BIOACADEMY 2008 – PROCEEDINGS

BIOAKADEMIE 2008 – SBORNÍK

New Developments in Science and Research on Organic Agriculture

Nové poznatky vědy a výzkumu v ekologickém zemědělství

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Bořivoj Šarapatka, Pavlína Samsonová (eds.)

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Working for organic farming in Europe

International Federation of Organic Agriculture Movements – EU Regional Group

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Dear Delegate

Bioacademy 2008

On behalf of the IFOAM EU Group, I am delighted to welcome you to the 8th Bioacademy.

The IFOAM EU Group is again honoured to be patron of Bioacademy during another eventful year for the organic sector.

True to form, Bioacademy is focussing on the key issues confronting and challenging us.

> The new EU regulation, crafted over the last 3 years and now approved, will mean some significant changes for both operators and certifiers. It lays a new foundation for organic food and farming in the EU.
>
> Quality is becoming an increasingly important factor in both production and the end product. Several studies recently have concluded that organic foods are higher in quality. But this is a controversial subject – what are the new developments in this field?
>
> The imperative of climate change means we need to consider localising markets and also making our production systems more robust. What else can we learn from the experience of others?

Bioacademy 2008 is a golden opportunity for sharing information, gaining inspiration and being stimulated by vigorous debate.

Enjoy!

Yours sincerely

Francis Blake

President

Dear friends and colleagues,

We are meeting for the 8th year of Bioacademy which, since the year 2000 has been gaining the support of a wide range of farmers, research and academic institutes, government bodies and many other specialist organisations. Over the years we have focused on many current issues in organic farming relating to the development and support of this agricultural system in the EU, non-chemical protection of plants, growing vegetables, grassland in organic farming, animal welfare, food quality and other topical themes.

With the passing years Bioacademy has not only become a meeting place for those involved directly with production, but also for researchers. This led to a change in the character of this year's conference and the introduction of a scientific part which will deal with current issues of research.

For the whole Bioacademy, we have chosen the broad topic of "New Developments in Science and Research on Organic Agriculture". Within this topic, the Conference for Practitioners will put emphasis on the transfer of up to date information directly into practice, while the Scientific conference will enable scientists of various specialisation to exchange the latest research findings from this agricultural system reaching into the related areas of landscape and the environment.

Nevertheless, we have no intention of dividing Bioacademy into two "camps"– scientific and practical. We believe in mutual communication, inspiration, meeting needs and listening to the opinions of individual groups. New scientific knowledge should affect current organic farming and, on the other hand, researchers should listen to practical needs and problems. In this discussion we can reveal problems limiting the development of organic farming, problems which it will be necessary to solve in the future.

The Proceedings you are now reading consist of several parts according to language. We have placed the English version at the beginning, as Bioacademy is an international event, as shown in its title – the 8th European Summer Academy on Organic Farming. Within individual language versions, the contributions are given according to the order of the programme. This refers to the Plenary Meeting, Conference for Practitioners "A" (abstracts from these two parts are published) and Scientific Conference "B" (opposed contributions in the form of scientific articles are given only in the English section of the Proceedings).

Before you start reading this material and listening to lectures, I would like to thank all the organisations that participated in the preparation of Bioacademy and whose logos are printed on the cover of the Proceedings. I would further like to thank all members of the organisational team and scientific committee of the conference.

I also thank all opponents from various countries, whose names remain anonymous, as the opponency of scientific articles is anonymous, too. We deeply appreciate their demanding work and we hope that, as with our organisational team, they will continue to work as our colleagues in the future.

I am sure that this new model of practical and scientific conference will prove effective and will attract an ever-widening range of specialist public. Please, excuse any possible "teething troubles" in the new structure, the preparation of which required a lot of effort from the organisers. I hope that, in a pleasant atmosphere in Lednice, we will enjoy three days filled not only with a specialist programme, but also numerous accompanying events.

I am already looking forward to meeting you all again in 2009

Prof. Bořivoj Šarapatka
Chairman of the Scientific Committee of the Conference

THE MAIN CURRENT TOPICS IN THE DEVELOPMENT OF ORGANIC FARMING IN THE EU 2008/2009: FROM THE POINT OF VIEW OF IFOAM

BLAKE, F.[1]

Key words: regulation, research, climate change, CAP

Abstract

A key topic for the IFOAM EU Group in the last three years has been the revision of the EU organic regulation (2092/91). We have analysed, publicised, consulted, responded to and generally pressurised the authorities to amend and improve the new framework regulation (834/2007) (stage 1) and then the implementing rules (stage 2). We have had some success, but the mandatory EU logo remains a major negative.

We are now well into stage 3 – the new areas of aquaculture, seaweed and wine. We have also started considering stage 4 – picking up all the loose ends and unresolved issues, including poultry standards, review of inputs against the new criteria, review of processing rules against the new principles, etc.

The IFOAM EU Group is planning to publish early next year a dossier that will explain the new regulation in a way that ordinary stakeholders will be able to understand. We are still looking for the final few responses to be partners in this project.

Looking wider, we co-ordinate the organic research technology platform. This is important to ensure a clear direction for organic research in the EU and to influence its research agenda.

Looking wider still, we are facing the global challenges of climate change, impending peak oil and increasing food prices. Organic farming can contribute significantly to meeting these challenges, so we need to intensify our lobbying for a reform of the CAP – to ensure it really does encourage the development of a truly sustainable agriculture.

We must also look to ourselves. How should we change to ensure organic will be able to operate optimally in a very different world? From more or less emulating conventional systems, we need to really start applying organic principles. As the paradigm moves in our favour, we must move with the paradigm – if we do that, then there is a bright future ahead.

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VISION FOR AN ORGANIC FOOD AND FARMING RESEARCH AGENDA TO 2025: ORGANIC KNOWLEDGE FOR THE FUTURE

NIGGLI, U.[1], SLABE, A.[2], SCHMID, O.[1], HALBERG, N.[3], SCHLÜTER M.[4]

Key words: research agenda, strategy, perspectives

Abstract

Organic farming is a productive low-input agriculture placing special emphasis on sustainability and offering innovative concepts for global problems such as the degradation of ecosystem services (e.g. soil fertility, biodiversity or clean water), the economic decline of rural areas with migration from the land, the provision of sufficient food in climate change scenarios and the fast growing demand for high quality food in developed and emerging regions of the world. The IFOAM-EU Group and ISOFAR developed a vision for the strategic priorities in future research which was published in August 2008. This vision was supported by many European stakeholders and civil society organisations.

The strategic priorities for research of the organic sector encompass i) viable concepts for the empowerment of rural economies in a regional and global context, ii) securing food and ecosystems by means of eco-functional intensification and iii) high quality foods as a basis for healthy diets and a key for improving quality of life and health.

Deduced from these strategic priorities, an intensification of the research activities at regional, national and European level is outlined in the vision paper. The overall aim of research is the support of a 'lead market' of the European food industry and to improve the provision of society benefits and the public good of agriculture. Organic food and farming systems offer unique opportunities for a competitive and sustainable future, which can be deployed by R&D efforts.

The vision paper is the first step towards a continuous research-agenda setting-process driven by stakeholder and society. Hence, the Technology Platform "Organic" will foster these important debates and facilitate the next steps.

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THE 'INTERNATIONAL SOCIETY OF ORGANIC AGRICULTURE RESEARCH' (ISOFAR)

NEUHOFF, D.[1], KÖPKE, U.[1]

Key words: research, organic agriculture, institutions

Abstract

The International Society of Organic Agriculture Research (ISOFAR) founded in 2003 in Berlin seeks to promote, encourage and support research in all areas of Organic Agriculture by facilitating global co-operation in research, methodological development, education and knowledge exchange, supporting individual researchers through membership services and integrating stakeholders in the research process.

Organic Agriculture addresses pivotal issues of the future of our globe in the broad scope of agriculture and food production. Research deserves high priority in the fields of sustainable land use, regional rural development, environmental impacts, food security, food quality and health as well as ethical and social aspects of agriculture. Current and future global challenges require joint interdisciplinary and participatory approaches. In this spirit, ISOFAR supports the development of sustainable organic agricultural systems worldwide by:

- *supporting individual researchers from both generalist organic systems and specialist disciplinary backgrounds through membership services including events and publications,*
- *facilitating global co-operation in research, education and knowledge exchange,*
- *encouraging conceptual, methodological and theoretical development and respecting the ethos of Organic Agriculture in a systems / interdisciplinary context,*
- *attempting to solve problems on site by fostering regional researcher-farmer group relationships,*
- *improving the scientific excellence of organic agricultural research, e.g. by integrating experts from international agricultural research centres while maintaining the roots of the organic idea.*

Check our website: www.isofar.org

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BIO-QUO VADIS

GEIER, B.[1]

Key words: organic, globalisation, markets, cooperation and vision

Abstract

Asking the question "quo vadis" (where are you going) about the way for organic agriculture raises the related question: "Where do the goods come from?"

The rapid growth and worldwide trade in organic products is a reality. It is true that this offers opportunities – not only for commercial enterprises, but also for small farmers in developing countries to sell their produce for an appropriate price.

But this worldwide flow of goods presents a challenge for the holistic principles of organic agriculture.

The presentation will reflect on how we can organise the economic expansion and globalisation of the organic sector without compromising the values that have identified organic agriculture also as an alternative economic approach.

The presentation will look at the recent development of – especially international – trade.

It will also highlight some examples of innovative cooperation and creation of synergy

Finally it will give an outlook on the challenges, but more so the opportunities ahead for the organic movement and its economic sector.

The background to the "visionary" element of the presentation will be the understanding that the popular slogan "think global – act local" falls short. We cannot really leave global "action" just to the World Trade Organisation and multinationals. And how successful can acting locally be if we don't "think" about it. This inevitably means that we must think and act locally, regionally and globally.

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FOOD AND AGROENERGY PRODUCTION IN ORGANIC FARMING – UNDESIRABLE OR SUSTAINABLE OPTIONS?

SCHÄFER, W.[1]

Key words: energy crops, renewable energy, efficiency

Abstract

Crop production is a conversion process of solar energy into biomass. Consequently, both the cultivation area and the insolation intensity of this area limit the agroenergy output of the globe. Cultivation measures support the photosynthetic conversion process. Although organic cultivation measures require less energy than mainstream agriculture, the overall efficiency remains below 1%. Nevertheless, agroenergy production is captivating with many win-win situations: environmentally neutral bio-fuels replace polluting fossil fuels, farmers get better prices for energy crops, and turnover of power industry grows due to increasing energy consumption to process biomass into fuel. Consequently, the state tax income improves too. However, better prices for energy crops may trigger export of environmental pollution because higher conversion efficiency in tropical countries favours the intensification of energy crop production at the expense of food production. The overall efficiency of fuel from energy crops will never be competitive with solar techniques. E.g. solar collectors replace fossil fuels for heat production much more efficiently. Yet, high process efficiencies of technical processes to convert biomass into fuel justify the production of fuel from organic waste and residues. Thus, organic farming should not focus on energy crop production but produce high quality food in an environment-friendly way. As a measure for sustainability of fuel production from biomass, the energy surplus of energy conversion from insolation to fuel per resident and square meter is proposed.

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HOW ECOLOGICAL ARE DIFFERENT AGRO-ENERGY CONCEPTS? MIXED CROPS AND ENERGY UTILISATION

PAULSEN, H. M.[1]

Key words: mixed cropping, oil crops, agro-forestry, resource efficiency

Abstract

Yield increases, reduction of energy input and the use of renewable energy sources could enhance low product-bound climate efficiency values in organic production. Efficiency of plant production can be improved by recycling nutrients from bio-energy processes on farms like biogas slurry, the use of straw ash, wood ash and oil cake as well as N-fixation by the increased integration of leguminous intercrops or undersown legumes for biogas production. Sequences of different crops for biomass production and breeding progress could increase the resource efficiency further. Relative yield increases and more effective resource utilisation are found in mixed cropping systems. For the reduction of energy input, cropping concepts guaranteeing effective weed suppression and technical perfection in soil treatment and drilling technology are demanded. But reduced tillage concepts are rarely experienced and could anticipate yield security. Agro-energy cropping concepts in organic farms can be the key for the reduction of green house gas emissions from production processes by yield increases and saving of fossil energy. But energy cropping is accompanied by product diversification. Due to increased relative yield mixed cropping concepts have the chance to combine food and energy production. But balances have to be found in economics and in the wish for food security. Agro-forestry systems and mixed cropping with oil crops show interesting options to fulfil these demands.

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ORGANIC FARMING POLICY INSTRUMENTS IN CENTRAL AND EASTERN EUROPEAN COUNTRIES: POSSIBILITIES AND BARRIERS

HRABALOVA, A.[1], WOLLMUTHOVA, P.[2]

Key words: organic farming, policy instruments, area payments, Central and Eastern European countries

Abstract

Organic farming (OF) has expanded rapidly in the Central and Eastern European countries (CEECs) due to policy support in the form of area payments which had already been introduced on a national basis before the EU accession in all CEECs. Significant adjustments in OF payments took place in CEECs in 2004, as a consequence of the EU accession, when the average area payment increased to €133/ha compared to €52/ha in 2003. A further significant increase in OF payments, mainly for special crops, was made for the 2007-13 period in SK, LV and CZ. Currently, the highest payment for arable crops and grassland is provided in SI (€298/ha, €228/ha) and for permanent crops and vegetables in CZ (€849/ha, €564/ha).

The research results have shown that OF payments were the most important and, in most cases, the only support for OF in the CEECs until 2004 and that CEECs are lagging behind in developing policy instruments to tackle the imbalance between supply and demand oriented measures. The existing OF policy favouring instruments focused on supply can not sufficiently solve the main problem areas such as underdeveloped processing and marketing, insufficient and inappropriate organic production capacity or lack of professional training and advisory services in such immature and un-transparent markets as they are in CEECs.

However, in recent years OF policy in CEECs has been developing towards more integrated approaches and all CEECs have used the opportunity to support OF through a variety of measures within the new rural development programmes such as: specialist training, the use of advisory services, added value to agricultural products or supporting participation in food quality schemes from Axis 1 and diversification of agricultural activities or encouragement of agri-tourism from Axis 3. In addition, most CEECs have recognized the need to integrate these policies into one plan and have implemented national action plans for OF. But it is clear that there is still great potential for the implementation of other policy tools strengthening OF development in all CEECs.

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EU REGULATION (EC) 834/2007 AND ITS IMPLEMENTING RULES FOR ORGANIC PRODUCTION, LABELLING AND CONTROL – WHAT WILL CHANGE?

FLADL, M.[1]

Key words: organic production, EU legislation

Abstract

The EU legislation on organic production, labelling and control has undergone a major revision. Council Regulation (EC) 834/2007 replaces Regulation (EEC) 2092/91 and will come into force as of 1. 1. 2009.

The Regulation is supplemented with implementing rules laying down technical details for various production fields. A first package of „implementing rules" was agreed by the Standing Committee of organic farming in July 2008. The text mainly results from transposition of the Annexes of Reg. 2092/91 without changing the substance. It has been re-structured and simplified where possible. A few legal clarifications and some new elements, in particular to enforce animal welfare, have been introduced.

A separate package on implementing rules for imports is in the pipeline.

The elaboration of implementing rules for entire new fields like organic aquaculture, yeast, seaweed and wine will take more time and therefore come into force at a later date.

The legal revision is a corner stone of the European Organic Action Plan (2004) and will be presented.

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IMPLICATIONS OF THE NEW EU REGULATION (EC) 834/2007 ON ORGANIC PRODUCTION FOR INSPECTION

DIERKES, B.[1], NEUENDORFF, J.[2]

Key words: organic production, control, EU-Regulation, inspection, certification

Abstract

The new EU-Regulation (EC) No. 834/2007 on organic agriculture will come into force on 1/1/2009. The new implementation rules were decided on 2/7/2008.

The inspection system and the inspection procedures for organic products were restructured under both new EU-regulations. They will be implemented in conformity with the requirements of Regulation (EC) No. 882/2004. Both new EU-regulations will bring some important and interesting changes for the inspection and certification of organic operators. At the farmer's level, a number of derogations will no longer require prior authorization by the inspection bodies.. Other derogations will need to be decided in future by competent authorities. Processing facilities for food and feed will need to implement a concept of "organic critical points (OCP)". This concept was developed in the framework of a German R&D-project in 2003. OCP will ensure that inspectors look first at risky areas in processing and focus on critical areas during the inspection.

The results of a German Research & Development project in the framework of the Federal Program for Organic Agriculture will be presented. The project aims to design effective and efficient methods and instruments for the future control system of organic products, taking into account the requirements of Reg. (EC) No. 882/2004.

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QUALITY ASSURANCE: HOW TO AVOID RESIDUES AT FARM LEVEL AND IN THE ORGANIC FOOD CHAIN

HEEB, M.[1], WYSS, G.[2], NOWACK, K.[3], SCHMID, O.[4]

Key words: residue levels, quality assurance, organic food chain

Abstract

Pesticide residues in organic production are a sensitive topic and critical for the image of the sector. Therefore, Inspection bodies, but also operators, need professional tools and concepts to handle cases of suspicion regarding organic products which are not in compliance with Regulation (EEC) No. 2092/91 (Annex III, article.9).

The inspection body is obliged to assess whether further investigations are necessary and is urged to use its expertise and extensive practical experience to generate a rapid explanation for the facts in question. Also operators shall initiate procedures a) for adequate management of sampling in their enterprise, and b) for handling residue cases in their produce. A broad understanding about sources of contamination and critical control points in organic farming and processing is crucial in order to develop appropriate sampling plans, but also for professional interpretation of residue cases and analysis reports. In the event of residue on organic produce, a thorough interpretation of the results, clear decision making structures and division as well as well defined communication channels are key aspects for the professional handling of the situation and preserving organic quality assurance and its image.

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SECURING QUALITY, TRACKING AND TRACING OF ORGANIC PRODUCE FROM PRODUCTION TO TRADE – FOOD SUPPLY CHAIN MANGEMENT AND MARKET PERSPECTIVES FOR ARABLE CROPS

VOLLERTSEN, D.[1]

Key words: organic products, supply chain management, arable crops, market demand

Abstract

Whereas in Northern America and Western Europe the demand for organic produce is growing strongly, in Asia, South America and in Eastern Europe the demand is still weak. This leads to strong product flow on a world-wide scale and to import and export. This is not without risk, as tracking and tracing is often no longer possible.

Besides economic considerations and fulfilment of the legal minimum requirements, it is important that, over the whole supply chain, failures and risks are identified and named. Transparency of origin is as important as quality of production and maintenance of raw material during transport to traders and storage.

EU Regulation No. 178/2002 is the legal framework but it cannot suffice to reduce the risk of false labelling of organic products and to ensure plausibility-checks in organic operations.

In fact the various participants, producers, processors and traders should use better contract and handling systems, with the support of specific electronic data information systems, in order to allow rapid data access in the case of problems.

The cultivation of protein and oil plants will become more important in Europe due to the planned further reduction of conventional feedstuff. Mainly peas, lupines, field (faba) and soya beans will be important. Cultivation is limited and has to be well-integrated in optimal rotation on organic farms. Also the demand for cereals is growing; here the right choice of cereal species is important to satisfy the demand.

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THE FUTURE OUTLOOK FOR MARKETING ORGANIC PRODUCTS IN THE CZECH REPUBLIC; THE ESTABLISHMENT OF THE MARKETING COMPANY PRODEJ-BIO S.R.O.

CHLAD, F.[1] LAČŇÁK, V.[1]

Key words: marketing organic products, cereals, legumes, PRODEJ-BIO s.r.o., PRO-BIO Association guidelines

Abstract

The PRO-BIO and BIOLAND associations for organic farmers have founded a new joint marketing organization in the CR – PRODEJ-BIO, s.r.o.

In connection with this, representatives from both organizations have agreed on the following common goals:

1. *to improve services for PRO-BIO members (sellers and buyers of organic products) – marketing organic products at favorable prices, helping with the storage of organic products, helping to choose crops to be marketed in a given year, purchasing feed and raw materials for producers of organic products and livestock farmers who are PRO-BIO members.*
2. *to improve the status of the BIOLAND Association and its brand in the CR – improving the opportunities for buying organic products and organic produce in the CR.*
3. *preferential status for Czech organic product suppliers and buyers – PRO-BIO Association members: a Czech supplier, a Czech buyer or a PRO-BIO member will be given priority over international suppliers and buyers and over non-members of the PRO-BIO Association. PRO-BIO Association members – buyers will have priority over buyers from the BIOLAND Association, or more precisely, from the BIOLAND Association trade organization.*
4. *trade relationships are governed by trade contracts of specified duration (preference given to long-term relationships.) In order to conduct trade, an appropriate document certifying the organic product or organic produce must always be attached.*
5. *the goal of the new company is also to promote the association guidelines. The guidelines were updated in January 2008 according to the latest version from Bioland e.V.*
6. *in addition to lucrative commodities, the new company also incorporates other commodities (e.g., organic beef and lamb.)*[1]

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CULTIVATION TECHNOLOGY OF WINTER OILSEED RAPE (*Brassica napus* L.) WITHIN ORGANIC AGRICULTURE

ŠKEŘÍK, J.[1], NERAD, D.[1], KAZDA, J.[2], KUCHTOVÁ, P.[2]

Key words: winter oilseed rape, organic production, agrotechnology, sowing rates, weeds

Abstract

Small-plot trials with organic winter oilseed rape (OOR) have been conducted since 2002 at the certified experimental station of the ČZU in Prague – Uhrineves. In the beginning, the yields obtained from OOR comprised only about 10% of conventionally grown oilseed rape. According to the results of individual years, the methodology had to be gradually adapted. Variants with higher sowing rates and wider row spacing were added, which facilitated weeding out between rows. Different non-chemical treatments against pests and diseases were tested. Recently, the yield of OOR achieved under optimal conditions in our trials presents a comparable level to the yield from conventional conditions. An effort is being made to verify our knowledge in semi-field trial conditions. Moreover, the occurrence of natural enemies (Hymenoptera) was monitored to determine their importance for pest reduction within organic and conventional oilseed rape production technology. Numerous oilseed rape pest parasitoids were found during flowering. The results show greater diversity in the occurrence of parasitoids, pests and in the level of parasitoid attack on pest larvae in organically grown plots compared to conventional plots. The consequences for organic and integrated oilseed rape pest management are discussed.[1]

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DEVELOPMENT OF THE MARKET POTENTIAL FOR ORGANIC VEGETABLES – THE EXAMPLE OF THE "ADAMAH" FARM IN AUSTRIA

ZOUBEK, G.[1]

Key words: organic products, supply chain management, arable crops, market demand

Abstract

"Adamah", which is the Hebrew word for arable soil, living soil but also for human being, leads our work: growing living products on living soil, which serve as living food for humans.

We started in 1997 on our 70 ha of arable land with the following aims: 1. to be more independent through diversity of products; 2. to sell directly in order to better explain the added value; and 3. that our arable farm can also be a working enterprise.

Already during conversion to organic farming many special vegetable rarities were cultivated: 70 different squash types, many different tomatoes and other vegetables. In order to sell these products a vegetable box scheme was started in 2002, as it has proven impossible to sell all these products on weekly markets in the Vienna Region. Every week boxes of vegetables and fruit are delivered. The products have to be seasonal, regional and allow wide variation. The customers sometimes get products they do not buy; recipes give them advice how to use them.

The system allows better planning of production. Today more than 4000 households in the Vienna region get the boxes. 50 % of the products are from our own farm, the other 50 % from organic wholesalers, with whom we have established a good working relationship. The cereals are sold to an organic bakery, which delivers fresh bread and pastries to the farm. Two times a year a farm festival is held. Communication will be even more important in the future. Our presence on 3 markets in Vienna and our own farm shop is another possibility. In the main season ca. 70 people work on our farm, also some seasonal workers. The maximum turn-over in 2007 was 5 million Euros and this figure is still growing.

We believe that in the future organic farmers must also take more responsibility for marketing. This does not necessarily mean direct marketing. The key questions are: Who needs what I produce? and What do consumers want? We should avoid the possibility of organic products becoming anonymous and losing their specific added value. Our approach is "Organic products with a biography". This puts the family, humans and the region in the centre. Our experience confirms that many consumers are searching for factual information and transparency about costs but also about the contribution to the environment. We plan to intensify both communication and the cultivation of locally adapted and tasty farm varieties, where taste is the main criterion and not yield (trial with carrots). If we can convince consumers of the added value, organic agriculture has a great and secure future.

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SUCCESS FACTORS FOR THE DEVELOPMENT OF ORGANIC VEGETABLE MARKETS

LICHTENHAHN, M.[1]

Key words: organic production, vegetables, market development

Abstract

Vegetables and fruit are the driving force for local market development, also in the organic market. As this produce is sold fresh with a very limited shelf life, continuity in the market is a big challenge. Especially when local organic markets start developing the offer from the farms is often very small and the diversity of produce is not sufficient to become attractive to customers. Together with freshness and product quality these are the most important factors to be considered when starting up a local organic market from scratch.

If farmers and traders realize that they are mutual partners working towards the same goal and have a well established exchange of relevant information, such as market needs and restrictions to production due to climate, , a big step towards sound market development is taken.

As an outcome of this understanding, joint production-planning will create much more security on both sides.

On the farmer's side the necessary know-how and, even in organic agriculture, the necessary farm inputs such as organic plant protection, must be available. Market development also requires strong concurrent technical support for farmers, bringing them the necessary expertise in production techniques.

From the marketing side, communication must accompany the produce to the market. Simple and clear messages, which are understandable to everybody, create the necessary attention for organic produce.

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INNOVATIVE PLANT-PROTECTION TECHNOLOGY IN ORGANIC VEGETABLE AND FRUIT GROWING AND IN ORGANIC VITICULTURE

HLUCHÝ, M.[1]

Key words: plant protection, innovation in plant protection, organic vegetable growing, organic fruit growing, organic viticulture

Abstract

Successful organic production of special crops such as vegetables, grapevines and fruit depends on the possibility of applying a highly sophisticated plant-protection system, linked with professional advisory services. This contribution compares the protection of organic grapevines, apple trees and some types of vegetables in Switzerland, the Czech Republic, Hungary and Slovakia. The grapevine example explains the inner relationships of such a system and its functioning.

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ROOT DISTRIBUTION OF WINTER WHEAT CULTIVARS AS AFFECTED BY DROUGHT

SCHWEIGER, P.[1]

Key words: wheat, drought, root distribution, genotypic variation

Abstract

Drought stress is one of the main environmental factors limiting crop yields. Choice of drought-resistant cultivars may minimise yield-losses under water-limited conditions. The development of a deeper root system contributes to increased drought resistance.

Based on this information, the genotypic variation in root system distribution in winter wheat was examined in a field experiment. Four winter wheat cultivars were grown under either natural rainfed conditions or with an induced water deficit. Foil tunnels with rollable foil were used to withhold rain during rain events. The distribution of roots was quantified at the wax-ripe stage.

Root length densities were highest in the top 20 cm and decreased down to a soil depth of 60 cm. They increased again in the 60 to 80 cm soil layer, with the lowest values measured in the 80 to 100 cm soil layer. Drought-stressed plants tended to produce less overall root length, and cultivars differed significantly in overall root lengths produced. Cultivars seemed to differ in their reaction to drought stress, but the difference was not significant.

In conclusion, data from additional growing seasons will be necessary to confirm variation in root distribution between cultivars in their response to drought-stress.

Introduction

Cereal grain yields are limited by a number of environmental factors, of which drought is one of the more wide-spread. Knowledge about genotypic variation in drought resistance may contribute to minimise yield-losses under water-limited conditions by choice of suitable cultivars. Drought resistance may besides other factors be conferred by the development of a deeper root system. This may help the crop to use water from deeper soil layers, which has been found to contribute significantly to grain yield (Richards, 2007). Measurements of rooting depth and distribution are however time-consuming and labour-intensive. As a consequence only limited information is available on genotypic variation in these traits.

The aim of the present study was to quantitatively describe the root depth distribution of winter wheat cultivars grown under field conditions with or without an induced water deficit. Potential links between genotypic differences in root depth distribution and yield loss due to drought are subsequently discussed.

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Materials and Methods

A field experiment was conducted in 2006 by the 'Institut für Sortenwesen' of the Austrian Agency for Health and Food Safety. The experiment was located at Oberweiden (E 16° 49' N 48° 18') approximately 40 km NE of Vienna/Austria. The soil at the site is a Tschernosem with a moderate water holding capacity. Average yearly rainfall is 540 mm and average air temperature 9.9° C. Twelve winter wheat genotypes were grown in two adjacent experiments on small plots (3.2–3.3 m^2 net area) randomised in three replicate blocks. One experiment was exposed to natural rain-fed conditions throughout the entire growth period. Foil tunnels with rollable foil were raised above the other experiment at a time when the wheat plants were approaching the end of shooting. Wheat plants in this experiment were exposed to ambient conditions during most of the time. Only at approaching rain events, the foil was manually unfolded to cover the wheat plants. In this way, plants in this experiment received 143 mm less rain than uncovered plants until the wax-ripe stage.

Four soil cores of 2.5 cm diameter (Pürckhauer corer) were taken at approximately the wax-ripe stage. Cores were taken between the rows of four selected winter wheat cultivars to a depth of 100 cm. The cores were separated into 20 cm soil layers, and soil layers of the same depth within each plot were pooled. Roots were washed out of the soil and their fresh weight was recorded. Root lengths were determined by a line-intersect method (Newman, 1966).

Data on the absolute and relative root depth distribution were analysed in SPSS 9.0 using the repeated measures procedure in GLM. Univariate tests were conducted after applying Mauchly's Test of sphericity. In case of significant sphericity, degrees of freedom were adjusted according to Greenhouse-Geisser. Significant treatment or factor effects were assumed at $p<0.05$.

Results

Cultivars differed in overall root lengths produced. These were in all four cultivars reduced by drought stress. Cultivars did however not respond differently in their root production in response to drought stress.

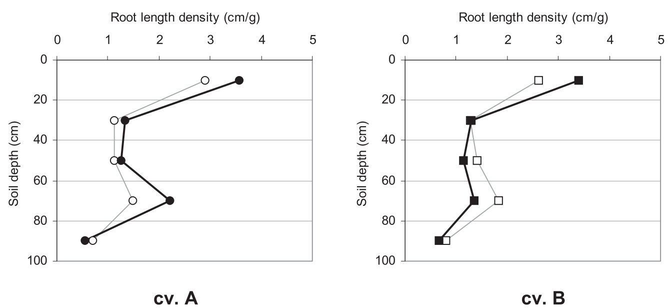

Figure 1. Root length densities of two winter wheat cultivars in cm root g^{-1} soil in the soil profile. Plants were either non-stressed (filled symbols, black line) or drought-stressed (open symbols, grey line).

Root length densities (RLD) of all cultivars ranged from 2.5 to 4.5 cm g^{-1} soil in the top 20 cm (examples given in Figure 1). RLD decreased to 1 to 1.5 cm g^{-1} in 20 to 60 cm soil depth but increased again in the 60 to 80 cm soil layer. The lowest RLD of <1 cm g^{-1} were measured for the 80 to 100 cm soil layer. Cultivars differed in RLD produced which also was affected by water supply. The general reaction of altered root distribution in response to drought was however quite consistent for all genotypes ($p>0.3$). Minor differences are exemplified by two examples given in Figure 1. RLD of cultivar A (left graph) were reduced under drought stress in all but the deepest soil layer examined. Contrary to that, cultivar B (right graph) produced higher RLD in the 40 to 80 cm soil layer under drought stress than when exposed to natural rain-fed conditions.

The relative distribution of roots in the soil profile was significantly affected by water supply. Cultivars did however not differ in the relative distribution of their roots ($p>0.3$) and reacted in this character similarly to drought stress ($p>0.3$).

Discussion and Conclusions

The RLD measured in the present study are comparable to previously reported values (Ford *et al.*, 2006). The observed increase in RLD at 60 to 80 cm soil depth may be due to a relative to the above-lying layers higher water content of the 60 to 80 cm soil layer which may have stimulated root growth (Xue *et al.*, 2003).

Especially one cultivar (cv. B in Figure 1) was under drought stress observed to distribute a greater proportion of its roots in deeper soil horizons. The yield of this cultivar was also much less depressed by drought than yield of for example cultivar A. This cultivar reacted in its root distribution very differently to drought stress. However, the differences were not significant.

Data for root production and distribution presented here are from only one growing season. Additional data will be necessary to determine whether the examined cultivars differ in the distribution of their roots in the soil profile in response to drought stress. Especially the ability to produce roots in deeper soil layers could markedly improve cultivar drought tolerance (Manschadi *et al.*, 2006).

Acknowledgments

I wish to thank my colleagues at Bio Forschung Austria for their assistance in sampling, measuring root lengths and data analysis. The 'Institut für Sortenwesen' of the Austrian Agency for Health and Food Safety planned, set up and conducted the experiments. All work was funded by the Austrian Federal Ministry for Agriculture, Forestry, Environment and Water Management (project Nr. 1315).

