). Over the last 20 or 30 years, plant breeders have been trying to produce higher yielding varieties of crops. As a result, it has been observed that for many crops we now rely heavily on a few modern varieties (Long, 2000). Teklewold et al. (2006) and Rasul et al. (2004) found out that marketing problem also constrains the adoption of any new technologies. In general, yield attributes are ranked higher for modern varieties than traditional varieties (Brush and Meng, 1998).When modern varieties are grown by farmers for the first time they can only replace landraces and hence will reduce the extent of their cultivation (Witcombe et al., 1996). Landraces are varieties developed by farmers over many generations of selection without the intervention of formal plant breeding (Sthapit and Jarvis, 1999). Diffusion of new varieties through exchange of seeds from farmer-to-farmer has been shown in many cases to be more important than formal sector seed distribution (Almekinders, 2001). Participatory plant breeding can increase the availability of genetic diversity for farmers and contributes to developing well-adapted improved varieties (Almekinders, 2001). Farmers can also, by themselves, be the source of inspiration and serve as very influential agents for the promotion of any agricultural innovations (Jintrawet, 1995).

Agricultural plant germplasm is found in wild relatives of cultivated plants, weedy forms, locally selected crop varieties, plant used in crop breeding, and modern cultivars (Fowler and Mooney, 1990; Hawkes 1983).

These days, organic farmers largely depend on varieties supplied by conventional plant breeders who use conventional breeding and seed production techniques and develop varieties for farming systems in which artificial fertilizers and agrochemicals are widely used (Lammerts Van Bueren et al., 2002a; Lammerts Van Bueren & Osman, 2002). Many authors argue that farmers need genetic diversity for the multiple subsistence purposes of the farmer-household (consumption, market, etc), as well as to cope with environmental variation. Farmers' use of crop genetic diversity is often described as a local system of integrated management of Plant Genetic Resources (PGR) in which farmers' seed production practices are inseparably linked with crop development and conservation (Almekinders, 2001). The success of *in situ* conservation strategies depends on how well researchers are able to identify the factors that affect farmer decisions to maintain local cultivars and develop ways to assist with their continued selection (Sandoval, 1994).

To attain yield stability organic farmers require varieties adapted to lower and organic input conditions. However, some modern varieties require high nitrogen levels to realize their high-yield potential (Schroen, 1986). Modern varieties need good land and a lot of fertilizer in order to yield well: so it means that they are useless for poorer farmers on less fertile land. Other reasons for maintaining crop diversity are intended to provide different dishes to eat, to ensure a harvest at different times of year, and also simply as a safe-guard for the future (Trupp, 1998). Nevertheless, variability in organic amendments, crop rotation and soil fertility in each crop cycle, unpredictable and uncontrollable production variables such as year-to-year weather variation, planting and harvest dates, nitrate in irrigation water, and plant disease, produced in some cases higher data variability that even led to contradictory results (Dorado et al., 2011). Variety characteristics should not only suit and optimize the non-chemical and agroecological cultivation practices of organic farming systems and benefit the quality of the environment, but should also lead to optimal product quality for traders, processors and consumers. Part of the quality concept is the absence of chemical residues (Lammerts Van Buern et al., 2002).

Variety registration requires the recording of sufficient morphological and agronomic data about a new variety so that it can be identified and distinguished from other varieties (Tripp and Louwaars, 1997). It is estimated that about 60% of the world's agriculture consists of traditional subsistence farming system in which there is both a high diversity of crops and species grown and in the ways in which they are grown, such as polycropping and intercropping, that leads to the maintenance of a greater or lesser amounts of a variation within the crops (FAO, 2010a). Irretrievable valuable genetic resources have left the farmers' seed system as the principal system for supply of seeds and the diffusion of new varieties (Almekinders, 2001). It is for instance not clear to what extent local varieties in marginal conditions are better yielding and more stable than improved varieties, or to what extent yield stability can be explained by a variety's genetic (Almekinders, 2001). It is known, that poor farmers are often the source of seeds taken from local varieties (Almekinders, 2001).

3.4.4 Seed exchange

Seed exchange, the introduction of new diversity from informal systems and seed fairs is believed to enhance the gene flow in villages and meet farmers' immediate needs, which you can see in Figure 11. Farmers' seed production, selection, storage and exchange, in combination with natural crossing between varieties and wild species, mutations and environmental conditions, represents an integrated, dynamic and evolving Plant Genetic Resource (PGR) system. Alternative methods, such as developing market for landraces, developing seed savers exchanges, participatory breeding programmes (Eyzaguirre and Iwwanaga, 1996) and educational campaigns are arguably more effective for meeting conservation and agricultural development goals (Brush and Meng, 1998). Variety release is an official authorization that allows seed of a variety to be sold or made available to farmers. The variety release decision is based on the results of registration and/or performance testing (Tripp and Louwaars, 1997). Hence, farmers produce food and seeds, while at the same time they practice a form of crop development and maintain genetic diversity *in situ* (Almekinders, 2001). Recently, farmers have started to take on a more central role in research and experimentation (King, 1999). Ramaswami (1991) describe a four-stage evolution of national seed systems which begins with farmers' seed supply; progresses to the emergence of public plant breeding programmes; continues in the development of commercial seed enterprises, often promoting public varieties; and culminates with private companies producing and marketing most varieties, with some basic plant breeding research still managed by the public sector.

Seed regulation examinating can be divided into two areas: variety regulation (including regulation, performance testing, and release), and seed quality control (including certification and seed testing) (Tripp and Louwaars, 1997).

Seed programmes have generally overestimated farmers' interest in buying seed, and underestimated the advantages and qualities of on-farm produced seeds, particularly in the case of self-pollinated crops (Almekinders, 2001). Seed quality control has two components, seed certification and seed testing. Seed certification verifies the genetic quality of seed. Seed testing examines various seed quality parameters, such as germination capacity, analytical purity, and pathogen levels. Certification of genetic quality requires that the certifying agency has access to the parent lines of the variety, which raises questions of control over genetic material (Grobman, 1992).

Another relevant feature is the fact from where these crops were brought to the region, whether it is imported crops or the crops directly from abroad and which crops are from tropical and subtropical areas.

Traditional seed supply systems represent an important source of diversity. Most farmers obtain the seeds of new varieties from informal seed source generally within their own community (Sthapit and Jarvis, 1999). Figure 3 indicates the importance of farmer-to-farmer seed exchange mechanisms.

3.5 Affected biodiversity

Organic farming is a promising agricultural method with positive effects on the human ecological and social environment. Governments have taken over a major role in defining organic farming by creating legal standards. Many countries all over the world have established a certification and accreditation system in order to protect the justified expectations of consumers with regard to processing and controlling the product quality of organic goods and to protect producers from fraudulent trade practices (Kruize *et al*., 2013).

Purportedly 'sustainable' farming system such as organic farming is now seen by many as a potential solution to this continued loss of biodiversity and it receives substantial support in the form of subsidy payments through EU and government legislation (Hole et al., 2004).

Direct support to farmer-communities by the formal sector is described from the perspectives of (*in situ*) conservation, crop development and seed supply. Indirect support involves market development, awareness-raising and capacity building. This also involves the generation of an institutional, policy and legal environment that supports and stimulates farmers' use of crop genetic diversity (Almekinders, 2001).

It is obvious that the main stimuli for further Czech OF development must be implemented through subsidy policy because legislative rules for OF are clearly set at a European level. European legislation allows such a situation (Action Plan for Organic Farming, 2011-2015).

As they are relevant to international trade, these standards do not only influence the organic farming movement at the national level but also have a converse impact across national borders. Organic farming was established in a bottom-up process as farmers aimed to design sustainable ways of using natural resources (Kruize et al., 2013).

The potential of subsidy policy is significant in terms of the stimulation of organic production. The subsidy title for organic farming is a part of agro-environmental measures; this means that it primarily focuses on supporting non-production functions. It is nevertheless obvious that the production function of OF is at least equally important. Organic production development has been and will be supported by the following stimuli:

- The main stimulus is to increase consumer awareness of the advantages of OF and organic foods which consequently increases the demand for organic foods by well-informed consumers,
- Stable demand for organic foods from consumers is necessary for the development of organic production,

- Organic arable acreage has been gradually growing for several years as well as the number of Czech organic food producers, which increases the demand for organic raw materials from organic farms,
- According to OF law every organic farmer must have a certificate for a given organic product (their organic production must be certified) (Action Plan for Organic Farming, 2011-2015).

There is no completely new stimulus to support organic production which has not been used at all yet. In the further period it will be necessary to develop an existing stimulus, especially maintain consumer confidence in organic foods, the conditions for annual renewal of certification for organic production etc. (Action Plan for Organic Farming, 2011-2015).

The formulation of seed and variety legislation and intellectual property rights favourable to farmers' use and conservation of crop genetic diversity need to find the support of national and international policy makers (Almekinders, 2001).

Organic farming has been developing for 20 years and during this time great progress has been made European legislation for OF and organic food has been unified and harmonized (Council Regulation No. 834/2007 and Commission Regulation No. 889/2008); there is also the national legislation for OF (Act No. 242/2000 Coll., and MoA1 Decree No. 16/2006 Coll.). Particular instruments for the support of the development have also been set (Action Plan for Organic Farming, 2011-2015).

The Czech Republic has a primary standard that defines organic agriculture and sets criteria for labeling products as "environmentally friendly products" and thus using the logo BIO in the Act No. 242/2000 Coll., on Organic Agriculture and amending Act No. 368/1992 Coll. Administrative Fees, as amended, which meets the IFOAM international standards (International Federation of Organic Agriculture Movements). The Czech Republic has also undertaken to observe the Council Regulation 2092/91 on Organic Farming, which is binding on all EU Member countries. Czech organic farming is also accredited by IFOAM EU (Potravinářská Revue, 2009). Organic farmers have steady support provided by the Czech Government through the Rural Development Program (RDP) 2007-2013 (Action Plan for Organic Farming, 2011-2015).

Inspection in organic farming has been carried out for many years in the Czech Republic. At present the supervision of the adherence to the principles of the OF and the inspection of activities related to the certification of the origin of organic products, either food or otherwise, is carried out by three private inspection bodies authorized by the Czech MoA (KEZ o.p.s., ABCERT AG - organizational unit and Biokont CZ) and now also a State inspection authority – Central Institute for Supervising and Testing in Agriculture (ÚKZ ÚZ). This organization ensures official inspection in accordance with the Regulation (EC) No. 882/2004 of the European Parliament and of the Council on official controls performed to ensure the verification of compliance with feed and food law, animal health and animal welfare rules (Action Plan for Organic Farming, 2011-2015).

The increase in the number of inspection bodies from one to three has brought competition in this field of activity and it was thus necessary to unify their approach to the certified companies. Therefore, since 2010, the MoA has issued procedural instructions for inspection of organic farms which the inspection bodies are obliged to adhere to. The instructions include e.g. the question of granting exceptions in OF or the management of organic orchards (Action Plan for Organic Farming, 2011-2015). You can see this costumer confidence and organic food market in Table 4.

Nevertheless, it must be noted that numerous Czech-produced organic foods contain imported raw materials or are only re-packed in the Czech Republic. Despite this fact the number of Czech producers of organic food is still increasing, along with the volume of Czech organic production (Action Plan for Organic Farming, 2011-2015).

Organic foods sold directly on farms or market places amounted to approximately 25 million CZK which gave direct sale a 1.4% share of the total market turnover. A project of farmers' markets was launched in 2010 in Prague and other Czech cities, where direct sale by organic farmers proved to be very successful (Action Plan for Organic Farming, 2011-2015).

The farming public should be provided with in-depth and relevant information as regards the comparison of conventional, integrated and organic agriculture, the comparison of important parameters, e.g. productivity, economic sustainability, market success etc., including information on innovation and new findings from research, as well as information on foreign demand together with information on the best options for sale of various OF products (Action Plan for Organic Farming, 2011-2015).

One of the key factors of OF as a newly developing sector is the system of know-how, an important part of which is the education system having the potential to prepare the required specialists. OF is taught primarily at certain secondary schools and universities. However, there is still a lack of experts in this area – specialists with sufficient practical experience are missing in the educational system. Research still does not provide enough information for agricultural practitioners and its range and focus does not correspond to the importance of organic farming and thus cannot meet the need for relevant knowledge (e.g. techniques of growing individual crop species) (Action Plan for Organic Farming, 2011-2015).

Farmers felt somewhat upset about the EU funds in the sense that they were distributed flatly meaning that the farmer with a wide scale of crops was to receive the same amount of money as the farmer with only a meadow, field etc. But if you compare the data in the Table 3, the subsidy from EU for permanent grassland (till 2013) is 2,339 CZK/ha/year for organic farmers and for arable land while for vegetable and special herb it is 14,824 CZK/ha/year. That means that the subsidy for permanent grassland is lower than for arable land.

Table 3 Level of subsidies for organic farming 2004 - 2013 (Action Plan for Organic Farming, 2011-2015).

Type of culture	**2004-2006 (HRDP) (CZK/ha/year)**	**2007-2013 (RDP) (EUR/CZK/ha(year)** **Rate of exchanging in 2010: Euro = 26,285 CZK**
Arable land	3,520	155/ 4,074
Permanent grassland	1,100	71 (89)*/ 1,866 (2,339)*
Vegetables and special herbs on arable land	11,050	564/ 14,824
Permanent culture (orchard, vineyards)	12,235	849/ 22,382
Permanent culture (extensive orchards)	12,235	510/ 13,405

*) The lower rate for organic farmers with parallel conventional production, the higher rate is for 100 % organic farmers.

Table 4 Organic food market and consumer confidence (Action Plan for Organic Farming, 2011-2015).

Activity	Responsibility	Until	Cooperation	Priority
1. Increasing consumer demand for organic foods in the form of education				
Information support for traders in their communication with the media and customers	PK	2010–2015	PRO-BIO, CTPOA	medium
2. Support for regional organic food sales				
Provide advisory and educational services for traders in the area of organic food sales and marketing in sales channels not yet exploited: public catering, direct marketing, hotel trade, tourism, processing organic products and organic food production including craft-style on-farm processing	PRO-BIO, Bio-institute	2011–2015	PK	high
Support for the establishment of local sales initiatives by farmers, producers, traders and consumers, using regional marking	PRO-BIO PK - BIO section	2011–2015	TPOA	medium
3. Support for effective cooperation within the organic food supply chain				
Continuously monitor and publish information and data about market, availability and demand, price development and consumer trends.	MoA	2011-2015	IAEI	high
Draw a proposal of measures for the reduction of production costs and improved effectiveness of cooperation within the organic food supply chain	PRO-BIO PK	2011	IAEI	medium
Support cooperation between farmers towards common marketing and sale	PRO-BIO	2011-2015	PK and other NGOs	medium
4. Building and improving confidence in the organic farming system				
Introduce national labeling for organic foods made from Czech raw materials	MoA	2012-2013	PRO-BIO PK	medium
Improve transparency and consistency in the inspection system.	MoA	2011-2015	OF inspection bodies, ÚKZÚZ	high

4 METHODOLOGY

4.1 Data collection method

In order to meet the objective of the thesis defined earlier in the text and thus maximize the relevance of my research, it was crucial to obtain all the fundamental information on organic farms. Data on the use of the given type of soil or genetic material was obtained based on a questionnaire. The questionnaire consisted of two types of questions: 1. Closed-ended questions with a multiple choice, 2. Open-ended questions – completely unstructured. The questionnaire survey is one of the quantitative methods employed by the public opinion research.