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EFFECTS OF ORGANIC WHEAT CULTIVATION IN WIDER ROWS ON GRAIN YIELD AND QUALITY

CAPOUCHOVA, I.[1], BICANOVA, E.[1], PETR, J.[1], KREJCIROVA, L.[1]

Key words: winter wheat, organic cultivation, wide row spacing, grain yield, grain quality

Abstract

Exact field small-plot trials with winter wheat varieties Ludwig and Sulamit (both the quality groups E–elite) in organic farming in the sugar-beet growing region of Central Bohemia were conducted in the years 2005–2007 to test the possibility of increasing in the crude protein content in grain and thereby improving of baking quality (row spacing 125, 250 and 370 mm, sowing rates 200, 300 and 400 germinating grains per m2) under the change of the wheat stand structure. Statistically significant increase of crude protein content in wheat grain dry matter by approximately 0.7 % was found at widening of row spacing from 125 to 250 mm and by about 1.5 % by widening of row spacing from 125 to 375 mm. So, the treatments cultivated in wider row spacings fulfilled the requirement for crude protein content in grain dry matter of food, baking wheat for minimum 11.5 %. Increase of sedimentation test Zeleny values was found at widening of row spacing from 125 to 375 mm, too. Wheat cultivation in wider rows had no negative impact on the grain yield.

Introduction

It is now clearly established that wheat grain quality is a function of grain composition, principally in proteins (Triboi *et al.*, 2000). Also, according to Pan *et al.* (2006) grain nitrogen concentration is one of the main quality parameters of wheat grains.

Organic techniques of cultivation can have an adverse effect on the technological quality, especially when protein content is an important factor. Lower protein content in the wheat grain limit the possibilities of food and baking processing (Moudry&Prugar, 2002). For wheat under the system of organic farming not using mineral nitrogen fertilizers, it is necessary to find another way that should have allowed increase of protein content and hence, improvement of baking quality. Protein production in grains, particularly of gliadins and glutenins, is also affected by duration and intensity of irradiation of plants in the stand (Petr *et al.*, 1987). Therefore, different type of wheat stand structure (wider row spacings, lower sowing rates) than in conventional farming, where it is seeded into narrow rows, could be one of the options, how to improve baking quality of organic wheat.

Materials and Methods

Exact small-plot field trials with two varieties of winter wheat Ludwig and Sulamit (both quality class E – elite) were conducted in the years 2005–2007 on the experimental station of

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the Department of Plant Production of CULS Prague in Uhrineves (sugar beet growing region, 295 m above sea level, average annual temperature 8.4°C, average annual sum of precipitation 575 mm). Clay-loam cambisol has a topsoil deep 250–300 mm, with neutral pH; humus content 1.74–2.12 %. Experimental station Uhrineves is certified organic for conductance of experiments in organic agriculture. Experiments were carried out by the method of randomised blocks in four replications; average size of experimental plot was 10 m^2. Three row spacings were used in the trial: 125, 250 and 375 mm and three sowing rates – 200, 300 and 400 germinating kernels per m^2. Pea was the preceding crop. Hoeing at wider row spacings was used two times during the spring vegetation; narrow rows were two times harrowed. After harvest of the trials the yield was assessed, crude protein content in grain dry matter (Czech Standard ČSN ISO 1871) and Zeleny´s sedimentation test (ČSN ISO 5529) were determined, too. Yield results and results of the quality evaluation were statistically assessed by analysis of variance of multiple classification (ANOVA) in the SAS system, significance of differences between means of varieties, years, sowing rates and row spacings was verified by LSD test, $\alpha = 0.05$.

Results

In all evaluated years increase of crude protein content in grain dry matter was found with increasing row spacing. At the row spacing 250 mm higher content of crude protein by 0.7 % was recorded, whereas at the row spacing of 375 mm this value was higher by 1.54 % compared to variant with traditional narrow row spacing of 125 mm (Tab. 1). On the contrary, sowing rate was not affected statistically significantly by the crude protein content.

Tab. 1: LSD test for the wheat grain yield, crude protein content in grain dry matter and Zeleny test – significance of differences among averages of varieties, row spacings, sowing rates and experimental years (LSD, α=0.05)

		Grain yield ($t.ha^{-1}$)	Sign.	Crude protein content (%)	Sign.	Zeleny test (ml)	Sign.
Variety	Ludwig	5.54	a	11.30	a	39.56	a
	Sulamit	5.28	b	11.70	b	43.97	b
d_{min}		0.22		0.28		2.19	
Row spacing (mm)	125	5.35	ab	10.76	a	38.63	a
	250	5.28	a	11.45	b	41.35	a
	375	5.59	b	12.30	c	45.33	b
d_{min}		0.24		0.42		2.76	
Sowing rate (germinating grains . m^{-2})	200	4.85	a	11.50	a	42.11	a
	300	5.57	b	11.52	a	41.17	a
	400	5.80	b	11.49	a	42.04	a
d_{min}		0.30		0.37		2.48	
Year	2005	5.59	a	11.35	a	41,80	a
	2006	5.54	a	11.44	a	41,74	a
	2007	5.09	b	11.72	b	41.78	a
d_{min}		0.24		0.36		2.05	

d_{min} = least significant difference

Baking quality not only depends of protein quantity but also of quality. The quality of protein complex in view of baking utilisation is very well characterised by Zeleny´s sedimentation test. The Czech standard gives 30 ml as a bottom limit of Zeleny´s test for baking wheat. It is evident from our results (Tab. 1), that both evaluated varieties Ludwig and Sulamit exceeded this value. With an increase of row spacing also in the case of Zeleny´s test increased the values of this analysis, but the minimum amount of Zeleny´s test for baking wheat was reached even in the variants cultivated in traditional narrow rows.

Apart from the quality of production in cultivation of organic wheat in wider row spacings, it is necessary to pay attention to the grain yields. It is evident from our results that the grain yield was affected by all evaluated factors – variety, row spacing, sowing rate and experimental year, but it is possible to say, that the effect of row spacing was the least. In addition, the highest average yield was reached in variants cultivated at the widest rows 375 mm; stand density varied between 355–427 ears per m^2, number of grain per ear between 28–36, grain weight per ear between 1.1–1.5 g and 1000 grains weight between 44–45 g (Sulamit) and 46–48 g (Ludwig). Yield components structure of variants cultivated in narrower rows was not too different, so that the yield differences between individual row distances were not high.

The highest yield was recorded at the highest sowing rate (400 germinating grains per m^2); the difference between sowing rates 300 and 400 germinating grains per m^2, however, was statistically not significant (Tab. 1).

Discussion

It follows from our results that protein content in wheat grain dry matter and values of Zeleny´s test increased with increasing row spacing; the best results were achieved in the widest tested rows 375 mm.

The above mentioned results are in congruency with the conclusions made by Förster *et al.* (2004) where it had been proved that at wide row spacings not only increases the protein content but also the values of sedimentation test. The results of the tests showed globally that high baking quality in wheat can be achieved using this system.

Hiltbrunner *et al.* (2005) performed similar research. They reported in their study a statistically significant increase in crude protein content in grain dry matter (by about 1%) at widening of row spacing from 187.5 to 375 mm. At the same time they add that no decrease in grain yield was found with increasing row spacing.

According to Petr *et al.* (1987), by different structure of winter wheat stand that should allow as best as possible irradiation benefit, it is possible to support the protein synthesis in grain. In addition, different stand organisation in wheat cultivation in wider rows could lead to better stand aeration and reducing of moist microclimate, suitable for plant diseases spread.

As reported by Förster *et al.* (2004) the selection of a suitable variety in organic farming is very important input factor. The use of varieties from quality group E (elite) is above all a prerequisite of success of cultivation of baking wheat in organic farming, because according to Petr *et al.* (1998), the varieties with genetically established good milling and baking quality preserve these traits at different cultivation systems, i.e. also at lower inputs. It is also evident from our results that the values of Zeleny´s sedimentation test were relatively high also in the variants cultivated in traditional narrow rows. These results giving evidence of prevailing genotype dependence of Zeleny´s test are in accordance with e.g. conclusion made by Matuz (1998) and Kadar & Moldovan (2003).

In cultivation in wider row spacing, particularly 375 mm, a strong competition between plants and reduction of the cumber of plants during vegetation are manifested. So, it can be said that in congruency with conclusions made by Förster *et al.* (2004), in wheat cultivation in wider row spacings lower sowing rates can be applied (approximately 300 germinating grains per m^2) than are usually applied in wheat cultivation in traditional narrow row spacings, without significant impact of this reduction of sowing rate on the grain yield.

Conclusions

Our results confirmed the possibility to increase the crude protein content in grain and improvement of baking quality of winter wheat in organic farming system under the change of the stand structure – cultivation of wheat in wider row spacings. Variants cultivated in wider row spacings fulfilled the requirement for crude protein content in grain dry matter of baking wheat for minimum 11.5 % (Czech standard). Wheat cultivation in wider rows had no negative impact on the grain yield.

Acknowledgments

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EFFECT OF THREE PRECEEDING CROPS ON YIELDS AND QUALITATIVE CHARACTERS OF WINTER WHEAT IN ORGANIC FARMING SYSTEM IN THE YEARS 2006–2007

KLIMEKOVÁ, M.[1], LEHOCKÁ, Z.[2]

Key words: winter wheat, preceeding crops, grain yields, qualitative parameters

Abstract

The aim of the study was to evaluate yields and selected qualitative parameters of winter wheat cultivated after three different preceeding crops in the years 2006–2007. Stationary field experiment was established on a loamy luvi-haplic chernozem in a maize –barley growing region in South – Western Slovakia. The tested variety Bardotka has a know good content of gluten and high values of sedimentation test. Average grain yield was 5.36 t/ha. The differences among winter wheat after different preceeding crops were statistically significant. The average yield after alfalfa was 5.93 t/ha and 5.20 t/ha after spring barley (winter wheat was amended by farm manure) and winter wheat yield after pea was 4.97 t/ha. Crude protein content was the highest after preceeding crop alfalfa (10.21 %). The lowest values of crude protein content and Zeleny sedimentation test as well as wet gluten content were determined after pea. In the years 2006–2007 the most suitable quantitative as well as qualitative parameters of winter wheat were obtained after alfalfa.

Introduction

The popularity of organic food and the farming area managed according to organic agriculture practices have been increasing during the last years. It is not clear, whether foods from organic and conventional agriculture are equal with respect to nutritional quality. Wheat (*Triticum aestivum L.*) as one of the most important crops offer a wide range of substances relevant for human nutrition (Langenkämper, G.; Zörb, C.; Seifert, M.; Mäder, P.; Fretzdorff, B. and Betsche, T. (2006). In organic farming winter wheat is typically grown after good pre-crops, as it pays well for this in terms of yield and quality. Wheat is valuable crop in organic farming, and much effort has been put into optimising yields and quality of organically grown wheat. A good pre-crop is typically one that leaves much available N in the soil that ideally is not released in higher amounts before winter to avoid nitrate leaching. (Pedersen, L.; Thorup-Kristensen, K. and Loges, R., 2006).

The aim of the paper is to evaluate the effect of three preceeding crops on grain yields and selected qualitative parameters of winter wheat in the years 2006–2007.

Materials and Methods

The stationary field experiment was established in the year 1990 at Borovce near Piešťany town (western part of the Slovak Republic) on a loamy luvi-haplic chernozem. The territory has

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continental character of climate with a mean annual precipitation of 593 mm per year (358 mm during the vegetation period) and with an annual temperature average of 9.20C (15.50C during the vegetation period). The area is classified as maize – barley growing region. The experimental design consists in a split plot arrangement with two replications. There were two six strips of field tested in the experiment: a1) alfalfa – alfalfa – winter wheat – sugar beet – spring barley – maize for grain, a2) maize for grain – spring barley – winter wheat – spring barley – pea – winter wheat. Farm yard manure at the rate of 40 t/ha was applied after spring barley. The harvested area of one plot represented 75 m2 (3x25 m). The agro technical operations were realized in accordance with the Law NR SR No. 421/2004 about organic farming. The model variety of winter wheat was variety Bardotka with the quality standard E, the sowing rate was 500 viable kernels per square meter at a row distance of 125 mm. Experimental plots were harvested at full maturity. Crude protein content was determined by the Dumas method (% N x 5.7) in according to the Slovak Technical Standard STN 46 1011. Selected indicators of baking quality included: test weight of grain according to the Slovak Technical Standard STN 46 1011-5, sedimentation index according to Zeleny (STN – ISO 5529), fall number according to the STN – ISO 3093, wet gluten content according to the STN 461011-9.

Obtained results were evaluated by variance analysis, differences testing by Tukey test.

Results and Discussion

Weather conditions are listed in the table 1a and 1b. During the two year trial period it was recorded that variability of winter wheat grain yield was not significantly affected by years. Grain quality indicators were significantly influenced by years or by interaction between years and preceeding crop. Grain yields of winter wheat were significantly influenced by the preceeding crop (table 2).

Table 1a: Weather conditions in the year 2006 (Borovce)

Month	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.
Temperature (°C)	-4,82	-2,51	2,1	11,53	14,75	18,99	22,96	17,31	17,21	12,38	7,43	3,07
Precipiation (mm)	56,1	30,1	25,3	52,7	66,5	136,2	0,5	83,7	0	30	49,4	13,3

Table 1b: Weather conditions in the year 2007 (Borovce)

Month	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	IX.	X.	XI.	XII.
Temperature (°C)	3,47	4,32	7,65	11,32	16,5	20,36	21,28	20,6	12,78	8,64	2,76	-1,00
Precipitation (mm)	53,1	36,2	56	0,0	58,9	55,7	33,8	93,6	109,6	34	36,2	32

Table 2a: Grain yield (t/ha) and test weight of grain (g/l) of winter wheat, variety Bardotka in the years 2006 and 2007 after three preceeding crops

Preceeding crops	2006	2007	Average	2006	2007	Average
	Grain yields			Test weight of grain		
Alfalfa	5.96	5.91	5.93a	772	757	765a
Pea	5.09	4.85	4.97b	763	755	759a
Barley	5.47	4.92	5.20ab	724	739	731b
Average	5.51	5.22	5.36	753	750	752

Averages values followed by the same letter in column do not differ significantly at P<0.05.

The lowest yields of winter wheat were after pea (4.97 t/ha), higher yields were after spring barley (5.20 t/ha) and significantly higher yields were after alfalfa (5.93 t/ha, ** $P<0.05$). In the tables 2b and 2c the selected qualitative parameters of winter wheat as influenced by the preceeding crop and year conditions are presented. In line with Muchova (2001) the year was a factor which significantly influenced selected qualitative parameters and also our results confirmed the strong impact of weather conditions on almost all characters of quality of winter wheat mainly in the ripening stage.

Table 2b: Crude protein content (%) and wet gluten content (%) after three preceeding crops in the years 2006–2007

	Crude protein			Wet gluten		
Preceeding crops	2006	2007	Average	2006	2007	Average
Alfalfa	9.61	10.8	10.21	20.25	25.35	22.8
Pea	9.23	9.16	9.2	18.75	19.2	18.98
Barley	11.07	9.07	10.07	26.2	17.65	21.92
Average	9.97	9.67	9.82	21.73	20.73	21.23

The average test weight of grain (table 2a) corresponded with the quality grade B (752 g/l) according to the Slovak Technical Standard STN 46 1100-2. Statistically significantly higher (** $P<0.05$) test weight of grain was obtained after both alfalfa (765 g/l) and pea (759 g/l) then after spring barley (731 g/l). The highest crude protein was after alfalfa (10.21 %), statistically significant differences were only with interaction year x preceeding crop (** $P<0.05$). According to the average content of proteins, the grain of winter wheat in our experiment was classified into the category P.

The physiology studies have showed that winter wheat has high nitrogen consumption mainly in the second part of the vegetation period, in the period of intensive grain production and filling (Michalík, 1992). In the year 2006 (Table 1a) the temperatures and precipitation were divided uniformly during the whole vegetation period and therefore the optimal nutrient mode was obtained in the period where the quality parameters of winter wheat were formed. Nitrogen releases from farm yard manure and subsequent uptake probably caused higher content of

Table 2c Falling number (s) and Sedimentation test (ml) after three preceeding crops in the years 2006–2007

	Fall number			Sedimentation test		
Forecrops	2006	2007	Average	2006	2007	Average
Alfalfa	337.0	422.0	379.5a	44.0	43.0	43.5ab
Pea	328.0	401.0	364.5a	40.5	34.0	37.3a
Barley	381.5	400.5	391.0a	58.0	31.5	44.7b
Average	348.8a	407.8b	378.3	47.5a	36.2b	41.8

Averages values followed in the same letter in column or in the line do not differ significantly at $P<0.05$.

protein as well as wet gluten in the grain of winter wheat after spring barley compared with the other two treatments. On the contrary in the year 2007 the deficit of rainfalls in the months March and May or the deficit of rainfalls in the month April may have caused a decreased nitrogen mineralization from farm yard manure resulting in a lower content of crude protein and wet gluten.

The average fall number was 378.3 s, statistically significantly higher was fall number in the year 2007 (407.8 s) in comparison with the year 2006 (348.8 s, ** $P<0.01$). The average content of sedimentation test according to Zeleny was 41.83 ml and the content was suitable for the standard quality of winter wheat (STN 4601100-2). Statistically (** $P<0.05$) lower content of sedimentation test was after pea (37.3 ml) in comparison with alfalfa (43.5 ml) and spring barley (44.7 ml). Weather conditions significantly influenced (** $P<0.01$) the level of the sedimentation test, in the year 2006 the average value was 47.5 ml and in the year 2007 only 36.17 ml.

Conclusions

Conditions of analysed years statistically modified qualitative parameters of winter wheat grain (fall number ** $P<0.01$, sedimentation test ** $P<0.01$).

Interaction year x preceeding crops modified the selected qualitative parameters of winter wheat.

Preceeding crops significantly influenced grain yields and test weight of grain in the years 2006–2007.

The most suitable quantitative and qualitative parameters of winter wheat grain were obtained after alfalfa in the organic farming system.

Qualitative parameters of winter wheat were more favourable in the year 2006 than in the year 2007.

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THE ABILITY OF VARIOUS WINTER WHEAT GENOTYPES TO SUPPRESS WEEDS IN CONSIDERATION OF THEIR DEVELOPMENTAL DYNAMICS AND MORPHOLOGICAL TRAITS IN AN ORGANICALLY MANAGED FIELD

PETRASEK, R.[1]

Key words: organic farming, winter wheat, weed, competitive ability

Abstract

In organic farming choice of suitable crop cultivars with the ability to suppress weeds effectively is a beneficial cultural technique for weed control. In this context a study was conducted with winter wheat to determine the influence of growth dynamics and shoot morphology on competitive ability against weeds. A further intention was to identify parameters that contribute to this characteristic that may be considered in future breeding efforts.

From 2004–2007 three field experiments with various winter wheat genotypes were conducted. Aboveground wheat and weed biomass was destructively harvested at different wheat developmental stages. Wheat leaf area was measured and biomass data were used to calculate growth rates. Wheat height development, leaf orientation and wheat as well as weed cover were assessed throughout the growth periods.

A high number of shoots in combination either with many or big leaves in spring and a rapid height growth at shooting were important. The development of a rather horizontal leaf structure in combination with a constant biomass development until flowering proved advantageous. During wheat ear emergence a considerable genotypic variation in the effect on weed growth was observed.

In conclusion, our work identified characteristics with a genotypic variation that may be used for the breeding of winter wheat varieties that are generally strong competitors.

Introduction

Due to the abandonment of herbicides weed control in organic farming is achieved by a combination of mechanical (e.g. mulching, thermal and biological treatments) and cultural practices (such as tillage, crop rotation, cultivation method). The latter include choice of suitable crop cultivars with the ability to effectively suppress weeds. In this context a study was conducted with winter wheat (*Triticum aestivum L.*) to determine the influence of growth dynamics and shoot morphology on competitive ability against weeds. Weed suppression proved to be a useful parameter in contrast to weed tolerance, because the ranking of the genotypes regarding weed suppression was detected as nearly stable throughout all examination years (e.g. Verschwele, 1994). Interspecific competition is a dynamic process that lasts the whole vegetation period.

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Nevertheless, at some development stages of winter wheat a strong competitive ability is more important for an effective weed suppression.

Winter wheat is of particular importance for organic as well as for conventional farming systems. Significant differences of winter wheat genotypes in weed suppression are well documented (e.g. Blackshaw, 1994). This genotypic potential, however, has not been utilised enough by farmers and breeders so far (Weiner, Griepentrog & Kristensen 2001).

In Austria, separate organic VCU (Value for Cultivation or Use) -test trials of wheat genotypes have been conducted by the Austrian Agency for Health and Food Safety (AGES) since 2002. In these trials new wheat parameters as leaf orientation and light perception are surveyed.

A further aim of our project was to detect additional wheat parameters, which improve weed competition and moreover may be considered in future breeding efforts. These characteristics should be fast as well as easy to measure and should be highly heritable.

Materials and Methods

The field experiments with various winter wheat genotypes were conducted in eastern Vienna, Austria (48°11´N, 16°31´E) in three vegetation periods from 2004 to 2007 in a fully-randomised plot experiment with four replicates. The soil type at this site ranged from loamy sand to sandy loam. The region is one of the driest in Austria with an average rainfall of 540mm per year. Winter and early spring conditions differed between the experiment years. The preceding crops were pea (2004 & 05) and potatoes (2006). Nitrate contents of the soil till 90 cm depths were between 136 kg/ha and 211 kg/ha in autumn and between 121 kg/ha and 288 kg/ha in spring.

Weed biomass was used as an indicator for the efficiency of the wheat genotypes to suppress weeds. Emergence and growth of the natural weed flora of this habitat was not manipulated. Aboveground wheat and weed biomass was destructively harvested at different wheat developmental stages (at the beginning and in the middle of shooting, ear emergence, the beginning of ripeness and maturation). Wheat leaf area was measured and biomass data were used to calculate growth rates. 2004/05 total weed biomass was sorted according to species or genus, for example *Galium spp*. and *Stellaria media*. Wheat height development and leaf orientation were assessed throughout the growth period. Wheat as well as weed cover density were quantified at tillering.

Results and Discussion

The wheat genotypes varied in developmental dynamics of biomass, height and leaf area as well as in ground cover and leaf orientation. Total weed biomass and its dynamic differed in the various winter wheat genotypes (figure 1).

Weed biomass on the fields varied strongly between experimental years. At the beginning of wheat shooting no significant genotypic differences in the amount of weed biomass were obtained (p=0,16). However, during wheat ear emergence a considerable genotypic effect on weed growth was observed (p=0,028). Weed suppression ability of the winter wheat genotypes was not dependent on yearly conditions. Thus, the amount of the aboveground weed biomass at ear emergence was found to best characterize the competitive ability of wheat genotypes against weeds.

An analysis of the complete dataset revealed that early development is one of the most important characters for competitive ability. This confirms previous work on weed suppression by wheat (e.g. Coleman & Gill, 2003).

A high number of shoots in combination either with many or big leaves and a rapid height growth at shooting were similarly important. For an effective weed suppression it was further important for the wheat plants to remain strong competitors throughout the growing period until the end of flowering. The development of a rather planophile (horizontal) leaf structure in

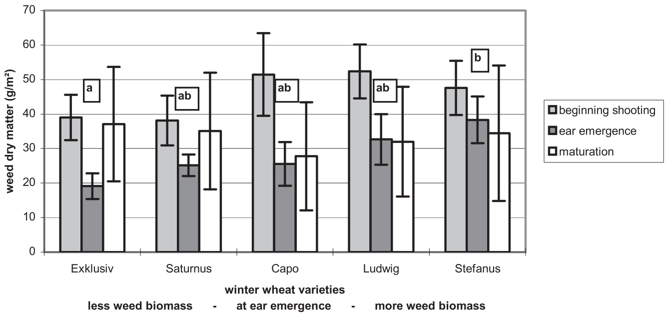

Figure 1: harvested weed biomass from 2004 to 2007 in winter wheat crop; bars represent mean weed dry matter at beginning of shooting (n=12), at ear emergence (n=10) and at maturation (n=8) of 5 winter wheat varieties. the error bars stand for the standard error of the mean. Significant differences between means at ear emergence at the 5% level (Tukey-HSD) are indicated by different letters.

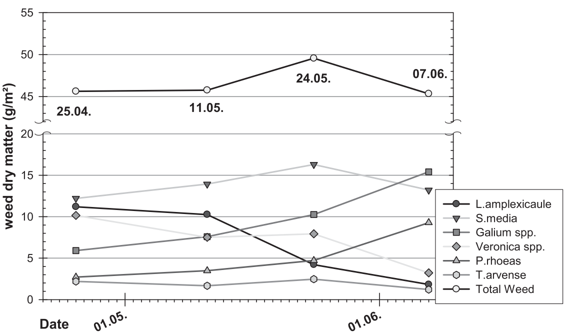

Figure 2: Biomass development of weed species and total weed 2004/05; harvest times were at the beginning and in the middle of shooting, ear emergence and at the beginning of ripeness; data points represent arithmetic mean of 64 (1.& 4. harvest) and 32 (2.& 3.), respectively measured values in all wheat varitiety plots

combination with a constant biomass development until flowering thus proved advantageous. For instance, a proportionally large increase in wheat biomass during tillering relative to subsequent growth resulted in more weed biomass at the beginning of wheat maturation. This reaction was strongly related to differences between weed species in their developmental dynamics during the vegetation period (figure 2). For example, *Lamium amplexicaule* was dominant at the beginning of shooting but disappeared towards ear emergence. In contrast, *Galium spp.* markedly increased in biomass at ear emergence and could thereby potentially outcompete wheat varieties that are only competitive in an early developmental stage.

The observed wheat parameters and the significant developmental stages at which they should be measured (e.g. height at shooting, shoot number and vigour at the end of tillering), verified by weed biomass, are mainly similar to the characteristic traits considered in the organic VCU-test trials of AGES (Oberforster *et al.* 2003).

Conclusions

In conclusion, our work identified characteristics with a genotypic variation that may be used for the breeding of winter wheat varieties that are generally strong competitors. Nevertheless, the ecology of the weed flora or at least of the relevant weed species, the developmental dynamics – above and below ground – of winter wheat genotypes as well as the climate and soil conditions of a field should be known and need to be considered for an effective weed control.

Acknowledgments

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YIELD AND QUALITY OF CROPS FROM ORGANIC MIXED CROPPING SYSTEMS WITH OIL CROPS

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Key words: oil crops, organic farming, mixed cropping, quality

Abstract

Yield and quality of crops grown in mixed cropping systems with legumes or cereals and different oil crops were determined. The idea of the cropping system is to produce enough vegetable oil per hectare to run the farm machinery and simultaneously uphold food production. In the trials, Pisum sativum L.(P) was grown with Camelina sativa L. Crantz (FF), Sinapis alba L. (WM) or Brassica napus L. (SR); Lupinus angustifolius L. (BL) was mixed with Camelina sativa L. or Carthamus tinctorius L. (SF) and Triticum aestivum L.(SW) was cultivated in combination with Linum usitatissimum L. (LS) or Camelina sativa L.; in winter crops Brassica napus L. (WR) was mixed with Hordeum vulgare L. (WB), Secale cereale L. (RY) or Pisum sativum convar. speciosum (WP). Seed yields of the different sole and mixed cropping systems were highly variable. Higher oil contents were found in FF seeds from mixed cropping with LS than in seeds from sole cropping. Furthermore, FF showed higher glucosinolate contents in mixtures. FF oil from mixed cropping showed a higher alpha-linolenic acid and a higher sensory quality. When combined with FF or LS, SW showed an increase in seed development, protein- and wet gluten-contents. Grain weights and grades were reduced in WB and RY when grown together with WR. Other quality parameters did not differ.

Introduction

Organic farmers are highly interested in producing vegetable oil because oil and oilcake are high-priced, valuable components in human and animal nutrition. Furthermore, vegetable oil is seen as the cheapest and most readily-available technology in the area of bio-fuels if the costs for CO_2-reduction are considered (SRU, 2007). Cold pressed vegetable oils can be produced in decentralized oil mills at the farm level, and provide energy for farm machinery. This would be an important step in making farming systems self-reliant in terms of energy. High pest and disease infestations (rapeseed) or low weed competition (linseed) make oil crops difficult to produce in organic farms. Rapeseed's high N-demands make it a competitor to other crops with higher yield security in the crop rotation. It was shown that mixed cropping with oil crops can offer higher weed competition and an increase of natural predators for pests (Paulsen *et al.* 2006). Yields and quality of different oil crops grown in sole and mixed cropping systems and their corresponding impact other crops of the mixtures are summarized in this article (Matthäus 2007, Paulsen and Seling 2007).

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Materials and Methods

The trials reported here were conducted in 2004 and 2005 on four organic farms in Germany. Mixtures of the following crops were tested in completely randomized block designs with four repetitions: Peas (P) were grown with false flax (FF), white mustard (WM) or spring oilseed rape (SR)); blue lupines (BL) together with false flax or safflower (SF) and spring wheat (SW) in combination with linseed (LS) or false flax; winter oilseed rape (WR) was mixed with winter barley (WB), winter rye (RY) or winter peas (WP). All crops were grown in alternating rows with a row distance of between 12.5 and 14.5 cm. To compare quality parameters and to determine land equivalent ratios (LER) (Mead and Willey 1980), each of the component crops was also grown in sole cropping. The mixed crops were harvested together with a plot combine and later separated. Straw yields were determined by a manual square-meter-harvest. The quality parameters were determined with the following methods: Oil crops: Oil content ISO 659: 1998; Fatty acid composition, ISO 5509: 2000; Tocopherol composition, HPLC method with fluorescence detection; Sterol composition, GC ISO 12228: 1999 (E); Glucosinolates (GSL) HPLC with UV-detection; Sinapines, HPLC with UV-Detection, Sensoric quality DGF C-II 1 (97). Cereals: TGW, hl-weight, ergot percentage, crude protein, wet gluten content, gluten index, ash and mineral content of flour, falling number, amylograph, dough elasticity, extension test, RMT-volume, wheat gluten, alpha-amylase activity, moisture content of dough, gluten index, water absorption capacity, sieve grades of barley. Details and references on the methods in field and laboratory are given in by Paulsen; Matthäus; Paulsen and Seling (2007).

Results

The yields of the mixed and sole cropping systems are summarized in Table 1 with average values of all sites. Additionally, maximum yield values are given indicating the sites with the highest yield of the first crop or the oil crop in the mixed cropping system, respectively. In the following comments the ranges of the site seed yields in t ha^{-1} dry matter of the different cultures in sole and mixed cropping are indicated in brackets (sole cropping/ mixed cropping): In FF (0.03–2.2/0.1–1.7) in mixtures with P (0.4–3.8/0–3.2) and SW (1.5–5.8/1.1–4.8) relatively low yield depressions in the 1st crop occurred. BL's (0.3–3.9/0.06–0.9) in mixture with SF (6.4–2.6/0.03–2) were heavily overgrown and lost a high number of kernels in the field due to different ripening times of the different cultures. But average LER values >1 were typical for all tested mixtures with FF or SF. In mixtures of P's and WM (0.2–1.8/0.02–1.6) the P's were suppressed. But LER values >1 were possible. LS (0.2–1.7/0.06–0.28) could not compete with SW of FF successfully and had over-proportionally high yield losses compared to sole cropping systems. But a small linseed production could be kept upright. SR (0–0.04/0–0.04) was totally destroyed at almost all sites, mainly through insect pressure. Also WR (0.2–1.2/0.04–0.8) had high yield losses. WB (2.4–6.3/0.2–4.1) sown early at end of August together with WR showed better field establishment and higher yields than WB sown late between the WR rows after hoeing (see Table 1, footnote [d]). RY (2.9–5.9/0.3–4.8) established more securely in the mixtures with WR, but dominated yields. The high LER in WP results from peas standing upright in the mixture contrary to lodging sole cropped peas with heavy yield losses. Further own trials on seed densities of WW x WR showed that the partners in this mixture directly compete for resources. This is obvious in the strong negative linear correlation of the low

Table 1: Seed yields [t ha^{-1} dry matter] of the components in different mixed cropping systems and in sole cropping, (means resp. maximum values of four sites and two years in Germany, 2004 and 2005)

	Means of all sites and years					Means of one site	
	1st crop	oil-crop	total	oil-crop		maximum at[a]	
	sole	sole	mixed	mixed	LER	1st crop	oil-crop
PxFF		1.10±0.6	1.87±1.1	0,75±0.6	1.4	3,2/0,1	0,7/1,7
PxSR	1.47±1.4	0.04±0.0	1.76±1.4	0.02±0.1	b	3,2/0,1[b]	3,2/0,1[b]
PxWM		0.63±0.6	1.11±1	0.45±0.5	1.2	2,5/0,2	0,7/1,6
BLxSF	1.41±0.9	1.08±0.8	1.27±0.9	0.80±0.6	1.1	1,1/0,7	0,9/2,0
BLxFF			1.66±0.7	0.75±0.7	1.3	1,7/0,1	1,1/1,5
LSxFF	0.74±0.6	1.10±0.6	1.14±0.7	0.90±0.7	1.1	0,5/0,1	0,3/2,1
SWxFF	3.66±1.3		3.03±1.2	0.37±0.3	1.1	4,1/0,4	4,1/0.7
SWxLS		0.74±0.6	3.14±1.2	0.14±0.1	1.0	4,8/0,3[c]	4,8/0.3[c]
WPxWR	0.32±0.3		0.87±0.4	0.49±0.3	1.9	0,9/0,2	0,2/0,8
WBxWR	3.58±1.6	0.72±0.5	1.91±1.5	0.25±0.3	0.8	4,1/0,1[d]	0,2/0,7[d]
WRyxWR	4.49±1.4		2.75±1.7	0.13±0.1	0.8	4,7/0,1	0,3/0,2

[a]first crop/oil-crop, [b]SR destroyed by *M. aneus* at most sites [c]same site and year [d]same site different years

rapeseed and wheat yields (Figure 1). Some significant statistical differences were found in quality parameters of seeds from each system (SAS: GLM-ANOVA, means test LSD, p=0.05, statistically firm differences are indicated by different letters). They might indicate different competitive conditions for site resources in the cropping systems. On average over all sites and years SW from sole cropping compared to SW from mixed cropping with FF or LD showed lower crude protein [%] (SW 11.7b, others 12,8a) and wet gluten contents [%] (SW 24b, others 26a). Thousand grain weights [g] of SW were highest in SWxLD (44.1a), followed by SW (42.7b) and lowest in SWxOL (42.1c). No other clear significant differences were found. RY from mixed cropping with WR showed lower hl-weights [kg] (RY 74.1a, RYxWR 72,6b) but higher falling numbers (RY 196a, RYxWR 183b). Sieve grades from WB from mixed cropping with WR were downsized in comparison to sole cropped WB [%] (WB >2,8mm: 62a, 2.2–2.5mm: 14a, <2,2mm: 2.7b, WBxWR >2,8mm: 56b, 2.2–2.5mm: 17b, <2,2mm: 3.8a) and even hl-weight was reduced [kg hl^{-1}] (WB: 62a, WBxWR: 61b). The other tested quality parameters of the cereals in the trials showed no significant differences when grown in mixed cropping with oil crops. Oil crop quality differed only slightly, and sometimes only for a single site. At the sites with the highest yields of both components in both years LS with FF in mixtures showed increases in oil contents [%] (LS 38.6a, FF 37,5a) compared to their seeds from sole cropping systems (LS 37.7a, FF 35.5a). On the three sites with significant FF oil yield, FF showed an increased alpha-linolenic-acid content when grown together with LS. The differences in the overall mean of four sites proved not to be statistically different [%] (FFxLD 35.8, FF: 32.7). The GSL of FF was oppositely influenced. On two sites the concentrations were significantly lower in mixed cropping with P, LS, BL and SW compared to

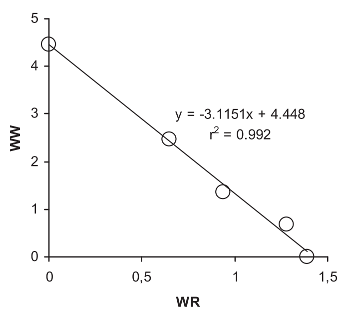

Figure 1: Yields of WR and WW in mixed cropping

the sole cropped FF. The average of all sites did not reveal this effect as significant [umol g^{-1}] (FF 16, PxFF 17.3, LuxFF: 18.7, SWxFF: 22.8, OLxFF 19.1). In the other quality parameters in oilseeds no comparable trends could be determined.

Discussion

Different site and weather conditions with resulting differences in field establishment caused very heterogeneous yield results. FF was relatively stable in all mixed cropping systems. Yield levels adapted to the competitive strength of the companion crops. Maximum oil yields of 629 kg ha^{-1} (37% oil) in PxFF were reached under high depression of the P yield. But at oil yields of 370 kg ha^{-1} in PxFF a significant feed production (3.2 t ha^{-1} P) would be kept upright and oil cake is produced as a by-product. The oil yield would roughly cover the fuel demand of 3 ha farmland when used as fuel in farm machinery. The measured changes in quality parameters like crude protein and wet gluten in cereals and the contents of oil or GSL of seeds and alpha-linolenic-acid of the oil give hints on systematic competitive differences between the mixed partners compared to their sole cropping. This might be used to enhance quality of crops with directed mixtures. The negative effects on grain development in cereal x WR mixtures indicate more strict competition situations.

Conclusions

The tested mixtures of legumes and cereals with oil crops showed different suitability in homogeneous crop development until harvest. FF proved to be a buffering mixture component, whereas LS had low, and SF and WS high competitiveness. The mixtures of cereals with WR showed no real yield advantages compared with sole cropping systems. Quality parameters of the crop components were differently affected. But hints that competition of species in mixed cropping systems is different compared to sole cropping systems might be used to regulate quality parameters. Successful mixed cropping systems with oil crops can produce more energy that is needed for crop cultivation. Food production can simultaneously be kept upright.

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YIELD FORMATION IN WHEAT (*Triticum aestivum* L.) IN ECOLOGICAL AGRICULTURE

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Key words: ecological agriculture, wheat, yield components, structure of yield.

Abstract

This contribution presents the results of the formation of yield elements in winter wheat grown in ecological agriculture. Two cultivars of winter wheat, EBI and ESTICA were grown in stands of different densities (with 250 and 500 seeds sown per 1 m² respectively) and in two periods of sowing (September and October). In the vegetative period there was a loss of plants during the period of sowing and germination of about 20% and with the higher sowing rates of up to 30%. With late sowing, 45 to 55 % plants were lost during germination. Overwintering was worse in the stands that had been sown later, due to insufficient cold resistance. The yields were higher with early sowing in the second half of September. The sowing rate of 250 seeds per 1 m² was insufficient; the optimum rate would have been 400 seeds. In each ear up to 35 seeds with a mass of 1.65 g can be formed and the mass of 1000 seeds should be high; in our experiment it was 47.2 g. In the described experiment this structure of the yield components brought an average yield of 6.56 tonnes per hectare. The hypothesis that yield in ecological agriculture is formed by the ear productivity has been confirmed. This is also associated with the release of acceptable nitrogen in the soil.

Introduction

Since 1991 the Czech University of Life Sciences in Prague is engaged in the research of ecological growing of field crops and in cereals with the focus on the suitability of cultivars for ecological agriculture as well as on agricultural technology and quality of production (Petr and Skerik 1999; Petr 2005, 2006). The formation of the cereals yield is a dynamic process, which starts with the establishment of the crop stand, performance of the stand, nutrients and treatment of the stand.

A specific feature of the ecological method of growing is the supply of nutrients, which is based on nutrients from organic fertilizers and, if necessary, from permitted natural mineral resources.

The essential yield elements are the number of ears per unit area, which is given by the number of plants, and productive tillering, i.e. the number of fertile stems, the number of grains in the ear, which depends on the number of established spikelets and fertile florets and the mass of caryopsis (i.e. the mass of 1000 grains) Each of these elements has during the period of formation of growth a point at which it reaches its maximum level and then its die-off or reduction occurs. The values of maximum levels represent potential possibilities of plants and the crop stand. The reduction of yield elements is caused by a range of factors, which is just as broad as the one involved in their creation.

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In ecological growing the level of each element and also the final yield is a reflection of the production potential under the given conditions (Petr and Dlouhy 1992). In this study the process of the yield formation was observed in an independent experiment and was supplemented by an evaluation of long term varietal experiments under identical conditions. We studied the hypothesis that the yield of wheat (and probably of other cereals as well) in ecological growing predominantly is formed by the productivity of ear.

Materials and Methods

We carried out experiments with two cultivars of winter wheat, Estica and Ebi, under the conditions of certified and checked Research Station for Ecological Agriculture in Uhrineves (in accordance with the Act 242/2000 Coll. and EHS 2092/91), using two dates of sowing (late and early) and two standards of sowing rates (250 and 500 germinating grains per 1 m^2). The research station is located in a fertile area with brown soil on loess with deep arable soils, good nutrient reserves and neutral pH. The production potential of the soils is relatively high at 84 points. Clover was used as a pre-crop in both years.

ESTICA is a late variety of the C quality group. EBI is a late variety of the A baking quality. The date of sowing in the first year was 14.9.2000 for the first period and 13.10.2000 for the second, with the sowing rate for both varieties being to same**.**

In the second experimental year the first date of sowing was 30.9. and the second one was on 31.10. In the third year of 2002/2003 the experiments were established but due to critical winter condition they suffered so much damage that their results are not useable. The arrangement of the experiment was by split plot in three replicates. During the vegetation the following elements of the yield were observed: number of plants, number of ears, number and mass of grains in the ear.

Apart from the above described experiment, the structure of yield was also observed in varietal experiments using the same method, and the same varieties and seeds as those in the state varietal experiments of the National Office for Varieties of the Czech Republic.

Results and Discussion

As stated previously, during the years of 2000–2002, the formation of yield in the EBI and ESTICA varieties was observed at lower and higher sowing rates (250 and 500 caryopsis per m^2), with early and late periods of sowing.

Table 1 shows the plant numbers that correspond with the aims of lower and higher rates of sowing (even though it is not always possible to obtain exact sowing rates). During the sowing-germinating period the number of plants is reduced and the reduction amounts to about 20% in average. This corresponds with our previous measurements and data from practical experience, when the plants number was reduced by about 10–20% (Petr *et al.* 1988). Under ecological cultivation the farming system itself could cause the reduction of germination by not using seed dressing to protect it against diseases.

In 2002 at higher sowing rates the reduction in plant numbers during the sowing-germination period was higher and reached as much as 30%. A mutual competition of germinating caryopsis could have taken place here. This concerns mainly competition for water. A larger reduction in plant numbers germinating after later sowing, when about 45–55% of plants were lost, has been

Table 1. Yield structure of winter wheat grown under ecological cultivation in 2001

Variety	Sowing* Rate/Time	1			2	3	4	5	6
		A	S	H					
Ebi	Lower/I.	310	238	190	462	1.0	19	53.2	4.69
Ebi	Higher/I.	566	328	226	436	1.2	23	52.5	5.29
Ebi	Lower/II.	336	190	172	475	0.9	17	52.3	4.12
Ebi	Higher/II.	572	334	311	570	0.9	18	51.1	5.21
Estica	Lower/I.	322	208	139	393	1.0	20	52.2	4.05
Estica	Higher/I.	504	189	157	469	0.9	17	51.5	4.22
Estica	Lower/II.	314	238	152	435	1.0	20	54.2	4.60
Estica	Higher/II.	500	322	224	517	0.9	17	52.6	4.72

* I. Sown on 14.9.2000, II. 13.10.2000,
Note: 1 – number of plants per m^2 (A – autumn, S – spring, H – harvest), 2 – number of ears per m^2, 3 – mass of grain per ear (g), 4 – number of grains per ear, 5 – thousand grains weight (g), 6 – yield (t per ha)

confirmed. This was given by worse conditions for the germination and emergence in late autumn, particularly due to lower temperatures and unfavourable water and air regimes of the soil. However, it was precisely the higher sowing rate at the delayed sowing time, which softened the impact of these conditions on the final yield. Despite the large reduction in the plants number there were 74 more plants in the spring, and 66 more plants by the harvest time. Stöppler (1989) cited by Sarapatka, Urban *et al.* (2006) observed in ecological method of cultivation the influence of the sowing rates and time of sowing on the number of plants, number of ears and number of grains per ear in relation to the yield. His results are in agreement with the data shown in Table 1.

Another period during which plants are lost is overwintering. The reduction varies according to the variety and mainly according to the weather conditions during winter. In our experiments the loss of plants differed also in dependence on the time of sowing and sowing rates. Overwintering was poorer in late sowing, which can be explained by a low level of hardening and a low content of reserves. In 2000/2001 the winter was mild, warm, and the wheat varieties did not acquire much cold resistance. During the next season there were only mild frosts and the crop stands were not damaged. However, the crop stands from late sowings which germinated in spring were damaged. The winter of 2002/2003 was so unfavourable that the experiments were cancelled due to severe damage.

The results from both experimental years show higher yields for early sowings in the second half of September. Likewise, higher yields were obtained with higher sowing rates in both years. It must also be emphasised that by the harvest time the numbers of plants had been drawn closer together due to the different reductions in both sowing periods. This would suggest that the ecological agricultural system can carry only a certain number of plants per unit of area. Based on multi-year experiments, this would correspond to about 270 plants per m^2 in the spring. The number of ears ranged from 350 to 450, occasionally up to 500 per m^2. In the long term varietal experiments the number of ears in 30 varieties was more likely to be 400 per m^2.

The number of ears is dependent on the dynamics of the release of nitrogen in the soil. Apart form other external factors it influences the formation of tillers. Analyses determined that in 2001 the content of the soil mineral nitrogen – N_{min} in spring to the depth of 30 cm was 19.1 mg/kg of soil, and in 2002 it was 17.8 mg, which is a low to medium level content. It was, therefore, not possible to expect greater tillering even when the stands were thin and would normally have produced more tillers. We must, of course, mention the influence of harrowing of the crop stands, which took place in April and beginning of May of both years three times in total and which, according to Dirauer and Stöppler (1994), leads to the release of nitrogen due to the aeration of soil. Simultaneously, however, the harrowing of the crop stands will also cause a certain reduction in the number of plants, more so in the stands from higher sowing rates.

Conclusions

In the long term experiments in ecological agriculture it proved to be most optimal to sow 400 grains per m^2. Only when the sowing is late the sowing rate is increased in view of the higher risk of the plants loss. The evaluation of a seven year trial shows that the yield structure from an average of 213 varieties and 650 plots was at 272 plants per m^2 after emergence and 201 plants after overwintering. The average number of ears was 400 per m^2 and in each ear there were 35 caryopsis with the mass of 1.65 g. Thousand grains weight was high at 47.2 g. This structure brought yield of 6.5 tonnes per hectare on average in the described experiment.

Acknowledgments

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HULLESS BARLEY FOR ALTERNATIVE USE

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Key words: cereals, breeding, human and animal nutrition

Abstract

A new breeding line of spring hulless barley (Hordeum vulgare, convar. distichon (L.) Alef., var. nudum), designated KM1910, has been tested for the third year in the registration trials of the Central Institute for Supervising and Testing in Agriculture, Czech Republic. This barley, which was developed within research projects supported by the Ministry of Agriculture of the CR, is assigned particularly for alternative food use. In the period of 2000–2007, its suitability for growing in low-input, organic and conventional farming and usability for various food traditional and less conventional applications with health protective impact was verified. Owing to the increased protein content, standard content of beta-glucans, decreased content of pentosans and generally higher energy value due to lower content of crude fibre, the grain of KM1910 is suitable also for feeding farm animals, particularly pigs.

Introduction

A barley proportion for direct food use in economically advanced countries is not high in spite of its increasing trend along with rising consumers´ interest in crops with beneficial nutritional and health impacts. An official form of knowledge about extraordinary health-preventive importance of barley consumption was declared in the USA by the Food and Drug Administration (2005). The declaration states that foods from wholemeal and milling products obtained during barley grain processing considerably reduce risks of cardiovascular diseases.

A way of how to encourage consumers´ and processing industry interest in barley for human nutrition is to grow forms with hulless grain that, similarly to wheat or rye, does not need additional dehulling (debranning, abrasion, pealing, and others).

Barley cultivars with hulless grain have been registered in numerous countries worldwide, however, in the Czech Republic (CR) most breeding programmes were stopped by the end of the last century due to lower grain yield. However, there is a hope now that growers and consumers in the CR will see the first home spring barley cultivar with hulless grain – the breeding line KM1910, which has been tested for the third year in the registration trials of the Central Institute for Supervising and Testing in Agriculture (CISTA), CR.

Due to lower grain yield in the conventional farming it will be expected to be used first in the low-input or organic growing conditions.

The presented communication summarises results of the survey of agronomic and biological traits, the evaluation of malt parameters and grain chemical composition in comparison with

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standard malting barleys and some genetic resources of the hulless barley from the Collection of Barley Genetic Resources, growing in the low-input conditions.

Materials and Methods

Spring barley (*Hordeum vulgare*, convar. *distichon* (L.) Alef.) materials: a) The line KM1910 with hulless grain was compared with malting cvs. Tolar and Jersey and selected genetic resources with hulless black coloured grain (Nudimelanocrithon and Nigrinudum abyssinum) under low-input conditions of the location Kroměříž (2004–2006, 10 m^2 plots in three replications). Selected agronomic traits were measured (grain yield in t/ha, TGW in g, resistance to diseases and lodging using a 9–1 scale). b) The grain of KM1910 and the selected registered cultivars of spring malting barley cultivated in 2006 at CISTA locations (without chemical treatment) was graded on sieves with 2.5 mm (or 2.2 mm for KM1910) openings and malted using the process described below.

Grain malting: The technological process was based on the preparation of standard malt (2 days steeping, the 1st day 4 h under water, 2nd day 6 h under water, water content of 45 % at germination), a total malting period 6 days, standard kilning at kiln temperature of 80 °C for 4 h.

Chemical analyses: The chemical analyses (dry matter, standard parameters of malt and wort, contents of N-substances, maltose, maltotriose, glucose and fructose in malt and wort, beta-glucans and pentosans in grain) were carried out according to standard methodologies (EBC, AOAC, etc.).

Results

Table 1 shows results of evaluation of agronomic traits and biological properties in KM1910 in comparison with standard cvs. Tolar and Jersey, and selected genetic resources of hulless barley Nudimelanocrithon and Nigrinudum abyssinum.

Table 1: Selected agronomic traits in a new hulless barley line KM1910 in comparison with standard cvs. Tolar and Jersey, and selected genetic resources of hulless barley (Kroměříž, 2004–2006)

Cultivar, line, genetic resource / trait	Grain yield, % of cv. Tolar	TGW, g	Lodging	B. g.	P. t.	P. h.
			medians, 9–12)			
Tolar, std.	100.0c1)	45.5bc	8.3	5.5	6.8	7.0
Jersey, std.	99.8c	41.8a	8.0	9.0	7.0	7.9
Nudimelanocrithon	38.5a	48.1c	8.0	9.0	8.0	5.0
Nigrinudum abyssinum	44.1a	42.1ab	4.0	2.0	6.0	6.0
KM1910	80.2b	40.8a	9.0	6.0	6.0	7.0

1) – mean values in the line marked with a different letter are statistically significantly different (P<0.05); 2) – state according to a 1–9 scale, where 9 = the best and 1 = the worst trait expression; diseases: B.g. = *Blumeria graminis*, P.t. = *Pyrenophora teres*, P.h. = *Puccinia hordei*

Table 1 shows the achieved progress in both grain yield (P<0.05) and resistance to lodging and some fungal diseases. Lower TGW (as compared to some cultivars and barley gene resources with hulless grain; P<0.05) was less satisfactory, which is recorded particularly in years with moisture deficit.

The evaluation of significant malt parameters (Table 2) in comparison with leading Czech spring barley cultivars confirmed especially high extractability of KM1910 grain and simultaneously a good level of some other malting parameters (RE, K). The line KM1910 has markedly better value of total enzymatic power of malt and produced wort contains a higher amount of sugars, especially maltose and maltotriose (table not included). The high beta-glucan content in both malt and wort, which is undesirable in malting cultivars and decreases modification parameters, would not be likely to be a problem in production of food malt, but conversely, it would contribute to a higher proportion of dietary fibre.

Table 2: Comparison of malt and wort parameters in KM1910 with hulless grain with selected Czech malting barley cultivars

Cultivar, line	Values in grain, malt and wort							
	N-subst. – grain	Extract	Rel. extract (45°)	Kolbach Index	Diastatic power	Final atten.	Friability	BG1)
	%	%	%	%	u.WK	%	%	mg/l
Bojos	11.0	83.0	36.8	42.5	368	79.7	85	145
Malz	10.9	83.2	37.7	42.4	319	81.0	82	256
Radegast	11.3	82.6	36.8	42.6	369	78.9	77	169
Tolar	11.4	81.3	33.8	39.3	417	81.0	81	248
KM 1910	12.0	86.0	39.4	42.0	229	77.7	73	635

1) BG = beta-glucan content in wort. Source: Results of the CISTA, 2006 harvest

However, the results in Table 3 demonstrate that the beta-glucan content itself does not cause its increased proportion in malt. This result can also be influenced by a combination of worse germination vigour due to damage of hulless grain during its processing along with lower beta-glucanase enzyme activity.

The increased content of N-substances and considerably lower content of pentosans in grain (in comparison with malting barleys) could explain a high nutritional quality of grain in KM1910 when experimentally fed to pigs (Vaculová 2004).

Table 3: The content of nutritionally important substances in grain of KM1910 in comparison with registered barley cultivars (grain from CISTA trials, 2006)

Cultivar, line	N-substances %	Beta-glucans %	Pentosans %
Bojos	11.4	3.9	8.0
Malz	11.1	4.1	7.7
Radegast	11.9	4.0	7.5
Tolar	11.6	4.6	7.3
KM 1910	12.0	4.4	6.0
Mean; sx	11.1; 0.6	4.4; 0.6	7.5; 0.8

Discussion and Conclusions

In accordance with our results of agronomic experiments done with some hulless barley lines at the three different locations (Vaculova *et al.*, 2004a), we found significant differences among examined barley materials and experimental years, which will be important not only in conventional as well as in low-input and organic farming conditions.

Nutritional evaluation of new breeding lines of hulless barley (including KM1910) was carried out within research projects of the Ministry of Agriculture of the CR in 2000–2007. Suitability of this line for various food traditional (both salty and sweet bakery and biscuit products) and less conventional (production of müsli, puffed grain, food malt, additives to milk products, etc.) applications with health protective impact was verified (Vaculova *et al.* 2004b) and recipes for use of hulless barley in bakery and biscuit products and healthy nutrition products have been developed and results in such a form took the Award of the Minister of Agriculture of the CR for the second best implemented outcome of research and development in 2006.

Similarly to findings abroad (Edney & Rossnagell 2000), our results documented that some hulless barley lines had extremely high extractability (Vaculova & Psota 2003) and can be directly used in food production. Results of the both sensory evaluations and chemical analyses of the products developed and tested until now and also feeding tests showed that the new hulless line KM1910 seems to be a material perspective for alternative final use in both human nutrition and farm animal feeding, particularly monogastrics.

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STORAGE PROTEIN COMPOSITION AND QUALITY OF WINTER WHEAT FROM ORGANIC AND CONVENTIONAL WAYS OF GROWING

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Key words: winter wheat, storage protein composition, quality, organic farming

Abstract

We tested the grain storage protein composition and wheat quality parameters in a set of varieties from different quality groups from organic farming during a two-year experiment. We also tested a set of varieties from conventional farming for orientation comparison of results. Our results show a statistically significant influence of organic and conventional ways of growing on the wheat grain storage proteins composition and the technological quality characteristics, predicative partly of the storage protein quantity, partly of the protein complex quality (sedimentation index by Zeleny, rheology characteristics determination on pharinograph and the yield of bread).

Varieties from conventinal growing systems and varieties from the elite (E) and high-quality (A) quality groups, which are the most suitable for baking utilization, reached higher percentage of HMW glutenins and reached also higher values of sedimentation index, pharinographic characteristics predeterminig good baking quality and higher values of yield of the bread.

Varieties from organic farming and from the C quality group (wheat unsuitable for baking utilization) were mainly characterized by the higher content of residual albumins and globulins, due to higher content of amino essential acids and higher nutritional quality of albumins and globulins we suppose, that this wheat is more suitable for feeding and also for human nutrition.

Introduction

The criteria for technological wheat grain quality evaluation are the object of many studies. Basically, the characters deciding the wheat grain quality are the content and viscoelastic character of gluten protein, grain hardness, flour yield, pharinographic water absorption and activity of hydrolytic enzymes. Technological quality and the wheat grain protein composition are influenced by the growing system, variety, locality, year conditions and growing technology significantly (Šíp *et al.*, 2000).

Materials and Methods

During the harvest years of 2004 and 2005 the grain storage protein composition and baker quality were evaluated in a set of winter wheat varieties Sulamit (E), Samanta (A), Apache (B), Meritto (B), Mladka (C) and Rapsodia (C), from different quality groups based on their baking

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quality (E – elite, the most suitable for baking utilization, A – high-quality, B – additional, suitable for use in a mixture, C – others, unsuitable for baking utilization) from organic farming at the Experimental Station of Plant production Department, Faculty of Agrobiology, Food and Natural Resources, Czech University of Agriculture in Prague – Uhříněves. For orientation comparison of results we used same varieties from conventional farming at the Stupice Breeding Station.

At the Experimental Station in Prague-Uhříněves the experiments were carried out in an organic growing system according to the principles of IFOAM (International Federation of Organic Agriculture Movements) and Methodical instruction for organic farming of the Ministry of Agriculture of the Czech Republic. Qualitative parameters of the wheat's technological quality parameters were statistically evaluated by the multifactor analysis of variance in the Statgraphics Plus, Version 5.1 programme, with the references of the statistical coefficients demonstrated at the 0.05 significance level. Values in tables are statistical means of reached results of used varieties.

Results and Discussion

Tab. 1: Electrophoretic analysis of storage proteins of wheat from the organic and conventional farming – harvests in 2004 and 2005

Growing system	Quality groups	HMW glutenins (%)	LMW glutenins + gliadins (%)	Residual albumins and globulins (%)
Organic	E	16,46	70,86	12,68
	A	12,72	69,88	16,42
	B	12,56	69,87	17,58
	C	9,31	69,25	21,45
Conventional	E	31,82	64,77	3,41
	A	27,95	65,41	6,89
	B	24,71	69,79	5,32
	C	22,45	65,27	11,89

Values in the Table are statistical means.

Tab. 2: Selected qualitative parameters of wheat from the conventional and organic farming – harvests in 2004 and 2005

Growing system	Quality groups	Crude protein content in grain DM (%)	Wet gluten content in grain DM (%)	Sedimentation index by Zeleny (ml)	Pharinographic water absorption (%)	Yield of bread (ml/100g of dough)
Organic	E	10,09	19,74	26	53,50	293
	A	9,61	19,86	28	43,88	291
	B	9,45	16,92	24	52,13	247
	C	8,86	15,06	15	50,87	245
Conventional	E	10,74	22,98	32	59,38	350
	A	11,63	27,05	34	53,87	331
	B	11,54	26,07	27	42,80	298
	C	10,86	20,77	23	50,23	271

Values in the Table are statistical means.

The obtained results (Tables 1 and 2) document the influence of organic and intensive ways of growing on the wheat grain storage proteins composition and technological quality characteristics, predicative partly of the protein quantity (total crude protein content and wet gluten content in the dry matter of grain), partly of the protein complex quality (sedimentation index by Zeleny and the yield of bread).

In case of HMW glutenins, a considerably higher percentage was found in the conventionally growed wheat; while in case of organic wheat we recorded a considerably higher percentage of the residual albumins and globulins, which have higher nutritional quality due to higher content of amino essential acids.

These results are also in accordance with the conclusions of Prugar (1980) and Graveland (1996), who found that nitrogen application generally increases the part of the protein fractions typical for gluten – glutenins and gliadins. Increasing the amount of these fractions in the total protein content leads to an improvement in the technological, especially baking, wheat quality, but also to a decrease in the biological and nutritional value of proteins, due to the reduction in the amino-acids content.

Except for the differences in the wheat grain storage proteins composition from organic and intensive growing we have recorded certain differences in the protein composition among the single varieties groups of quality. In both the conventional and organic way of growing the highest percentages of HMW glutenins and at the same time the lowest percentages of albumins and globulins were found in the varieties from the quality group E and the A, and the lowest in the varieties from the quality group C, which is unsuitable for baking utilization. This supports the results of some authors, according to which the changes in the ratio of single protein fractions are affected. Not only by the total proteins content in wheat grain, but also by the genotype and results of Prugar (1999) and Capouchová (2003), who show that the varieties from the quality groups E and A being observed, have genetically dependent differences in the characters of the baking quality and act as technologically better, superior, while also using an ecological way of growing. The differences in the wheat grain storage proteins composition reflect also at the level of the technological quality parameters.

We noticed a relatively marked influence of the growing intensity on sedimentation index. The lower levels of sedimentation index in the organically grown wheat are also mentioned by Petr *et al.* (1998) and Capouchová (2003) on the basis of their results. The baking test is the final direct indicator of the wheat baking quality. The higher yield of bread in both harvests years reached varieties from intensive growing system.

Conclusions

Varieties from organic farming (and also from the C quality group) were mainly characterized by the statistically significant higher percentage of residual albumins and globulins, due to higher content of amino essential acids and higher nutritional quality of albumins and globulins we suppose, that this wheat is more suitable for feeding and also for human nutrition.

Varieties with higher percentage of HMW glutenins (varieties from intensive growing systems and varieties from the elite (E) and high-quality (A) quality groups), which are the most suitable for baking utilization, reached higher values of sedimentation index and higher values of yield of the bread.

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VIENNESE PROGRAMME OF CONTRACTED NATURE CONSERVATION „BIOTOPE FARMLAND“: AVOIDING WEED PROBLEMS IN CONSERVATION FALLOWS BY SOWN WILDFLOWER MIXTURES

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Key words: nature conservation, wildflower strips, seed-mixtures, harmful weeds

Abstract

Since 2001, the Viennese Programme of Contracted Nature Conservation "Biotope Farmland" aims at increasing nature conservation value as well as functional biodiversity of farmland in the urban area of Vienna. Farmers voluntarily contract with the Municipal Department of Environmental Protection to take arable fields out of production and convert it into nature conservation areas by appropriate cultivation measures like mulching and mowing. One of the following successional types is allotted to the fields: "Nature Conservation Fallow" with sown wildflower-mixture, "Weed Conservation Field" with sown rye-and-weed mixture and "Species-rich Dry Meadow". At present, a total of 72 fields with an acreage of 33.2 hectares are contracted. 58 fields (81%) of the fields are cultivated by 14 conventional farms, 14 (19%) by 4 organic ones. In accompanying research performed by Bio Forschung Austria, the vegetational succession is recorded continuously for adapting management methods as well as detecting upcoming of weeds potentially threatening adjacent fields, especially organic ones. Up to now, no weed problems arose due to sown wildflower mixtures successfully suppressing harmful weed species.

Introduction

Due to longtime intensive fertilization and area-wide herbicide application (Maurer *et al.* 2003) arable landscape (approx. 5,200 hectares) in the urban area of Vienna has a low nature conservation value. In 2001, the Viennese Programme of contracted nature conservation "Biotope Farmland" was started. It aims at increasing general biodiversity in arable landscape, creating living space of endangered species as well as enhancing functional biodiversity in terms of pest antagonists and pollinators. Furtheron, it contributes towards maintaining of farmers income as well as improving the recreational value of arable landscape. For that, fields are taken out of cultivation and evaluated for their potential of development for conservation purposes by Bio Forschung Austria. If accepted, the farmer contracts with the Municipal Department of Nature Conservation for subsidy to cultivate the field according to one of the following management schemes: "Nature Conservation Fallow" with initially sown wildflower-mixtures (at present covering 48 fields with a total acreage of 21.3 hectares), "Weed Conservation Fields" with a yearly sown mixture of weed seeds and rye as cover crop (at present 2 fields with 1.6 hectares) and

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"Species-rich Dry Meadows" (spontaneous fallow vegetation, managed by mowing; at present 22 fields, totalling 10.3 hectares).

The programme has been developed in a "bottom-up" approach: the cultivation schemes and the compatibility of management measures with e.g. the available farm machinery as well as the procedure of contracting and the level of subsidies have been discussed prior to implementation of the programme with representatives of Viennese arable farmers. Thereby, a high level of acceptance and readiness for participation was ensured. With special emphasis on the potential threat of weed problems, the accompanying research performed by Bio Forschung Austria consists of a continuous observation of vegetational succession in all conservation fields by inspecting them twice a year. Additionally, in seven selected sites representative of the three management schemes the vegetation has been monitored annually. In this paper, vegetation results of two "Nature Conservation Fallows" are presented.

Materials and Methods

The two investigated sites "Stammersdorf 1" (0.37 hectares; highly fertile, dry chernozem on loess; loamy sand) and "Breitenlee" (0.54 hectares, middle fertile, dry tchernozem on limy, loess-like fine sediments; sandy silt to loamy sand) are situated in Vienna North (average yearly temperature 11°C, yearly precipitation 518mm; 2003–2008) and followed longtime, intensive arable cropping. In early April 2000, a seed mixture ("Voitsauer Wildblumenmischung", www.wildblumensaatgut.at), consisting of up to 60 different segetal and ruderal domestic flowering species was sown in a fine seed bed and rolled. The vegetation was recorded according to Braun-Blanquet, adapted by estimating the plant coverage in 1% steps. The recordings were performed end of May/beginning of June each year from 2000 until 2007 in six 6 x 4 m plots in each field. The plant species were classified for origin from sown seed-mixture or autochthonous seed bank, life span, biotope requirements and red list status.