I collected the data from March to September 2014 from 63 respondents – organic farmers - in the central area of the White Carpathians.

Methods of data collection can be divided in the following three steps: electronic method, telephone questions and personal communication method (personal interviews and open talking). The advantage of the electronic method is above all its low ongoing cost but it tends to be overly general. Telephone questionnaires are intended to clarify the answers of organic farmers who responded with less accuracy to some of the questions. The personal method can be more detailed and in-depth, which allows us to obtain a lot of comprehensive and relevant information. The main disadvantage of the personal method is that it can be extremely expensive and time-consuming to train and maintain an interview panel survey. However, the personal method proved to be the most helpful, i.e. interviews and open talking carried out with individual farmers.

Many citing materials come from scientific articles and publications from the Švehlova library. Other publications and books were provided directly by the particular organic farmers.

4.2 Description of the methods used

The methodology of the project is divided into four stages. The first stage is based on the collection of the basic data by means of the questionnaire presented to organic farmers. The second stage consists in the identification of the common, traditional and unusual species detected on organic farms, including crops and also old varieties of fruit trees in orchards. The third one refers to the conservation strategy, genetic material acquisition and seed exchange. The fourth stage refers to the collection of the used part of the plants and their further usage by local organic farmers.

The final part of the thesis is focused on the collection of the obtained data and their statistical processing.

The distribution of the various types of species specified above – common, traditional and unusual – is in part controlled by organic farmers themselves and it is partly derived from the following verification; Some species appear to be identified by farmers as unusual (extremely rare species). However, these cultivated species are, by contrast, found rather commonly on other farms in the area of the White Carpathians. Sometimes it is quite the opposite. Some species are identified by farmers as commonly grown but the incidence of the given species is not expanded to such an extent in the Czech Republic (or in the White Carpathians).

It should be noted that species that we now commonly find, and which are widely grown for centuries, have their origins in countries from Asia to America. Some species were therefore only brought or imported to our territory and subsequently got adapted to the specific Czech local conditions.

Each farmer included in the research and operating an organic farm was asked to participate semi-structured and structured interviews.

The questionnaires were sent to sixty nine organic farms in the White Carpathians territory. Out of the total number of sixty nine respondents, sixty three respondents, as it is shown in Figure 4, provided answers to the questionnaire. We may conclude that eighty four percent of the respondents filled in the questionnaire and sent it back.

In total, seven percent of the respondents gave a negative answer and they let me know that they were not interested in their taking part in the research project. What is more, they indicated at the same time the lack of their interest in providing me with information as regards the types of plants/crops which they produce. The most common reason for their reluctance was the fact that they were too busy. Nine percent of the farmers being subject to the research project and registered in the list of organic farms in the Information Centre for the Development of Moravské Kopanice, o.p.s., Starý Hrozenkov (*Informační středisko pro rozvoj Moravských Kopanic, o.p.s., Starý Hrozenkov*) are no longer active in the field of organic agriculture and their responses were not taken into account.

The interview collected the data on the crop diversity of farm and on unusual plants is shown in the Table 6. Verbal evidence was used for appraising and confirming of structured and semi-structured interviews.

Data were collected in order to determine what factors or combination of factors affect the conservation and use of this diversity (Watson and Eyzaguirre, 2001).

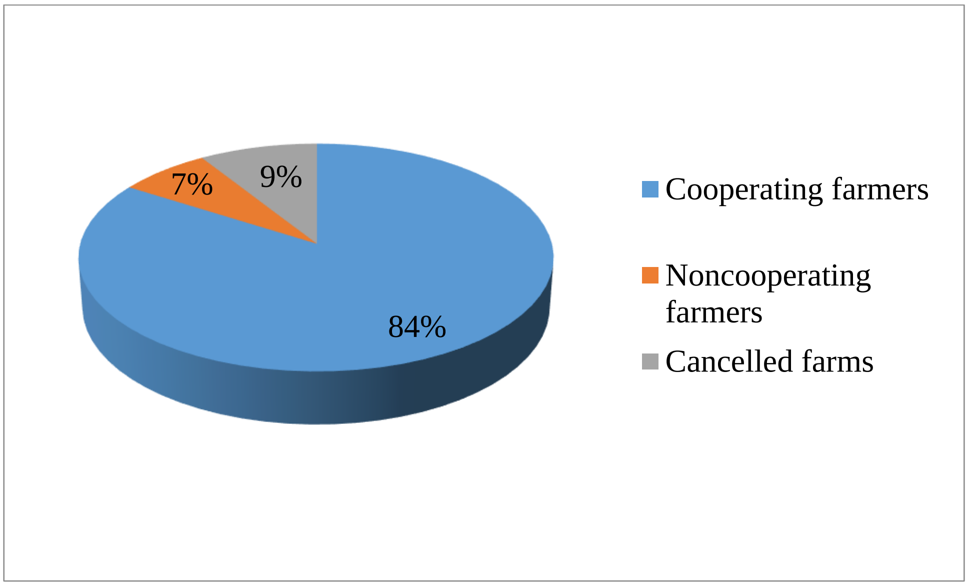

Figure 4 The total number of questionnaires sent to respondents – organic farmers in the region of the White Carpathians.

4.3 Perspectives for future studies

The methods and techniques specified above are recommended to become a model for further research having the same focus, i.e. getting an in-depth overview of agricultural biodiversity on organic farms in the region of the White Carpathians also in the subsequent years. The comparison of the methods applied and the research results of the present and future studies would mean a significant contribution and important implications for future research in this field.

5 RESULTS

The results of the interviews conducted with the selected organic farmers in the given region serve as a basic description of the agrobiodiversity and the related occurrence of exotic or unusual species. Moreover, it enables us to find out the ways of their obtaining of the genetic material. This research also provides a summary of crops used by organic farmers.

5.1 Organic farms´ specialization

The information centre of Moravské Kopanice (*Informační středisko pro rozvoj Moravských Kopanic, o.p.s.*) provides a register of organic farms situated in Zlín and Hodonín regions in the area of the Carpathian Mountains. Organic farms in the Carpathian Mountains cover an area spread on 336 ha of meadows and pastures, 10.83 ha of orchards 11,191 ha of arable land, and 14,764 ha of land without designated purpose. This division of land use has an impact on the general orientation of organic farms. Organic farms were divided according to their specialization to animal, crop and combined, as you can see in Figure 5. This study is focused on crop (mainly) and combined production.

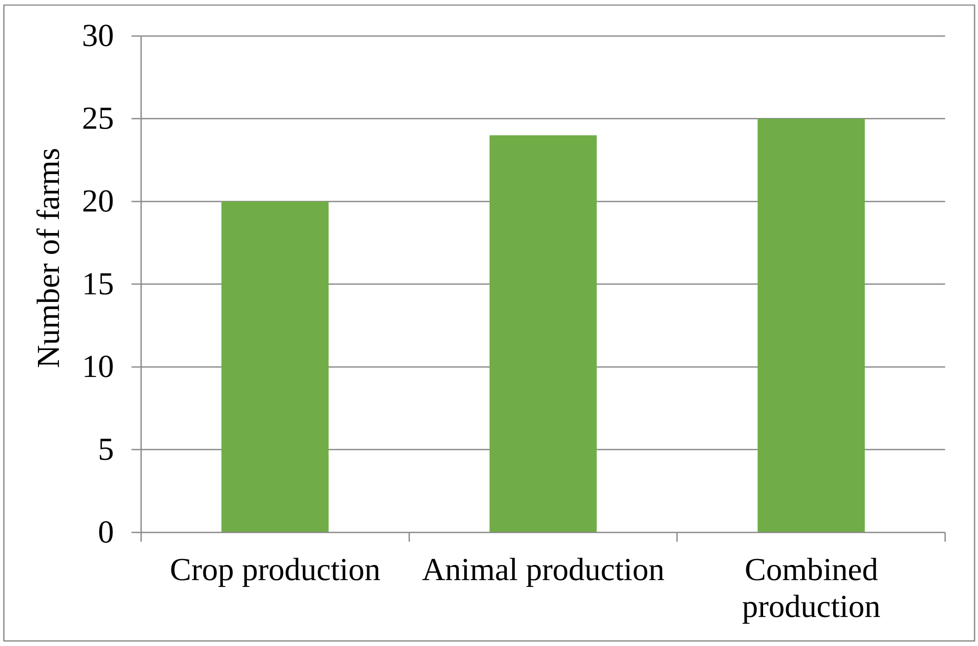

Figure 5 Specialization of organic farms in the Carpathian Mountains.

5.2 Growing species

5.2.1 Species composition

In the Carpathian Mountains there is a higher number of farms with combined production, followed by strictly animal production and then solely crop production. Some of organic farms were cancelled. The main reason for the cancellation of some of these organic farms was the fact that, according to farmers, organic farming was not their main means of subsistence and it was a loss-making business. The second reason stated by organic farmers was the problem of inconvenient subsidies granted by the European Union. They were mostly complaining of the way the financial means have been distributed from the EU funds, for example the same amount of money heading to permanent grass growth as well as to fields with crops. The second example is logically more money-challenging. But when we compare the complaints of farmers with the official data, it does not seem so unfair. However, some changes in the legislation as regards the distribution of the EU funds are envisaged in the near future.

The observed species in the central area of the White Carpathians is divided into three groups. This is not an official general distribution of plants. Common species were present in the central area of the White Carpathians and in other regions of the Czech Republic. Unusual (uncommon) species are present mostly in the area of the White Carpathians. For traditional species are considered to be those that have the local farmers a long tradition and they are transmitted from generation to generation. It is designed primarily for old varieties, mostly in the orchards.

The existence of Czech organic farming was primarily based on the cultivation of cereals, field vegetables, fiber crops, hay meadows near the homestead and orchards. In the White Carpathians species grown in gardens with different varieties are commonly present, according to the particular season of the year. It is for example: *Allium cepa* (varieties - ´Dagmar´, ´Karmen´, etc.), *Allium sativum* (varieties – ´Jovan´ and ´Karel´), *Brassica oleracea* (varieties – italica, botrytis, gongylodes, sabauda and gemmifera), *Pisum sativum* (varieties – ´Radovan´ and ´Oscar´) etc., see Table 5.

Next, organic farmers listed species which they consider as uncommon or introduced for this region or the whole Czech Republic. All of these species are indicated in Table 6. Most frequently noted species are as follows: *Aronia melanocarpa* (variety – ´Nero´), *Cornus mas*, *Hipophae rhamnoides*, *Lonicera kamtschatica*, three species from the family *Moraceae: Morus alba*, *Morus rubra*, *Morus nigra*, and some species from the family Rosaceae*: Mespilus germanica, Sorbus aucuparia, Sorbus domestica* and others.

The family *Rosaceae* is not present among the uncommon species in the given region; it excels also with fruit trees like: apple, pear, plum, cherry, sour cherry, peach, and apricot. Farmers grow them in their orchards, mainly focusing on the old varieties, which are common in this location.

Based on the survey conducted through questionnaires and the subsequent personal interviews with individual farmers we can deduce that the most common way of gaining seeds or vegetative material is to buy them from commercial companies (79%), extension centres (2%), from abroad (0%), NGO´s (0%) whereas 19% organic farmers obtain genetic material from their own seed sources.

In the area of the White Carpathians a lot of farmers focus on the cultivation of fruit trees and orchards. The related use of fruit (apples, pears, plums and others) is determined by their quality and variety.

5.2.2 Common species

On the organic farms visited during the research in the White Carpathians, there were registered crops that are grown by local organic farmers. These are crops to be commonly found in gardens or in fields used for farmers' own needs as well as for sale purposes. The list of crops is set out in Table 5. The most frequently represented families are as follows: *Alliaceae, Apiaceae, Poaceae, Chenopodiaceae, Brassicaceae, Cucurbitaceae, Polygonaceae, Rosaceae, Asteraceae, Juglandaceae, Fabaceae* and *Solanaceae*. The percentage representing the families in common species in Figure 6 shows that the most abundant families are *Poaceae, Brassicaceae* and *Fabaceae.*

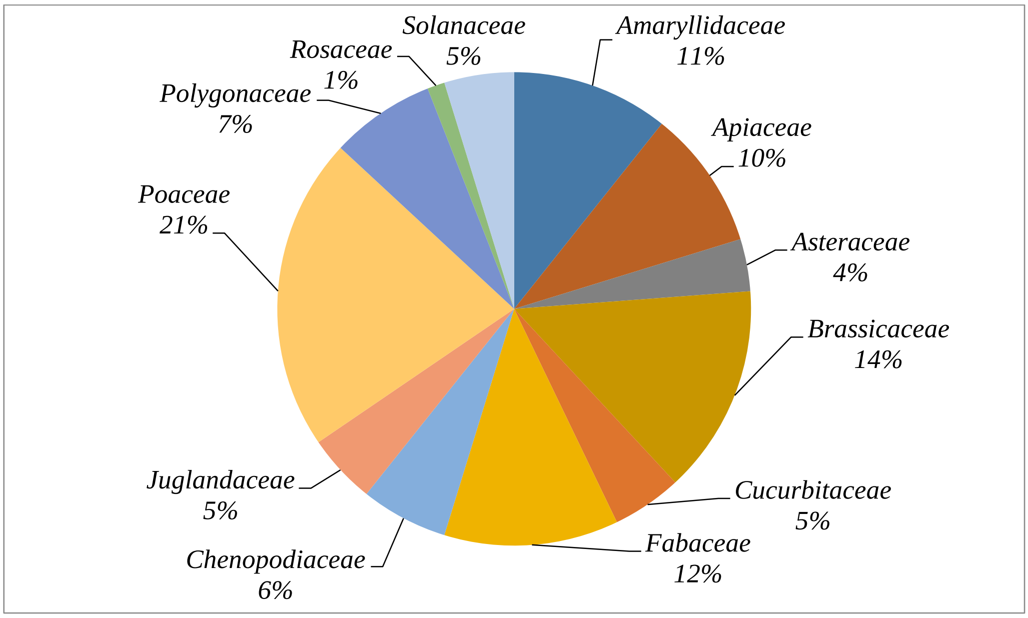

Figure 6 Families represented in common species.

Another part of crop production, which has a long tradition in this region, are undoubtedly fruit trees cultivated in large orchards. Some farmers are engaged in new varieties while others prefer the old ones. One opinion of an organic farmer was very interesting as he argued that he did not accept the old varieties, but rather the new varieties, because these were the future for our market. However, he also mentioned that if you did not go in the old footsteps and would not take an example from that, it was not a good approach, either. In his opinion, the best way is something in between. Local farmers grow various species; in Table 8 you can see fruit trees such as: *Malus domestica*, *Pyrus communis*, *Prunus domestica*, *Prunus avium*, *Prunus cerasus*, *Prunus persica*, *Prunus armeniaca*.