Results and Discussion

In both sites, a species-rich vegetation was recorded over the years (Table 1). The higher number of total species found in the site Stammersdorf 1 is due to being embedded in a diverse cultivated landscape with crop fields, grassy fallows, field margins, hedges and woodland plots whereas Breitenlee is isolated in an intensively cropped area poor in uncultivated landscape structures. In Stammersdorf 1, 34 % of plant species originated from the sown mixture compared to 38% in Breitenlee, in a few cases it remained unclear though if a species germinated from the sown mixture or from the autochthonous seed bank. Due to the rich surroundings, 57% of the recorded 26 red list species were autochthonous in Stammersdorf 1 (e.g. *Ajuga chamaepitys*) compared to only 40% of 20 in Breitenlee.

Nevertheless, Breitenlee proved to have a high conservation value for wildlife biodiversity, e.g. in wild bees: due the warm, sandy habitat character of the site some rare, stenocio-eremophilic and psammophilic species were found in 2004 (e.g. *Eucera pollinosa*, *Andrena limata*), some of them following host plants from the sown mixture (e.g. *Colletes fodiens* and *C. similis* on *Tanacetum vulgare*) (Pachinger 2004, unpubl.). Likewise, in both sites rich carabid assemblages containing rare xerothermophilic elements were recorded (Kromp *et al.* 2004).

Tab. 1: Total number of species, species originating form the sown mixture and red list species recorded in two conservation fallows in Vienna North from 2000 until 2007

Conservation fallows	Total nr. of plant species recorded	Species originating from the sown mixture	Red list species
Stammersdorf 1	161	55	26
Breitenlee	141	54	20

Since the prevention of weed problems in adjacent arable fields is considered crucial for acceptance of nature conservation schemes by farmers, the composition of the wildflower seed-mixture sown is intended for suppressing autochthonous annual as well as perennial harmful arable weed species. In Fig. 1, the vegetational succession is shown in terms of plant coverages of life span types. In the first year, annual weeds prevailed with a high amount of sown *Agrostemma githago* and *Bromus secalinus*. In the second year, sown biennials like *Isatis tinctoria* and *Malva sylvestris* took over as well as the perennial grasses *Lolium perenne* and *Dayctylis glomerata*. The dominance of biennials (mainly the sown *Melilotus officinalis* and the autochthonous *Carduus acanthoides*) from 2003 to 2005 reflect a disturbance of the site by construction vehicles due to erection of a wind turbine in 2002. From the sixth year onwards, perennial grasses and herbs (e.g. *Tanacetum vulgare*) were predominating.

In Table 2, the average coverages of potentially harmful weeds are provided. From the annual autochthonous weeds, *Amaranthus retroflexus* and *Chenopodium album* only occurred in the first year of fallow whereas *Tripleurospermum inodorum* showed higher coverage in the first and third year of succession, possibly due to the disturbance in 2002 mentioned above. The problematic perennial weed *Cirsium arvense* occurred in the fallow from 2002 onwards but in low densities only.

Similar low densities of harmful weeds also were recorded in Stammersdorf 1, with exception of *Agropyron repens* covering over 40% in the fourth year of succession but decreasing again in

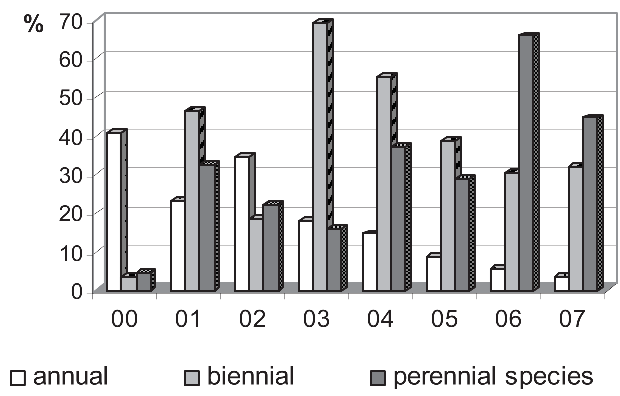

Figure 1: Vegetational succession in the nature conservation fallow Breitenlee/Vienna North: coverages of annual, biennial and perennial plant species from 2000 to 2007

Tab. 2: Average plant coverage (%) of undesirable weed species in the conservation fallow Breitenlee in Vienna North from 2000 until 2007

Weed species	2000	2001	2002	2003	2004	2005	2006	2007
Amaranthus retroflexus	<1							
Chenopodium album	29	<1	1					
Tripleurospermum inodorum	16	7	27	4	2	1	1	<1
Cirsium arvense			<1		1	<1	<1	<1

the following years to around 20%. In Switzerland, Eggenschwiler (2003) found significantly lower coverages of *A. repens* and *C. arvense* in sown mixtures compared to spontaneously vegetated fallows. Sown mixtures proved itself with regard to both weed suppression as well as high floristic diversity, especially in previous intensively cropped arable sites with impoverished seed banks. The development of conservation fallows over the years decisively depended on the successful establishment of the sowings (Pfiffner and Schaffner 2000, Günter 2000).

Conclusions

In Vienna, spontaneously vegetated fallows on sites with high soil fertility usually are dominated by undesirable plant species like *A. repens*, *Bromus sterilis* and *C. arvense*. So for implementation of nature conservation fallows, seed mixtures are considered useful in previous intensively farmed arable fields with impoverished autochthonous seed banks.

Acknowledgments

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EFFECTS OF LANDSCAPE INFRASTRUCTURE AND CONVERSION TO ORGANIC FARMING ON CARABID BEETLE COMMUNITIES

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Key words: ecotone, organic/conventional farming, epigaeic fauna, carabid beetles

Abstract

Our research compared both the effects of land structures (ecotones) and farming systems (conventional, organic) on carabid beetles in four experimental plots. During the five year study specimens belonging to 91 carabid species were collected with 5 species dominating: Poecilus cupreus, Pseudophonus rufipes, Anchomenus dorsalis, Pterostichus melanarius and Bembidion lampros. The methods of multidimensional statistical analysis used in our study (RDA, CCA) distinguished complexes of species according to their preference for ecotone, margin or field centre. Consequently, the analysis detected the increasing ability of organic management to influence carabid communities, and finally it confirmed significant differences in the structure of carabid communities in organically and conventionally managed fields.

Introduction

Changes induced by different agricultural management methods can be monitored in agricultural habitats using several methods. Carabids (Carabidae) are a very suitable subject for ecological surveys for the following reasons: this group is one of the most important parts of the epigeon – as primary, and especially, as secondary consumers, they play an important role at their food level. Carabids represent a taxonomically well covered group with a lot of available information concerning their geographical distribution, ecological demands and the life style of particular species. Many of them are very sensitive to changes in their environment.

The composition and seasonal dynamics of communities of carabids in agricultural ecosystems with different crops have been monitored by many authors world-wide (Dritschilo & Erwin, 1982; Lövei, 1984; Yano *et al.*,1989; Helenius *et al.*, 1995). Besides agroecosystem management the effects of field margins on carabid beetle populations were described in several papers (e.g. Kromp & Hartl, 1991; Pfiffner & Luka, 1996; Mauremooto *et al.*, 1995, Frampton *et al.*, 1995).

Our work was based on the hypothesis that carabids, as the terminal predators in the epigeon, efficiently indicate effect of landscape structure – ecological compensation areas and conversion of the farming system to organic farming.

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Materials and Methods

Pitfall traps were located on four experimental plots (F1 – F4): two plots with organic (F2 and F3), and two with conventional management (F1 and F4). During the evaluation, all fields had similar crop rotation with crops typical for this region. On the conventional fields the following crops were grown: winter wheat – barley – maize – winter wheat – barley, and on the organically farmed fields: winter wheat – barley – maize + clover – mixture with grain and legumes – barley.

A modified method of bait-free formalin pitfall traps (Skuhravý, 1957) was used to obtain a sufficient amount of carabid beetles for further analysis. Glasses of 0.7 l volume were used as traps. The glasses were inserted into the ground and covered with a metal plate cover. Each trap contained approx. 200 ml of fixating medium. The traps were located in three lines, five traps in each line. Lines of traps were oriented parallel to the field margin. The first line (marked as „E" for „ecotone") was situated at the edge of arable soil and the solid, untilled margin; the second line („FM" for field margin) 10 m from the margin, and the third line („FC" for field centre) 100 m from the margin, thus approximately in the centre of the field. The type of ecotone differed among the fields: F1 and F3 were bordered by a small stream with a tree-lined bank, F2 had a similar margin without a stream and F4 was surrounded by other fields with just a narrow field margin covered by nitrophilous vegetation.

Basic cenological indices were calculated separately for each line of traps in individual fields in every year of the experiment. The relationship of management type to the values of cenological indices was tested using several forms of variance analysis (ANOVA). Moreover, the data was analysed by ordinance methods using the linear method partial redundancy analysis (partial-RDA). CANOCO 4.0 programmes for Windows were used for the calculations.

Results

Using partial redundancy analysis statistical differences were found between individual species in preference to ecotone, field margin and field centre independent of farming system (organic vs. conventional). More species were ecotone-dependent e.g. forest species *Abax parallelepipedus* and further *Leistus ferrugineus, Nothiophilus palustris, Patrobus atrorofus* or *Stomis pumicatus*. Other species e.g. *Dyschirus globosus, Ophonus nitidulus* or *Trechoblems micros* prefered the field margin whereas *Clivina collaris, Harpalus signaticornis* and *Microlestes minutulus* were typical for the field centre. Also, the analysis distinquished a complex of species occurring outside of the ecotone without special preference for either the field margin or the field centre. These species are inhabitants of "open" agrocenoses (*Bembidion lampros, B. quadrimaculatum, Clivina fossor, Demetrias atricapillus* and especially *Poecilus cupreus*).

The effect of the ecotone type on carabid beetle communities is shown by Figure 1. The field margin in conventional plot Nr. 4 (F4) was different from the other fields (grassland with nitrophilous plants with scattered trees) and such a margin was prefered by *Calathus fuscipes, Bembidion properans, Harpalus affinis* or *Calathus melanocephalus*.

In 2nd RDA analysis only the data from the final year of the study was examined using the farming system as the main variable (Figure 2). In the final period of evaluation the preference of *Amara eurynota, Carabus granulatus, Carabus scheidleri, Dyschirius globosus* or *Poecilus cupreus* for the organically managed fields was distinct and *Amara plebeja, Anchomenus dorsalis, Calathus fuscipes*, *Calathus melanocephalus, Harpalus affinis* and *Trechus quadristriatus* for the conventional fields under intensive cultivation.

Discussion and Conclusions

Our results show that conversion to organic farming did not lead to an expressive increase in carabid.abundance. The conversion also did not significantly affect indices of dominance, diversity or equitability. Our results on number of species and species diversity contrast with data published by Pfiffner & Niggli (1996). Nevertheless, their data was collected after 10–12 years of conversion to organic farming, when the differences between such communities could be better established. Similar results are published by Kromp (1989, 1999) and Kaiser & Schulte (1998). In our research the indices were mainly affected by the position of the traps in relation to the field border. Ecotones had a well-balanced community; in open field there were more dominant species. The year of experiment, wetness, and light conditions typical for crop type were almost all of the same importance, which agrees with results of Holopainen *et al.* (1995). Species diversity in ecotones is higher than in surrounding fields (Desender & Bosmans, 1998) because of the well balanced vegetation structure in the ecotones (Altieri, 1995). Accordingly, in our research ecotones were more diversified and well balanced. Towards the field centre, dominance of the common species increased. RDA described the difference between ecotones and field centres, whereas the effects of year and season did not show significance.

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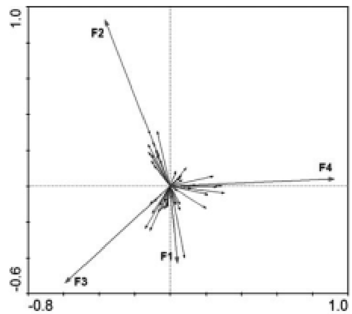

FIGURE 1. The effect of ecotone type on carabid beetle communities Typical species for individual types of ecotones were mainly:
F1 – *Abax parallelepipedus*,
F2 – *Pterostichus niger, Ophonus nitidulus, Patrobus atrorufus*,
F3 – *Loricera pilicornis, Ophonus rufibarbis, Abax ovalis*,
F4 – *Harpalus affinis, Bembidion properans, Calathus fuscipes, Calathus melanocephalus*.

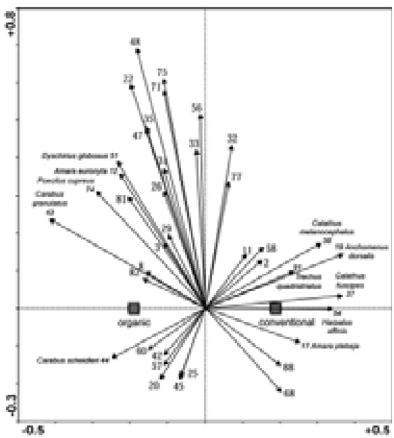

FIGURE 2. RDA analysis of the effect of farming systems on carabids in the 5th year of the experiment.

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EFFECTS OF CLIMATE CHANGE ON THE DISPERSION OF WHITE GRUB DAMAGES IN THE AUSTRIAN GRASSLAND

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Key words: grassland, white grub damage, climate change, drought, Austria

Abstract

Recent changes in occurrence of agricultural pests in Austria might already reflect climate change phenomena. In this study, an inventory of white grub (Melolontha melolontha, Amphimallon solstitiale and Phyllopertha horticola) damages in Austrian grassland including organic cultivation was performed by questioning plant protection consultants of 74 Agricultural County Chambers. Altogether, a cumulated 14,800 hectares of white grub damages were recorded. From 2000 onwards, a steady increase of white grub damages occurred with a climax in the year of heat and drought 2003. The infested fields extended along the alpine main ridge from Vorarlberg up to the alpine foreland. Additionally, southern slopes of the Danube valley in Upper and Lower Austria were affected. Very likely, the damages were mainly due to the garden chafer P. horticola. From 2004 to 2006, the extent of damages decreased again all over Austria. By studying meteorological data, it became obvious that the damaged areas were mainly situated in regions with a strong precipitation deficit. On-farm investigations performed in 2007 strengthened the hypothesis that drought and elevated soil temperatures might be the decisive factors for a strong development of grub populations and subsequent feeding damages. Additionally, drought can increase the effects of grub damage by delaying the regeneration of the damaged sward. A strongly damaged sward on slopes can be dangerous for the farmers e.g. by slipping machines.

Introduction

Recently the soil-dwelling grubs of the cockchafer (*Melolontha melolontha*), the June beetle (*Amphimallon solstitiale*) and the garden chafer (*Phyllopertha horticola*; Scarabaeidae, Coleoptera) caused significant damages to Austrian cultivated grassland. Heavy grub feeding to the grass roots can even endanger farmers by causing their farm machines to slip down slopes on the detached sward. From available literature on the biology of these species it was derived that climatic and soil conditions could be main factors responsible for high densities of white grubs and their feeding damages to the grass roots. Drought can intensify the effects of grub feeding to the sward by accelerating its withering. Grub damages particularly affect Austrian organic farming, due to the high percentage of grassland, approximately 60% (Schneeberger *et al.* 2005), and the delayed effect of entomopathogenic fungi products like Melocont® (*Beauveria brongniartii*) against cockchafer and GranMet®-P (*Metarhizium anisopliae*) against garden chafer. After application the fungus-epidemic takes time to spread in soil (Strasser 2004). So the design

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of a risk forecasting system and the assessment of the future development of regions at risk regarding climate change would help organic farmers to take measures in time.

In this investigation, carried out as a part of the Startclim2006 project (Grünbacher *et al.* 2007) from autumn 2006 to summer 2007, interrelations between grub damages and climate data as well as site and soil parameters were investigated as the basis for a risk forecasting system suitable in practice.

Materials and Methods

In order to gather information about the occurrence of grub damages in Austrian grassland from the year 2000 to 2006, we mailed grub-questionnaires to a total of 74 Agricultural County Chambers. The reported grub-damages were grouped by years and agricultural region according to Walter (2002). If the respondent could locate grub damage occurrences on municipal level, these areas were regarded as remarkably infested in the respective year of damage.

The regional precipitation deficits in the year of heat and drought 2003 were calculated on the basis of a digital elevation model of Austria and weather data from the Central Institute for Meteorology and Geodynamics (ZAMG). A chi-square test was used to statistically compare the intensity of aridity in areas affected by grub damage to the intensity in regions with grassland percentages more than 20% (Grüner Bericht 2006).

On four farms with serious grub damages in 2003 (counties “Murau/Judenburg” and “Weiz”, Styria) inspections were performed to collect background data on the topographic situation and the cultivation measures of the damaged fields.

Results

From 74 mailed grub-questionnaires 60 were answered, resulting in a 81% response rate. Altogether a cumulated damaged acreage of 14,800 hectares was reported in the investigated period, mainly in grassland. Starting with only two counties in the years 2000 and 2001 respectively, the number of counties affected by grub damage increased in 2002 (6) and showed a prominent peak (33) in the very hot and dry year 2003 (Figure 1). In this year, 64% of the counties having reported grub damages, were situated in the alpine region, 30% in the foothills of the Alps. In the following years, the number of affected counties decreased to 16 in 2004 and 6 in 2005 and 2006.

Figure 2 shows the situation in 2003, the year with the greatest extent of grub damages. The infested areas were mainly situated alongside the alpine main ridge from Vorarlberg in the West to the south-eastern foothills of the Alps, following the valleys of the central Alpine rivers like Inn, Salzach and Mur. Furthermore, damages were reported for several municipalities in the Innviertel, the southern slopes of the Danube valley and one small area of the Waldviertel in the North of Austria. The typical grassland regions in the northern Alpine foothills remained nearly unaffected.

The infested regions in 2003 were characterized by drought during summer (Figure 3). They significantly had more parts with strong precipitation deficits than the whole Austrian area with a relevant grassland percentage (observed proportions in infested regions: >55% deficit = 10% of

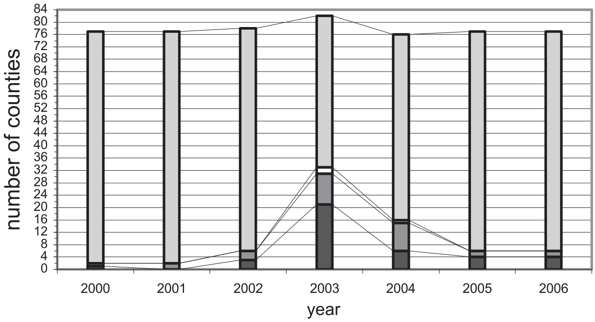

Figure 1: Counties affected by grub damage in alpine region (dark grey), in medium altitude (light grey), in lowland (white) and counties without reported damages or missing data (hatched) per year.

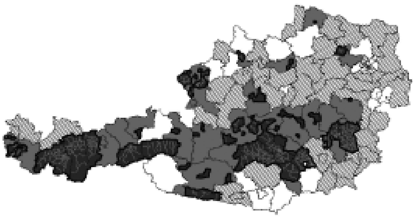

Figure 2: Austrian counties (grey) and municipalities (dark grey) affected by grub damage in the year 2003. Counties without response are coloured white, counties without reported damages or with missing data are hatched.

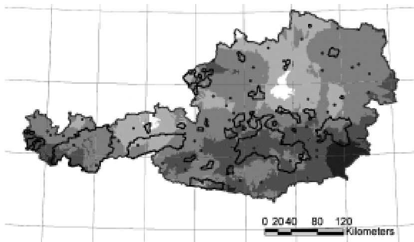

Figure 3: Precipitation deficits (%) of the period 1.1.–28.8.2003 in relation to normal precipitation (100%), averaged from the precipitation sums from 1.1.–28.8. of the years 1961–1990, visualized in shades of grey: <35% dark, 36–45%, 46–55%, 55–65%, >66% light. Areas damaged by grubs on a municipality level in 2003 are outlined black, weather stations are marked by dots.

Source: Grünbacher *et al.* (2007), Layout: Formayer H. (BOKU, Institute of Meteorology, Vienna).

area, 46–55 = 46, 36–45 = 43, <35 = 1; expected in grassland >20%: >55 = 23; 46–55 = 47, 36–45 = 29, <35 = 1; chi-square: p = 0.000).

The farm inspections showed a clear tendency of the damaged fields to south or east-facing slopes and sandy, permeable soils, rich in humus.

Discussion

In accordance to the literature, the questionnaires and farm inspections confirmed that hot and arid climatic conditions as well as permeable soils are decisive for the emergence of grub damages. In combination, these factors cause high soil temperatures, especially on south-exposed slopes, and so enhance the development of high grub densities by abbreviation of the egg- and larval period.

The massive grub damages in 2003 very likely can be attributed to the garden chafer, which is encountered in higher altitudes than the cockchafer. Its short, one year life cycle enables this insect to react much faster on favourable climatic conditions than the cockchafer with its three years development (Milne 1983).

Conclusions

Regarding the future scenarios for the effects of climate change in the alpine region with a higher probability of hot and dry summers (Kromp-Kolb 2004), we conclude that the years with remarkable grub damages will become more frequent and the damaged grassland acreage will increase.

The implementation of a reliable risk assessment system needs accurate knowledge on ecological demands of the above mentioned grub species, mainly concerning soil parameters. The validation of grub damage prognoses should be performed in long term outdoor investigations, supported by laboratory experiments.

Acknowledgments

We thank the plant protection consultants of the Austrian Agricultural Chambers for accurately filling in the mail grub-questionnaires and helping us to perform this study.

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PHYTOCENOTIC CHARACTERISTICS AND YIELD IN ECOLOGICAL HERBAGE

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Key words: ph ytocenotic charakteristic, yield, grassland.

Abstract

*Legumes play an important role in organic farming, as they enable farmers to reduce the use of nitrogen fertilizer. In an eleven years plot experiment in Lithuania, legumes were the most variable part of the floristic component. Their variation was usually cyclic and depended on different factors. Composition of herbage phytocenoses varied depending on their biological properties and ability to adjust to meteorological conditions. Legumes amount in the sward varied from 13.2 to 43.6%. They spread best (34.4–43.6%) when summer was rainy. The spread of legumes in herbage is also affected by mineral fertilisers. Having fertilised the sward with P60K60 and having calculated the relationship between legumes and fertilisers used it was found that phosphorus fertilisers had a greater effect on the spread of white clover. A medium strong correlation (r = 0.52) was determined between these indicators. Grasses occupied from 32 % to 63.1 % of the sward area. With sward senescence the content of forbs (mainly Taraxacum officinale L.) increased. Dry matter yield varied within 2.3–5.1 t ha-1 range. It was determined by legumes. The effect of legumes on herbage dry matter yield was very strong (r = 0.786**l), and that of grasses moderate (r = 0.619*l).*

Introduction

Species composition of herbs is largely dependent on soil type, natural conditions, sward fertilisation, management, utilisation and other factors. Between grasses and legumes there exist biotic relations that are beneficial for both populations. Legumes accumulate nitrogen in the soil which can be used by grasses too. Mutalism is specific to legume and grass populations, which manifests itself between legume plants and nitrogen fixing Rhizobium bacteria. The bacteria are able to turn free molecular nitrogen that has passed with air into nodule's intercells into available nitrogen for legumes and for themselves (Lapinskas, 1998; Stravinskienė 2003). Legumes are the most variable part of the floristic component. Its variation is usually cyclic and depends on different factors (Gutauskas, 2003). Natural conditions also have a great impact, however, a proper choice of perennial grass species and mixtures for specific natural zones could eliminate this factor. The yield difference depends on soil potential fertility. Water deficit influences the basic processes connected with grass productivity (Assuero *et al.*, 2002; Jones, 1998). The portion of legumes and grasses in dry matter yield is in the relationship of cyclic fluctuation. The duration of cyclic fluctuation in legumes spread varied between 5–7 years (Daugėlienė, 2002; Gutauskas, 2003). Some literature sources indicate that 25–35 % of legumes in pasture swards can supply grasses with nitrogen (Breazu *et al.*, 2002). Under such conditions the number of species of herbs also declines (Golinska et al, 2005).

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Materials and Methods

The experiments were conducted in Western Lithuania. The soil of the experimental site was a sod podzolic *Hapli-Endohypogleyic Luvisols* (IDg4-p) light loam on medium loam with top soil pH KCl 5,2, available P_2O_5 of 108 mg kg^{-1} and K_2O of 142 mg kg^{-1}. The liming was done before pasture sowing. Grass mixture, containing 35% *Trifolium repens* L., 40% *Phleum pratense* L. and 25% *Poa pratensis* L. were sown. The sward was fertilized annually in spring with 60 kg ha^{-1} of both P_2O_5 and K_2O. Treatments were replicated 4 times and grazed 4 times with a herd of dairy cows. The botanical composition (grasses, clovers, forbs) of the samples was measured after separation as dry matter weight. DM yield was determined on the basis of total DM amount per plot and calculated as DM yield ha^{-1}. Analysis of variance and correlation-regression methods were used for experimental data processing. Variation coefficient (V %) was calculated (Tarakanovas *et al.*, 2003).

Results and Discussion

The spread of legumes in a pasture sward is also affected by mineral fertilisers. Having fertilised the sward with P60K60 and having calculated the relationship between white clover and fertilisers used it was found that phosphorus fertilisers had a greater effect on the spread of white clover. A medium strong correlation ($r = 0.52$) was determined between these indicators. Grasses occupied on average half of the long-term sward's area and their variation was the least (Table 1). During the eleven years of use the content of grasses either increased or declined depending on the weather conditions under the effect of which the share of legumes varied. A marked reduction in the content of grasses was identified in the fifth year of sward use when only 366 mm of rainfall fell during the growing season. Although the amount of rainfall in July only inappreciably exceeded the monthly mean, the torrential rains that resulted in this amount of rainfall did not have any decisive effect on grasses. The share of grasses declined by 9 % in the final year compared with the first year of sward use.

Tab. 1: The variation of floristic composition of grassland (% of the DM), averaged data from 1992–2003.

Botanical composition	Mean	Standard error	Minimum	Maximum	Coefficient of variation %
Legumes	26,55	3,02	13,00	44,00	37,76
Grasses	47,64	2,91	32,00	63,10	20,29
Forbs	30,57	4,04	15,70	61,50	43,88

With the senescence of swards the competitive power of the good legumes and grasses diminishes and weeds spread rapidly, of which dandelion accounts for the largest share. In the long-term trial forbs occupied on average one third of the sward area (Table 1). Variation coefficient suggests that distribution in different years was very high. With the sward growing older the content of forbs consistently increased. During the 11 years of use the content of forbs in the sward increased from 19.8 to 33.28%. The highest content of forbs (61.5%) was identified in the ninth year of sward use. *Taraxacum officinale* L. was the dominant forbs species.

In our experiment having fertilised with P60K60 in a drier year it was possible to obtain both a low (2.05–2.62 t ha^{-1}) and optimal (3.04–3.6 t ha^{-1}) dry matter yield best utilised by cattle. In wet years dry matter yield reached 4.69–5.05 t ha^{-1}. Such great yield variation is reflected by a high coefficient of variation (29%).

The results of correlation analysis indicate that herbage dry matter yield of the long-term sward was mostly dependent on the content of legumes in the sward (Table 2). A strong linear correlation of 99% probability level was identified between these characteristics.

Tab. 2: The influence of dry matter yield from yield floristic composition t ha^{-1}, averaged data from 1992–2003.

Indices		Linear correlation		Linear regression	
x grasses	y yield	r	Sr t05	Y = A+	Bx
Grasses	1,46	0.619*l	± 0.262	0,261	2,002
Legumes	0,87	0.786**l	±0 .206	1,911	1,464
Forbs	0,85	0.72*l	± 0.231	2,042	1,341

Conclusions

The amount of legumes in the sward ranged from 13.2 to 43.6%. It spread best (34.4–43.6%) when the summer was rainy. Grasses accounted for 32% to 63.1% of the total sward area. With sward senescence the content of forbs increased.

Dry matter yield of herbage varied within the 2.3–5.05 t ha^{-1} range. The amount of rainfall in July had the greatest effect on the yield. A strong correlation (r=0.75) was identified between the dry matter yield of herbage and the amount of rainfall. The effect of legumes on the dry matter yield was also very strong (r=0.786**l) and that of grasses moderate (r=0.619*l).

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THE EVALUATION OF STUBBLE CATCH CROPS

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Key words: biomass, nitrogen, weather, soil nitrogen

Abstract

Ten plant species, used or proposed as stubble catch crops, were evaluated in a field experiment at two sites with different soil-climate conditions during the years 2006 and 2007. The experiment was established for winter wheat, at two sowing dates; summer (middle of august), and early autumn (middle of September). The results during the two years demonstrated that white mustard, radish, and phacelia had the highest biomass yield stability and also the highest quantity of nitrogen fixed into the biomass on both sowing dates, in comparison with other species. The crops also showed a good emergence on the autumn seeding date, and a reasonable performance under the dry conditions in 2006.

Introduction

The stubble catch crops are cover crops sown in late summer and early autumn after the harvest of the main crops (e.g. Vach *et al.* 2005, Vos and Putten 1997). They are introduced into cropping systems to prolong the period of vegetative cover of the soil. The catch crops are used with the prospect of several benefits: especially soil protection from erosion, and retention of nitrogen to reduce the risk of nitrate leaching; but also for the input of organic matter, enhancement of nutrients and soil microbial activity, weed and pathogen suppression, as well as a refuge and source of food for the macrobiota. Additionally, the impact of introduction of catch crops on the productivity of the main crops, short- and long-term balance, and the effectiveness of nitrogen in crop rotations have been the objects of intensive research (e.g. Thorup-Kristensen *et al.* 2003, Berntsen J. *et al.* 2006).

The expected positive effects depend directly on the success of the catch crops, which is the ability to produce substantial amounts of aboveground biomass (more relevantly total one) before the onset of winter. Under the fluctuating climate conditions of Central Europe (Climate Atlas of Czech Republic, 2007, www.chmi.cz) the establishment and growth of catch crops is limited chiefly by the length of the growing period, as determined by radiation, (sum of) temperatures, the occurence of early frost, and by water availability (some years). The poor growth of catch crops decreases the positive effects on soil protect ion.

To increase the area of catch crops, a subsidy (of 104 Euros) is granted to farmers who register with this system and will grow catch crops regularly (minimum-maximum acreage is 3–10 % of the arable farm soil). Twenty crops, both over-wintering and frost-susceptible species, are entitled to this subsidy. The crops must be sown before the 20th of September, and must be left in the field until at least the 15th of February. Farmers sometimes are inclined to postpone the sowing until the end of September in order to have less crop residue in the Spring. The date of sowing also

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varies, due to the date of harvest of the pre-crops and the actual weather conditions. Typically, the catch crops after potatoes and fodder maize (highly risky crops), in the potato growing region, are often sown too late to fulfil the expected effects.

To use catch crops effectively and to broaden the diversity of suitable species, a better understanding of the impacts of the site and weather conditions in interaction with variable sowing dates upon their growth is needed.

The aim of this contribution was to compare the performance of several species of listed (or prospective) catch crops, at optimum and delayed sowing dates. The experiment is part of wider research at several locations within the Czech Republic aimed at improvement of agro-ecological zonation of catch crops, with respect to the variability of meteorological conditions.

Materials and Methods

In the field experiment, 10 plant species (including both overwintering and frost susceptible ones) were evaluated: white mustard (*Sinapis alba* L.), phacelia (*Phacelia tanacetifolia* Benth.), radish (*Raphanus sativus* L. var. *oleiformis*), buckweat (*Fagopyrum esculentum* L. Moench.), millet (*Panicum miliaceum* L.), sea kale (*Crambe abyssinica* Hochst. Ex. R.E.FR.), semiperenial rye (*Secale cereale* L. var. Multicaule Metzg.), common canary grass (*Phalaris canariensis* L.), safflower (*Carthamus tinctorius* L.), mallow (*Malva verticillata* L.) and Westerwold ryegrass (*Lolium multiflorum* var. Westerwoldicum) (only at Lukavec). A bare-soil treatment was additionally included into the scheme.

The field experiments were established at two sites with different soil-climate conditions: Praha-Ruzyně (heavy soil, higher average temperature, and lower precipitation) and Lukavec at Pacov (medium soil, lower temperature, and higher precipitation). The crops were sown after winter wheat on two dates; summer (in the middle of August), and a more delayed date (middle of September) – with 10 m^2 plots, in four repetitions, in a split plot experimental arrangement.

Table 1 Meteorological conditions in the 2006 and 2007 seasons, Praha-Ruzyně.

	Precipitation	Temperature	Radiation	Relative humidity
2006	mm	°C	MJ	%
August	99.4	16.6	13.4	79.1
September	6.6	17.4	14.3	74.2
October	30.2	11.3	7.5	85.3
November	10.2	6.6	3.3	88.6
December	13.4	3.6	2.5	90.7
2007	mm	°C	MJ	%
August	80.8	19.0	16.7	73.2
September	72.0	13.0	10.8	81.5
October	15.4	8.5	6.6	88.4
November	35.6	2.5	3.3	92.1
December	15.0	0.5	1.9	92.2

Results and Discussion

The figure, the results of the experiment with the catch crops from the two sites are represented; only data from Praha-Ruzyně is shown (Figure 1, 2).

The results showed a great variability in the biomass and N-yield among species (more than 100%); and also in the reaction to delayed sowing, dry summer and autumn (2006), warm winter (season 2006/07), plus sensitivity to autumn frost (season 2007/08) (Table 1). Further, the different weather conditions during the winter affected the content of nitrates in soil and in the soil solution at early spring. While during both seasons, the nitrate content using crops with a high biomass was very low before winter, in comparison with bare soils; the spring content was higher in 2008 than in 2007 (probably due to fast mineralization of the catch crop material partially or fully destroyed by autumn frost and due to favourable conditions for mineralization during winter 2007/08). The autumn and winter 2006/07 was exceptionally warm, dry and without frost periods, so that most of the examined species survived until spring and were able to accumulate nitrogen in their biomass.

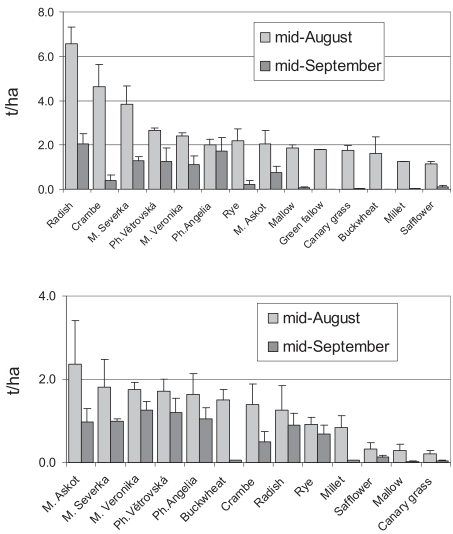

Figure 1: The above-ground biomass of stubble catch crops sown in mid-August and mid-September in years 2006 (top) and 2007 (bottom); harvest before the onset of winter. Yields of three cultivars of white mustard (M.) and two cultivars of phacelia (Ph.) are shown.

The results of the field experiment showed that white mustard, radish, phacelia, and to some extent also crambe and buckwheat, had the highest biomass yields (and the highest quantity of nitrogen fixed into biomass) in both years, as well as on both dates of sowing (with the exception of buckwheat); when compared with other species (Figs. 1 and 2). The crops also showed excellent emergence on the autumn seeding date and under the dry conditions in 2006. Mustard, radish, and phacelia also had great root biomass that increased their ability to reduce erosion. Similar results were obtained from the other (Lukavec at Pacov) experimental site (a potato growing region).

The crops that are more sensitive to low temperatures (buckwheat and millet) were killed earlier by short-term night frosts during autumn, in both years. This fact decreases their positive effect on soil protection from erosion and the uptake of nitrogen. On the other hand, soil cultivation in Spring is easier, due to low amounts of crop residues.

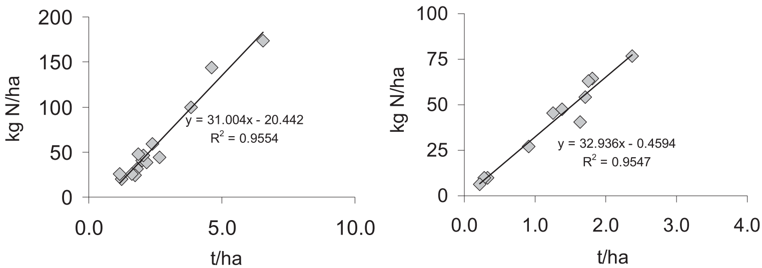

Figure 1: The relationship between above-ground biomass (t/ha) and N-yield (kg/ha) of catch crops, sown at mid-September and harvested before winter in 2007 (left) and 2006 (right).

Conclusions

The two-year results of the field experiment showed that the weather conditions in the experimental years differentially affected the growth and biomass of several catch crops, in interaction with the date of sowing. The results suggest both the possibilities and limitations for the utilization of less-common, un-traditional catch crop species.

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INFLUENCE OF STAND ORGANIZATION ON PRODUCTION INDICATORS OF ORGANICALLY GROWN FODDER BEET

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Key words: fodder beet, technologies, organic farming

Abstract

In three years trials, established in 2005, 2006 and 2007 at the ecological area in Prague – Uhříněves various growing technologies for fodder beet different row distances (45 cm and 37.5 cm), plant distance in row (18 and 25 cm) and weed regulation (line weeding, line weeding and digging, line weeding, digging and weeding) were compared. Weed abundance, attack by leaf noted, chlorophyll content and yield of roots were evaluated. Significant influence of year was discovered. In 2005 variation in canopy organization did not exchange plant attack by leaf diseases and bulb yield and way of weed regulation had significant influence on plant attack by leaf diseases and bulb production. In 2006 variation of canopy organization affected plant attack by leaf diseases. Bulb yield was influenced by way of weed regulation. In 2007 canopy organization did not influence plant attack by leaf diseases but it influenced the bulb production. Higher yields were obtained at the variants of narrower rows.

Introduction

In ecological production of fodder beet we have some unsolved questions concerning e. g. weed control, beet competitiveness improvement and optimal stand density. Fodder beet is a wide-row crop with slow initial development, which reduces its competitiveness in relation to weeds.

The aim of organic farming is to create coexistence of multilateral, biologically and ecologically balanced weeds with low biomass production and strong culture crop. In weeds regulation we use preventive measures (seed rotation, late sowing, parallel growing of covering undersowings etc.), but also direct regulation methods, i.e. harrowing and line weeding (Petr, Dlouhý *et al.*, 1992).

Materials and Methods

During 2005 – 2007 experiments with fodder beet were established at the certified and controlled ecological site of the Experimental station in Prague – Uhříněves. The aim of the project was to optimize fodder beet row spacing under ecological growing conditions with respect to weed infestation, leaf diseases (*Cercospora beticola*, *Erysiphe betae*, *Ramularia beticola*) and yield.

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Weed regulation problematics was targeted to be solved by row spacing. In order to achieve earlier row covering we tested the reduction of interrow distance from 45 cm to 37,5 cm. In our experiments changes caused by different stand organization and further treatments (Table 1) per number of vascular bundle circles and production indicators were evaluated. During vegetation weed infestation and degree of leaf diseases were evaluated.

Results were evaluated by statistical program SAS using analysis of variance at a significance level of $\alpha = 0{,}05$. Significant differences are marked by different letters (a,b,c,d) and non-significant values by „ns".

Results and Discussion

Modification in stand organization (reduction of interrow distance and stand density increasement) did not result in changes in leaf disease infestation of plants in 2005 (Table 4). During 2006–2007 row spacing and weeds regulation influenced plants infestation with leaf diseases. Statistical evaluation of yields in 2005 did not show an influence of spacing on root yield (Table 3). Average weight of one root was influenced by stand organization and weed infestation regulation (Table 2). The number of vascular bundles was not influenced by stand organization. Weed regulation methods confirmatively influenced plant infestation with leaf diseases in 2005. Variants, in which weeds in the row were not regulated, but only between the rows, have been more infested with leaf diseases. Before harvest beet leaves in non-weed variant at 45 cm rows were the most infested.

Before harvest in 2006 the least statistically confirmative infestation was found in non-weed variant with wider rows (34 %) and the highest infestation was found in variant with narrow rows with line weeding and hoeing (39 %). Diseases infestation level in 2006 in all monitored variants at the end of vegetation reached in average only 35%. In 2007 differences before harvest disappeared, leaf diseases infestation did not differ between the treatments. On average of all monitored variants diseases infestation reached 64 % at the end of the vegetation in 2007.Roots production was during 2005 and 2006 significantly influenced by weeds regulation method (Table 3). In 2005 with both stand densities (determined by different interrow distances – 45 cm and 37,5 cm) the highest yield was reached by control variant without weeds. In 2006 the highest yield was reached by variant with wider rows with hoeing (86,8 $t*ha^{-1}$), followed by the control variant with narrow rows without weeds (83,8 $t*ha^{-1}$). The worst results were obtained by the variants with narrow rows with line weeding, narrow rows with line weeding and hoeing and narrow rows without weeds with higher distance between plants in row. Average weight of one root was the highest in 2006 in non-weed variant with narrow rows and higher distance of plants in row (1490 g). The number of vascular bundles was not influenced by stand organization (Table 3). Yield values, weight of one root and number of vascular bundles were not statistically confirmative in 2006.

Higher yields in 2007 were reached in variants with narrow rows in comparison with wider rows. The highest yield was reached by variant of narrow rows with hoeing. Differences among obtained yields were not significant. In 2007 average weight of single roots was the highest in non-weedeed variant with narrow rows and higher distance between plants in row (1160 g). Number of vascular bundles was not influenced by stand organization. Values of single root weight were not statistically significant between compared variants. Given the relatively small weed infestation, roots production was more influenced by row spacing than by weed regulation method. Generally higher yield was reached by variants with narrow compared to wider rows.

Tab. 1 Canopy organization variants and weed regulation

Row distance	Canopy density	Weed regulation
45 cm	100 tis.ha^{-1}	without weeds – line weeding (as necessary), digging in row and weeding during vegetation
45 cm	100 tis.ha^{-1}	line weeding (as necessary) + 1x digging in row during singling
45 cm	100 tis.ha^{-1}	line weeding (as necessary) + 1x digging in row before canopy connection
37,5 cm	120 tis.ha^{-1}	without weeds – line weeding (as necessary), digging in row and weeding during vegetation
37,5 cm	120 tis.ha^{-1}	line weeding (as necessary) + 1x digging in row during singling
37,5 cm	120 tis.ha^{-1}	line weeding (as necessary) + 1x digging in row before canopy connection
37,5 cm	100 tis.ha^{-1}	without weeds – line weeding (as necessary), digging in row and weeding during vegetation

Tab. 2 One root average weight

Row distance (cm)	Technology	1 bulb average weight (g)			
		2005	2006	2007	average
45	without weeds	1095a	1080b	1042ab	1090
45	line weeding	204c	1200ab	976ab	667
45	line weeding and digging	596bc	1300ab	964ab	982
37,5	without weeds	884b	1330ab	842b	806
37,5	line weeding	213c	1120ab	918ab	739
37,5	line weeding and digging	586bc	1180ab	940ab	784
37,5 (25 cm in row)	without weeds	1051a	1490a	1157a	1233

Tab. 3 Yield of roots

Row distance (cm)	Technology	Yield (t*ha-1)			
		2005	2006	2007	average
45	without weeds	114,0c	79,1a	87,9a	93,7
45	line weeding	17,2a	74,4a	87,2a	59,6
45	line weeding and digging	59,4b	86,8a	79,6a	75,3
37,5	without weeds	102,5c	83,8a	94,8a	93,7
37,5	line weeding	23,9a	70,7a	94,9a	63,2
37,5	line weeding and digging	66,5b	72,5a	97,0a	78,7
37,5 (25 cm in row)	without weeds	108,9c	72,8ns	92,3ns	91,3

Conclusions

Fodder beet is suitable crop for organic farming. It can be grown so in 45 cm and in 37,5 cm interrow distance. Stability of yield is warranted only in technologies with weed liquidation. The best seems to be technology without weeds with line weeding, digging in row and weeding during all over the period of vegetation.

Tab.4: Plant attack by leaf diseases

Row distance (cm)	Technology	% of attacked leaves						
		2005			2006		2007	
		28.7.	12.8.	4.10.	6.9.	22. 9.	4. 9.	24. 9.
45	without weeds	13a	27a	99c	25	34 c	40b	65
45	line weeding	15ab	31ab	94bc	30	37abc	50a	65
45	line weeding and digging	9w	35ab	85ab	29	35abc	46ab	65
37,5	without weeds	22bc	41ab	82ab	26	35 b	43ab	64
37,5	line weeding	10a	31ab	92abc	23	38 ab	45ab	63
37,5	line weeding and digging	14ab	33ab	89abc	32	39 a	47ab	66
37,5 (25 cm in row)	without weeds	27c	49b	80a	23 ns	33c	42ab	64ns

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TREATMENT EFFECTS OF FUNGICIDAL BIOAGENTS ON POPPY SEEDS (*Papaver somniferum* L.)

KUCHTOVA, P.[1], DVORAK, P.[1], TOMASEK, J.[1], PSENICKA, P.[1]

Keywords: Polyversum, Supresivit, poppy seed, yield, capsule, fungal infection, mycotoxins

Abstract

Polyversum (oospores of Pythium oligandrum) and Supresivit (Trichoderma harzianum Rifai aggr., spores PV 5736-89) are bioagents with suppressive fungicidal effect registered in CR for use in organic farming. In 2006 and 2007, they were applied in four dosages in a replicated field trial at an organic farm in Central Bohemia. Treatment effects on fungal disease incidence of capsules of three poppy varieties as well as seed contamination by naturally occurring mycotoxins were determined. The application of Polyversum and Supresivit increased yield of the poppy seeds in varying degrees as well as decreased disease incidence.

Introduction

Minimalised soil preparation, sophisticated application of fertilizers and plant protection chemicals used in abundance are typical for intensive yield production in conventional large-area arable farming (Tomasek, 2008). However, large-scale application of chemicals in plant protection not only were profitable but also brought a number of disadvantages, like generated resistance of harmful organisms to pesticides, instability of agro ecosystems and contamination of the environment (Okrouhla, 1993).

Pleospora calvescens (syn. *P. papaveracea*) is considered to be the most harmful fungal pathogen (Hosnedl, 1998) attacking poppy seeds (*Papaver somniferum*); it can cause yield reductions of up to 80 %. Therefore it is even considered by authorities as a potential biocontrol agent against opium poppy (Bailey, 2004).

It is necessary to respect prevention and plant protection against pests and diseases in any ecological farming system. At present, a number of registered biocontrol agents are available in the Czech Republic (Tomasek, 2008). Biocontrol agents need a different approach than chemicals, as their use is more difficult from the methodical point of view, since both pathogens and treatment conditions of bioagents have to be observed (Duskova *et al.*, 1994). Advantage of bioagent application is that they have no negative effects on the poppy plants nor cause problems by overdosing or residues.

Materials and Methods

Field trials with the three varieties Albin (white seed, registered in 1991), Major and Opal (both blue seed, registered in 2002 and 1995, respectively) of poppy seed were conducted in

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a field of an organic farm in Budyne nad Ohri in 2006 and 2007 to investigate the efficacy of the bio-fungicides Polyversum (oospores *Pythium oligandrum,* Drechsler, 1 x $10^6.g^{-1}$) and Supresivit (*Trichoderma harzianum*, Rifai aggr., spores 14 billions per g) on the incidence of *Pleospora herbarum* and *P. papaveracea* (perfect stages of *Stemphylium botryosum* and *Helminthosporium papaveris*, respectively) symptoms on poppy capsules harvested. Finally, yield was determined and quality of seed in terms of Aflatoxin B1 and Ochratoxin A contents was measured from harvest in 2006.

The trials were carried out in a randomised block design in three replications; the average size of the experimental plots was 10 m^2 in 2007 and 2.55 m^2 in 2006, due to an intense incidence of *Cirsium arvense*, leading to the intentional reduction of trial plot size. In 2006, two varieties (Major, Opal) and different dosages of Polyversum and Supresivit were used in the experiment: 1.0 $g.m^{-2}$ for Supresivit (S1) and 0.1 (P1), and 0.2 (P2,) $g.m^{-2}$ for Polyversum (Tab. 2). In 2007, the trials were extended and three varieties (Albin, Opal and Major) and three increasing dosages of two bio agents were used in the trial: 1.0 (S1), 2.0 (S2) and 3.0 g $.m^{-2}$ for Supresivit, 0.1 (P1), 0.2 (P2,) and 0.3 (P3) $g.m^{-2}$ for Polyversum. Sowing dates were April, 4th in 2006 and April 14th in 2007. The row spacing was 45 cm. The sowing rate was 55 germinating seeds per m^2 (2.5 kg per hectare). Spelt (2006) and potatoes (2007) were the previous crops, respectively.

After manual harvest of the trial plots, yield and fungal diseases (*Pleospora herbarum*, *P. papaveracea*) incidence on the poppy capsules were observed. 30 capsules per replication of each variant were chosen for determination of infestation ratio; they were categorized into three groups in accordance with the extent of infestation (%): < 25, < 60 and > 60 and, with the aim to simplify of explication of our observations, it was used formula to calculate of the infestation ratio (data at disposal at the author).

Seed contaminations by naturally occurring mycotoxins were determined by testing seed samples in reference to contents of mycotoxins (Aflatoxin B_1 and Ochratoxin A). 12 samples (mixtures of seeds from 3 replications of each variant), 8 samples from ecological experimental location at the organic farm in Budyne nad Ohri and 4 comparative samples from conventional experimental location in Cerveny Ujezd (analogous natural conditions, 37 km as the crow flies) were chosen. Contents of mycotoxins in the samples were determined by using radio immunochemical methods developed by Pichova *et al.* (Aflatoxin B_1, 1981) and by CHU *et al.* (Ochratoxin A, 1976) in RIA laboratory at the State Health Institute in Brno. The results were verified by HPLC, ibid. (Reisnerova, personal notification, 2007)

The results of yields and fungal disease evaluation were statistically assessed by an analysis of variance of multiple classifications (ANOVA) in the Statgraphic system. Significance of differences between means of varieties, years and treatment dosages were verified by an LSD test, $\alpha = 0.05$.

Results and Discussion

In 2006, the results in the table 1 show the highest yield achieved by the variety Opal (2.261 t), followed by the variety Major (2.068 t), both treated by Supresivit in a dose of 1.0 $g.m^{-2}$ (S1). The variety Opal clearly reacted well to climactic doses in the case of Polyversum at the level 0.2 (1.844 t, P2) and 0.1 (1.767 t, P1) g per m^2, respectively. As well, averaged results seem to be favourable for treatment by Polyversum at the level 0.1 $g.m^{-2}$ (P1), there was probably some fault due to natural condition, while result of control was higher than treatment P2 for variety Major in 2006 (Tab. 1).

Tab. 1: Yield of poppy seed under treatment of fungicidal bioagents (t per ha). Budyne nad Ohri, 2006, 2007.

2006		P1	P2	P3	S1	S2	S3	Control
SD.s 0.3340	SD.s	0.1011	0.3734		0.1365			0.0969
	Major	1.624	1.316		2.068			1.338
Yield (t.ha^{-1})	Opal	1.767	1.844		2.261			1.475
	Mean	1.696	1.580		2.165			1.407
2007		P1	P2	P3	S1	S2	S3	Control
SD.s 0.13024	SD.s	0.0862	0.0526	0.1045	0.0320	0.2304	0.0781	0.0685
	Albin	1.243	1.152	1.457	1.393	1.310	1.120	1.038
Yield (t.ha^{-1})	Major	1.319	1.257	1.259	1.330	1.425	1.035	1.133
	Opal	1.147	1.200	1.300	1.352	0.981	1.191	1.171
	Mean	1.236	1.203	1.339	1.358	1.239	1.115	1.114

In our results from the year 2007, the highest yield was achieved by the variety Albin (1.457 t), treated with a triple dose of Polyversum at the level of 0.3 g.m^{-2} (P3), followed by the variety Major (1.425 t), treated with S2 (Tab. 1).

Tab. 2: LSD test for significance of differences among poppy seed yields, fungal disease infestation ratios of the poppy capsules, means of varieties, treatments and experimental years (LSD, α=0.05)

		Yield (t.ha^{-1})	d_{min}	Sign.	Infestation ratio (%)	d_{min}	Sign.
Variety	Albin	1.15		a	1.60		a
	Major	1.46	0.07	b	1.95	0.09	b
	Opal	1.34		ab	1.95		b
Treatment	P1	1.42		bc	1.95		bcd
	P2	1.45		bc	2.23		d
	P3	1.34		abc	1.35		a
	S1	1.36	0.10	abc	1.45	0.12	a
	S2	1.24		abc	1.68		abcd
	S3	1.12		abc	1.49		abc
	Control	1.23		ab	2.01		bcd
Year	2007	1.18	0.05	a	1.55	0.23	a
	2006	1.71		b	2.59		b

dmin = least significant difference

Even though, P2 was superior in average of both experimental years (Tab. 2), it is notable that the difference between averaged yields of varieties treated with Polyversum and Supresivit is not very high. Regardless of the applications used in our experiment, the variety Major had the highest-rating (Tab. 1, 2).

The influence of experimental year on yields and level of infestation was significant, probably due to not only meteorological differences among years (when observations were made by the same person) but influenced also the sowing rotation. At last, this significant difference between the years is facultative explication for the statistically significant resistance of the variety Albin against fungal disease infestation of poppy capsules (Tab. 2).

Regarding mycotoxins, the contents of the Aflatoxin B_1 (AFB_1) and Ochratoxin A in the poppy seeds harvested in our experiment were, in the majority of cases, difficult to detect (contents of AFB_1 in all of samples were ≤ 2.0 µg per kg, Ochratoxin A was from ≤ 1.0 to ≤ 3.0 µg per kg) and all correspond to the Czech regulation (No. 298/97, Col. maximum permissible content of AFB_1 and Ochratoxin A is 5 and 10 µg per kg, respectively; data at disposal at the author).

Conclusions

Results of trials showed Major as the variety with the statistically highest yield potential compared to Albin and Opal.

The application of Polyversum and Supresivit in our experiment increased the yield in average from 20 % to 50 %, compared to the control treatment. However, the influence of these preparations is not completely clear. Treatments of Supresivit increased productivity and inhibited the occurrence of fungal diseases symptoms on the poppy capsules. It seems however that higher doses of Supresivit might induce yield depression. Increased doses of Polyversum influenced positively the yield of poppy seed, and simultaneously declined the attack of fungal diseases.

Our results confirmed the possibility of achieving a good yield of poppy seed cultivated in organic farming system under the choice of the agricultural interventions – cultivation of poppy in wider row spacing (45 cm), the preference of varieties resistant to fungal diseases and Polyversum and Supresivit treatments.

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SELECTED SOIL QUALITY INDICATORS IN A LOAM DEGRADED CHERNOZEM ON LOESS UNDER ORGANIC AND CONVENTIONAL MANAGEMENT

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Key words: conventional farming system, organic farming system, soil reaction, organic matter, microbial biomass

Abstract

Problems arising from conventional management in agriculture have led to the development and promotion of low input or even organic farming management systems. The assessment of soil fertility and soil quality are important objectives mainly in organic farming. To improve soil fertility, efforts need to be made to increase soil organic matter content. An understanding of microbial processes is important for the management of farming systems, predominantly those that rely on organic nutrients inputs. Transformation of soil organic matter is associated with the activity of microorganisms and enzymes in soil. The microbial biomass contributes to maintaining long-term agricultural sustainability. This study compared organic and conventional farming systems in term of organic matter and microbial biomass contents in soil. During the years 2003 and 2005 the parameters were observed on the precise field experiment plots in Borovce (near Piestany, in the western part of the Slovak Republic). The soil representative is loam and clay, loam degraded Chernozem on loess. In the conventional system where physiologically acid mineral fertilizers were applied the values of soil reaction were lower than in organic farming system although the differences were not statistically significant. Statistically higher contents of organic matter in soil and also statistically higher microbial biomass carbon (C_{mic}) were in organic plots. These results indicate that organic management positively affected soil reaction, soil organic matter content and microbial biomass in soil, thus improving soil quality and therefore influence also implications for nutrient bio-availability.

Introduction

Problems arising from conventional management in agriculture (i.e., frequent pesticide applications, excess inorganic fertilizer usage, declining soil organic matter, soil erosion and the presence of pesticide residues in food) have led to the development and promotion of organic farming management systems that take account of the environment and public health as main concerns (IFOAM, 1998). An understanding of microbial processes is important for the management of farming systems, particularly those that rely on organic inputs of nutrients (Melero *et al.*, 2005). Soil microorganisms constitute an active component of the soil organic pool, controlling the breakdown of organic matter and, hence, the release of nutrients and their availability for other organisms. The microbial biomass also acts as a small but labile reservoir of nutrients that contributes to maintaining long-term agricultural sustainability. The microbial biomass, rather than total amounts of organic C, has been suggested as a useful and

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more sensitive measure of a change in organic matter status. Changes in microbial biomass C can provide an early indication of short-term trends in total organic C of soils (Bergstrom *et al.*, 1998).

Recent studies comparing conventional and organic farming have shown an increase in organic matter, nutrient content, and microbial biomass (C_{mic} and N_{mic}) in organically managed soils (Edmeades, 2003; Bulluck *et al.*, 2002, Fliessbach *et al.*, 2006).

Materials and Methods

The experimental plots were situated in an area with a continental character of weather (average annual temperature of 9.2 ^{0}C and the mean annual precipitation of 593 mm). A large variability of temperature and unequal precipitation are a characteristic of this area. The soil representative is loam and clay loam degraded Chernozem on loess. The chemical and biological soil properties were determined within two farming systems:

Organic system: Organic farming management has been carried out since 1995. All operations were undertaken in compliance with Slovak Law SR 421/2004. Crop rotation: alfalfa, winter wheat + intercrop, pea, winter wheat + intercrop, potatoes, spring barley + alfalfa underseeding. Phacelia and mustard were used as an intercrop mix. Farm yard manure fertilisation took place three times during the crop rotation to potatoes and winter wheat after pea and alfalfa. Vermisol preparation was used to pea and spring barley and winter wheat mainly for the quality of production improvement. The P and K fertilisation couldn't be undertaken as there was no permit available in the Slovak Republic. Within the system there was mechanical weed control but there was no chemical plant protection.

Conventional system: This system had the same crop rotation as the organic system. Farmyard manure fertilisation took place once during the crop rotation on the potatoes, Vermisol was applied to winter wheat after both forecops. The synthetic N fertilisers were used to pea, spring barley and to wheat and P and K mineral fertilisation was defined by the balance method. Chemical protection was used against pests and diseases.

The same varieties and soil tillage practices were used in both farming systems and nitrogen inputs from organic fertilisers in organic system were equal as this in conventional system from synthetic fertilizers. The soil samples were taken four times during the vegetation period, from the depth of 0.02–0.2 m. The air dried soil samples were used for the chemical analysis (pH/KCl, C_{ox}, N_t, N_{in}). The biological analyses were determined in the fresh soil samples.

Used methods: pH/KCl measured by Ion Analyser (JENWAY, VB), C_{ox} measured by analyser CNS-2000 (LECO, Corp. St. Joseph, MI, USA), and microbial biomass C_{mic} defined by fumigation – extraction method.

The obtained results were statistically evaluated by non-parametric method by means of the Wilcoxon pair test.

Results and Discussion

The two farming systems (organic and conventional) compared in Borovce, near Piešťany has emphasised interesting differences in the observed soil quality indicators in the years 2003–2005. The soil pH was not statistically different between conventional and organic management (Table 1) although a higher soil reaction was discovered in the organic farming system. The similar results were obtained also by Fliessbach *et al.* (2007).

The decrease of organic matter content in the soils in Slovakia is becoming to be a problem of cardinal importance. More than 59 % of the land are in Slovakia belongs to the areas where organic matter decline represents the very important degrading process. The organic management system and the use of organic residues and farmyard manure have been shown to maintain soil organic matter at higher levels than inorganic fertilisation (Table 1). In all monitored years the organic matter content was higher in organic farming system (the average amount represented 1.306 %) than in conventional farming system (the average amount represented 1.223 %). Our results are in the line with the research results published by Edmeades (2003).

Microbial biomass C varied from 575.1 to 780.5 $\mu g.g^{-1}$ in the conventional farming system and from 611.3 to 883.4 $\mu g.g^{-1}$ in the organic farming system (Table 1). In the average microbial biomass was statistically significantly higher under the organic than the conventional management system (** P<0.01). Microbial serves as an important reservoir of plant nutrients, such as N and P (Marumoto *et al.*, 1982). Microbial biomass, in response to environmental changes, can therefore have important implications for nutrient bioavailability.

Tab. 1: Soil chemical and biological characteristics in organic and conventional system in the years 2003–2005

Indicator	Year	Organic farming system	Conventional farming system
pH	2003	6.72	6.63
	2004	6.74	6.74
	2005	6.85	6.69
	Average	6.77	6.69
C_{ox} (%)	2003	1.307	1.228
	2004	1.287	1.223
	2005	1.325	1.218
	Average	1.306	1.223
Microbial biomass ($C_{mic}.g^{-1}$ dry matter)	2003	790.0	780.5
	2004	611.3	585.1
	2005	883.4	728.6
	Average	761.6	698.1

Tab. 2: Wilcoxon pair test (significance of differences between organic and conventional system)

Indicator	Number of no-zero differences	Test value	P-value
pH/KCl	36	0.166667	0.867628
C_{ox}	36	4.5	0,0000068016++
Microbial biomass	83	1.97576	0.0481821++

+ Significant for P<0.05, ++ Significant for P<0.01

Conclusions

The results obtained during the years 2003 and 2005 indicated that organic management slightly positively affected soil reaction and increased organic matter content. Organic management system promoted the increase of the amount of microbial biomass C.

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SOIL FERTILITY MANAGEMENT WITH USING DIFFERENT ORGANIC FERTLIZER IN RICE PRODUCTION SYSTEMS OF IRAN

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Key words: organic fertilizer, rice yield, soil properties

Abstract

The main area of rice cultivation in Iran is Mazandaran province (240,000 hectares of rice which produces 45 percent of the country's rice). Addition of different organic materials in to the soil is one of the most common rehabilitation practices to improve yield and soil physicochemical properties in rice production systems in Mazandaran. For this purpose organic materials with various origins were applied in paddy soil to manage soil fertility in a proper way for long-term rice cultivation. Organic materials which used were compost, manure, rice straw, faba bean residue and clover. Results showed that the fertilizer source had significant effect ($p< 0.05$) on percentage of organic carbon, organic matter, total nitrogen, availability of P and K, CEC & pH but had not significant effect on EC. Treatments had very significant effect ($p\leq 0.01$) on soil physical properties such as bulk density, porosity. In the plots which received faba bean residue and clover, grain yield and biological yield of rice were higher in comparation with other treatments. In general, organic materials was more useful for the improvement of soil properties than conventional management and the use of faba bean residue and clover as green manure was more effective than other organic fertilizer..

Introduction

Rice is the second main food consumed in Iran, with wheat being the main staple for most of the population. In general, rice consumption in Iran dates back more than 25 centuries, and has risen with increased incomes. Iranian rice is long grain, and is generally grown under irrigation in lowland areas. The wet Caspian lowlands in the northern provinces of Gilan and Mazandaran are the primary growing areas, where heavy rainfall typically facilitates paddy cultivation in this sub-tropical, humid region.

Mazandaran province has 240,000 hectars of rice and the highest area in the Iran. The state's rice farming system is highly reliant on agrichemical inputs. Increasing cropping intensity with modern rice varieties has enhanced nutrient mining from the soil because nutrient removal has exceeded annual replacement, even if the national recommended fertilizer doses are applied. Moreover, farmers in Mazandaran are mainly concerned about the application of N fertilizer and tend to neglect P and K fertilizers for rice cultivation because their application often does not produce the yield advantages of the past.

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Indiscriminate use of chemicals and fertilizers has altered the biological ecosystem, affected non-target organisms and adversely influenced microorganisms in the soil. Organic farming, which aims at cultivating the land and raising crops in such a way to keep the soil alive and in good health may be an alternative to the present system of farming which solely depends on chemicals (Dahama, 1996). Application of organic amendments has a positive effect on crop production. Improvement in the soil physical structure after amendment with organic wastes such as crop residue ,manure and compost has also been well documented. Use of organic amendments (OA) is generally seen as a key issue for soil health and sustainability in organic rice-based systems, both in terms of maintaining the amount and quality of soil organic matter (SOM) and in terms of supplying important micronutrients (Yadav *et al.*, 2000; Timsina and Connor, 2001). The general concepts of long-term SOM dynamics are similar in different cropping systems, but the significance of SOM for specific soil properties or crop productivity varies considerably in different types of rice soils and cropping systems (Dobermann and Witt, 2000; Olk *et al.*, 2000; Powlson and Olk, 2000). The objective of this research was to study the effects of different organic fertilizer on rice grain yield and physicochemical properties of soil .

Materials and Methods

A field experiment was conducted during two successive growing seasons (2004/2005 and 2005/2006) in a rice field in the north of Iran. Rice straw, compost, faba, bean, clover residue and manure were used as organic fertilizers and rate of these fertilizers were 6, 10, 16, 20 and 20 t ha^{-1} respectively. For comparison of results with conventional farming systems, chemical fertilizer (120–60–50 kg ha^{-1}) also was used. Experimental design was completely randomized block with three replications. The organic materials were mixed within the first 30 cm of the soil surface layer before sowing. Mineral nitrogen was added to soil as ammonium sulfate (20.5% N) immediately after sowing. Superphosphat (15.5% P_{2O5}) and potassium sulphat (48%K_{2O}) were added to soil before sowing. Dry matter and grain yield of rice was measured at the end of the growing season. After crop harvest three soil samples were taken from each plot, combined and analyzed for physicochemical properties. Data were analyzed by using Excel, SAS (SAS Institute, 2000) and MSTAT software.

Results

Results of analysis of variances of yield and physical properties of soil are shown on Tab. 1. Effects of organic materials on crop productivity were significant ($p<0.01$). The highest grain yield was obtained with using faba bean and clover residue. Straw yield was significantly ($p < 0.01$) affected by the treatments and by application of compost and chemical fertilizer highest amount of biological yield was obtained. Organic fertilizers in comparison with mineral fertilizer have significant effect on crop production, bulk density, porosity and hydraulic conductivity of soil (Tab. 1). The highest total porosity of 0.55 $cm^3\ cm^{-3}$ was obtained with faba bean residue; whereas the lowest values were from the control (0.38 $cm^3\ cm^{-3}$) and fertilizer (0.37 $cm^3\ cm^{-3}$).