Table 5 Growing crops on organic farms in the White Carpathians.

Latin name	**English name**	**Czech name**	**Variety**	**Family**
Allium cepa	onion Stuttgart giant	cibule jarní	stuttgartská	*Alliaceae*
Allium cepa	kitchen onion	cibule kuchyňská	dagmar	*Alliaceae*
Allium cepa	kitchen onion	cibule kuchyňská	karmen	*Alliaceae*
Allium cepa	kitchen onion	cibule kuchyňská	oválná	*Alliaceae*

Latin name	**English name**	**Czech name**	**Variety**	**Family**
Allium cepa	onion	cibulka jarní		*Alliaceae*
Allium porum	leek	pór zahradní		*Amaryllidaceae*
Allium sativum	garlic	česnek kuchyňský	jovan	*Alliaceae*
Allium sativum	garlic	česnek kuchyňský	karel	*Alliaceae*
Allium schoenoprasum	chives	pažitka pobřežní		*Alliaceae*
Allium ursinum	great headed garlic	česnek medvědí		*Alliaceae*
Apium graveolens	celery	miřík celer		*Apiaceae*
Avena nuda	oat	oves nahý		*Poaceae*
Avena sativa	oat	oves setý		*Poaceae*
Avena sativa	oat	oves jarní		*Poaceae*
Beta vulgaris	swiss chard	řepa cukrová		*Chenopodiaceae*
Beta vulgaris	red swiss chard	řepa červená	vulgaris	*Chenopodiaceae*
Brasiica oleraceae	kale	kapusta kadeřavá	acephala	*Brassicaceae*
Brassica campestris	brassica rapa	zelí pekingské	pekinensis	*Brassicaceae*
Brassica chinensis	chinese cabbage	zelí čínské		*Brassicaceae*
Brassica oleracea	broccoli	brokolice květáková	italica	*Brassicaceae*
Brassica oleraceae	cauliflower	květák	botrytis	*Brassicaceae*
Brassica oleraceae	kohlrabi	kedluben	gongylodes	*Brassicaceae*
Brassica oleraceae	savoy cabbage	kapusta hlávková	sabauda	*Brassicaceae*
Brassica oleraceae	Brussels sprout	růžičková kapusta	gemmifera	*Brassicaceae*
Cucurbita pepo	pumpkin	tykev obecná	giromontiina	*Cucurbitaceae*
Daucus carota	carrot	mrkev obecná		*Apiaceae*

Latin name	English name	Czech name	Variety	Family
Fagopyrum esculentum	buckwheat	pohanka obecná		*Polygonaceae*
Fragaria ananassa	strawberry	jahody		*Rosaceae*
Hellianthus annuus	sunflower	slunečnice		*Asteraceae*
Hordeum vulgare	winter barley	ječmen ozimý		*Poaceae*
Hordeum vulgare	spring barley	ječmen jarní		*Poaceae*
Juglans regia	walnut	ořech vlašský		*Juglandaceae*
Lactuca sativa	iceberg lettuce	locika setá	saladin	*Asteraceae*
Lupinus angustifolius	narrow leafed-lupin	lupina úzkolistá		*Fabaceae*
Lupinus luteus	yellow lupin	lupina žlutá		*Fabaceae*
Lycopersicum esculentum	tomato	rajčata jedlé	cherry	*Solanaceae*
Malus domestica	apple	jabloň domácí		*Rosaceae*
Petroselinum crispum	garden parsley	petžel kadeřavá		*Apiaceae*
Pisum sativum	spring field pea	peluška jarní	Speciosum	*Fabaceae*
Pisum sativum	garden pea	hrách setý	radovan	*Fabaceae*
Pisum sativum	garden pea	hrách setý	oskar	*Fabaceae*
Prunus armeniaca	apricot	meruňka obecná		*Rosaceae*
Prunus avium	wild cherry	třešeň ptačí		*Rosaceae*
Prunus cerasus	sour cherry	višeň obecná		*Rosaceae*
Prunus domestica	plum	slivoň švestka		*Rosaceae*
Prunus persica	peach	broskvoň obecná		*Rosaceae*
Pyrus communis	uropean pear	hrušeň obecná		*Rosaceae*
Raphanus sativus	radish	ředkvička setá	sativus	*Brassicaceae*

Latin name	English name	Czech name	Variety	Family
Secale cereale	rye	žito seté		*Poaceae*
Sinapis arvensis	wild mustard	hořčice polní MP		*Brassicaceae*
Solanum tuberosum	yellow flesh potato	brambory žlutomasé		*Solanaceae*
Trifolium pratense	clover	jetel luční		*Poaceae*
Trifolium pratense	red clover	jetel červený		*Fabaceae*
Triticale	winter triticale	triticale ozimé		*Poaceae*
Triticum aestivum	winter wheat	pšenice ozimá		*Poaceae*
Triticum aestivum	spring wheat	pšenice jarní		*Poaceae*
Triticum spelta	drinker wheat	pšenice špalda		*Poaceae*
Vicia tetrasperma	sparrow vetch	vikev čtyřsemenná		*Fabaceae*

5.2.3 Unusual species

In addition to the commonly grown and the well-known crops organic farmers grow also species originating in countries other than the Czech Republic. These crops are successfully grown in our country, mainly in the area of the White Carpathians. For an overview of unusual plants see Table 6 specifying also varieties that local organic farmers tend to grow most often. The most frequently occurring family in Figure 7 is the family *Rosaceae*.

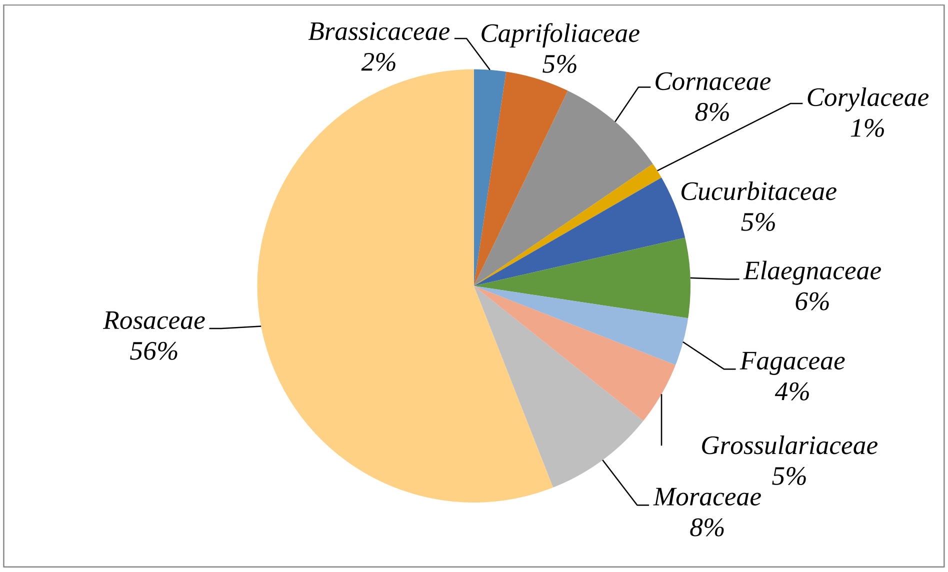

Figure 7 Families represented in unusual species.

Many organic farmers show that the crop is usually of the local origins instead of being imported. Nonetheless, this is not entirely true. In the local area of the White Carpathians growing crops is so common that farmers often domesticated the given crop. I have to point out the partial lack of knowledge of organic farmers. They buy seeds, seedlings and grafted trees from Czech suppliers. They are interested in using and cultivating the most successful crops available in the market.

Table 6 Unusual species grown in the White Carpathians.

Latin name	English name	Czech name	Variety	Family
Amelanchier alnifolia	pacific serviceberry	muchovník olšolistý	cussikii	*Rosaceae*
Amelanchier canadensis	Canadian serviceberry	muchovník kanadský		*Rosaceae*
Amelanchier grandiflora	serviceberry	muchovník velkokvětý	Prince William	*Rosaceae*
Aronia melanocarpa	aronia	jeřáb černý	nero	*Rosaceae*
Castanea sativa	sweet chestnut	kaštanovník setý		*Fagaceae*
Cornus mas	cornelian cherry	dřín obecný		*Cornaceae*

Latin name	English name	Czech name	Variety	Family
Corylus avellana	common hazelnut	líska velkoplodá	hallská obrovská	*Corylaceae*
Cucurbita maxima	arikara squash	tykev velkoplodá	hokkaidó	*Cucurbitaceae*
Cydonia oblonga	quince	kdouloň obecná		*Rosaceae*
Eruca sativa	roquette	roketa setá		*Brassicaceae*
Hippophae rhamnoides	common sea-buckthorns	rakytník úzkolistý		*Elaeagnaceae*
Lonicera kamtschatica	honeysuckle	zimolez kamčatský		*Caprifoliaceae*
Mespilus germanica	medlar	mišpule německá		*Rosaceae*
Morus alba	white mulberry	moruše bílá		*Moraceae*
Morus nigra	black mulberry	moruše černá		*Moraceae*
Morus rubra	red mulberry	moruše červená		*Moraceae*
Ribes aureum	Black Giant Missouri	meruzalka plodová		*Grossulariaceae*
Rubus fruticosus	black satin	ostružina beztrnná		*Rosaceae*
Rubus idaeus	red raspberry	malinoostružina		*Rosaceae*
Sorbus aucuparia	mountain-ash rowan	jeřáb sladkoplodý	moravica	*Rosaceae*
Sorbus domestica	service tree	jeřáb oskeruše		*Rosaceae*

5.2.4 Traditional species

The White Carpathians are one of the very few locations in the Czech Republic where you can still find ancient and local varieties of fruit trees. The zone is mainly filled with plum and pear trees (ZO ČSOP Veronica, 2001).

Disappearing aged fruit trees forced keepers of the nature from Veselí nad Moravou to map with the help of local farmers specializing in fruit all the old local varieties of fruit. Originally it was the region of Horňácko and later the whole region of the White Carpathians that was noted for the opulence of fruit varieties transmitted by farmers.

Nowadays, the summary of the local gene pool is being created, which is important both for the future cultivation and for the variety of regional products, as well as for keeping the scenery. Grafts from the registered varieties are being moved to gene pool orchards presenting one of the possibilities of preserving the varieties and their future existence and distribution. The best-secured varieties will be those grown in people's orchards and gardens (ZO ČSOP Veronica, 2001).

The use of production for example in organic orchard in the small town of Pitín, according to Ševčík (2003), is roughly as follows: 5% of apples are picked for direct consumption (fresh). Fallen apples (25%) are temporarily stored for drying. The last and the biggest part of apples in Pitín is also represented by fallen apples but it is used for making must (in the cider house in Hostětín). Pears, cherries, plums and nuts are intended almost solely for drying.

The most frequent family detected when researching organic farms in the White Carpathians is *Rosaceae*, see in Figure 8 . This family is represented by some species having a high number of varieties, see in Figure 9. This family is represented by apple (*Malus domestica)* with 75 varieties, pear *(Pyrus communis)* with 25 varieties, plum *(Prunus domestica)* with 20 varieties, cherry *(Prunus avium)* with 12 varieties, sour cherry *(Prunus cerasus)* with 12 varieties, peach *(Prunus persica)* with 7 varieties, and apricot *(Prunus armeniaca)* with 7 varieties.

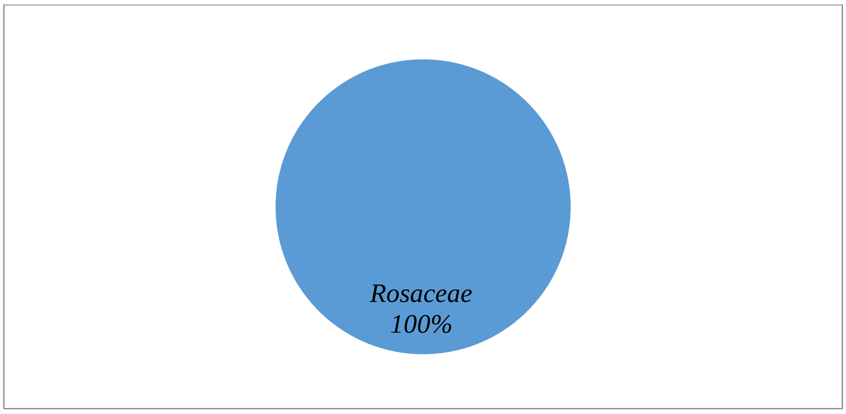

Figure 8 The family represented in traditional species.

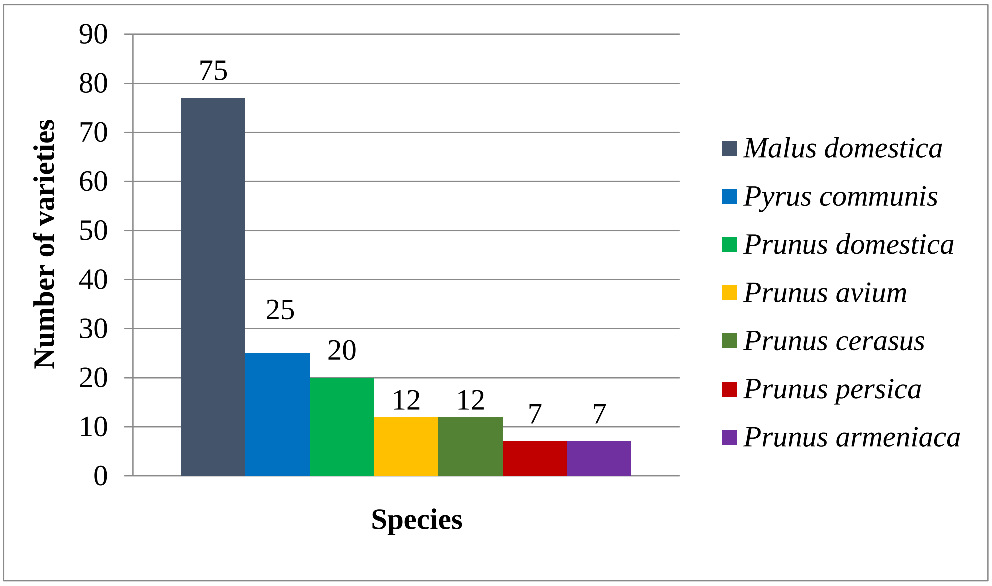

Figure 9 Number of varieties from the family *Rosaceae* in the White Carpathians.

In terms of the cultivation of local varieties it is possible to make use of the principles of cultivation verified over years. Besides the choice of suitable varieties, it is equally important to preserve life-giving conditions for various types of plants and animals. Such farming, which is considerate with respect to the nature, is described as organic agriculture (ZO ČSOP Veronica, 2001).