Similarly by application of organic fertilizers chemical properties of soil significantly changed, whereas mineral fertilizers have less effect on these factors (Tab. 2). Electrical conductivity of soil (EC) was not affected by any of these treatments. Organic matter, organic carbon, total nitrogen, P and K of soil was higher in the organic materials plots than chemical and control treatments (tab. 2).

Table. 1: Effect of different treatment on crop and soil properties

Treatments	straw (t/ha)	Grain yield (t/ha)	HI (%)	buck density (g/cm^3)	Porosity (cm^3/cm^3)	Hydraulic conductivity (cm/h)
compost	4.3	3.1	42	1.1	0.53	1.8
manure	3.3	2.7	45	0.9	0.45	2
rice straw	3	2.6	46	0.85	0.4	1.3
faba bean residue	4	4.2	51	0.9	0.55	1.9
clover residue	4.2	4.1	49	1.0	0.5	2.1
NPK	4.3	3.9	48	1.87	0.38	0.7
control	2.9	2.4	45	1.7	0.37	0.8
	**	**	*	*	*	**

* significant at $p < 0.05$, ** significant at $p < 0.01$; Data are means of two years experiment

Table. 2: Effects of different treatments on chemical properties of soil

treatments	Organic matter %	Organic carbon (%)	Total N (%)	CEC (coml. kg^{-1})	EC (dSm^{-1})	pH	P (mg/kg)	K (mg/kg)
compost	1.5	1	1.1	18.5	0.9	6.5	27	315
manure	1.7	1.4	0.9	20	0.95	6	29	214
rice straw	2.1	1.2	1.1	19	0.78	7	18	215
faba bean residue	2.2	1.6	1.5	24	0.88	7.3	37	329
clover residue	1.9	1.7	1.7	22	0.7	7.2	23	297
NPK	1.3	0.9	1	16	0.7	6.4	17	265
control	1	0.9	0.7	17	0.75	7	14	182
	*	**	*	**	NS	*	**	*

* Significant at $p < 0.05$, ** significant at $p < 0.01$, NS: non significant; Data are means of two years experiment

Discussion

The organic treatments had positive effects on micro porosity compared with control and fertilizer treatments at depth of 0–30 cm. Similar results were found by Aggelides and Londra (2000) who determined that organic compost application considerably improved soil physical properties by increasing total porosity and changing distribution of pore sizes in loamy and clay textured soils. Marinari *et al.* (2000) also found that total soil porosity increased with organic fertilizers and compost, depending on the amount of materials applied. Bulk density decreased with application of organic matter sources such as faba bean residue, manure and rice straw. Organic matter amendments generally increased soil organic matter concentration leading to a decrease in bulk density. These results are supported by other studies (Aggelides and Londra, 2000).

Conclusions

The organic materials was more useful for the improvement of soil properties in comparison with mineral (NPK) fertilizers. Using faba bean and clover residue as green manure had more effect on crop yield and soil properties than compost, manure or rice straw. Therefore, double cropping of rice-faba bean or rice-clover in Mazandaran produces reasonable yields as well as maintains soil health and fertility. Faba bean and clover use winter rainfall thereby prevent losses of resource (water, nutrients and light) and their residues (shoot and root biomass) provide nutrients for rice.

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INFLUENCE OF MANURES AND BIO-FERTILIZER ON GROWTH AND YIELD OF ROCKET PLANTS

ABDELAZIZ, M.E.[1], POKLUDA[2], R.

Key words: rocket, manure, bio-fertilizer, yield

Abstract

In two successive seasons, a field experiment was conducted to study the effect of cattle manure and chicken manure with or without bio-fertilizer or N on growth and yield of rocket plants (Eruca sativa) grown under open field condition. Plant height, total leaf area and yield showed the highest values with cattle manure combined with N if compared to other treatments. In addition, application of bio-fertilizer to cattle manure led to favorable increase in rocket yield compared to control, visversa trend was obtained with chicken manure. In conclusion, the combination between organic manure and bio-fertilizer could be a successful tool to improve growth and yield of rocket plants and decrease environmental pollution. These effects can be attributed to the good equilibrium of nutrients and water in the root medium and for improving the physical and chemical condition of the soil. To optimize organic manure application, additional experiments have to be done.

Introduction

Rocket is a popular leafy vegetable in Mediterranean countries and the spicy hot taste of its leaves is meanly used to garnish and to flavor salads as well as a large variety of meals (Nicola et al, 2005). In addition, leafy vegetable production found to be positively influenced by N-fertilization (Fontes et al, 1997). However, mineral fertilization may increase nitrate content in the leaves to undesirable levels (Dellacecca and Patruo, 1990). Organic manure found to be the best in realizing good yield with low nitrate content in the leaves (Premuzic et al, 2004). Aim of this work was study the effect of cattle manure and chicken manure with or without bio-fertilizer or N on growth and yield of rocket plants grown under open field condition.

Materials and Methods

This experiment was carried out during the two successive seasons 2001 and 2002 at the Experimental Research Station, Faculty of Agriculture, Cairo University, Egypt. Seeds of rocket plants (*Eruca sativa*) were sown under open field condition on November 1st 2002 and 2003 then harvested 6 weeks after planting, respectively. Plants were arranged in complete block design with four replicates. The physical and chemical analyses of the soil are presented in Table (1).

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[2] As Above

The experiment included the following treatments:

1. Control – only cattle manure (50 $t.ha^{-1}$, Table 2)
2. Control – only chicken manure (25 $t.ha^{-1}$, Table 2)
3. Cattle manure + Bio-fertilizer (Nitroben, a mixture of nitrogen fixing bacteria)
4. Chicken manure + Bio-fertilizer (Nitroben)
5. Cattle manure + N fertilizer (180 kg ammonium $sulphate.ha^{-1}$).
6. Chicken manure + N fertilizer (180 kg ammonium $sulphate.ha^{-1}$).

The mineral N fertilizer and organic manure were applied to the soil as pre-planting soil applications, while bio-fertilizer (600g. h^{-1}) was mixed with rocket seed before planting.

Table (1): Physical and chemical properties of the soil

Physical properties:	
Clay (%)	22.9
Silt (%)	36.2
Fine sand (%)	37.1
Coarse sand (%)	3.8
Soil texture	Clay loam
pH	8.0
EC ($mmohs.cm^{-1}$)	1.11
Organic matter (%)	2.4
Chemical properties:	
N (%)	1.15
P (%)	0.44
K (%)	1.25
Fe ($mg.kg^{-1}$)	40.16
Zn ($mg.kg^{-1}$)	28.90
Mn ($mg.kg^{-1}$)	30.54
Cu ($mg.kg^{-1}$)	15.65

Table (2): Manure analysis

Nutrients	Chicken	Cattle
N (%)	3	1,66
P (%)	1,5	0,78
K (%)	2,6	3,55
Fe ($mg.kg^{-1}$)	1300	3690
Mn ($mg.kg^{-1}$)	825	117
Zn ($mg.kg^{-1}$)	520	40
Cu ($mg.kg^{-1}$)	46	7

Results

Data in Figs. (1–3) showed that the highest significant increase of plant height (25.3, 23.0 cm), leaf area (39.0, 33.4 cm^2) and yield (15.7, 15.4 $t.h^{-1}$) were found with cattle manure combined + N fertilizer followed by chicken manure + N fertilizer, respectively. In addition, the combination between bio-fertilizer and organic manure revealed favorable effects on yield compared to control treatment in the two seasons. The data in Fig. 3 showed that Nitroben increased significantly yield at the rate of 35.5, 14.5 % with cattle manure in the two seasons respectively, and 13.4 % with chicken manure in the first season.

Discussion

Application of N to both manures increased growth and yield than control. This might be related to the increase of available nutrient in soil caused by N treatment. Moreover, the effect of nitrogen fertilization on plant might be through its effect on either the biosynthesis or destruction of some plant hormones (Hanafy Ahmed et al, 1997). In addition, cattle manure found to be more effective on growth and yield of rocket plants based on fact that organic acids of the chicken manure acted as growth inhibitors for the microorganisms of the bio-fertilizers (Abdelaziz et al, 2007).

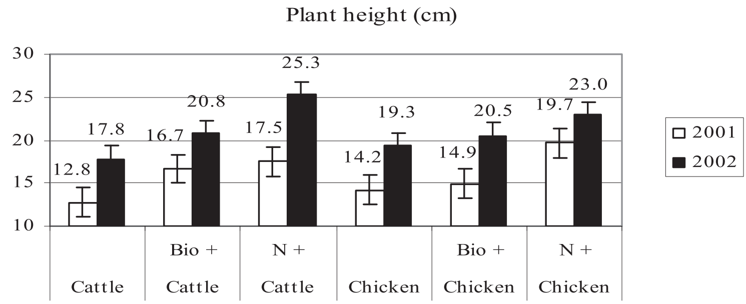

Fig. 1. Plant height of rocket a affected by different fertilization treatments in the two season*

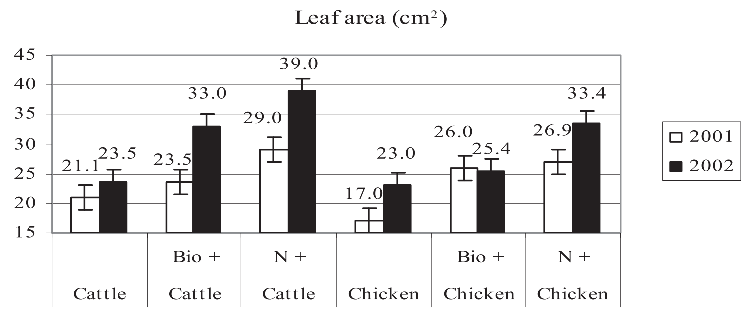

Fig. 2. Leaf area of rocket as affected by different fertilization treatments in the two seasons*

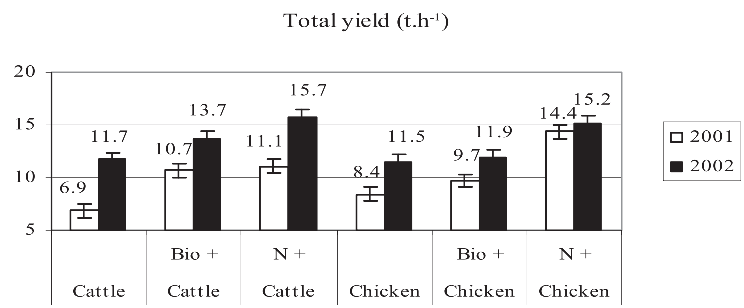

Fig. 3.Yield of rocket as affected by different fertilization treatments in the two seasons*

* Intervals represent L.S.D 0.05

Conclusions

The combination between organic manure and bio-fertilizer could be a successful tool to improve growth and yield of rocket plants, decrease environmental pollution and support ecological production. These effects can be attributed to the good equilibrium of nutrients and water in the root medium and for improving the physical and chemical condition of the soil. In this respect, it can be suggested that bio-fertilizers could be a successful tool to improve growth and yield of rocket plants and decrease environmental pollution.

Acknowledgments

The author is deeply grateful to late Prof. Elsherbeny Abo-El Hassan Professor of Vegetable at the Faculty of Agriculture, Cairo University for his ideal supervision, their help and conductive guidance throughout the course of the study. This work supported by Faculty of Agriculture, Cairo University and project QF4195, Ministry of agriculture, Czech Republic.

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OCCURRENCE OF PEST NATURAL ENEMIES IN ORGANICALLY GROWN WINTER OILSEED RAPE (*Brassica napus* L.)

NERAD, D.[1], ŠKEŘÍK, J.[2], KAZDA, J. [3],

Key words: winter oilseed rape, pest, natural enemies, parasitoid, Hymenoptera

Abstract

The occurrence of natural enemies (Hymenoptera) was monitored to determine their importance for pest reduction within organic and conventional oilseed rape production technology. Numerous oilseed rape pest parasitoids were found during flowering: Hymenoptera: Ichneumonidae – parasitoids of pollen beetles (Meligethes spp.); Hym: Braconidae, Pteromalidae and Platygastridae – parasitoids of cabbage seed weevil (Ceutorhynchus assimilis) and Brassica pod midge (Dasineura brassicae). The difference in occurence of parasitoids, pests and level of their larval parasitization was found between organically grown plots and those with chemical protection. The consequences for organic and integrated oilseed rape pest management are discussed.

Introduction

With exception of weeds, the problems with growing winter oilseed rape in organic agriculture are also related to the incidence of pest. Under the influence of growing areas and prevailing conventional technology, the balance between pest and their natural enemies within oilseed rape have been strongly affected during last 15 years. This study aims to specify occurrence and importance of main group of oilseed rape pest natural enemies (Hymenoptera) within organic and conventional production technology. Furthermore, the detailed knowledge of Hymenopterans occurrence peaks could improve the pest management decisions and their protection.

Materials and Methods

The small-plot trials (10 m^2) with winter organic oilseed rape (OOR) were conducted since 2002 at the experimental station of the ČZU in Prague – Uhříněves, on the officially certified field for organic production. Since 2005 the occurrence of pests and parasitoids was monitored weekly during end of April till end of June on a weekly basis, using a 250 mm sweep net. The numbers of pest larvae and level of their parasitization were monitored weekly since half of May till half of July on a weekly basis, using water traps. Organically grown plots and those with conventional crop protection (COR) at neighbouring area were compared.

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[3] Czech University of Life Sciences Prague, email: kazda@af.czu.cz

Results and Discussion

Numerous oilseed rape pest parasitoids were found during flowering: namely *Tersilochus* and *Phradis* (Hym: Ichneumonidae) – parasitoids of pollen beetles (*Meligethes* spp.) (Figure 1, 2), *Trichomalus*, *Mesopolobus* (Pteromalidae) and *Bracon* (Braconidae) – parasitoids of cabbage seed weevil (*C. assimilis*); *Platygaster* (Platygastridae) – parasitoids of brassica pod midge (*D. brassicae*). Results proved much higher diversity in the incidence of all groups of insects in organic oilseed rape (OOR) growth. The diversity of insect species and greater and more stable representation of pest natural enemies are typical for it. Insecticide treatments may exterminate or repel them and colonizing of the stand appears lower and with time delay (Petr, Dlouhý, 1992). The level of parasitized larvae of pollen beetles was found between 14–40 % by conventionally grown oilseed rape (COR) and between 13–18 % by OOR. However, the total amount of pollen beetle larvae released within OOR growth was more than ten time higher than by COR growth. The level of parasitized larvae of cabbage seed weevil was found only by OOR growth, where ranged between 22–25 %. The occurrence peaks by booth groups of parasitoids (related to *M. Aeneus* and *C. assimilis*) were detected in period of beginning of flowering (BBCH 59–61) until very end of flowering (BBCH 67–69). The insecticide treatments against stem mining weevils (*Ceutorhynchus napi*, *Ceutorhynchus pallidactylus*) and pollen beetles (*M. aeneus*) are obviously carried out earlier – during stem extension (BBCH 31–39) by stem mining weevils and during flower buds development (BBCH 61–57) by pollen beetle. Therefore, these units of parasitoids were not fully endangered by insecticide treatments carried out by COR growth (see Fig. 1–4). However, much more dangerous for them would be late insecticide treatment during flowering (BBCH 61–67), often used in practical conditions against Brassica pod midge (*Dasineura brassicae*).

Conclusions

Under optimal conditions (crop rotation, leguminous or clover based forecrop, plowing soil cultivation, mechanical weeding), the total yield potential of OOR could achieve 60–70 % of

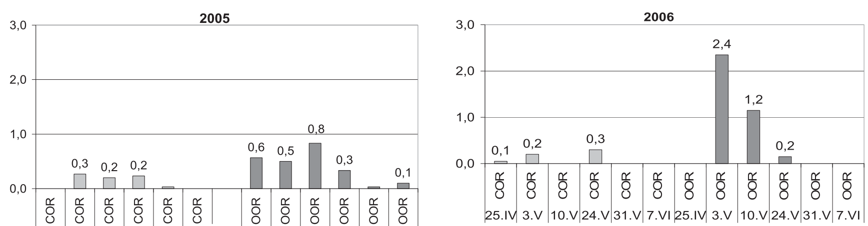
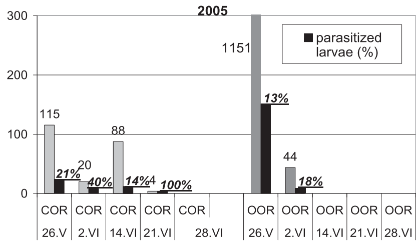


Figure 1, 2: Number of pollen beetle parasitods (Ichneumonidae fam.) per m 2 in 2005 and 2006 captured by sweep net in conventionally grown plots (COR) and in organically grown plots (OOR) between May and June at the experimental site in Prague Uhříněves. Insecticide treatment at COR: 6.4.: cypermethrin + chlorpyrifos (20.4. in 2006), 2.5.: deltamethrin (booth years).



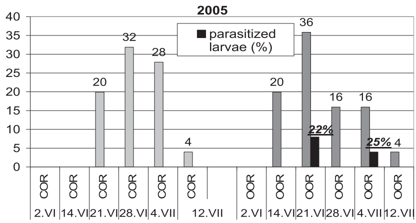


Figure 3, 4. Number of larvae of pollen beetles (3) and cabbage seedpod weevils (4) and percentage levels of their infestation by parasitoids in area of 1 m2. Comparison of COR and OOR growth between May and June 2005 at experimental site in Prague Uhříněves.

yields commonly reached by conventional technology. Although the pest density was higher by insecticide untreated OOR, the damages didn´t cause serious yield loses. The observation in OOR showed higher density of population both pests and their parasitoids. The absence of insecticide treatments could increase the population of pest natural enemies and thereby stronger reduce the pests. However, further studies are necessary for closer determination of parasitoids incidence considering to weather conditions, which change intensely during the spring vegetation of oilseed rape.

Acknowledgments

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INVESTIGATIONS ON THE OCCURRENCE OF WHEAT BUGS (Scutelleridae, Pentatomidae; Heteroptera) IN ORGANIC FARMING OF EASTERN AUSTRIA

GRÜNBACHER, E.[1], KROMP, B.[1]

Key words: wheat bugs, landscape elements, spatial distribution, seasonal occurrence, winter quarters

Abstract

Wheat bugs, an umbrella term for a set of different species, damage wheat by sucking on semi-ripe grains. The proteolytic enzyme inserted with the saliva destroys the gluten. If more than 1.5–2% of the grains are infected, the ground wheat looses its baking quality. In 2003, for the first time since the fifties, a significant occurrence of wheat bugs was recorded in Eastern Austria. Since in organic farming no insecticides are available for direct control, the farmers were advised to grow quality wheat at the greatest possible distance to fallows, windbreaks and other uncultivated areas. To clarify their significance for the wheat bug occurrence, a diploma thesis was performed in the year 2004. The sampling sites were situated in Burgenland, Eastern Austria. The spatial and temporal distribution of the bugs (Scutelleridae, Pentatomidae) was evaluated by hand-searching the ground litter and by sampling with enclosures, sweep net and visual observations in windbreaks, forest edges, field margins, grasslands, fallows and winter–wheat fields (1, 10 and 60 meters from the field edge) and sporadically also in other crops (lucerne, barley, rye and spelt). As a total, 368 individuals from 22 species of bugs were collected. 316 individuals belonged to potentially harmful 10 wheat bug species, Eurygaster maura (67%), Aelia acuminata (16%) and E. austriaca (4%) being most abundant. The sweep net was the most efficient sampling method. The earliest wheat bugs occurred directly in the wheat fields. During the growing season, the species E. maura, A. acuminata und E. austriaca were found almost entirely in winter-wheat fields, whereas in the uncultivated habitats other species occurred. Our data do not suggest that landscape elements as well as fallows enhance wheat bug infestations. The wheat bug infestation of wheat fields might be influenced mainly by the weather conditions in spring and summer. After having compared the climatic conditions of 2003 with the "wheat bug years" 1953 and 1954, we suggest that the recent outbreak of wheat bugs might have been due to the significantly above average temperatures in the years 2000 to 2003.

Introduction

Wheat bugs, an umbrella term for a set of different species of Scutelleridae and Pentatomidae, damage wheat by sucking on semi-ripe grains. The proteolytic enzyme inserted with the saliva destroys the gluten. If more than 1.5–2% of the grains are infected, the ground wheat looses its baking quality (Schöggl *et al.* 2005). Wheat bugs, mainly the climatically dry and warm-adapted *Eurygaster integriceps*, are well-known as important cereal pests in the Near and Middle

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East as well as in parts of the former USSR (Critchley 1998). During years of mass-occurrence, economically significant wheat bug damages by other *Eurygaster* and *Aelia* species also can occur regionally in Eastern Europe. In 2003, for the first time since the early fifties (Bullmann & Faber 1958) a significant occurrence of wheat bugs was recorded in Eastern Austria. Since in organic farming no insecticides are available for direct control of wheat bugs, the farmers were advised to grow baking wheat at greatest possible distances to fallows, windbreaks and other uncultivated areas because they were considered as potential wheat bug winter quarters and sources of infestation.

To clarify this assumption, a diploma thesis (Grünbacher 2005) was performed in the year 2004 to find out species and dominance distribution of the wheat bug assemblage (Scutelleridae, Pentatomidae; Heteroptera) in Eastern Austria as well as their seasonal and spatial occurrence in dependence of landscape elements as potential winter quarters.

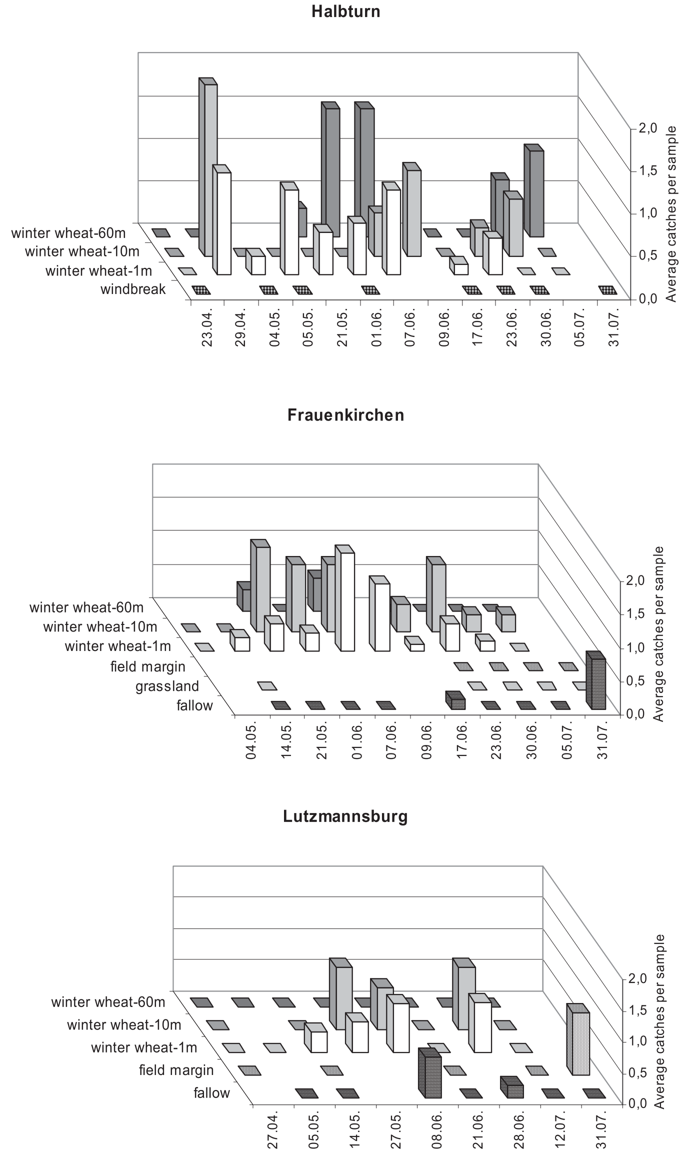
Materials and Methods

The 7 sampling sites were situated in the municipalities Halbturn, Frauenkirchen, Steinberg-Dörfl, Lutzmannsburg, Donnerskirchen, Oggau and Zillingtal, all in Burgenland, Eastern Austria. Each sampling site consisted of several fields and adjacent uncultivated areas, representing different biotopes of the regional agricultural landscape. Sampling was performed from April to July 2004. Early in spring, overwintering wheat bugs were sampled by enclosure traps (Lutzmannsburg: 5, Halbturn: 2) and hand-searching the ground litter of forest edges and windbreaks as well as grassy margins. Later in the season, the spatial and temporal distribution of wheat bugs was evaluated by sweep-netting (triangular-framed sweep-net with side length of 30 cm; 15 double-strokes per sample) in windbreaks, forest edges, field margins, grasslands, fallows and winter wheat fields in 1, 10 and 60 meters from the field edge and sporadically also in other crops (lucerne, barley, rye and spelt). For estimating the significance of sweep net catches with regard to area-related wheat bug abundances, comparative countings by sight were performed in wheat fields.

Results and Discussion

As a total, 368 individuals from 22 species of bugs were collected by sweep-net in the year 2004. 316 individuals belonged to 10 bug species, which had been defined as potentially harmful by Bullmann & Faber (1958), *Eurygaster maura* (67%), *Aelia acuminata* (16%) and *E. austriaca* (4%) being the most abundant ones. Compared to 2003, wheat bug incidence generally was low in 2004, possibly due to cold and wet weather periods in spring and early summer, very likely being unfavourable for population development of the warm and dry preferent wheat bug species. In comparison to counting by sight on the wheat vegetation, sweep-netting proved to be the more reliable and practicable sampling method for comparing different sampling sites as well as for providing material for later species determination, though the abundances might be only of limited area-related meaningfulness.

Concerning the seasonal and spatial pattern of wheat bug distribution, the earliest specimens of *Eurygaster maura*, *Aelia acuminata* and *E. austriaca* were recorded directly in the winter wheat fields where they almost entirely occurred also later on during the growing season. In the adjacent



Figs. 1a – c: Sweep-net catches of the wheat bug *Eurygaster maura* from April until July 2004 in winter wheat fields and adjacent uncultivated habitats in 3 localities of Burgenland: a) Halbturn, b) Frauenkirchen, c) Lutzmannsburg.

field margins and fallows, the first wheat bugs appeared after harvest, as is shown for the most abundant species *E. maura* from three different sampling locations in figs. 1a – c. Probably, the bugs there continued their maturation feeding on wild grass species before moving on towards winter quarters. However, no specimens of *E. maura* and the other two dominant wheat bug species had been found in the investigated potential overwintering sites early in the season. In other crop fields as well as in the uncultivated habitats a different set of bug species were sampled like for example *Eurydema ornatum* and *Palomena prasina* in lucerne, *Eurydema oleraceum* in forest edges and *Dolycoris baccarum* in field margins and lucerne.

Conclusions

Our data do not suggest that landscape elements or fallows and other crops enhance wheat bug infestations in adjacent cereal fields by providing winter quarters. The wheat bug infestation of wheat fields might be influenced mainly by the weather conditions in spring and summer. After having compared the climatic conditions of 2003 with the "wheat bug years" 1953 and 1954, we suggest that the recent outbreak of wheat bugs in Eastern Austria might have been due to the significantly above average temperatures in the years 2000 to 2003 (Grünbacher *et al.* 2006).

Acknowledgments

Thanks are due to organic farmers in Burgenland for providing sampling sites and informations.

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RELEVANCE OF SEED HEALTH FOR DISEASE DEVELOPMENT ON LEAF STRIPE DISEASE (*Drechslera graminea*) AND NET BLOTCH (*Drechslera teres*) ON SPRING BARLEY IN ORGANIC FARMING

WEINHAPPEL, M.[1]

Key words: seed infection, leaf stripe disease, net blotch, infection rate,

Abstract

Factors influencing the seed borne infection cycle of leaf stripe were investigated in a three-year project. Important factors concerning the relationship between seed and field infection levels are environmental conditions (e.g. low temperature during field emergence) on one hand, as well as varieties showing a wide variation in susceptibility. Significant differences between varieties have been detected, concerning the relationship between field infection levels including high infected neighbour fields and the harvested new generation of seeds, but none of the tested varieties was resistant in this part of the infection cycle.

The results of the studies on net blotch confirm the importance of the seed borne component of this disease. Especially in early growing stages the disease is highly influenced by the seed infection level. During the growing season factors like variety and environment gain in importance, nevertheless the statistical analysis indicated significant influence of the seed infection in late growing stages as well. The observed yield reduction could be verified by statistical methods in most of the cases.

Introduction

From 2005 until 2007 investigations on the relevance of seed health for development of leaf stripe disease and net blotch were carried out in the scope of a research project on varieties and seeds for organic farming. The main goal of the studies on leaf stripe (*Drechslera graminea*) was the identification and quantification of influencing factors of the seed borne infection cycle, like seed infection level, vegetation conditions, infection level of neighbouring fields or variety properties. Especially the germination temperature and variety susceptibility are reported as important factors (WALTHER, 1980, MÜLLER, 2006, NIELSEN, 2002)

Net blotch (*Drechslera teres*) is partly a seed borne disease as well. Seed infection causes disease symptoms on young plants and influences the further disease development depending on vegetation conditions or variety susceptibility. The importance of the seed borne component of net blotch has been reported and investigated especially in Scandinavian countries (PINNSCHMID *et al.*, 2005, BRODAL, 2006).

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Materials and Methods

From 2005 to 2007 in total eight trials on **leaf stripe disease** have been carried out. The trials were scattered over the main spring barley production areas.

During the whole project period ten varieties were tested; for every variety the same block of plots was sown (Figure 1) in four replications. The most important collected parameters were as follows:

- Seed infection rate with *Drechslera graminea*
- Field infection rate caused by the utilized seed
- Infection rate of the harvested samples caused by infected neighbour plots

Concerning the investigations on **net blotch** in total twelve trials were carried out, located in the same areas like the trials on leaf stripe. Three different seed infection levels (low – medium – high) and four varieties with different susceptibility against net blotch have been used. The most important collected parameters were as follows:

- Seed infection rate with *Drechslera teres*
- Infection rate in two to three leave stage
- Two (three) further examinations during the growing season and the yield level

For seed health tests the PDA-Method according to ISTA Working Sheet No. 6 (ANONYMUS 1) was used.

Results and Discussion

The infection rate with **leaf stripe** of the harvested samples obtained by healthy plots but neighbouring diseased plots differed strongly and significantly depending on the factor year and environment. The average infection level with leaf stripe was between 1,6% and 31,1% (Tab. 1). When the field was already infected with *D. graminea*, the infection rate of the harvested samples did not increase significantly.

Tab. 1: Average infection level with D. graminea of the harvested samples depending on the health status and depending on the year and the location.

	Location and year						
	ASP 2005	ASP 2006	WAV 2006	KAP 2006	ASP 2007	WAV 2007	LOB 2004
Healthy plots	4,0%	12,9%	1,6%	31,1%	2,6%	6,2%	15,3%
Infected plots	6,1%	14,8%	2,3%	-N-	3,2%	6,5%	19,4%

The statistical calculation of the data using ANOVA showed a significant influence of the parameter infection level of the harvested sample by the factor variety. Three of the varieties were significantly more susceptible for the infection rate on the harvested seeds (Fig. 2). The ranking of the varieties regarding this parameter was highly comparable over all trials.

Regarding the correlation of seed infection level and rate of diseased plants the varieties showed a wide range of tolerance or susceptibility (Fig. 3).

With some of our tested varieties no or only a small number of infected plants could be identified in spite of high seed infection rate. For other varieties the seed infection level corresponds very well with the rate of infected plants. As far as the varieties were also tested in studies of MÜLLER, 2006 und NIELSEN, 2002, the variety ranking is comparable.