Because the orchards are old in the most of the cases, we can find great majority of the noteworthy varieties there though the orchards are often degraded (with age, lack of maintenance and care or even destroyed due to cutting down). The mapping demonstrated that all endangered species grow in the so-called gene pool orchards. The first of them was established in 1991 in Velké nad Veličkou and it is a part of the National nature reserve Zahrada pod Hájem. On three hectares of the orchard area, which is still being expanded, there are more than 500 trees of various fruit varieties and a few of them is grafted by a new species on a year-to-year basis (ZO ČSOP Veronica, 2001).

A similar orchard was established by Kosenka in 1999 in Poteč. On one hectare of land there are probably 200 trees – more than 50 varieties of apple, plum, pear, cherries, sour-cherry trees, nuts and service trees from South Valašsko. In the future two more gene pool orchards are planned to be established that are envisaged to cover the same area and preserve the natural conditions of the region (ZO ČSOP Veronica, 2001).

In total 75 varieties of *Malus domestica* was found. Organic farmers use different varieties for different purposes, according to the characteristics of each variety, see Table 7. Three most widely identified ways of using the apples by organic farmers are direct consumption, culinary purposes and drying as you can see in Figure 10.

Table 7 Varieties of apple (*Malus domestica*) in the White Carpathians and the best uses as identified by organic farmers.

Malus domestica **(apple)**	**Best use* 1**	**2**	**3**	**4**	**5**
Aderslebenský kalvil	●				
Astrachán bílý	●		●		
Aurora	●				
Banánové zimní	●				
Baumannova reneta	●				
Bernské růžové	●			●	
Blenheimská reneta	●				
Bojkovo	●			●	
Borovinka (Charlamowski)	●			●	
Boskoopské ("koženáč")	●		●	●	
Car Alexandr	●				
Coulonova reneta	●		●		
Coxova reneta			●		
Croncelské	●		●		
Červené tvrdé		●			
Eduard VII			●		
Elise Rathke	●				
Gascoygneho šarlatové	●				
Gdánský granáč (hranáč)					●
Grahamovo	●				
Grávštýnské červené	●				
Gustavovo trvanlivé	●				
Hammersteinovo	●		●		
Hedvábné červené letní		●			
Honťanské	●				
Hvězdnatá reneta	●			●	
Chodské	●	●	●		●
Jadernička moravská	●		●	●	
Jadernička pruhovaná	●				
Jeptiška	●			●	

Malus domestica (apple)	Best use*				
	1	2	3	4	5
Kalvil červený podzimní	●			●	
Kalvil z Vlčí	●				
Kanadská reneta	●				
Kardinál žíhaný			●		
Kasselská reneta		●			●
Knížecí zelené	●				
Kožená reneta zimní			●		
Královnino	●	●			
Krasokvět žlutý	●	●			
Kronenprinz Rudolf	●				
Kyselík				●	
Landsberská reneta	●	●			
Lebelovo	●			●	
Limburské				●	
Londýnské	●			●	
Madame Galopin	●			●	
Malináč holovouský	●				
Malináč hornokrajský	●				
Markova zlatá reneta	●			●	
Matčino	●	●			
Ontario	●		●	●	
Oranienské	●		●		
Panenské české	●	●	●		●
Parkerovo	●	●		●	●
Parména zlatá zimní	●		●	●	
Peasgoodovo	●			●	
Průsvitné letní	●		●		
Ribstonské	●				
Rote Walze	●		●		
Rozmarýnové bílé	●				
Řehtáč soudkovitý			●		
Signe Tilisch	●				
Sikulské	●		●	●	
Smiřické vzácné	●	●	●	●	
Strýmka červená	●		●		
Studničné	●		●	●	
Sudetská reneta	●	●	●		
Trevírské vinné	●	●			
Vejlímek červený	●		●		
Vilémovo	●		●		

***Malus domestica* (apple)**	**Best use***				
	1	**2**	**3**	**4**	**5**
Vlkovo	●	●	●		
Watervlietské	●		●		
Wealthy	●		●	●	
Wesenerovo	●		●	●	
Zuccalmagliniova reneta			●	●	

*) 1 – direct consumption, 2 – juice, 3 – culinary purposes, 4 – dry, 5 – distillates

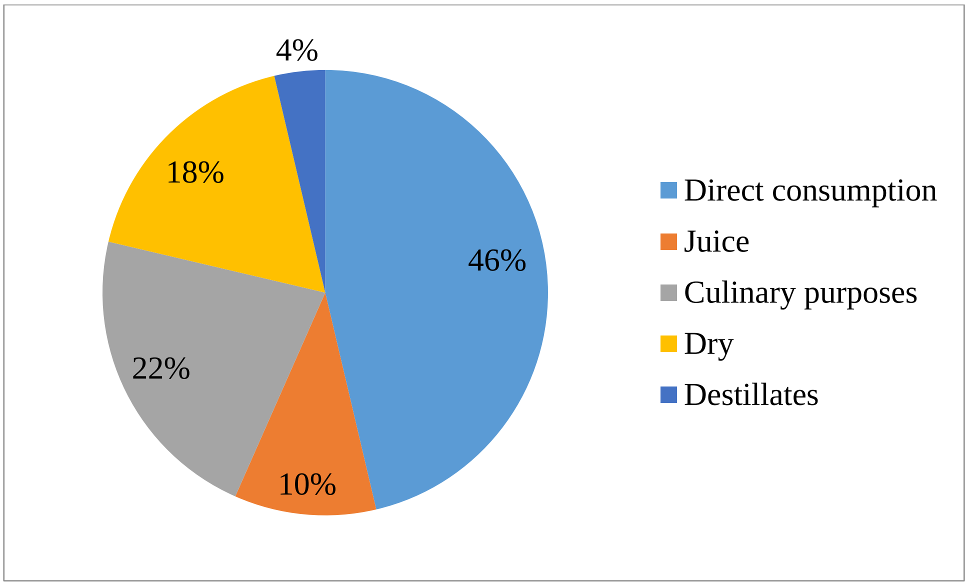

Figure 10 The best ways of using apple varieties as specified by organic farmers in the White Carpathians.

Table 8 Varieties of pears (*Pyrus communis)*, plums (*Prunus domestica)*, cherries and sour cherries (*Prunus avium/P.cerasus)*, peaches and apricots (*Prunus persica/P.armeniaca)* in the White Carpathians.

Variety (Czech name) from the family *Rosaceae*			
Pyrus communis **(pear)**	***Prunus domestica*** **(plum)**	***Prunus avium/P.cerasus*** **(cherry/sour cherry)**	***Prunus persica/P.armeniaca*** **(peach/apricot)**
„Hýle“	„Švestička“	Dönissenova žlutá	Amsdenova
„Jakubínka“	„Žlutá slíva“ (Bílá slíva)	Kaštánka	Pinckot
„Jurigova“	Althanova renklóda	Kordia	Primissima Delbard
„Michálky“	Čačanská rodná	Rivan	Kompakta
Amanliská	Durancie	Újfehértoi Furtos	Hargrand
Beregriska podzimní	Gabrovská	Érdi Botermo	Vynoslivij
Boscova lahvice	Hanita	Burlat	Harlayne
Clappova máslovka	Katinka	Karešova	
Červencová	Lovaňská	Královna Hortenzie	
Hardyho máslovka	Malvazinka	Napoleonova	
Charneuská	Mirabelka nancyská	Donissenova žlutá	
Jačmenka (majdalenka)	Myrobalán „Obilnaja“	Hedelfingerská	
Konference	Ontario (renklóda)		
Krvavka letní	Opál (renklóda)		
Madame Verté	Oullinská renklóda		
Medula (z Blatničky)	Stanley		
Merodova	Špendlík žlutý		
Nagevicova	Švestka domácí		
Pařížanka	Valjevka		
Praskula	Wagenheimova		
Solanka			
Solnohradka			
Šídlenka			
Špinka			
Williamsova			

5.3 Acquisition of plant genetic material

The most frequent way of collecting plant material or seeds by organic farmers is their own production and buying as it is shown in Figure 11. The questionnaires are to assess the methods used by farmers for obtaining genetic material (for example exchange of seeds among farmers, purchasing the seeds, gift from another farmer or other methods). The emphasis is placed on the quality and biodiversity of crops grown by individual farmers. The questionnaires will also focus on farmers' knowledge about unusual species, specifically for these special types of crops. Another important question was related to the place from which the particular crops were brought to the region, whether it concerned imported crops or the crops directly from abroad, or possibly the crops coming from tropical and subtropical areas.

The most frequently mentioned sources identified by organic farmers as regards the sources where they acquire (buy) genetic material are as follows:

a) ZEMASPOL Uherský Brod a.s.
b) PRO BIO.cz
c) SEMO a.s. (only certified seeds for organic production)
d) Radim Pešek – stare odrůdy.org
e) DLF trifolium, Hladké Životice, s.r.o.

It should be noted that the maintenance of genetic diversity within local production systems also favors the conservation of local knowledge (FAO, 2010b).

In particular, it is in general recognized that organic farms are valuable sites for the conservation of agrobiodiversity (Hammer, 1998) and related knowledge.

Evaluating the potential for the utilization and conservation of biodiversity in agricultural landscapes requires new types of communication and cooperation, e.g., among agriculturalists, ecologists, and economists to identify and establish adequate assessment strategies (Robertson and Swinton, 2005), between anthropologists and ecologists to preserve ethnobotanical species and functions (Brush, 2004), and between conservation biologists and agriculturalists to seek common ground for managing genetic, species and ecosystem diversity in agricultural landscapes (Banks, 2004).

It was revealed, as in Figure 3, that six famers use seed only from their own source of crops, three farmers only buy seeds, twenty eight farmers use both methods of seed acquisition – it means buying and using seeds from their own production. Local seed exchange is an important mechanism for seed supply and the diffusion of new varieties (Almekinders, 2001). Out of the total number of sixty nine organic farms being the respondents of the research, only four reported the use of seed exchange.

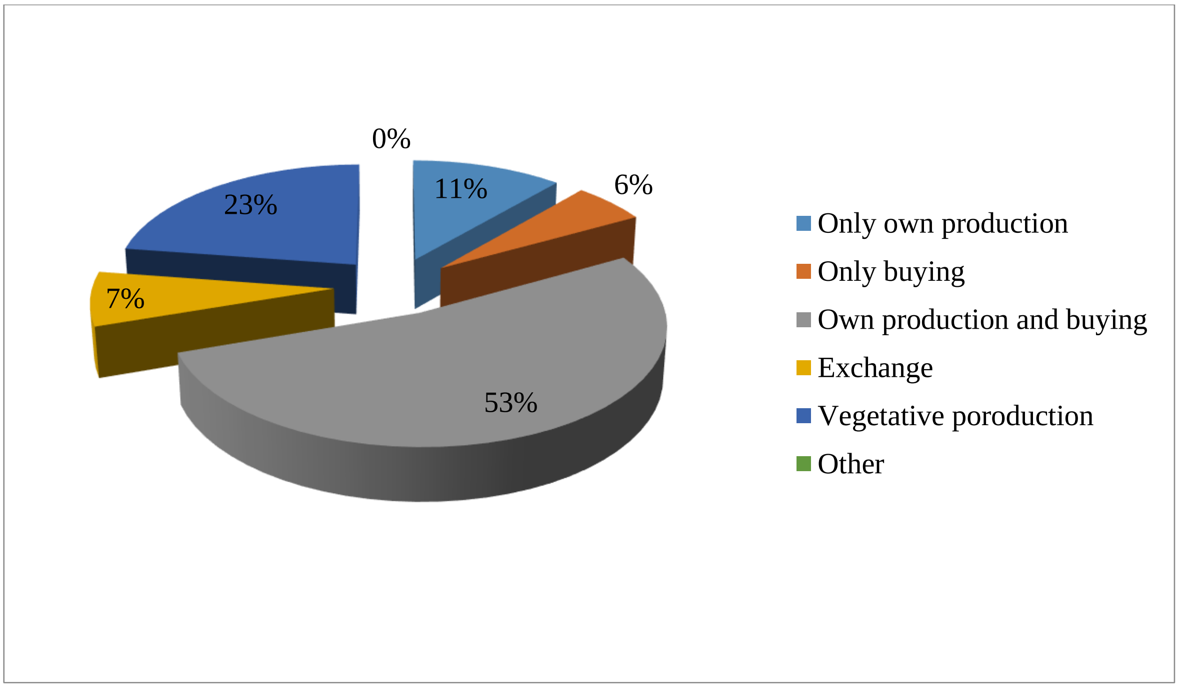

Figure 11 Acquisition of seeds or vegetative materials on organic farms in the White Carpathians.

5.4 The use of plant species

They are appropriately used for direct consumption, it concerns mainly gathered fresh fruits for making must, brandy or for drying. That means longer time of storage. For the purposes of fruit drying, farmers are skilled in making use of modern dryers able to heat the fruit up to 60°C to keep all the vitamins inside as well as keep the fruit fresh. With a higher temperature, vitamins and taste are fading away.

Some authors have found that organic fruits contain more minerals and vitamins than conventional crops (Bourn and Prescott, 2002; Magkos et al., 2003).Worthington (1998, 2001) compared several studies about the nutritional quality of organic versus conventional crops, indicating that organic crops had significant higher levels of iron, magnesium, and phosphorus. In addition, some studies have shown differences in the content of nutrients in different crops from different farm systems (Warman and Harvard, 1997; Maqueda et al., 2001).

The White Carpathians are not represented only by organic agriculture, we can also find here traditional crafts like production of tea service on a potter's wheel, "hl'adění" (it is one of the most decorative part of a festive woman's folk costume, apples' must and syrups, coopers' products and wines' barrique, fermentation barrels for wine and calvados, hand woven products, dried fruits, herbal teas, grower distilleries, bobbin lace, decorative gingerbread, basketry products, puppets, marionettes, puppet theater, wine, wood carving and others, which is proved by the regional trademark "Tradition of the White Carpathians" – helping the residents to show the magic of local products.

Some kind of attention in gene pool plantations must be given to local fruit production, especially the way in which they are treated. Tradition of fruit manufactories is considerably extensive; mainly using method of drying in the White Carpathians. Dried fruit were exported in huge amount abroad and for the farmers it was both enhancing their table as well as increasing their income (ZO ČSOP Veronica, 2001).

Nongovernmental organizations (NGOs) often take care of preserving the gene pool heritage. For example, the Gengel institution (named after barley landraces) cooperates with voluntary growers and tries to preserve old varieties of crops and it also publishes "*A list of old landraces and lesser-known crops"* (Gengel). But in the research no organic farmer was identified as a user of this method of the acquisition of genetic material.

Old orchards are typical for the White Carpathians. As time flows, they are disappearing and being replaced by new varieties. But zone local varieties have many attributes, which we lack in modern varieties – resistance to diseases, adaptation to local microclimatic conditions, as well as various options of use. While some of them are suitable for direct consumption, others are better for must, wine, distillates, and jams or for drying. Fruit was a very important source of food and income for local farmers. In the past it has also been used as medicine for various diseases and is still part of traditional cuisine. Besides that, in the White Carpathians there are still present varieties of fruit, which were enhancing and diversifying the offer of traditional fruit types. On exposed and warm places or near fruit dryers there are to be found cornelian cherries while in gardens near houses there are white, black and red mulberries. In warmer locations service trees are present, their berries look similar to little pears and are beneficial against stomach problems and, moreover, very tasty spirits are made of it (ZO ČSOP Veronica, 2001).

One of the organizations enhancing the programme for supporting traditional fruit production in the White Carpathians is called "Tradition of the White Carpathians". It has been bringing together both organizations and individuals interested in growing, manufacturing and mapping of varieties. The "Tradition of the White Carpathians" has brought apple must since the year 2000 to the domestic market and it is made by a wine cellar in Hostětín (ZO ČSOP Veronica, 2001).

In addition to the assurance as for the origin coming from the White Carpathians this brand also guarantees that it often concerns unique products made by traditional technologies, with a specific proportion of manual or craft work of local raw materials, high quality and environmentally sound manner (Tradice Bílých Karpat, 2009).

It aims to raise the awareness of local products among the public. The customer will contribute to the economic recovery of the region and will help to restore the regional market by purchasing the labeled products. The marking also assures customers that the purchased product meets strict conditions attached to the authorization.

Local people from organic farms use varieties of crops for different purposes, such as cooking, tea, salve, brandy, liqueur, for direct consumption and other purposes, as it is shown in Table 9. The most commonly used plant parts are fruits and leaves as it is indicated in Figure 13. All these parts are gathered and have a wide application for ethnobotanical use Figure 12.

Table 9 Use of different crop´s parts of the species on organic farms, picking part and number of processors (number of organic farms which pick up a special part of the crop).

Family, Species	Processing and Use	The part of use	N. of Processers	T/ U/ C*
AMARYLIDACEAE				
Allium cepa	medicinal purposes	bulb	35	C
Allium cepa	spices	bulb	49	C
Allium porrum	culinary purposes	bulb	41	C
Allium sativum	medicinal purposes	bulb	48	C
Allium sativum	spices	bulb	53	C
Allium schoenoprasum	culinary purposes	bulb	8	C
Allium schoenoprasum	medicinal purposes	bulb	11	C
Allium ursinum	spices	bulb	38	C
Allium ursinum	medicinal purposes	bulb	29	C
APIACEAE				
Apium graveolens	culinary purposes	bulb	36	C
Apium graveolens	culinary purposes	stem	47	C
Apium graveolens	medicinal purposes	stem	6	C
Petroselinum crispum	dry	leaves	26	C
Petroselinum crispum	tea	leaves	12	C
Petroselinum crispum	spices	leaves	50	C
Daucus carota	culinary purposes	tuber	38	C
Daucus carota	direct consumption	tuber	38	C
ASTERACEAE				
Hellianthus annuus	culinary purposes	seed	4	C
Hellianthus annuus	dry	seed	4	C
Lactuca sativa	direct consumption	leaves	29	C
BRASSICACEAE				
Brassica campestris	direct consumption	tuber	2	C
Brassica campestris	animal feed	tuber	2	C
Brassica chinensis	direct consumption	leaves	14	C
Brassica oleraceae var. acephala	culinary purposes	leaves	15	C
Brassica oleraceae var. botrytis	culinary purposes	flower	14	C
Brassica oleraceae var. gemmifera	culinary purposes	leaves	11	C
Brassica oleraceae var. gongylodes	animal feed	leaves	13	C
Brassica oleraceae var. gongylodes	animal feed	tuber	13	C

Family, Species	Processing and Use	The part of use	N. of Processers	T/ U/ C*
Brassica oleraceae var. gongylodes	culinary purposes	tuber	10	C
Brassica oleraceae var. gongylodes	direct consumption	tuber	22	C
Brassica oleraceae var. sabauda	culinary purposes	leaves	14	C
Eruca sativa	culinary purposes	leaves	12	U
Eruca sativa	direct consumption	leaves	12	U
Raphanus sativus	direct consumption	tuber	31	C
CAPRIFOLIACEAE				
Lonicera kamtschatica	direct consumption	flower	15	U
Lonicera kamtschatica	tea	flower	9	U
Lonicera kamtschatica	compote	fruit	2	U
Lonicera kamtschatica	tea	leaves	9	U
CORNACEAE				
Cornus mas	compote	fruit	6	U
Cornus mas	distillate	fruit	3	U
Cornus mas	marmalade	fruit	8	U
Cornus mas	medicinal purposes	bark	4	U
Cornus mas	medicinal purposes	fruit	3	U
Cornus mas	medicinal purposes	leaves	4	U
Cornus mas	syrup	fruit	9	U
CORYLACEAE				
Corylus avellana	culinary purposes	fruit	4	U
CUCURBITACEAE				
Cucurbita maxima	culinary purposes	fruit	16	U
Cucurbita maxima	compote	fruit	5	U
Cucurbita maxima	culinary purposes	fruit	16	U
Cucurbita maxima	marmalade	fruit	14	U
Cucurbita pepo	culinary purposes	fruit	8	C
Cucurbita pepo	compote	fruit	3	C
Cucurbita pepo	culinary purposes	fruit	13	C
Cucurbita pepo	marmalade	fruit	5	C
ELEAGNACEAE				
Hippophae rhamnoides	distillate	fruit	2	U
Hippophae rhamnoides	marmalade	fruit	6	U
Hippophae rhamnoides	liqueur	fruit	3	U
Hippophae rhamnoides	syrup	fruit	8	U
Hippophae rhamnoides	tea	fruit	7	U

Family, Species	**Processing and Use**	**The part of use**	**N. of Processers**	**T/ U/ C***
FABACEAE				
Lupinus angustifolius	culinary purposes	seed	2	C
Lupinus angustifolius	animal feed	seed	5	C
Lupinus luteus	direct consumption	seed	2	C
Lupinus luteus	culinary purposes	seed	3	C
Pisum sativum	animal feed	husk	14	C
Pisum sativum	animal feed	leaves	14	C
Pisum sativum	direct consumption	husk	12	C
Pisum sativum	direct consumption	seed	17	C
Vicia tetrasperma	culinary purposes	upper part of the plant	7	C
Vicia tetrasperma	manure	tuber	13	C
FAGACEAE				
Castanea sativa	culinary purposes	seed	1	U
Castanea sativa	culinary purposes	seed	1	U
Castanea sativa	culinary purposes	seed	1	U
GROSSULARIACEAE				
Ribes aureum	direct consumption	fruit	27	U
Ribes aureum	syrup	fruit	16	U
Ribes aureum	marmalade	fruit	20	U
Ribes aureum	culinary purposes	fruit	21	U
CHENOPODIACEAE				
Beta vulgaris	animal feed	bulb	6	C
Beta vulgaris	animal feed	leaves	5	C
Beta vulgaris	animal feed	stem	5	C
Beta vulgaris	manure	leaves	6	C
Beta vulgaris	manure	stem	6	C
JUGLANDACEAE				
Juglans regia	direct consumption	seed	12	C
Juglans regia	medicinal purposes	green pericarp	12	C
Juglans regia	medicinal purposes	leaves	12	C
Juglans regia	medicinal purposes	seed	12	C
MORACEAE				
Morus alba	shade	all tree	2	U
Morus nigra	direct consumption	fruit	3	U
Morus nigra	compote	fruit	2	U
Morus nigra	wine	fruit	1	U
Morus rubra	direct consumption	fruit	4	U
Morus rubra	culinary purposes	fruit	2	U
Morus rubra	marmalade	fruit	2	U

Family, Species	Processing and Use	The part of use	N. of Processers	T/ U/ C*
POACEAE				
Avena nuda	culinary purposes	seed	2	C
Avena sativa	animal feed	seed	12	C
Avena sativa	culinary purposes	seed	2	C
Hordeum vulgare	animal feed	leaves	16	C
Hordeum vulgare	animal feed	stem	16	C
Hordeum vulgare	direct consumption	seed	3	C
Secale cereale	animal feed	tuber	12	C
Trifolium pratense	animal feed	upper part of the plant	8	C
Trifolium pratense	manure	tuber	8	C
Triticale	animal feed	seed	9	C
Triticum aestivum	animal feed	upper part of the plant	12	C
Triticum aestivum	culinary purposes	seed	2	C
Triticum aestivum	culinary purposes	seed	6	C
Triticum aestivum	culinary purposes	seed	7	C
Triticum spelta	culinary purposes	seed	13	C
Triticum spelta	filler for pillows	husk	3	C
Triticum spelta	filler for pillows	seed	3	C
POLYGONACEAE				
Fagopyrum esculentum	animal feed	leaves	1	C
Fagopyrum esculentum	animal feed	stem	1	C
Fagopyrum esculentum	culinary purposes	leaves	2	C
Fagopyrum esculentum	culinary purposes	stem	2	C
Fagopyrum esculentum	tea	flower	3	C
Fagopyrum esculentum	tea	leaves	2	C
ROSACEAE				
Amelanchier alnifolia	substitute resins	leaves	3	U
Amelanchier alnifolia	tea	fruit	3	U
Amelanchier alnifolia	tea	leaves	2	U
Amelanchier alnifolia	medicinal purposes	fruit	3	U
Amelanchier alnifolia	medicinal purposes	leaves	3	U
Amelanchier canadensis	substitute resins	fruit	2	U
Amelanchier canadensis	substitute resins	leaves	2	U
Amelanchier canadensis	tea	fruit	4	U
Amelanchier canadensis	tea	leaves	5	U
Amelanchier canadensis	medicinal purposes	fruit	2	U
Amelanchier canadensis	medicinal purposes	leaves	1	U

Family, Species	**Processing and Use**	**The part of use**	**N. of Processers**	**T/ U/ C***
Amelanchier grandiflora	substitute resins	fruit	4	U
Amelanchier grandiflora	substitute resins	leaves	2	U
Amelanchier grandiflora	tea	fruit	3	U
Amelanchier grandiflora	tea	leaves	2	U
Amelanchier grandiflora	medicinal purposes	fruit	4	U
Amelanchier grandiflora	medicinal purposes	leaves	3	U
Aronia melanocarpa	marmelade	fruit	16	U
Aronia melanocarpa	dye	fruit	1	U
Aronia melanocarpa	ornamental purposes	fruit	9	U
Aronia melanocarpa	wine	fruit	5	U
Cydonia oblonga	culinary purposes	fruit	6	U
Cydonia oblonga	marmalade	fruit	14	U
Cydonia oblonga	marmalade	fruit	17	U
Cydonia oblonga	rootstock	stem	23	U
Fragaria ananassa	direct consumption	fruit	21	C
Malus domestica	direct consumption	fruit	53	T
Malus domestica	juice	fruit	21	T
Malus domestica	cider	fruit	3	T
Malus domestica	distillate	fruit	6	T
Malus domestica	liqueur	fruit	2	T
Malus domestica	dry	fruit	26	T
Malus domestica	compote	fruit	18	T
Malus domestica	culinary purposes	fruit	31	T
Mespilus germanica	direct consumption	fruit	5	U
Mespilus germanica	wine	fruit	2	U
Prunus armeniaca	direct consumption	fruit	26	T
Prunus armeniaca	marmalade	fruit	22	T
Prunus armeniaca	wine	fruit	3	T
Prunus armeniaca	distillate	fruit	7	T
Prunus armeniaca	dry	fruit	12	T
Prunus armeniaca	compote	fruit	18	T
Prunus armeniaca	culinary purposes	fruit	10	T
Prunus avium	marmalade	fruit	16	T
Prunus avium	compote	fruit	19	T
Prunus avium	syrup	fruit	4	T
Prunus cerasus	compote	fruit	21	T
Prunus cerasus	marmalade	fruit	14	T
Prunus cerasus	juice	fruit	5	T
Prunus cerasus	culinary purposes	fruit	12	T
Prunus domestica	compote	fruit	30	T

Family, Species	Processing and Use	The part of use	N. of Processers	T/ U/ C*
Prunus domestica	marmalade	fruit	24	T
Prunus domestica	dry	fruit	11	T
Prunus domestica	distillate	fruit	28	T
Prunus domestica	liqueur	fruit	4	T
Prunus domestica	distillate	fruit	9	T
Prunus domestica	culinary purposes	fruit	38	T
Prunus domestica	direct consumption	fruit	42	T
Prunus persica	direct consumption	fruit	22	T
Prunus persica	distillate	fruit	6	T
Prunus persica	dry	fruit	2	T
Pyrus communis	medicinal purposes	fruit	4	T
Pyrus communis	dry	fruit	12	T
Pyrus communis	compote	fruit	13	T
Pyrus communis	culinary purposes	fruit	14	T
Pyrus communis	direct consumption	fruit	17	T
Rubus fruticosus	tea	leaves	8	U
Rubus fruticosus	direct consumption	fruit	18	U
Rubus fruticosus	syrup	fruit	3	U
Rubus idaeus	tea	leaves	12	U
Rubus idaeus	direct consumption	fruit	20	U
Rubus idaeus	syrup	fruit	5	U
Sorbus aucuparia	wine	fruit	6	U
Sorbus aucuparia	syrup	fruit	9	U
Sorbus aucuparia	compote	fruit	2	U
Sorbus aucuparia	culinary purposes	fruit	2	U
Sorbus aucuparia	culinary purposes	fruit	1	U
Sorbus aucuparia	dry	fruit	8	U
Sorbus aucuparia	medicinal purposes	leaves	4	U
Sorbus domestica	direct consumption	fruit	24	U
Sorbus domestica	compote	fruit	24	U
Sorbus domestica	marmalade	fruit	22	U
Sorbus domestica	dry	fruit	15	U
Sorbus domestica	distillate	fruit	3	U
Sorbus domestica	liqueur	fruit	2	U
Sorbus domestica	spices	fruit	6	U
SOLANACEAE				
Lycopersicum esculentum	direct consumption	fruit	36	C
Lycopersicum esculentum	dry	fruit	5	C
Lycopersicum esculentum	culinary purposes	fruit	12	C
Solanum tuberosum	direct consumption	tuber	16	C

*) “T” means traditional species, “C” means common species and “U” means unusual species.