The infection rate with **net blotch** (*D. teres*) depends in early growing stages (EC12-13) significantly on the level of seed infection. In all applied trials significant correlation was observed between these two parameters. In these early growing stages for the factor variety no significant influence was detected in our trials. During the further ongoing growing season the influence of variety susceptibility and vegetation conditions increases. Nevertheless

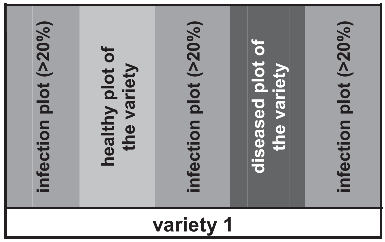

Fig. 1: plot design for one variety in the scope of the leaf stripe trials

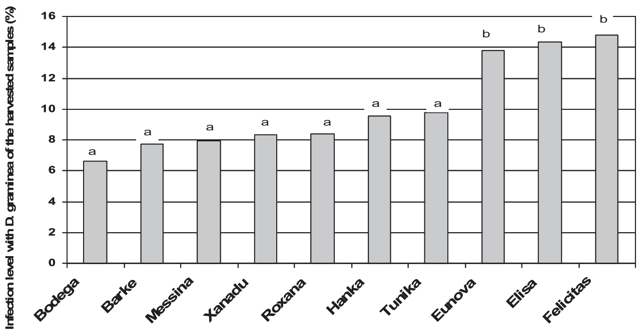

Fig. 2: Infection level of the harvested samples caused by neighbouring high infected plots, in dependence of the variety, 2005–2007 (Duncan-Test, p=0.05)

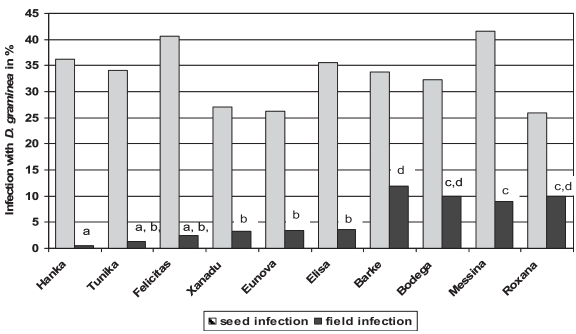

Fig. 3: Field infection caused by the seed infection level, in dependence of the variety, 2005–2007 (Duncan-Test, p=0.05)

in later examinations in most trials the infection level was significantly influenced by the seed infection level as well, especially under suitable growing conditions

Yield reduction caused by the different seed infection levels was detected in most of the trials, especially in ones with higher yield levels; but in only three trials of our project significance via ANOVA was established.

Conclusions

The results on **leaf stripe** show that the infection risk of the harvested seeds depends on the evidence of high infected neighbour fields, the vegetation conditions in the growing period, the location and the variety. Otherwise the results show a wide range in the relationship between seed and field infection; some varieties diseased very low even with high seed infection level.

The studies confirmed the seed borne component of **net blotch**. Especially in early growing stages the seed infection level is the most important factor. During the further plant and disease development other criteria like variety or environment become important, but the influence of the seed infection level was still evident.

Especially for Organic farming the studies confirmed, that seed health is an important precautionary measures to avoid these diseases. A further important aspect is to ensure high phytosanitary standards in all production regions.

Acknowledgments

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THE UNIQUE PROPERTIES OF RED CLOVER IN THE DIET OF RUMINANTS

STEINSHAMN, H.[1]

Key words: red clover, ruminants, meat, milk, fatty acids, organic farming

Abstract

Grassland legumes are essential in organic ruminant livestock production due to their ability to fix atmospheric nitrogen (N), providing high yields of high feeding value without N fertilization. White clover (Trifolium repens L.) and red clover (Trifolium pratense L.) are the most important legumes of temperate grasslands with white clover as the most widely used. New research has reviled new properties of red clover that may affect animal performance and product quality significantly. Red clover containing diets have increased the production of milk and meat (compared with grasses) and the content of beneficial fatty acids in milk and meat (compared with grasses and other legumes), improved the efficiency of feed N utilization (compared with Medicago sativa L.), and increased the milk content of isoflavones (compared with grass and white clover). Red clover contains high levels of the enzyme polyphenol oxidase that might reduce the extent of lipolysis and proteolysis. The paper presents a review on resent results from own and others' research on the use of red clover in the diet of ruminants and the likely mechanisms by which red clover affects production and product quality.

Introduction

Legumes are essential in organic agriculture due to their ability to fix atmospheric nitrogen (N) and thereby determine to a large extent the productivity of the system. In organic grassland livestock farming, the perennial legumes not only ensure the N input, they also provides high quality fodder. It is recognized that grassland legumes have superior feeding value with higher intake and animal production than grasses (Frame *et al.*, 1998). White clover (*Trifolium repens* L.), lucerne (*Medicago sativa* L.), and red clover (*Trifolium pratense* L.) are the most widely cultivated grassland legumes with the white clover as the most important in Europe. In recent years, the interest for red clover has increased, partly because red clover possesses unique properties that may affect animal performance and product quality. In this paper, some recent published research with red clover and its effect on animal performance and animal products (milk and meat) is reviewed.

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Animal performance

Early experiments with red clover silage fed to beef and dairy cows demonstrated higher feed intake and performance (growth rate, milk yield) than pure grass silage (Thomas *et al.*, 1981; Thomas *et al.*, 1985). These results have been confirmed in more recent experiments with dairy cows (Dewhurst *et al.*, 2003b; Vanhatalo *et al.*, 2006), and Fraser *et al.* (2004) observed higher growth rate in lamb grazing red clover than on perennial ryegrass (*Lolium perenne* L.). Others have found only small differences or that differences between red clover and grasses depended on seasonal growth conditions (Bertilsson and Murphy, 2003; van Dorland *et al.*, 2006). The positive effect of red clover relative to grass has been explained by higher voluntary intake at similar digestibility. Higher voluntary intake is ascribed to higher concentration of cell contents in red clover than in grasses resulting in faster rates of particle breakdown in the rumen and more rapid clearance of particles from the rumen (Frame *et al.*, 1998).

More recently, red clover has been compared with other legumes. Red clover silage has often proved to be superior to lucerne silage in relation to milk yield relative to feed intake (Broderick *et al.*, 2001; Dewhurst *et al.*, 2003b; Hoffman *et al.*, 1997), and lamb grazing red clover had higher live weight gain than those grazing lucerne (Fraser *et al.*, 2004). Broderick *et al.* (2001) estimated from animal performance data that the net energy of lactation was 18 % greater in red clover than lucerne. Red and white clover are to a large extent equivalent in usable energy and protein supply, as only minor differences in feed intake and milk yield have been observed when compared (Bertilsson and Murphy, 2003; Dewhurst *et al.*, 2003b; Steinshamn and Thuen, 2008; van Dorland *et al.*, 2006).

Red clover containing diets have increased ruminal non-ammonia N flow in terms of increased flows of microbial and dietary N entering the small intestine when compared with grass silage (Dewhurst *et al.*, 2003a; Vanhatalo *et al.*, 2006) and with lucerne. Consequently, higher apparent N conversion from feed N to product N is often observed on red clover than on grasses or lucerne (Broderick *et al.*, 2001; Vanhatalo *et al.*, 2006). However, due to high N content improved N efficiency relative to grasses or other legumes are not consistent (Bertilsson and Murphy, 2003; van Dorland *et al.*, 2006). This inconsistency warrants further research.

Product quality

Only small and inconsistent effect of red clover has been reported on the milk content of fat, protein and lactose. However, red clover seems to have a pronounced effect on the milk and meat fatty acids composition. Red clover containing diets has increased the product content of polyunsaturated fatty acids, particularly of the beneficial alpha-linolenic acid (C18: 3n-3), both when compared with grasses and other legumes (Table 1, Al Mabruk *et al.*, 2004; Dewhurst *et al.*, 2003b; Fraser *et al.*, 2004; Steinshamn and Thuen, 2008; Vanhatalo *et al.*, 2007). The inclusion of red clover in the diet of dairy cows is likely an important explanation for the often observed higher content of nutritional desirable fatty acids in organic than in conventional produced milk (Butler *et al.*, 2008; Ellis *et al.*, 2006).

Another striking feature with red clover is the high content of phytoestrogens of the isoflavone group. In a dairy cow experiment with organic managed cows, Steinshamn *et al.* (2008) found that milk content of biochanin A (1.86 vs. 0.37 µg/l), equol (318 vs. 75 µg/l), and formononetin

(6.5 vs. 2.7 µg/l) were several times higher on red clover than on white clover containing silage diets. Phytoestrogens, and particularly equol, may have beneficial health effect, and increased content in milk may be important when health benefits of milk are studied.

Tab. 1: Milk content of alfa-linolenic acid (% of total milk fatty acids) of dairy cows fed either grass, white clover (WC) or red clover (RC) silages

Reference	Grass	WC	RC	Grass *vs* clover	WC *vs* RC
Al-Mabruk *et al.* 2003	0.47		0.93	***	
Dewhurst *et al.* 2003b	0.40	0.96	1.28	***	***
Vanhatalo *et al.* 2007	0.39		1.11	***	
Van Dorland *et al.* 2008	0.90	1.14	1.04	(*)	ns
Steinshamn and Thuen 2008		0.73	0.87		***

(*) significant for P<0.10; *** significant for P<0.001

Plant mechanism explaining the red clover effect

Red clover contains high levels of both the enzyme polyphenol oxidase (PPO) and its subtrate *o*-diphenol. PPO convert phenols to quinones, which bind with proteins and reduces proteolysis and lipolysis in silo and in rumen (Albrecht and Muck, 1991; Lee *et al.*, 2007; Sullivan and Hatfield, 2006). Proteolysis and lipolysis are catalyzed by the enzymes protease and lipase. These enzymes are proteins, and the quinones formed after harvesting binds to the enzymes and partly denaturalize them. The result is that more of the original plant protein remains intact after ensiling and rumen passage, explaining higher conversion of feed N into meat or milk N on red clover than on other forages. Likewise, reduced lipolysis results in reduced rumen biohydrogenation of fatty acids. Consequently, a higher proportion of the unsaturated fatty acids in the ingested feed passes the rumen to the intestine for absorption. Thus, a higher transfer rate of C18: 3n-3 from feed to milk is observed on red clover diets (Dewhurst *et al.* 2003b; Steinshamn and Thuen, 2008).

Conclusions

Red clover has superior feeding value and higher ruminant performances (higher milk yield and growth rate) are often obtained when compared with grasses and lucerne. Red clover contains high amounts of polyphenol oxidase (PPO) and its phenolic substrate. High PPO activity reduces proteolysis and lypolisis, which is the likely mechanism for improved conversion of feed N into product N and to higher transfer of polyunsaturated fatty acids from feed to product. Red clover also contains high amounts of isoflavonoids, which is reflected in milk from dairy cows fed red clover containing diets.

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STRUCTURAL CHANGES IN ORGANIC FARMING IN NORWAY, AND FARMERS' REASONS FOR OPTING OUT

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Key words: converting, farm structure, parallel production, certification

Abstract

From 2002 to 2007, the number of organic farms in Norway has increased slightly, from 2303 to 2611. The area of organically certified and in conversion farmland has increased much more, from 32,499 to 49,563 ha. Hence, the average size of organic farms has increased considerably, from 19.7 to 25.5 ha agricultural area per farm. This is 20 % above the Norwegian average farm size. As parallel production is permitted, many farms have both organic and conventional production. The average organically managed agricultural area has increased from 11 to 15.4 ha per farm, and the number of milking cows on organic dairy farms from 15 to 20. Many small farms have opted out of certified organic agriculture, whereas farmers with more land are converting to organic. While most of the public financial support in Norwegian agriculture is differentiated in relation to farm size and region, support for organic agriculture is little differentiated. This encourages the conversion of larger operations. However, the diversity of the organic sector is reduced when smaller farms do not convert or opt out, and it should be considered how organic farming can be an interesting option for farmers independent of farm size.

Introduction

In former studies, the average size of organic farms (ha agricultural area) has often been found to be smaller than for conventional farms (e.g. Lockeretz & Anderson 1990; Burton et al 1997). The importance of horticulture and subsistence holdings among organic farmers is among one of the reasons for this difference. Contrary to this, Offermann and Nieberg (2000) found that the average organic farm in the EU was larger than the average conventional farm. Since the late 1980's, average organic farms in the EU have been larger than conventional farms. In this paper we present key characteristics about the structural changes of organic and conventional farms in Norway and discuss the reasons why organic farms on average experience a more rapid increase in agricultural land and herd size than conventional farms.

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Materials and Methods

This paper is based on results from previous Norwegian studies, agricultural statistics (Debio 2008, SSB 2007) and recent results from a research project with a combined quantitative and qualitative approach. A comprehensive survey was conducted, producing material of 664 farmers that was analysed. Interviews were conducted among four formerly organic farmers with various production (sheep, dairy, cereals, vegetables) and two organic advisors, to better understand the complex phenomena of conversion and opting out.

Results

The number of farms in Norway has been rapidly decreasing, from 213,000 in 1949 to < 50,000 in 2007 (SSB 2007). However, the agricultural land is kept in production by increasing average farm size for the remaining farms. Compared to other European countries, which generally have experienced the same structural changes in agriculture, Norwegian farms and herds are still relatively small, with an average farm size of 21.3 ha agricultural area and an average dairy herd of 18 cows (Table 1). The average size of organic farms[5] has increased even more than the general structural development, from 19.7 to 25.5 ha during 2002–06. As parallel production is permitted, farms may have organic, in conversion and conventional area. The share of organic area has remained constant at about 60 %. The number of milking cows per organic dairy farms has also increased more rapidly than the general average. For organic sheep farms, there was no significant growth in the herd size, while for sheep farmers in general the number of sheep increased by about 2 per year.

On the background of these significant structural changes, the farmers who opted out have explained their reasons in the survey as well as the interviews as being mainly due to problems with the organic standards, dissatisfaction with economic results and a general frustration about rapid changes in agricultural policy and frame conditions. Small farmers opting out complained about the costs of getting certified. Especially the farmers who were still claiming to, or planning to manage the farms according to organic principles, but without certification, were strongly disappointed about the certification, being too bureaucratic, and the standards being too complicated and too often changing. This group comprises a surprisingly large amount (36 %) of the farmers that have opted out or plan to do so.

Few farmers mentioned personal reasons or social relations as important reasons to give up organic farming. Agronomic challenges (e.g. weeds) were in an intermediate position.

Discussion

Our study shows that the average farm size and size of dairy herd has increased more rapidly in organic than conventional production from 2002 to 2007. This result compares well to Nieberg (1997), who found a similar difference in the growth of farm size between organic and conventional farms. One explanation for the Norwegian result is that many farmers with less agricultural land, on average for 2002–05 they had 18.5 ha, have been opting out of certified

[5] We use the term organic farm for farms registered with certified organic production.

organic agriculture, 7.1 % of the certified organic holdings have stopped certified organic production each year between 2002 and 2007. Further, larger farms with larger herds have converted.

While most of the public financial support for Norwegian agriculture is differentiated in relation to region and decreasing with farm size, support for organic agriculture is little differentiated. This may encourage the conversion of larger operations. On larger farms full time employment of the farmers may be easier achieved and this may facilitate good agronomic practice. This is extra important in organic systems, refraining from agrochemical inputs. Some growers may be attracted to organics due to the reward in the industry if one can manage well without the use of agrochemical inputs. Farmers with larger farms may in addition easier adapt to changes in the regulations for organic agriculture and use more machinery to reduce work load.

Tab. 1: Numbers and key characteristics of Norwegian farms from 2002 to 2007

Year All Norwegian farms[1)]	2002	2003	2004	2005	2006	2007	Average change per year 2002–07
Number of farms	58627	54946	52879	51069	49369	48077	-2037***
Agricultural area, ha	17.6	18.7	19.4	20.1	20.8	21.3	+0.7***
Dairy cows on dairy farm	15.2	15.9	16.6	16.8	17.6	18.4	+0.6***
Sheep >1 year on sheep farm	55	59	62	64	65	66	+2.2**
Organic farms[2)]							
Number of organic farms	2303	2466	2484	2496	2500	2611	+47.3*
Agricultural area on organic farms, ha	19.7	21.6	22.9	23.9	24.7	25.5	+1.1***
Certified organic area on organic farms	10.9	12.6	14.0	14.6	15.5	15.4	+0.9**
Dairy cows on organic dairy farms	15.0	16.4	17.1	17.8	19.1	20.4	+1.0**
Sheep > 1 year on organic sheep farms	64	55	55	58	60	65	+0.8 ns
New organic farmers	397	357	191	154	157	270	Not calculated
Farmers opting out	199	210	182	153	151	160	

* significant for P<0.05; ** significant for P<0.01; *** significant for P<0.001, ns not significant
1) Source: SSB; 2) Source: Debio

Seen in the light of the structural changes, the large numbers of farmers opting out seem frustrated about the bureaucracy, but still committed to organic principles. As Norwegian support for organic production is linked to certification, it is highly interesting to see that 36 % of farmers opting out want to manage their farm close to organic, without any extra payment. On average, this group of farmers had converted the farm two years before those who plan to go back to conventional management. In a study of Norwegian dairy farmers, Flaten *et al.* (2006) found that early converters were more strongly convinced about philosophical ideals, with a more diverse production, whereas later converters were more specialized, with higher milk yields. The late converters also ranked public financial support and organic premium prices higher that the early converters. Darnhofer *et al.* (2005) distinguishes between “committed organic” farmers, farming for the environment, and “pragmatic organic” who do it for the money. Guthman (2004) has proposed a "conventionalization thesis", stating that the ideological elements will fade with increasing numbers of organic farmers. The number of farmers that were found to claim that they are farming close to organic in the present study, refraining from the extra funding they easily could receive, may be interpreted as if committed organic farmers are leaving the (certified) organic movement, leaving the development of the organic agriculture in Norway into a more conventional direction, but maybe they contribute to a greening of conventional agriculture. Some of the farmers opting out, having small farms and claiming to follow organic principles were using direct marketing. For them costly certification may not be necessary, since it does little to enhance their direct sales if a confidential customer relationship results in a premium price for the farm products. It should be studied how the organic certification and financial support system can be changed to oblige the interests of these environmentally engaged farmers.

Conclusions

Besides the general structural change in agriculture in Norway, the structural change for organic farms has been especially strong. The last years 7.1 % of the certified organic farmers opted out. It seems that a significant part consists of committed organic farmers, frustrated about frame conditions.

Based on the results from the questionnaire, more farmers would continue with certified organic farming if control and certification were perceived as less bureaucratic, the support payments for organic farming were higher, the agricultural policy was more stable and the premium prices for organic products were higher.

Today's regulations and policies promote farmers with more farmland and/or more animals to convert to organic farming. However, the diversity of the organic sector is reduced when smaller farms do not convert or opt out, and it should be considered how certified organic farming can be an interesting option for farmers independent of farm size.

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CHALLENGES AND BENEFITS OF INTEGRATING LIVESTOCK AND ORGANIC GRAIN PRODUCTION IN THE INLAND NORTHWEST, U.S.

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Key words: integrated, organic, livestock, crop, rotation

Abstract

Crop and livestock integration may provide low-cost weed management and on-site fertility for organic farming systems. However, little is known about the profitability of these systems and how to terminate persistent pastures without chemicals or a moldboard plow. The objective of this research was to assess the performance of a Triticale (× Triticosecale) grain crop following grazed alfalfa terminated with increasing degrees of tillage. Treatments consisted of moldboard plowing and low soil disturbance under-cutting sweeps with either 100% or 80% surface coverage. An alfalfa control served as a baseline. Measurements of soil inorganic nitrogen (N), grain yield, tillage effectiveness, and profitability were collected. Soil NO_3-N accumulated in low disturbance treatments, organic unfertilized Triticale grain yield was positively correlated to degree of disturbance, ranging from 200 to 4200 kg/ha, and yield was negatively correlated with alfalfa re-growth. Profitability of an integrated Triticale/ grazed alfalfa rotation was compared to non-integrated grazed alfalfa, with the integrated system showing greater profitability. Use of grazing livestock in crop rotations may offer a productive, profitable and low-input option for organic grain production, but low-disturbance tillage methods still need refining to ensure soil conservation during perennial to annual transitions.

Introduction

Soil erosion, increasing soil acidity, surface and groundwater contamination, near complete loss of native ecosystems, and declining soil quality threaten the long-term agricultural sustainability of cereal production in the Pacific Northwest, U.S.A. (Rasmussen 1989; Mahler and Harder, 1984; Jennings *et al.*, 1990; Noss *et al.* 1995). Organic agriculture offers a sustainable alternative to current farming practices. Between 1995 and 2005 in Washington State, certified organic acreage of apples, vegetables, tree fruit, and small fruit and seed crops increased as much as 135 percent; however, certified organic wheat acreage increased by only 13 percent (Granatstein and Kirby, 2007). Reasons for the slow adoption of organic practices in cereal production include lack of

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options for weed control and enhancing soil fertility, undeveloped strategies for conservation tillage, and lack of knowledge concerning start-up costs for biologically intensive practices.

The objective of this experiment was to determine the potential of crop-livestock integration to overcome these obstacles. We assessed the performance of an organic crop-livestock system in terms of: (1) utilization of biological nitrogen; (2) grain yield; (3) adaptability to conservation tillage, and; (4) ability to increase profits through on-site exchanges of cropping system inputs and outputs. We hypothesized that crop-livestock integration could facilitate the use of organic practices through efficient on-site nitrogen management, that conservation tillage could be applied to perennial-annual transitions in these systems, and that the complementarity of crop-livestock farming systems would increase profitability over non-integrated systems.

Materials and Methods

In September, 2006 trials were initiated at Thundering Hooves farm in Walla Walla, Washington on the western edge of the Palouse region. This farm has raised organic grassfed beef on irrigated alfalfa and grass pasture since 1998. Conversion of alfalfa to an annual cereal crop has traditionally been achieved using a moldboard plow. In this experiment, treatments consisted of three primary tillage operations following 10 years of alfalfa pasture: (1) moldboard plowing to a depth of 10 cm; (2) low soil disturbance under-cutting sweeps operated at 7 cm depth with 100% surface coverage and (3) low soil disturbance undercutting sweeps operated at 7 cm depth with 80% coverage. A fourth treatment was managed as grazed alfalfa, which received simulated grazing three times during the growing season. Plots were 4.5 m by 8 m, arranged in a randomized complete block design with four tillage treatments (including zero tillage residual alfalfa) and four blocks. Treatment means were analyzed by Tukey pairwise comparisons. Primary tillage operations were imposed in the fall of 2006 and spring of 2007. Organically certified triticale grain (var. 37812) purchased from Progene Plant Research (Othello, WA) was sown on March 7th, 2007.

Soil cores were collected at spring seeding, grain harvest (July 12th) and fall (Nov. 21st) to 2.4 m by 30 cm depth-increments and analyzed for inorganic soil N using an ALPKEM RFA™ 300 auto-analyzer. Tillage effectiveness was measured by grain yield, aboveground biomass and number of alfalfa crowns that survived tillage. Alfalfa managed in a simulated grazing manner served as a baseline comparison for soil N dynamics. Alfalfa biomass and yield data was collected for economic comparisons between a pasture-only and an integrated pasture-grain cropping system. Data was collected to assess profitability, including infrastructure and field operations with some generalized data utilized from typical farm budgets for the region.

Results

Degree of tillage of alfalfa significantly impacted triticale grain yield, alfalfa regrowth, and soil inorganic N accumulation (Table 1). Subsoil inorganic N accumulations and treatment effects on depth were not observed (data not shown). There was a positive correlation between the number of surviving alfalfa crowns and total aboveground biomass, and a negative correlation between surviving alfalfa crowns and triticale grain yield. Grain yield was therefore inversely related to degree of tillage with moldboard plow yields 2.58 times that of the best performing conservation tillage method (100% coverage under-cutting sweeps).

Soil mineralization as measured by incubated [NH_4-N] was 5.4 and 2.4 times greater in the 100% sweep treatment than the plow and alfalfa treatments at mid-summer, respectively. By fall, there was 1.62 and 1.76 times greater non-incubated soil [NO_3-N] in the 100% treatment than plow and alfalfa. No significant differences in soil inorganic N were observed between plow and alfalfa treatments at any time.

Table. 1: Aboveground biomass at grain harvest, number of surviving alfalfa crowns, grain yield, and seasonal soil inorganic N fluctuation following different degrees of tillage to terminate alfalfa.

	Ave. bio-mass ($g\ m^{-2}$)	Ave. no. alfalfa crowns (no. m^{-2})	Triticale grain yield (kg ha^{-2})	Spring soil [NO_3-N] (mg/kg)	Summer soil [NO_3-N] (mg/kg)	Summer soil [NH_4-N] (mg/kg)	Fall soil [NO_3-N] (mg/kg)
Alfalfa	668[a]	11[a]	-	34.7[a]	13.0[a]	10.3[a]	19.3[a]
Plow	383[b]	5.5[b]	4200[a]	47.4[a]	9.7[a]	4.5[a]	21.6[a]
100%	601[c]	8.25[c]	1630[b]	44.2[a]	9.4[a]	24.3[b]	34.0[b]
80%	721[a]	16.75[d]	200[c]	-	-	-	-
	*	*	*	n.s.	n.s.	*	*

100%: full under-cut sweep cultivation; 80%: partial under-cut sweep cultivation
Soil [N] in top 1.5 m; a, b, c: sign. different; n.s: not significant; '*' sign. for $P< 0.05$

Integrating a grain crop into the alfalfa pasture rotation increased returns over total costs through an increase in returns over variable costs (Figure 2). Returns over total costs for each of these components of crop rotations were $442/ha, $166/ha and $91/ha for integrated Triticale, non-integrated Triticale and grazed alfalfa, respectively.

Discussion

Utilizing crop and livestock integration to close on-farm N cycles and increase profit depends on adequate control of perennial pastures in rotation. Conservation tillage treatments resulted in yields well below acceptable levels. By contrast, a similar alfalfa-barley trial in south central Idaho is indicating

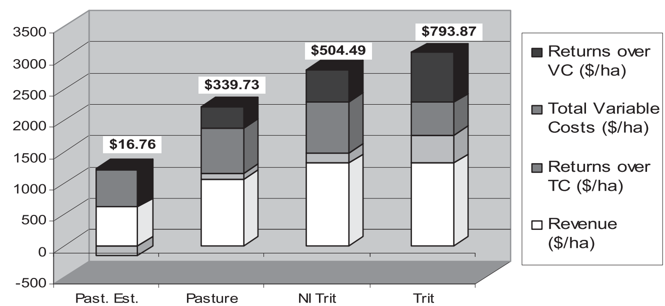

Figure 1: Budget summary of rotation components in integrated and non-integrated grain-pasture rotations (values shown are returns over variable costs).

a more aggressive under-cutting sweep could be more effective at mechanically terminating alfalfa (Dave Huggins, pers. comm., 2008). More work is needed to refine these minimum-disturbance tillage methods for use in organic crop-livestock systems. Higher summer [NH_4-N] and fall [NO_3-N] in the 100% treatment was likely due to inadequate utilization, and hence accumulation, of mineralized N. We hypothesize this was due to low grain yields combined with a disturbed alfalfa root system in this treatment. The greatest values for biomass and alfalfa crowns in the 80% treatment reflected an alfalfa stand reinvigorated by partial disturbance insufficient for grain, but providing alfalfa an advantage over weeds otherwise encroaching in the non-disturbed alfalfa.

The profitability and effective management of these systems depends on understandings of organic N mineralization. Other researchers have documented tillage and cropping system impacts on soil N dynamics (Mohr *et al.*, 1999), but our trials did not reveal tillage effects between plow and undisturbed alfalfa. Significant block interactions and significant block x treatment interactions suggest a high degree of spatial variability in soil organic N in our research plots. This explanation is supported by observations of uneven soil nutrient redistribution by ruminant herbivory (Heady and Child, 1994). Future research designs should consider the minimum number of sub-samples necessary to overcome this within-block variability.

Substantial profitability seems possible when grain crops are integrated into livestock production. Increased returns over variable costs resulted because grains integrated with alfalfa pasture required no fertilizer or weed management. This enabled the integrated, organic grain crop to be more profitable than either organic grassfed beef or organic grains raised in isolation. Such rotations, however, do require management practices and skills that are somewhat uncommon in agriculture today.

Acknowledgments

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ESTONIAN CONSUMERS` AWARENESS AND ATTITUDES TO ORGANIC FOOD

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Key words: consumers, Estonia, organic food

Abstract

In order to better develop the organic market in Estonia, a consumer study was conducted in order to better understand the consumer perception and understanding of organic food and farming. The results showed that of 259 interviewed Estonian supermarket consumers 83% of them are able to name at least one difference between organic and conventional food. The most well known aspect of organic agriculture is that artificial fertilizers are not used (51%), but the positive effects to environment, animal welfare and GMO-freedom are mentioned only by few consumers. Health (62% of respondents) is the prevalent motive in purchasing organic food products for Estonian consumers. The most requested products are organic fruits, vegetables, milk and meat products. High price and inadequate assortment/availability of organic products are the main barriers of consuming organic food. To conclude Estonian consumer needs more education about the principles of organic production.

Introduction

Organic agriculture has been growing rapidly everywhere in the Europe. The organic market in Estonia is at the emerging stage. Although there are more than 1200 organic farms and Estonia stands at the 5th place in the world with a share of 8.8% of the organic land (Willer *et al.* 2008), only few local organic food products are available in supermarkets. Consumers are one of the key factors of market development; therefore the study was carried out to analyse Estonian consumers` awareness and attitudes to organic food.

Materials and Methods

A special questionnaire was developed, which contained 13 close and 5 open questions. In autumn 2007 259 occasional consumers were interviewed in 5 different purchase places in the two Estonian biggest cities- Tartu and Tallinn. Questioning took place at the sales place of supermarkets, where randomly selected occasional customers were interviewed. Consumers were examined what differences they know between organic and conventional food, whether they have bought organic food and why, what are the preferred purchase places for organic products, barriers of organic food consumption, whether they recognise Estonian organic label and if consumer are ready to pay a higher price for organic food.

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Results

The study showed that 83% of the interviewed consumers are able to name at least one difference between organic and conventional food, but the named aspects are frequently inaccurate and quite general (e.g. grown naturally, healthy, pure food). The most well known aspect of organic agriculture is that artificial fertilizers are not used (51%), 30% of respondents know that organic food is free of synthetic additives, 26% mentioned that pesticides are not used. The positive effect to environment, animal welfare, non-use of GMO and their derivates were named only by few consumers.

Further questions were asked only to consumers, who were able to name at least one difference between organic and conventional food.

73% of the respondents have noticed that organic products are available in supermarkets. 56% claim to have bought them, mostly organic vegetables, milk and cereal products.

Health (62% of respondents) is the prevalent motive in purchasing organic food products for Estonian consumers. Only 4% of consumers buy organic food, because it is environmentally friendly. Main barriers of purchaising organic products are the high price and inadequate assortment/availability (Figure 1).

This confirms, that the high price is an important buying barrier in several consumer studies in Europe (Zanoli 2004, Rutkoviene *et al.* 2006).

The most requested products are organic fruits, vegetables, milk- and meat products. 42% of the consumers are interested in all organically produced food groups. Preferred places to buy organic food are supermarkets (85%).

99% of consumers, who named at least one principle of organic agriculture, claimed to be ready to pay higher price for organic food. For the 58% of respondents the price difference should not exceed 10%, one-third are ready to pay up to 20% more compared conventional food. 63% of consumers recognized Estonian national organic label among the other food labels.

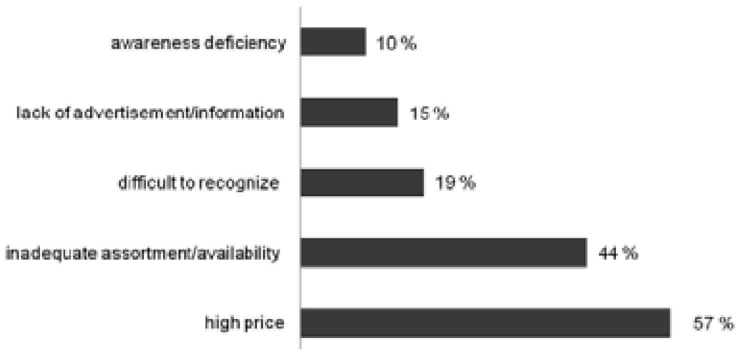

Figure 1: Main barriers in purchaising of organic food products (% of respondents).

Discussion

Although 83% of interviewed consumers were able to name some differences between organic and conventional food, the mentioned aspects are frequently very general and the awareness still needs improvement. Principles of organic production such as animal welfare, no use of GMO, positive impacts on environment should be better communicated. Also the knowledge about the connection between organic farming and the environment as well as health needs improvement.

High price and inadequate assortment/availability of organic products are the main barriers of consuming organic food. Most of the organic food in Estonian supermarkets is imported and the price is quite expensive; only few local products are available. Supermarket consumers are interested in buying organic food and they prefer supermarket as purchase place of organic food. Processing and marketing of organic food products are crucial for further development. These problems are typical to emerging organic markets (Richter *et al.* 2005).

Consumer with basic understanding about differences of organic food, claim to be ready to pay a higher price for organic food. It is obvious that if organic food would be available in shops, at least part of the consumers would really buy it. There is also need for a clear explanation, why organic food costs more than conventional.

Most of the respondents were not actually sure about their awareness about organic labels. There is a problem with identifying organic products; it seems that many consumers are rather confused what is organic and what is not. The Estonian organic label needs further introduction.

Conclusions

Estonian consumer needs more education about the principles of organic production. Better understanding helps to make better choices for health and environment. The products should be available and well distinguished in supermarkets. It is necessary to organize public promotion campaigns to educate the consumers about the principles of organic food and the organic label(s).