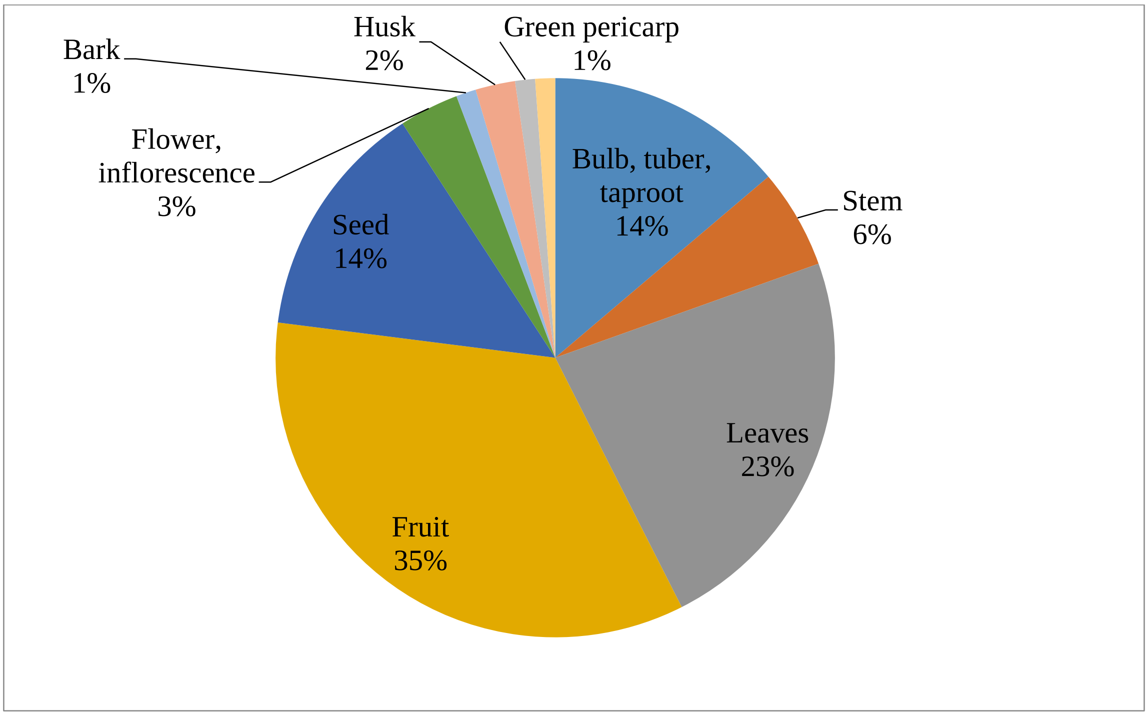

Figure 12 Plant parts used by organic farmers in the White Carpathians.

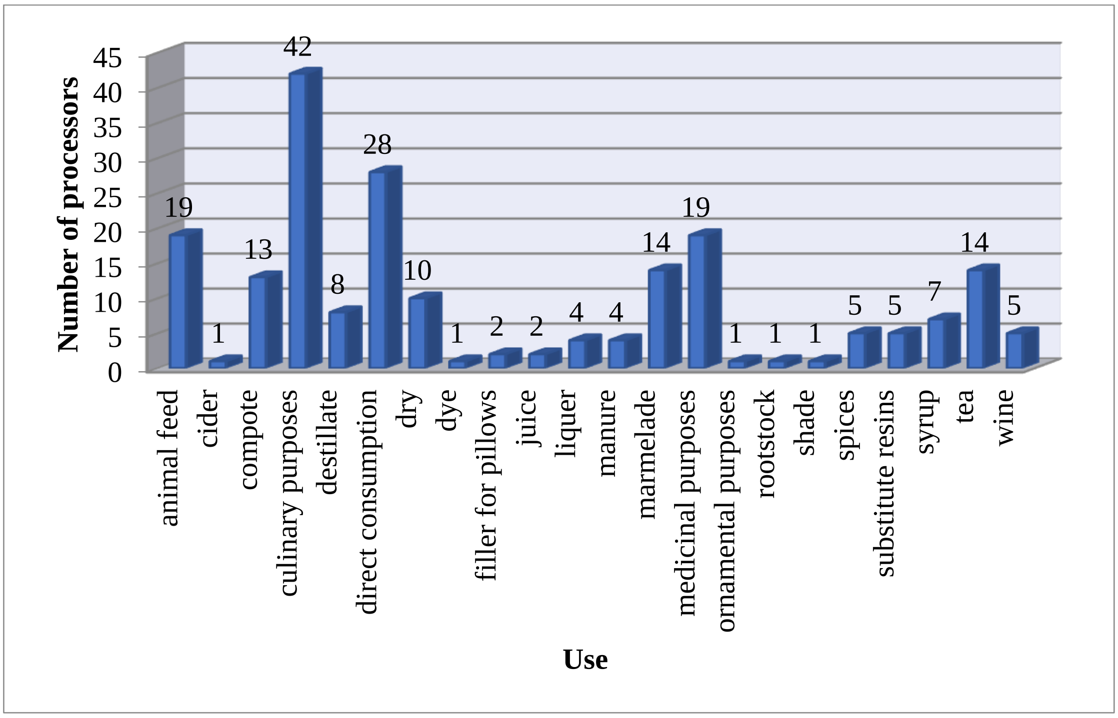

Figure 13 Uses of the plants on organic farms in the White Carpathians.

According to the research carried out in the White Carpathians on organic farms I found out the existence of a number of types of cultures. In total sixty-one organic farms were questioned, however only fifty-eight of them were eventually cooperating, as demonstrated by Figure 4. Five farms out of this number refused to cooperate even after repeated queries and request but three of them have a website where it was possible to obtain all the relevant information. Forty-five of the total number of sixty-one farms proved to be farming on arable land. Grassland occurs on thirty-six farms where cattle can graze or where the location contributes to maintaining species diversity of grasses and meadows. Twenty-five farms grow vegetables. The vegetables cultivated on some farms include major priority crops, other organic farms cultivate it only as a means to support themselves or for their own use only. Growing herbs for commercial purposes is not engaged in any of the farms, but ten farms grow herbs for drying, ointment production and especially for further use in the kitchen to flavor dishes, for culinary purposes and for their own use in gardens. Figure 14 shows the percentage of the land use as regards the type of the culture on organic farms. Forty-five organic farms own arable land. About three less, i.e. forty-two organic farms, manage orchards. Permanent grassland is found on thirty-six organic farms in the White Carpathians. By almost half less when compared with the arable land, twenty-five are organic farms cultivating vegetables. The least represented are organic farms growing herbs, which are found on ten organic farms only. The chart below shows that the predominant arable land and orchards make up over half of other types of culture. Another significant representation is found out with grass areas, mostly on farms specialized in animal production.

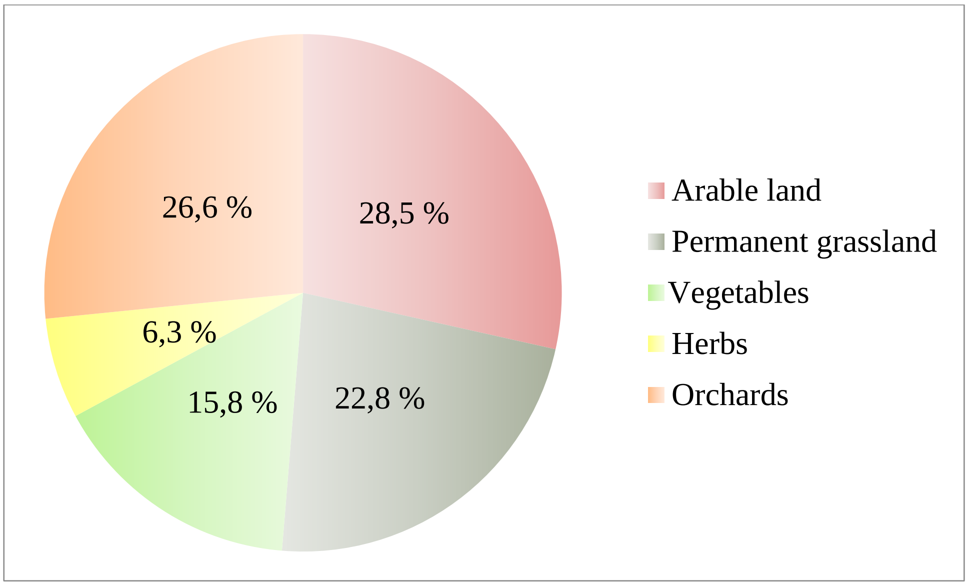

Figure 14 Percentage representation of the type of the culture on organic farms in the White Carpathians.

5.5 Statistical analyses

In order to obtain simple figures a pivot table from the Microsoft Excel programme was used. It was facilitated based on completing and the comparison of the data from the research together.

With a view to determine and confirm the potential loss of agricultural biodiversity on organic farms in the White Carpathians, as it was found with grassland species (Piro and Wolfová, 2008) in the same location, which is one of the protected landscape areas of the Czech Republic, it is necessary to have reliable and sufficient data from several years. It is vital to monitor the same features with different data on a yearly basis. Data may vary in terms of the occurrence of crops or possibly in the way of using the given number of crops

/ plants when compared with the initial study, for instance as for the families identified in the original research etc.

The present research contains data of agrobiodiversity obtained in the period from March to September 2014.

The relevant use of statistical methods for the purposes of this study requires the collection of data from several subsequent years in order to be able to monitor them. Our point of focus were, for example, changes in the number of cultivated species, the use of each plant, changes in the use of plants or the question whether they can be divided into three groups specified in this research (common, unusual and traditional).

Following the research of agrobiodiversity on organic farms in the White Carpathians and obtaining of the genetic material in the next years (2015, 2016, 2017, 2018 and 2019), I recommend using the following methods: correlation analysis and the use of pivot tables from the Microsoft Excel programme (in the same way as in this research).

In 2024 (that is ten years after the first study) I recommend using the same methods and subsequent calculations for the statistical evaluation of whether it is possible to make conclusions with respect to the degradation or, by contrast, the development of agricultural biodiversity on organic farms in the White Carpathians.

It is then important to determine whether it would be appropriate to change the approach to growing crops as well as methods of obtaining genetic material, or if the approach and methods applied so far should remain the same.

6 DISCUSSION

First of all, it is important to mention that so far only a minority of studies has indicated little or no difference between both systems and there has been little evidence that conventional systems would be beneficial for certain species across a great variety of families (Hole et al., 2004).

An interesting comparison of crops can be found in two different locations of the Czech Republic. These are the White Carpathians on the south-eastern part of the Czech Republic and the Jizerské Mountains in the North of the Czech Republic. Both these areas can boast its wide variety of species, classified as protected landscape areas (PLA). Each area is located in a different range of altitude, but the research of the crops studied on the selected organic farms was carried outin areas with similar altitude of approximately 200-850 m above sea level. Climatic conditions of the two protected landscape areas are also very similar throughout the whole year. For example in winter the snow cover is coming already in November and lasts until February / March. This is very important information for farmers who have to squeeze their production to the rest period and have to be well prepared for the beginning of the season.

The total area of the protected location of the White Carpathians is 715 square kilometers and it is situated at an altitude of 175-970 m above sea level PLA. It is located on the south-east of the Czech Republic (AOPKČRa, 2014). Protected Landscape Area Jizerské Mountains is situated in the Jizerské Mountains and on the East it directly interferes with the KRNAP. Its total surface covers 368 square kilometers, out of which 274 square kilometers is represented by forest. Altitude range is 320-1124 m above sea level 1124m (difference is 804 m). This Protected Landscape Area is one of the oldest in the Czech Republic (AOPKČRb, 2014).

Most of the area consists of Krkonošsko-jizerský pluton which is made of the granite of many types. Apart from the White Carpathians, where flysch zones dominate, this was the result of the seismic activity known as Alpine folding (AOPKČRa, 2014).

Species planted only in the Jizerské Mountains, according to my study from August/September 2013 on organic farms are as follows: *Vaccinium corymbosum, Origanum majorana, Verbascum densiflorum, Rheum rhabarbarum, Ribes uva-crispa, Aronia arbutifolia (var. 'Nero'/'Viking´).* These species are not planted in the White

Carpathians. In a similar vein, species planted only in the White Carpathians are as follows: *Amelanchier alnifolia, Sorbus domestica, Ribes aureum, Aronia melanocarpa (var.´Nero´).*

Species planted in both localities of plant protected areas on organic farms are the following: Black currant *(Ribes nigrum),* Red currants *(Ribes rubrum),* Buckthorn (*Hippophae rhamnoides*), Canadian blueberries (*Vaccinium corymbosum)* trees from family *Rosaceae*: apple *(Malus domestica),* pear *(Pyrus communis),* plum *(Prunus domestica).*

Local people in the Jizerské Mountains do not have a tendency to focus on growing crops the same as local people from the White Carpathians do. Instead, they prefer keeping of sheeps and goats. What is more, fruit trees from the family *Rosaceae* are grown only in gardens but not in orchards for further manufacturing processes such as drying or must-making as it is common in the White CarpathiansOn organic farms in the Jizerské Mountains, even if they are focused more likely on animal husbandry, we can still find small gardens located nearby houses. Nevertheless they tend to be use for private use only. Unlike in the White Carpathians where some organic farmers spend their whole life growing crops since it is their main source of income, the situation in the Jizerské Mountains is considerably different.

Less common but still quite frequently grown crops in the Jizerské Mountains for consumer use are: strawberries, lettuce, radishes, turnip cabbages, tomatoes, zucchinis, potatoes and others. In the White Carpathians the biodiversity is more varied, a vast array of crops is grown here always according to the particular season of the yeat.

However, since the Jizerské Mountains are situated in a higher altitude than the White Carpathians, winters here tend to be much harsher and they come earlier. According to the locals it lasts from the end of October to the half of April. But needless to say, in the White Carpathians there are also a few places with the same conditions, for example the village of “Lopeník”, which is locally famous for herb spirit produced by a local farmer, has similar snow conditions but the crops found in the fields are much more varied, even though they are not the main source of income for farmers.

In the Jizerské Mountains, we can find also unusual species like Buckthorn *(Hippophae rhamnoides),* Aronia *(Aronia arbutifolia 'Nero'/'Viking')* or Rhebarb *(Rheum officinale).*

Two of these species – buckthorn and aronia are also located in the White Carpathians and the local people, similarly as in the Jizerské Mountains, are making organic juice and organic jam from them, or they are using them for direct consumption. Herb gardens with herbs like lavender, rosemary, mint, oregano and other are often the case since the locals dry these herbs and use them in cuisine as seasoning throughout the whole year.

Another interesting perspective on organic farming can be compared with the view of the Czech agronomist Assoc. Prof. František Čuba CSc. He is in favor of a more conventional farming. It is therefore more valuable for farmers to re-orient mostly to a combined or livestock production and at the same time encourage the biodiversity of crops growing in the Czech Republic, especially in Zlínský region located in the White Carpathians. To discuss this topic, I visited Assoc. Prof. Čuba CSc. and he made me aware of the state-of the-art in terms of the approach of the president of the Czech Republic as regards the problem linked with the remaking of the system distributing the EU funds towards organic agriculture. Although a supporter of conventional agriculture and thus preferring more likely the quantity of crops and the usage of fertilizers (unacceptable for organic farming), the views of a poor distribution of money and grants made by the president (or the government in general) concerned Mr. Čuba as much as great many supporters of organic agriculture.

After the consultation with the professor, who has substantial knowledge as regards Czech agriculture and the market situation and, what is more, can make proposals to amend certain laws forwarded for signature to the president of the Czech Republic, particularly in the area of agriculture and organic farms, I learned that Mr. Čuba just filled a motion to amend the grant system. Documents submitted by Čuba (2014) deal with the distribution of food and the related necessity to expand the assortment of food available in the Czech market. In terms of crop production, these include: fresh vegetables and fruits. Assortment of crop production expanded to: food, buckwheat, beans, peas, lentils, potatoes and flowers. Example of a programme: Agriculture will change. Increased export of vegetables and reduced traffic intensity. There were 1.000 ha of greenhouses in the Czech Republic twenty years ago. Nowadays, the number has dropped to only 25 ha of greenhouses. The production of 1.000 ha greenhouses is associated with 25 to 30 billion CZK. Greenhouses will increase production by up to 1 billion CZK a year. All EU Member States are able to benefit from a shared budget contribution amounting to 106 billion euros. Within this budget, Member States are benefiting both with respect to settlement prices and their development. EU, however, is notoriously known for extremely bureaucratized institutions. Therefore, the financial resources from the EU budget will not get to those who are entitled to benefit from them or who simply need them, but it is more probable that it will get to all those who are more confident when it comes to their capacity to fill in the right form or request based on which the money from the EU fund is allotted. The Czech Republic failed to solve the problem of obtaining 30 billion CZK this year. Czech agriculture is particularly suffering due to the inefficient grant system and inappropriate targeting of subsidies.

According to the results obtained in the research it can be assumed that the organic farms engaged in the cultivation of vegetables (15.8% according to Figure 14) have greenhouses. Thus, in the White Carpathians the future of organic farming is not in the cultivation of fruit trees, orchards, but it is more likely in growing vegetables.

Is it possible if we consider the tradition of old varieties, orchards and fruit trees growing in the White Carpathians? The question of whether this would disrupt the diversity of species on organic farms seems to remain.

An interesting opinion of the professor Čuba, who characterizes the organic farming as a deceptive concept, mentioned in an interview, that the only positive step is to reduce meat consumption by about 10-30% and replace it by growing vegetables in greenhouses. Now, the growing of vegetables in greenhouses should be restored. A greater number of greenhouses might increase the number of grown vegetables and herbs.

Prof. Čuba can see the future especially in the cultivation of crops with the highest yield such as corn, wheat and barley (for malt production). For agriculture, it is advantageous to use everything and it should focus on the above-mentioned cultivation of wheat or grass in fields.

For obtaining genetic material, he prefers to purchase seeds, because the preservation of seeds from its own resources does not guarantee such a high yield as the purchased seeds do. If we compare it with the common practice of organic farmers in the White Carpathians then the research reveals that 6% of organic farmers get genetic material and seeds only by buying. 53% of organic farmers get vegetative material and seeds both from their own production and purchase.

7 CONCLUSION

The White Carpathians are well known for their rich agrobiodiversity. Eighty-nine species from nineteen families were noted on organic farms. Twenty-one species of them were marked by local farmers as having been introduced in the Czech Republic. Introduced species (unusual species) are represented by the following families: *Rosaceae, Brassicaceae, Moraceae, Grossulariaceae, Cornaceae, Corylaceae, Elaegnaceae, Caprifoliaceae* and *Fagaceae.*

According to the questionnaire organic farmers are acquiring seeds mostly by purchasing them and by their own seed savings. Sadly enough, not too many farmers are into seed exchange despite the fact that more frequent exchange would help the development of the biodiversity in the region.

The representation of the common species of the families is very diverse and consists of 12 families. The situation was similar as in the case with unusual species, where 10 families were identified in total and over a half of them was represented by the family *Rosaceae*. Traditional species are represented by only a single family - *Rosaceae*.

Rosaceae trees have a very long tradition in this area. There are many orchards focusing on growing apples, pears, plums, cherries, sour-cherries etc. Subsequent uses of fruits are as follows: direct consumption, drying, must making or spirit making. However, it is not the only tradition typical for the region of the White Carpathians. We can also find here puppets carver, wine and calvados barrel maker, women making decorative gingerbread and others.

The most numerous varieties from the family *Rosaceae* are apples (*Malus domestica).* The three most frequent uses of apples are direct consumption, culinary purposes and drying. Almost by a third less numerous species from the family *Rosaceae* are represented by pear *(Pyrus communis)* and plum *(Prunus domestica)* varieties. The same number relates to the varieties of cherries *(Prunus avium)* and sour cherries *(Prunus cerasus)*, tough less than the varieties mentioned above. The least represented varieties of the family *Rosaceae* are apricots *(Prunus persica)* and peaches *(Prunus armeniaca).*

Ethnobotany use of organic plants is wide. Organic farms use different parts of the plant. We can distinguish 10 plant parts. The most used part of plants is fruit and leaves whereas bulb, pith and seed are at the same position with the same percentage use. Less frequent use was identified with bark, green pericarp and all trees.

The most common use of local organic farmers can be considered: culinary purposes, direct consumption and medicinal purposes.

Framework conditions of the state, including the risks, determine the conditions for a planned complex of producers, processors and traders. Marketing of organic products or organic food is much more demanding than with conventional agriculture products; both in terms of financial means, knowledge, time, risk, competitive space, and geographic space.

List of grown species on organic farms should be helpful in the further studies, for example to recognize if the biodiversity in the White Carpathians is rising or declining.

8 REFERENCES

- Action plan for organic farming 2011 – 2015. 2011. ISBN 978-80-7434-007-9.
- *AOPKČRa.* 2014. Agentura ochrany přírody a krajiny České republiky: Bílé Karpaty [online]. [cit. 2014-04-15]. Dostupné z: http://www.ochranaprirody.cz/ .
- *AOPKČRb.* 2014. Agentura ochrany přírody a krajiny České republiky: Jizerské hory. [online]. [cit. 2014-04-15]. Dostupné z: http://www.ochranaprirody.cz/ .
- Alcorn JB. 1997. The scope and aims of ethnobotany in a developing world. Ethnobotany – The Evolution of a Discipline 23-39.
- Almekinders C. 2001. Management of Crop Genetic Diversity at Community Level. Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) GmbH. Project: Managing Agrobiodiversity in Rural Areas.
- Almekinders CJM, Fresco LO, Struik PC. 1995. The need to study and manage variation in agroecosystems. Netherland Journal of Agricultural Science 43: 127-142.
- Anonymous. 1991. Council Regulation (EEC) No 2092/91 of 24 June 1991 on organic production of agricultural products and indications referring thereto on agricultural products and foodstuffs (including all amendments). Officiak Journal of the European Economic Community (EEC) No L 198, EEC, Brussels. 28p.
- Anonymous. 2002. Basic standarts for organic production and processing. International Federation of Organic Agriculture Movements (IFOAM). Tholey-Theley, Germany. (www.ifoam.org) (Site last visited September 2002).
- Aude E, Tybirk K, Pedersen MB. 2003. Vegetation diversity of conventional and organic hedgerows in Denmark. Agriculture ecosystems and Environment 99: 135-147.
- Banks JE. 2004. Divided culture: integrating agriculture and conservation biology. Frontiers in Ecology and the Environment 2: 537-545.
- Bourn D. and Presscott J. 2002. A comparison of nutritional value, sensory qualities and food safety of organic and conventionally produced foods. Critical Review in Food Science and Nutrition 42 (1): 1-34.

- Brooks D, Bater J, Jones H, Shah PA. 1995. Invertebrate and Weed Seed Food-sources for Birds in Organic and Conventional Farming Systems. BTO Report 145. Thetford.
- Brush SB. 1995. In situ conservation of landraces in centers of crop diversity. Crop Science 35: 346-354.
- Brush SB. 2004. Farmers' Bounty: Locating Crop Diversity in the Contemporary World. Yale University Press, New Haven, CT. USA.
- Brush SB. and Meng E. 1998. Farmers' valuation and conservation of crop genetic resources. Genetic Resources and Crop Evolution 45: 139-150.
- Charlton CA. 1987. Problems and prospects for sustainable agricultural systems in the humid tropics. Applied Geography 7: 153-174.
- Collins WW. and Qualset CO. 1999. Biodiversity in Agroecosystems. CRC Press. Inc. Boca Raton. FL, USA. 334p.
- Čuba. F. 2014. Naši občané. 28p.
- Čuba. F. 2014. Zemědělské podniky ČR vykazují stale větší závislost na dotacích a na přerozdělování. 11p.
- DEFRA. 2002. Action Plan to Develop Organic Food and Farming in England.
- Dorado JAR, García-Galavís PA, Herencia JF, Maqueda C. 2011. Comparison of nutritional quality of the crops grown in an organic and conventional fertilized soil. Scientia Horticulturae 129: 882-888.
- Dvorský J. 2008. FOA. Nadační fond pro ekologické zemědělství 2008. ISBN 978-80-254-2795-8
- Evans LT. 2003. Argicultural intensification and sustainability. Outlook on Agriculture 32: 83-89.
- Eyzaguirre P. and Iwanaga M. 1996. Participatory Plant Breeding. Proceedings of a Workshop on Participatory Plant Breeding 26-29 July 1995. Wageningen, The Nederlands. International Plant Genetic Resources Institute, Rome.
- FAO (Food and Agriculture Organization of the United Nations). 2010a. The State of Food Insecurity in the World. Adressing food insecurity in protracted crises. FAO, Rome.

- FAO (Food and Agriculture Organization of the United Nations). 2010b. Second Report on the State of the World's Plant Genetic Resource for Food and Agriculture, FAO, Rome.
- Fjelkner-Modig S, Bengtsson H, Stegmark R, Nystrom S. 2000. The influence of organic and integrated production on nutritional, sensory and agricultural aspects of vegetable raw materials for food production. Acta Agriculturae Scandinavica, Section B – Soil Et Plant Science 50: 102-113.
- Fountas S, Kyhn M, Jakobsen H, Wulfsohn D, Blackmore S, Griepentrog H. 2009. A systems analysis of information system requirements for an experimental farm. Precision Agriculture 10: 247–261.
- Fountas S, Wulfsohn D, Blackmore BS, Jacobsen HL, Pedersen SM. 2006. A model of decision-making and information flows for information-intensive agriculture. Agricultural Systems 87: 192–210.
- Fowler C. and Mooney P. 1990. Shattering: Food Politics, and the Loss of Genetic Diversity. University of Arizona Press, Tucson, AZ.
- Gardener SM. And Brown RW. 1998. Review of the Comparative Effects of Organic Farming on Biodiversity. MAFF. London.
- Geier B. 2000. The relationship between nature conservation, biodiversity and organic agriculture. Stimulating Positive Linkages between Agriculture and Biodiversity. 101-105.
- Gengel. *GENGEL o.p.s. Obecně prospěšná společnost Gengel* [online]. [cit. 2014-04-15]. Dostupné z: http://www.gengel.webzdarma.cz/
- Godbole A. and Eyzaguirre P. 1997. Ethical Issues in Conservation and Ethnobotanical Research with Examples from Indigenous and Traditional Communities in India. Ethics and Equity in Conservation and Use of Genetic Resources for Sustainable Food. Agronomy 1–85.
- Gollin D. and Smale M. 1999. Valuing genetic diversity: crop plants and agroecosystems. Biodiversity in Agroecosystems. 237-265.
- Grobman A. 1992. Fostering and fledgling seed industry. Public and Private Roles in Agricultural Development. Proceedings of Twelfth Agricultural Sector Symposium. World Bank Washington DC.

- Hammer K. 1998. Agrarbiodiversität und pflanzengenetische Ressourcen Herausforderung und Lösungsansatz. Schriften zu Genetischen Ressourcen 10: Zentralstelle für Agrardokumentation und Iinformation (ZADI), Bonn, Germany: Stiftung zum Schutze gefährdeter Pflanzen.
- Hawkes JG. 1983. The Diversity of Crop Plants. Harvard University Press, Cambridge, MA.
- Henning J, Thomassin P, Bekr L. 1991. Organic farmers in Quebec: Results of a survey. Canada: EAP Publication.
- Heywood VH. 2011. Ethnopharmacology, food production, nutrition and biodiversity conservation: Towards a sustainable future for indigenous peoples. Journal of Ethnopharmacology 137: 1-15.
- Hole DG, Perkind AJ, Wilson JD, Alexander IH, Grice PV, Evans AD. 2004. Does organic farming benefit biodiversity? Biological Conservation 122: 113-130.
- Iltis HH. 1982. Discovery of no. 832: An essay in defense of the National Science Foundation. Desert Plants 3: 175-192.
- *Informační středisko pro rozvoj Moravských Kopanic, o.p.s.* [online]. Http://www.iskopanice.cz/. [cit. 2014-04-14]. Dostupné z: 2007 © IWG, o.s.
- Jackson LE, Pascal U, Hodgkin T. 2007. Utilizing and conserving agrobiodiversity in agricultural landscapes. Agriculture, Ecosystems and Environment 121: 196-210.
- Jaffee S. and Srivastava J. 1994. The roles of public and private sectors in enhancing the performance of seed systems. The World Bank Research Observer 9: 97-117.
- Jarvis D, Hodgkin T, Eyzaguirre P, Ayad G, Sthapit BR, Guarino L. 1997. Farmer selection, natural selection and crop genetic diversity: the need for a basic dataset. Streghening the scientific basis of in situ conservation of agricultural biodiversity on-farm. Options for data collecting and analysis. Proceedings of a workshop to develop tools and procedures for in situ conservation on-farm. 25-29, August 1997. Rome, Italy.
- Jintrawet A. 1995. A decision support systems for rapid assessment of lowland rice based cropping alternative in Thailand. Agriculture Systems 47: 245-258.

- Jongerden J. and Ruivenkamp G. 1996. Patterns of Diversity. Rapport No 1. Werkgroep Technologie en Agrarische Ontwikkeling (TAO). Wageningen University, Wageningen. 245p.
- Jungmeier M. 1997. Die kulturlandschaft der Nationparkregion Hohe Tauern in Karnten. Karntner Nationalpark-Schriften. 9p.
- Khon Kaen University. 1987. Proceedings of the 1985 International Conference on Rapid Rural Appraisal.
- Kilcher L. 2006. How can organic agriculture contribute to sustainable development? Paper presented at the Tropentag 2006: Conference on Prosperity and Poverty in a Globalized World: Challenges for agricultural research. Held on 11 October 2006. Germany, Bonn.
- King AB. 1999. Tools for participatory research on crop and tree diversity. Farmer participatory research on coconut diversity. Workshop report on methods and field protocols 6-25.
- Köhler-Rollefson I. 2000. Management of animal genetic diversity at community level. A Report prepared for the GTZ.
- Koopmans C. and Bokhorst J. 2000. Optimising organic farming systems: nitrogen dynamics and longterm soil fertility in arable and vegetable production systems in the Netherlands. Proceedings of the 13th International IFOAM Scientific Conference, 28-31. August 2000, Basel. Hochschulverlag ETH Zurich, Zurich 69-72.
- Kouřilová J. 2007. Multifunkční ekologické a konvenční zemědělství se zřetelem na podhorské a horské oblasti. Jihočeská univerzita v Českých Budějovicích. Zemědělská fakulta. Věděcká monografie. Part I. ISBN 978-80-7394-012-6.
- Kruize JW, Robbemond RM, Scholten H, Wolfert J, Beulens AJM. 2013. Improving arable farm enterprise integration – Review of existing technologies and practices from a farmer's perspective. Computers and Electronics in Agriculture 96: 75-89.
- Lammerts Van Bueren ET, Osman A, Bonthuis H. 2001. Assessment, Testing and Admittance of Varieties for Organic Agriculture – a Pilot Study on Carrot and Wheat. Louis Bolk Institute, Driebergen. 52p.

- Lammerts Van Bueren ET, Struik PC, Jacobsen E. 2002. Ecological concepts in organic farming and their consequences for an organic crop ideotype. Netherlands Journal of Agricultural Science 50: 1-26.
- Lammerts Van Bueren ET, Struik PC, Jacobsen E. 2002a. The concepts of intrinsic value and integrity of plants in organic plant breeding and propagation. Organic plant breeding and propagation: concept and strategies. PhD thesis Wageningen University, Wageningen. 105-131.
- Lammerts Van Bueren ET. and Osman A. 2002. Organic plant breeding and seed production: the case of spring wheat in the Nederlands. Organic plant breeding and propagation: concept and strategies. PhD thesis Wageningen University, Wageningen. 133-187.
- Lammerts Van Buern ET. and Van Der Broek R. 2002. The best onion varieties – the first results of field trials. Ekoland 22 (2): 24-25.
- Lampkin N. 2002. Organic Farming. Old Pond, Ipswich.
- Lampkin NH. And Padel S. 1994. The economics of organic farming: An International Perspective. United Kingdom, Biddles Ltd.
- Lapple D. and Rensburg T. 2011. Adoption of organic farming: Are there differences between early and late adoption? Ecological Economics 70: 1406-1414.
- Lenné JM. and Wood D. 1999. Agrobiodiversity: Characterization, Utilization and Management. Journal of Ecology 88. 181p.
- Lenné JM. and Wood D. 2011. Agrobiodiversity management for food security, ISBN-13: 978 1 84593 761 4.
- Lockeretz W. 1997. What Explains the Rise of Organic Farming? Organic farming: An international history. London, UK. ISBN 978-1-84593-289-3.
- Long J, Cromwell E, Gold K. 2000. On-farm management of crop diversity: an introductory bibliography.
- Louise EJ. 2013. Agrobiodiversity, Encyclopedia of Biodiversity (Second Edition), 126-135.
- Magkos F, Arvaniti F, Zampelas A. 2003. Organic food: nutritious food or food for thought? A review of the evidence. International Journal of Food Sciences and Nutrition 54 (5): 357-371.

- Maqueda C, Ruiz JC, Morillo E, Herencia JF. 2001. Effect of an organic amendment on nutrient availability and plant content 11th Int Symp Environmental Pollution and its Impacton Life in the Mediterranean Region Mesaep&Secotox Proceedings Limasol (Chipre).
- McNeely JA. And Scherr SJ. 2003. Ecoagriculture: Strategies to Feed the World and Save Wild Biodiversity. Island Press, Washington DC. USA.
- Mowbray D. 1995. From Field to Lab and Back; Women in Rice Farming Systems.
- Offermann F, Zander K, Hohenheim S. 2007. Organic Farms in a Changing Policy Environment. Impacts of Support Payments. EU-Enlargement and Luxembourg Reform / Hiltrud Nieberg. Organic Farming in Europe: Economics and Policy 13. ISBN 978-3-933403-12-4
- Pedersen SM, Fountas S, Blackmore BS, Gylling M, Pedersen JL. 2004. Adoption and perspectives of precision farming in Denmark. Acta Agriculturae Scandinavica, Section B – Plant Soil Science 54: 2–8.
- Pierce FJ, Nowak P, Donald LS. 1999. Aspects of Precision Agriculture. Advances.
- Piro Z. and Wolfová J. 2008. Zachování biodiverzity karpatských luk. FOA. Nadační fond pro ekologické zemědělství. Praha. 108 p.
- Potravinářská Revue. 2009. 1. vydání, Praha: AGRAL s.r.o., s. 68, ISSN 1801-9102.
- Prescott-Allen C. and Prescott-Allen R. 1986. The First Resource: Wild species in the North American Economy, Yale University Press, Newhaven, Connecticut.
- Qualset CO, McGuire PE, Warburton ML. 1995. 'Agrobiodiversity': key to agricultural productivity. California Agriculture 49: 45-49.
- Rasul G, Tapa GB, Zoebisch MA. 2004. Determinants of land use changes in the Chittagong hill tracts of Bangladesh. Applied Geography 24: 217-240.
- Rasul G. and Thapa GB. 2004. Shifting cultivation in the mountains of south and Southeast Asia: regional patterns and factors influencing the change. Land Degradation & Development 14: 495-508.
- Raswami B. 1991. A Framework for Seed Policy Analysis in Developing countries. International Food Policy Research Institute. Washington DC.

- Robertson GP. And Swinton SM. 2005. Reconciling Agricultural productivity and environmental integrity: a challenge for agriculture. Frontiers in Ecology and the Environment 3: 38-46.
- Sandoval-Nazarea V. 1994. Memory Banking Protocol: A Guide for Documenting Indigenous Knowledge Associated with Traditional Crop Varieties.
- Schroen G. 1986. White cabbage for storage requires more than at first thought – by switching from open-pollinated to hybrid varieties. Groenthe en Fruit 4: 10-13.
- Ševčík Z. 2003. Extenzivní ovocnářství v centrální části Bílých Karpat. Seminary work under Mendel's University of Agriculture and Agroforestry in Brno.
- Simon PW, Peterson CE, Lindsay RC. 1982. Genotype, soil and climate effects on sensory and objective components of carrot flavor. Journal of the American Society of Horticultural Science 107: 644-648.
- Simon PW. 1993. Breeding carrot, cucumber, onion and garlic for improvement quality and nutritional value. Horticultura Brasileira 11: 171-173.
- Sperling L, Berkowitz P. 1994. Partners in Selection: Bean Breeders and Women Bean Experts in Rwanda.
- Sthapit BR. And Jarvis D. 1999. Participatory plant breeding for on-farm conservation. Ileia Newsletter, December 1999.
- Swift MJ. and Anderson JM. 1993. Biodiversity and ecosystem function in agricultural systems. Biodiversity and Ecosystem Function. Springler Verlag, Berlin. 15-38.
- Tansley AG. 1935. The use and abuse of vegetational concepts and terms, Ecology 16: 284-307.
- Teklewold H, Legesse D, Alemu YA, Negusse D. 2006. Adopting Poultry Breeds in the Highlands of Ethiopia. Research report Ethiopia: Ethiopian Institute of Agriculture Research.
- Thapa GB. and Rattanasuteerakul K. 2011. Adoption to extend of organic vegetable farming in Mahasarakham province, Thailand. Applied Geography 31: 201-209.
- Thrupp LA. 1998. Cultivating Diversity: Agrobiodiversity and Food Security. World Resources Institute.

- Tilman D, Fargione J, Wilff B, D’Antoino C, Dobson A, Howarth R, Schindler D, Schlesinger WH, Simberloff D, Swackhamer D. 2001. Forecasting agriculturally driven global environmental change. Science 292: 281-284.
- Tradice Bílých Karpat. 2009. Občanské sdružení Tradice Bílých Karpat [online]. [cit. 2014-04-15]. Dostupné z: http://www.tradicebk.cz/
- Tripp R. and Louwaars N. 1997. Seed regulation: choices on the road to reform. Food Policy 22 (5): 433-446.
- Vandermeer J. 1995. The ecological basis of alternative agriculture. Annual Review of Ecological Systems 26: 201-224.
- Vogl CR, Kilcher L, Schmidt H.-P. 2005. Standards and regulations of organic farming: Moving away from small farmers' knowledge. Journal for Sustainable Agriculture 26: 5-26; ISSN: 1044-0046.
- Vogl-Lukasser B. and Vogl ChR. 2002. Ethnobotany as an interdisciplinary method for the study of the management of agrobiodiversity in home gardens of alpine farmers in Eastern Tyrol, Austria Interdisciplinary Mountain Research, 264 – 273, ISBN 3-8263-3464-5.
- Vogl-Lukasser B. and Vogl ChR. 2004. Ethnoboatnical Research in Homegardens of Small Farmers. The Alpine Region of Osttirol (Austria): An example for Bridges Built and Building Bridges, Ethnobotany Research & Applications 2: 111-137 (www.ethnobotanyjournal.org/vol2/i1547-3465-02-111.pdf).
- Warmann PR. and Harvard KA. 1997. Yield, vitamin and mineral content of organically and conventionally grow carrots and cabbage. Agricultuer, Ecosystems & Environment 61 (2): 155-162.
- Watson, J.W. and Eyzaguirre, P.B., 2001: Home gardens and in situ conservation of plant genetic resources in farming systems, Proceedings of the Second International Home Gardens Workshop 17–19.
- Weatherell Ch, Tregear A, Allinson J. 2003. In search of the concerned consumer: UK public perceptions of food. Farming and buying local. Journal of Rural Studies 19: 233–244.
- Witcombe JR, Joshi A, Joshi KD, Sthapit BR. 1996. Farmer participatory crop improvement. Varietal selection and breeding methods and their impact on biodiversity. Experimental Agriculture 32: 445-460.

- Woese K, Lange D, Boess CH, Werner K. 1997. A comparison of organically and conventionally grown food: result of a review of the relevant literature. Journal of the Science of Food and Agriculture 74: 281-293.
- Wood D. and Lenné JM. 1999. Agrobiodiversity Characterisation, Utilisation and Management. CAB International. Wallingford, UK.
- Worthington V. 1998. Effect of agricultural methods on nutritional quality: a comparisom of organic and conventional crops. Alternative Therapies In Health And Medicine 4: 58-69.
- Worthington V. 2001. Nutritional quality of organic versus conventional fruits, vegetables, and grains. Journal of Alternative and Complementary Medicine 7: 161-173.
- Žmolík M. 2008. Správa CHKO Bílé Karpaty, 2008. Mapový podklad: ArcČR © 1997 ARCDATAPRAHA, s.r.o.
- ZO ČSOP Veronica. 2001. Kraj ovoce. Ovocnářství v Bílých Karpatech, ovocnářství bez chemie, zpracování ovoce – sušení a moštování. Centrum Hostětín.

APPENDIX

1. Questionnaire
2. Photos of the White Carpathians (by Bc. Kateřina Šalková and Ing. Zdeněk Ševčík):
    - 2.1 Spring in the White Carpathians – organic orchard in Komňa
    - 2.2 Spring in the White Carpathians – detail of flowers of *Malus domestica*
    - 2.3 Spring in the White Carpathians – old variety of *Pyrus communis* in Pitín
    - 2.4 Organic farm of combined production
    - 2.5 Organic farm of combined production in accessible (north) part of the White Carpathians
    - 2.6 The preparation of the soil before sowing involves the whole family
    - 2.7 Difficult accessible land for farmers near the village Lopeník
    - 2.8 Pre-cropping of plants in the plastic boxes and in the yoghurt´s cups
    - 2.9 Organic farm´s market of local production
    - 2.10 Graft stocks called "Anetky"
    - 2.11 Organic farm in Pitín, specialized in orchards
    - 2.12 Fruit dryer
    - 2.13 Process after drying
    - 2.14 Packaging of apples
    - 2.15 Yield in the village Pitín on the organic farm of Zdeněk Ševčík

1. Questionnaire

ROSTLINNÉ ZDROJE NA ČESKÝCH EKOLOGICKÝCH FARMÁCH

Česká zemědělská univerzita v Praze

Použití rostlinných zdrojů na českých ekologických farmách se zaměřením na etnobotanické znalosti, získávání genetického materiálu a původu druhů rostlin

Use of plant resources on Czech organic farms with special reference to ethnobotanical knowledge, genetic material acquisition and origin of plant species

Kateřina Šalková

Salkova.Katerina@seznam.cz

Jedná se o dotazník určený specializovaným farmářům pracujících na ekologických farmách v České republice – oblast Bílých Karpat. Prosím o vyplnění následujících otázek, které poslouží k výzkumu v mé diplomové práci s výše uvedeným názvem (práce je psána v anglickém jazyce, avšak pro snadnější komunikaci dotazníkovou formou s českými eko-farmáři byl zvolen jazyk český).

1. **Zaškrtněte zaměření farmy:**
   a) Rostlinná výroba
   b) Živočišná výroba
   c) Kombinovaná

2. **Jak využíváte půdní fond?**
   a) Pastviny
   b) Sady
   c) Pole
   d) Zahrada (např.: ovocné stromy + traviny; užitková zahrada - tzv. kuchyňská zahrada přímo u domu)

3. **Který z výše uvedených typů využité půdy obsahuje největší sortiment užitkových druhů plodin?**

4. **Vyjmenujte sortiment plodin, které pěstujete (v sadu, na poli, atd.):**

5. **Vyjmenujte hlavní plodiny (a jiné, meziplodiny), které využíváte v osevním postupu:**

6. **Považujete některé z plodin, nebo jejich produktů, za netradiční v ČR nebo v regionu?**
    a) Ano - které:
    b) Ne
7. **Pěstujete krajové odrůdy?**
    a) Ano – u kterých plodin:
    b) Ne

8. **Jaké metody využíváte pro zlepšování úrodnosti půdy?**

9. **Jak postupujete při zjištění výskytu nákazy, viru, napadení škůdci aj. z hlediska ochrany rostlin**
    a) Odvar z bylin
    b) Hnojivo (vyhovující požadavkům pro EZ)
    c) Poradenská firma
    d) Vyřešíte sám/sama
    e) Jiné:

10. **Využíváte (zkoušíte pěstovat) i plané rostliny?**
    a) Ano – které:
    b) Ne

11. **Které plodiny jsou nyní spotřebiteli žádanější než dříve?**

12. **Které ze svých plodin považujete za:**
    a) nejžádanější:
    b) méně žádané:

13. **Způsob získávání (osiva popř. vegetativního materiálu – pokud se plodina/rostlina množí vegetativně) (zaškrtněte, popřípadě očíslujte priority):**
    a) Vlastní osivo (část vlastní úrody = osivo)
    b) Kupujete (sedlák, firma)
    c) Výměna
    d) Dostanete darem
    e) Jiné:

14. **Napište prosím příklad plodin, které získáváte dle výše zvoleného způsobu:**

2. Photos of the White Carpathians

2.1 Spring in the White Carpathians – organic orchard in Komňa

2.2 Spring in the White Carpathians – detail of flowers of *Malus domestica*

2.3 Spring in the White Carpathians – old variety of *Pyrus communis* in Pitín

2.4 Organic farm of combined production.

2.5 Organic farm of combined production in accesible (norths´) parts of White Carpathians.

2.6 The preparation of the soil before sowing involves the whole family.

2.7 Difficult accessible land for farmers near the village Lopeník.

2.8 Pre-croping of plants in the plastic boxes and in the yogurt´s cups.

2.9 Ogranic farm´s market of local products.

2.10 Graftstocks called „Anetky".

2.11 Organic farm in Pitín, specialized in orchards

2.12 Fruit dryer

2.13 Process after drying.

2.14 Packaging of apples.

2.15 Crop yield in the village of Pitín on the organic farm of Zdeněk Ševčík