Acknowledgments

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THE MYCOBIOTA OF STORED 'GOLDEN DELICIOUS' APPLE FRUITS: A COMPARISON STUDY OF ORGANIC AND INTEGRATED PRODUCTION SYSTEMS IN SWITZERLAND

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Key words: *Malus domestica* Borkh., organic production, microorganisms, fungi, fungal diversity

Abstract

The effects of organic and integrated production systems on the cultivable mycobiota (fungal microflora) of stored apple fruits from five matched pairs of certified organic and integrated 'Golden Delicious' farms were studied at five representative production sites in Switzerland. Isolated fungi were identified morphologically. Abundance (colony numbers), colonization frequency (percentage of apples colonized), and diversity (taxon richness) were assessed for each orchard. Compared to integrated apples, organic apples had significantly higher taxon diversity, abundance of total fungi, and frequencies of filamentous fungi. Canonical correspondence analysis (CCA) of the total fungal community revealed a clear differentiation among production systems and sites.

Introduction

Pathogenic microorganisms are major causes of economic losses in apple production and challenge crop protection strategies. However, the microflora of crops also includes a large proportion of non-pathogenic microorganisms that have been recognized as beneficial components of the natural microflora of many plants, including apple, by acting as antagonists toward plant pathogens or by inducing the plant's own defense mechanisms (Fokkema, 1976; Ippolito *et al.*, 2000). Apple farm management practices, namely the use of pesticides, may influence such complex microbial interactions with substantial consequences for the microbial composition and outcome of their interaction. As an example, organic and integrated apple production differ considerably with respect to crop management practices (e.g., no use of chemically synthesized fertilizers, herbicides, fruit thinners, and plant-protecting agents in organic apple production (Avilla and Riedl, 2003; Weibel and Häseli, 2003), but only scant information exists about the effects of such production systems on the microorganisms associated with apple. In a previous study, a comparison of the apple phylloplane microflora in organic and integrated apple orchards showed a greater abundance and diversity of microorganisms on leaves from organic trees (Waipara *et al.*, 2002).

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Here, we focus on the mycobiota (fungal microflora) of stored 'Golden Delicious' apple fruits and compare the influence of organic and integrated farming practices on fungal population abundance (colony numbers), colonization frequency (percentage of apples colonized), composition, and diversity (taxon richness) with established morphological and microbiological methods.

Materials and Methods

In September 2004 we picked mature and well developed apple fruits under aseptical conditions at ten commercial fruit farms (five matched pairs of certified organic and integrated farms) in representative apple-producing regions in Switzerland: two sites were in the canton of Valais (VS1, VS2) and one in the canton of Vaud (VD) (both southwestern cantons); one site was in the northwestern canton of Aargau (AG) and one site was in the northeastern canton of Thurgau (TG). The apples (30 per orchard, in total 300 fruits) were stored under normal atmospheric conditions at 2°C and a relative humidity of 90–95% while preventing microbial contamination during the storage. The sampling of microorganisms from the stored apple fruits was from January until April 2005.

Epiphytic microorganisms were lifted from the edible fruit surface (excluding the non-eaten calyx, stem, and stem cavity) using a sterile swab and collected into a plastic tube containing 1.8 ml Ringers Solution and 0.005% Tween 80. Aliquots of 100 µl of 10^{-1} to 10^{-2} dilutions of the suspension were spread in duplicates on DG18 (Oxoid, CM 0729) isolation plates supplemented with chloramphenicol (0.01% w/v). Endophytes were sampled from the same fruits: the whole fruits were surface-sterilized and 12 discs (5 mm in diameter, including skin and a 1–2 mm layer of fleshy tissue) per apple were taken randomly from the edible fruit surface using a sterilized cork borer. Discs were placed with the fleshy tissue layer down on isolation plates (12 discs per plate and per apple) supplemented with chloramphenicol (0.01% w/v). Both epiphytic and endophytic colonies were counted after seven days of incubation at 25°C. Epiphytic and endophytic counts were expressed in colony forming units (CFU) and viable disc colonies (VDC), respectively. Fungal abundance was expressed in CFU per gram fresh weight and in VDC per apple, respectively. Following incubation, colonies with a distinct morphology (color, shape, size) were identified at different taxonomic levels (taxa), e.g., species or genera, or as recognizable groups according to color, shape or lack of spores (sterility). The number of different taxa was expressed as taxon richness and the fungal diversity as taxon richness per apple.

We used the nonparametric Wilcoxon's matched-pairs signed-ranks test (SPSS 13.0 for Windows) for pairwise comparisons of organic and integrated apples. To test the factor effects "site" and "production system" on the composition of fungal populations on apples we used Monte Carlo permutation tests using CANOCO 4.5 (Biometris, Plant Research International, Wageningen, NL). The ordination of samples relative to the treatment factors was performed using canonical correspondence analysis (CCA).

Results

The standard quality of the stored fruits was comparable for both organic and integrated apples and complied with national food hygiene standards. Only on apples maintained by integrated management practices residues of contact and systemic synthetic fungicides, used to prevent pre-harvest and post-harvest diseases, were detected within permissible limits (data not shown). Yeasts (6 taxa) and *Aureobasidium pullulans* were the dominant epiphytes, filamentous fungi (21 taxa) the dominant endophytes. The most common fungi occurred at all sites and belonged to the "white" and "pink" yeasts, *A. pullulans*, *Cladosporium* spp., *Alternaria* spp., and sterile species.

Compared to integrated apples, organic apples had significantly higher taxon diversity, abundance of total fungi, and frequencies of filamentous fungi (data not shown). Canonical correspondence analysis (CCA) of the total fungal community revealed a clear differentiation among production systems and sites (Fig. 1). Both inherent experimental factors, i.e., production systems and sites, were significant, while the production systems are differentiated along the first canonical axis and the sites mainly along the second canonical axis. Production systems and sites explained 35.9% of the total variation. The major part of the variability (64.1%) remained unexplained. The influence of the sites was highly significant, explaining 23.5% of the total variation, whereas the production systems accounted for 12.4% of the total variation.

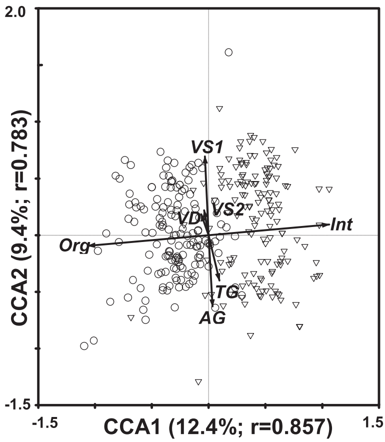

Fig. 1. Constrained ordination of the first two canonical axes as determined by canonical correspondence analysis (CCA) of cultivable numbers of epiphytic and endophytic fungi (CFU per gram and VDC per apple, respectively) on apple fruits from paired organic (Org: circles, n = 149) and integrated (Int: triangles, n = 148) orchards and five geographically different sites (VS1, VS2, VD, AG, TG) in Switzerland.

Discussion

The effects of the production system on the mycobiota are most likely due to the different plant protection strategies. Similar effects on fungal populations were shown by Teixido *et al.* (1999) on untreated apples compared to apples treated with synthetic fungicides. The incidence of potential mycotoxin producers such as *Penicillium* and *Alternaria* species was not different between production systems, and, as we worked with symptomless apples, an accumulation of harmful mycotoxin concentrations was unlikely to occur in our samples. Other fungi, for example *A. pullulans*, are potential biocontrol agents against post-harvest pathogens of apples (Ippolito *et al.*, 2000; Leibinger *et al.*, 1997). Notably, in our study *A. pullulans* occurred naturally at elevated population densities on organic apples at all sites tested, suggesting a beneficial role in postharvest pathogen control on organic apples.

In conclusion, canonical correspondence analysis (CCA) of the total fungal community revealed a clear differentiation among production systems and sites. Fungal populations of orchards located in the northern areas (AG, TG) were clearly differentiated from those located in the southern areas of Switzerland (VS1, VS2, VD). This may relate to climate conditions, with warmer temperatures and less rainfall in the south than in the north of Switzerland. A higher fungal abundance and diversity on stored edible organic fruits was one effect relating to the type of production system. We suggest that higher fungal diversity may generally be associated with organic production and may increase the level of beneficial and antagonistically acting species known for their potential to suppress apple pathogens, which may be an advantage to organic apples, e.g., in respect to natural disease control. The role of potential biocontrol agents on apples, however, needs to be studied.

Acknowledgments

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ADVANCED STRATEGIES IN ASSESSMENT OF BIO-PRODUCTS QUALITY & SAFETY

SCHULZOVA, V., HAJSLOVA, J., KRAJCOVA, A., DRABOVA, L., ZACHARIASOVA, M. [1]

Key words: food-safety, hygienic-toxicological quality, secondary metabolites, contaminants

Abstract

There is a wide range of physical and chemical parameters associated with the quality and safety of food crops. In most studies conducted until now main components responsible for the nutritional value such as lipids, proteins, (poly)saccharides, vitamins, and minerals have been examined when assessing and comparing conventional and organic crops. Other biologically active compounds – both health promoting and toxic – should be taken into consideration as well. In this presentation several case studies will be presented to show our laboratory approaches:

- *Examination of the levels of natural toxins (glycoalkaloids, calystegines) and other secondary metabolites (ascorbic acid, carotenoids, chlorogenic acid, amino acids etc.) in potatoes and tomatoes (Solanaceae family)*
- *Monitoring of phytoestrogens (lignans) and antioxidants (carotenoids) in flaxseed (Linum usitatissium)*
- *Occurrence of natural toxicants (mycotoxins), residues (pesticides) and environmental pollutants (polycyclic aromatic hydrocarbons)*

Introduction

Higher quality standards, better taste and greater satisfaction represent consumers´ motives for the purchase of fruit and vegetables from organic or low input farming (Heaton, 2001). Generally, many plant crops are known for their richness in micronutrients and dietary fibre, thus their consumption has been distinctly recognized as being important factor for good health (Worthington, 1998). The influence of the way of farming on the overall composition of organic crops as compared to conventional products has not been fully assessed until now. No detailed research on the toxicological aspects of organic crops has been conducted, most of existing studies were concerned with nitrates or toxic metals.

Materials and Methods

Two types of samples were employed for our studies: (i) crops from field experiments (the same locality of farming, same variety, etc.) grown according to IFOAM principles. This approach allows identification of potential impact of alternative ways of farming on the crop composition (ii) products with "organic" label from the retail market. In this case no information was available regarding growing conditions and farming site. The generated data can be used

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for the comparison of the consumers dietary exposure to target biologically active compound occurring in organic versus conventional food. Accredited chromatographic methods were employed for examination of samples. T-test (α=0.05) was used for statistical evaluation.

Results and Discussion

A) Bioactive health promoting compounds

No relationships between the levels of vitamin C and the way of fertilization were observed in tomatoes however slightly higher levels of vitamin C were found in potatoes from organic farming. Higher levels of vitamin C were found in organic grown parsnip compared to conventional one. Significant differences in vitamin C content were found between the varieties and years of farming.

The impact of growing conditions on the amount of chlorogenic acid in potato tubers was demonstrated. Mean values of chlorogenic acid were higher in potatoes from organic farming and these differences were statistically significant.

Health promoting secondary metabolites represented by carotenoids lycopene and β-carotene were analysed in different tomato varieties grown by different practices. Carotenoids content varied and was depended on the way of farming, variety, and other parameters. Lutein, the main flaxseed carotenoid, was detected in various cultivars from different fertilisation systems and no significant differences were found.

The influence of various genotypes of flaxseed, different types of fertilization, and climatic conditions on phytoestrogens content was monitored. Levels of lignans (secoisolariciresinol and matairesinol) depended on cultivar, nutrition content, fertilization, climatic conditions, and stress factors.

B) Natural toxins

Elevated concentrations of glycoalkaloids (sum of α-solanine and α-chaconine) in some potato varieties grown in organic farming systems were found (Figure 1, differences were not statistically significant).

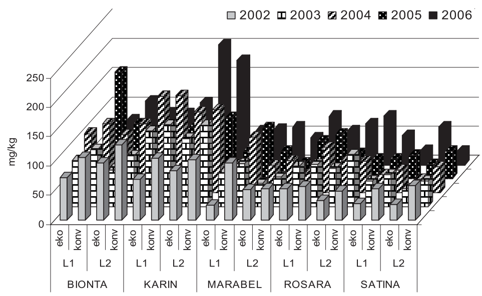

Figure 1: Glycoalkaloids content in tested potato varieties produced in organic (eko) and conventional (konv) farming systems at localities L1 and L2

The amount of glycoalkaloids (α-tomatine and dehydrotomatine) in tomatoes depended on their size and ripeness. The glycoalkaloids content in red tomatoes was in maximum 10 mg/kg while in green ones their levels may were as high as 100 mg/kg. The highest levels of these natural toxins in ripen tomatoes were found in mineral farming, the lowest in organic one. The glycoalkaloids content varied among tested varieties.

Northropane alkaloids calystegines occur in plant families Convulvoceae, Maraceaceae and Solanaceae, especially in *Solanum melongena* (eggplant) and *Solanum tuberosum* (potato). Rather surprisingly the sum of three main calystegines (A_3, B_2 and B_4) in examined potato varieties was higher than the sum of α-solanine and α-chaconine. No correlation was observed between the levels of these alkaloids groups. Although the toxicity of calystegines for humans has not been fully assessed, the health risk for consumers due to dietary exposure has to be taken into consideration as their levels may exceed glycoalkaloids content.

Levels of furanocoumarins in edible food plants of the Apiaceae family such as celery, parsnip, parsley, carrot, etc. was influencing by various factors. Growing attention was paid to the quality of crops from organic farming and its comparison with conventionally grown products. Their levels had been shown to be strongly affected by individual variety and also fertilization strategy. Climatic conditions in particular crop years also played an important role in the furanocoumarins occurrence. Because furanocumarins occurred as a result of a plant stress and mechanical injury, their level could be different in organic and conventional farming methods. This effect was more pronounced in conventional farming crops (Schulzova, 2007).

Mycotoxins, secondary metabolites of microscopic filamentary fungi genera, may contaminate the food chain and cause health disorders in humans and animals. The most incident are the trichothecenes produced mainly by *Fusarium* sp., their content is usually expressed as marker deoxynivalenol (DON). In Figure 2 the relationship between DON content and the way of wheat farming was shown. While in the years 2004–2006 the mean value of this fusarium toxin was lower compared to conventional farming, in 2007 bio wheat was more contaminated. This study documents high inter annual variability of the results and, at the same time, the impossibility to draw general conclusions on the basis of a one year field experiment.

The resistance of the wheat varieties varies (Hajslova, 2007). Mycotoxins as well as other xenobiotics can be partly metabolised by the living plants. On this account humans and animals consuming contaminated plants are not just exposed to the native mycotoxins but also to their metabolites formed by plants. Recently DON-3-glucoside was identified as the main DON

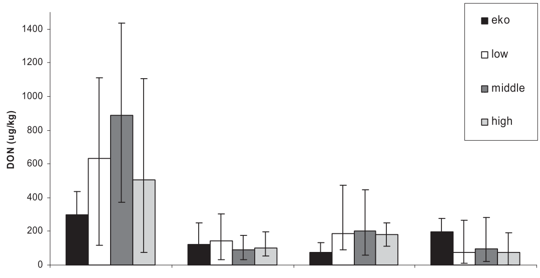

Figure 2: DON content in wheat samples grown in different intensity of farming

metabolite which was released in large quantities during fermentation process (Lancova, 2008). The amount of this ″masked″ mycotoxins also depends on the way of farming.

C) Contaminants

Olive oil represents undoubtedly a healthy item of human diet. However under certain conditions it may contain various contaminants such as polycyclic aromatic hydrocarbons (PAHs) or pesticides. While the first group of compounds may has origin in environmental pollution or in inproper processing practices (drying above open fire), the latter group of contaminants represented by various insecticides, fungicides, herbicides etc. are residues of olive treatment used against pests and weeds. It is rather difficult to avoid traces of environmental PAHs in olive oil, nevertheless, no pesticides residues are present in commodity obtained from organically grown olives. Our study examined a large number of olive oils collected from the Czech market. While practically all conventional extra virgin olive oils contained endosulfan sulphate residues and many of them also other organophosphates, such as fenthion and chlorpyrifos methyl, no residues exceeding the method`s detection limit were found in organic extra virgin oils. On the other hand organic and conventional olive oil could not be distinguished on the basis of PAHs content. Their levels corresponded to common environmental background.

Conclusions

In spite of a deep interest in the crops from organic farming the knowledge on the impact of growing conditions on their toxicological aspects is limited. The research conducted in our laboratory showed some differences in natural toxicants levels, nevertheless, the general concentration trend was not identified. Based on a market products study focused on olive oils the absence of pesticide residues in organic products was demonstrated while occurrence of residues in conventional oils was documented.

Acknowledgments

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THE CONTENT OF BIOACTIVE COMPOUNDS IN ORGANICALLY AND CONVENTIONALLY PRODUCED FRESH TOMATO AND TOMATO JUICES

REMBIAŁKOWSKA, E.[1], HALLMANN, E.[2]

Keywords: organic tomato, conventional tomato, tomato juices, bioactive compounds

Abstract

Four tomato cultivars have been used in the study: three standard tomato cultivars (Rumba, Kmicic and Gigant) and one cherry tomato cultivar (Koralik). The samples of the ripe tomato fruits and tomato juices have been chemically analysed. The results obtained showed that content of bioactive compounds such as vitamin C, beta-carotene and phenolic acids was significantly higher in tomato fruits from organic than conventional cultivation. Organic tomato juices contained more vitamin C, beta-carotene, flavonols and phenolic acids than conventional one.

Introduction

Tomatoes are versatile vegetables that are consumed fresh as well as in the form of processed products (Giovanucci *et al.* 1995). Fruits and vegetables from organic production contain more bioactive compounds. A lot of epidemiological studies suggested that regular consumption of fruits and vegetables from organic production, including tomatoes, can play an important role in preventing cancer and cardiovascular problems (Rao *et al.* 2000). The nutritional qualities of organically and conventionally grown tomatoes in the past were an object of our study. In experiment with tomato Giovannucci *et al.* (1995) showed that consumption of tomato was positively correlated with diminishing effect of prostate cancer (Giovannucci *et al.* 1995). There is very scarce information about the composition of the organic and conventional tomato juice on human health. Therefore it has been decided to investigate the nutritive value the organic vs. conventional tomato fruits and juice.

Materials and Methods

In 2007 year the experiment on the organic and conventional tomato and tomato juice has been carried out. Four tomato cultivars have been used in the study: three standard tomato cultivars (Rumba, Kmicic and Gigant) and one cherry tomato cultivars (Koralik). Tomato plants were cultivated in certified organic and conventional farms. The fertilization and plant protection in the experimental farms have been organized according to the organic and conventional

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Organic Foodstuff

[2] As above

farming rules. The samples of the ripe tomato fruits have been collected and chemically analysed. The contents of dry matter (PN-A-75101-03: 1990), vitamin C (PN-A-75101-11: 1990), carotenoids (beta-carotene, lycopene) (Saniawski i Czapski 1983) and total flavonols and phenolic acids (Strzelecka *et al.* 1978) have been determined. All analyses have been done in six replications. The second part of the experiment was carried out on tomato juice. The results of those qualitative characteristics of fruit were statistically calculated with ANOVA test at α = 0.05.

Results

The results obtained are presented at fig 1. Organic tomatoes contained more dry matter in comparison to conventional one, but it was not a statistically significant difference. After tomato processing the content of dry matter increased in both tomato juices: organic and conventional. Organic fresh tomato fruits contained significantly more vitamin C in comparison to conventional tomato (fig 1). The level of vitamin C was higher in juice than in fresh fruits and contained more of this compound. The main carotenoid in fresh tomato – lycopene was more abundant in conventional fruits. Processing of tomato fruits has decreased the lycopene content in tomato juice. Tomato juice prepared from organic fruits contained more lycopene in comparison to conventional one (fig.1). In the case of beta-carotene the situation was contrary. Organic tomatoes contained more beta-carotene, but after the processing a level of beta-carotene was lower in the organic juice. Organic tomatoes contained significantly more flavonols in comparison to the conventional fruits. After tomato processing the level of flavonols has diminished, but still organic juice had more of these antioxidative compounds (fig.1). Organic tomato contained significantly more phenolic acids in comparison to the conventional one. Processing of tomato has increased the phenolic compounds level and still organic juice contained more phenolic acids in comparison to the conventional one (fig.1).

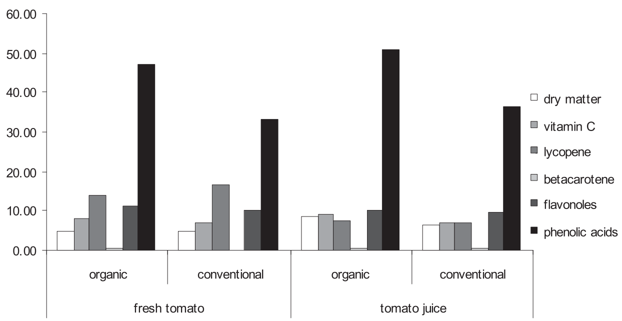

Fig 1. Content of dry matter (g/100 g.f.w.) and bioactive compounds (mg/100 g.f.w.)

p-value cultivation	dry matter	vitamin C	lycopene	β-carotene	flavonols	phenolic acids
fresh tomato	n.s.	0.0001	0.0040	<0.0001	0.0300	<0.0001
tomato juice	<0.0001	<0.0001	0.0009	<0.0001	0.0320	<0.0001

fig.1

Discussion

There are only a few research studies comparing the nutritional value of organic and conventional tomatoes. As showed Caris-Veyrat *et al.* (2004), the organic tomato contained more vitamin C in comparison to conventional one. In a presented experiment the results were similar. Organic tomatoes contained significantly more vitamin C. Similar results were presented by Pither and Hall (1990) who found a higher content of vitamin C in organic tomatoes. In Sweden Lundegårdh *et al.* (2000) carried out an experiment over three years of cultivation methods on tomato quality. The results showed that organically produced tomatoes has a higher content of vitamin C than conventionally cultivated ones. Furthermore, Toor *et al.* (2006) found higher levels of vitamin C in organically produced tomatoes. In this experiment we have found a clearly higher content of lycopene in conventional tomatoes. These results are contrary to those previously presented by Caris-Veyrat *et al.* (2004), and similar to the results of Toor *et al.* (2006) who found a slightly higher content of the lycopene in conventionally cultivated tomatoes compared to organic tomatoes. There are no results showing a content of carotenoids in organic vs. conventional tomato juice. In the examined tomato juices we have observed an increase of lycopene in organic products and decrease in conventional one. At the same time we have noticed a decreasing level of beta-carotene in organic and an increasing level of this colorant in conventional tomato juice. According to Slimestad i Verheul (2005) a temperature above 32 °C cause the re-inversion of lycopene to beta-carotene again. The heating process during the juice preparation causes the change level of carotenoids level in tomato products. Organic tomato juice contained significantly more flavonols and at the same time had the higher note of bitter taste in a sensory analysis. There was a strong correlation between flavonols content and bitter taste (0.87 and 0.54 for organic and conventional products). According to Kohlmünzer (1998) flavonols belongs to group of bioactive substances and have clear bitter taste. Organic tomatoes contained significantly more beta-carotene than organic ones. This result is similar to data presented by Caris-Veyrat *et al.* (2004), who has showed that organic tomato contained 1.23 mg 100 g^{-1} f.w. beta-carotene and conventional only 0.87 mg 100 g^{-1} f.w. In the same study also the higher level has been found in the organic tomatoes, similarly to a presented study. Organic production was connected with the higher level of phenolic acids (phenolic compound) in tomato fruits. The obtained results were similar to presented by Toor *et al.* (2006) who showed that organic tomatoes contained 17% more phenolic compounds in comparison to the conventional one. As has been indicated above, there is evidence that some organic vegetables, in this case tomatoes and tomato juices, contain more antioxidants than conventional ones. Both the research data presented here and the cited results appear to confirm the above tendencies.

Conclusions

1. Fresh organic tomatoes contained more total and reducing sugars, vitamin C, β-carotene, flavonols and phenolic acids than conventional ones.
2. Conventional tomato fruits contained more lycopene and organic acids than organic ones.
3. Organic tomato juice contained more dry matter, vitamin C, lycopene, flavonols and phenolic acids than conventional products, that were richer in β-carotene and glutamic acid.

4. Fresh organic tomatoes and tomato juices can be recommended in health preventive diet, because they contain a lot of beneficial bioactive compounds.

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ECONOMIC EFFICIENCY OF GROWING TECHNIQUES FOR WINTER WHEAT

JÁNSKÝ, J.[1], NOVÁK, P.[1], LÉTALOVÁ, P.[1]

Key words: organic farming, cereals, growing techniques, economic efficiency

Abstract

The paper deals with the impact of recommended growing techniques on the economics of selected field crops, in particular with winter wheat. It was carried out in order to increase the competitiveness as well as the comparison with economic results in conventional system of farming, which can contribute to increasing share of cereals grown on arable land thereby meeting increasing demand for bio-products of organic origin in the Czech Republic.

Introduction

Growing of field crops is an important part of plant production securing the main part of human nutrition. Nevertheless, field crops could be possibly considered as ecosystems in which man is not only an important force, but for this kind of ecosystem also the necessary condition for its existence. Man uses field crops so, that a significant share of its energy, which the crops gain from the photosynthesis process, gets out during the harvesting from the place of rise and regulates the stream of energy into the places of need" (Jánský, 2005).

The agriculture under the European conditions should be multifunctional, sustainable and competitive. Approximation to or achieving the sustainable agriculture demands: decrease of inputs, increasing the efficiency of all used sources and stronger use of natural processes such as biological nitrogen fixation, recirculation (recycling) of nutrients, prevention in plant protection and so on. These general principles must be realized with respect to specific conditions on each farm.

The system of organic farming, under appropriate scale and under selected conditions together with the observance of environmentally friendly or equilibrium rules in agro-systems is one of the ways, which could play an important role for a better sustainability of agriculture but with lower yields.

Materials and Methods

This paper is providing an overview of recommended growing techniques /technological processes of selected cereals in organic farming system. It is assumed that the achieved results

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contribute to increase the share of crops grown on arable land where the supply of organic production in the Czech Republic does not meet the demand and the possibilities of sale.

The methodology was launched in three partial steps (Jánský, Živělová, 2005):

- Setting of recommended growing techniques and its economic evaluation for selected cereals;
- Economic effectiveness evaluation of designed growing techniques on data from particular farms;
- Economic efficiency based on a comparison of selected crops grown in organic as well as conventional farming systems.

The paper is a partial output of a Research project of FBE MUAF Brno, (MSM No 6215648904) „Czech economy in the process of integration and globalization, and the development of agrarian sector and the service sector under the new conditions of an integrated marked“ as a part of thematic direction 05 „Social-economic context of sustainable development of multifunctional agriculture, and actions of agrarian and regional policy“.

Results

As an example, growing technique was proposed for winter wheat including its evaluation. Wheat is the most demanding crop regarding soil fertility and water accessibility out of all crops. It uses very good, deep and heavier soils with large water capacity. Very light or shallow and peaty soils are not suitable for wheat.

Winter wheat reacts the most sensibly from all crops to the crop grown in prior season, i.e. crop rotation is very important. Very good prior-crops for winter wheat are crops with wide leaf or crops fertilized with manure. For example these can be perennial fodder crops (besides the drier areas, where it can worsen the water regime for consequent crop). Other very good crops are pulse crops, pulse-cereals mixed with green crops, early and semi-early potatoes and corn for silage. These kinds of crops are important for the quality of winter wheat, especially concerning the amount of aleurone, which is important for determining the baking quality of pastry also for bio-food. The highest amounts of aleurone are after clover and pulse crops.

The overview of average costs per one hectare of harvested area while following above mentioned technological processes in system of organic farming is clear from Table no. 1.

It is clear from the structure of the costs that the highest share of costs is filled up with cultivation costs, which represents 44 % out of total costs (more in Tab. 1)

Tab. 1: Structure of average costs and revenues for winter wheat in system of organic farming

Indicator	Costs per 1ha of harvested area (CZK)	Indicator	Costs per 1ha of harvested area (CZK)
Seeds	1 765	Costs in total	10 442
Fertilizers	1 113	Gross margin	619
Other direct material costs1	210	Costs of major product (CZK/t)	3 829
Direct material costs in total	3 088	Per hectare yield (t/ha)	2,40
Cultivation costs	4 619	Average farmers' price (CZK/t)	3 469
Indirect costs	2 735		

While comparing costs and revenues of winter wheat grown according to proposed growing techniques together with costs and revenues of sample file of organic farmers using recommended growing technology (shown in Tab. 2)[2] it is clear that individual farms achieve very different values.

Tab. 2: Costs and revenues characteristics for winter wheat in the sample file of organic farmers

Indicator	Average	Minimal value	Maximal value	Median
Seeds	1 787,60	750,00	2 440,00	1 600,00
Fertilizers	1 307,10	875,00	5985,00	1 859,00
Other direct material costs	35,00	0,00	520,00	24,00
Direct material costs in total	3 129,71	1 625,00	8 945,00	3 483,00
Cultivation costs	5 643,39	948,00	21 518,00	4 343,00
Indirect costs	1 618,16	x	x	5 048,00
Costs in total	10 391,26	7 407,00	24 203,00	12 874,00
Gross margin	- 443,46	x	x	5 043,70
Costs of major product (CZK/t)	6 178,08	2 332,64	8 048,37	4 315,59
Per hectare yield (t/ha)	2,03	1,14	4,15	3,10
Average farmers' price (CZK/t)	4 110,33	3 199,99	5 000,04	4 151,52

Total per hectare costs achieved by organic farmers are 3 972 CZK lower average value than companies in conventional system of farming. In the means of median it is less by 1 489 CZK. The main reason for lower costs is the absence of the use of chemical plant protection products by organic farmers as well as the use of farm-based fertilizers, which is shown from indexes[3] in Tab. 3.

Different per hectare yield is exposed into costs per one ton of grain. From the median in the level of 4 152 CZK it is possible to conclude that organic farmers are only partially selling the organic winter wheat as organic product. It is also necessary to consider the undeveloped market for organic production in the Czech Republic. Nevertheless, the winter wheat seems to be unprofitable crop in the system of organic farming in present market conditions.

Tab. 3: Comparison of average costs and revenues of winter wheat for companies farming in organic and conventional conditions

Indicator	Index	Indicator	Index
Seeds	1,64	Costs in total	0,73
Fertilizers	0,44	Gross margin	x
Other direct material costs	0,08	Costs of major product (CZK/t)	1,44
Direct material costs in total	0,49	Per hectare yield (t/ha)	0,51
Cultivation costs	0,79	Average farmers' price (CZK/t)	1,08
Indirect costs	1,19		

[2] i.e. plant protection agents, if the use is in conformity of organic farming law, other material costs items excluding fertilizers, seed, which could be directly allocated to the crop.

[3] The comparison index is ratio of individual costs and revenues items for wheat growing in organic and conventional farming systems.

Out of Tab. 3 it is clear that comparison index for total cost of winter wheat grown in organic and conventional farming system is less than one. It indicates, similarly as in other countries, that organic production is cheaper for cultivation (regarding cost for hectare). Indeed, if we evaluate the amount of per hectare yield of wheat grown in organic farming systems, which is 51 % of per hectare yield in case of wheat grown in conventional farming systems, it indicates that unit costs are obviously higher. The price of production is by 8 % higher for wheat grown in organic farming systems. Similarly for other crops grown on arable land, more details mentioned in publication Jánský, Živělová, Křen, Valtyniová (2006). If the comparison index for crops grown in organic farming systems in the Czech Republic is compared to other European countries, the situation is similar.

Conclusions

An important aspect that influences the decision-making of farmers to convert to organic farming is the economic results. For better awareness in this area it is necessary to compare the economic results of individual sectors in conventional as well as organic farming systems. This would help to get objective data for consequent decision-making about how to contribute to the development of organic farming. Especially important is organic farming on the arable land, which represents in the conditions of the Czech Republic 7,5 % out of total area of organically farmed land.

The result of this paper is setting of recommended growing techniques of selected cereals in organic system of farming. A similar analysis as it was carried out for winter wheat was also made within the research project for other cereals such as spring wheat, spelt, winter barley, oats, rye, triticale and some other plants grown on arable land (for more details see Jánský, Živělová, Křen, Valtyniová (2006).

The impact evaluation of recommended growing techniques on selected field crops and the comparison with economic results in conventional farming systems was carried out in order to increase the competitiveness of organic farming. This can contribute to increase the share of crops grown on arable land and thereby meeting increasing demand for organic products in the Czech Republic.

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CHEMICAL COMPOSITION AND NUTRITIONAL VALUE OF FEEDINGSTUFFS FROM ORGANIC AND CONVENTIONAL FARMS

GRELA, E.R.[1], SEMENIUK, V.[2]

Key words: organic feed, grains, leguminous, nutritional value

Abstract

There was analyzed the chemical composition of feeds obtained from 16 organic farms in Poland. The following feeds were sampled: cereal grains – rye, wheat, triticale, spelt, barley, oats; legume seeds – garden pea, horse bean and oil plant seeds – flax, rapeseed cake. The feed samples were examined for a content of dry matter, crude ash, crude fat, crude fiber and detergent fiber fraction as well as crude protein, and minerals. Besides, the EM content for pigs was calculated. The conventional feeds and the ecological ones, were produced under the similar soil-weather conditions, whereas the agrotechnical practices employed differed significantly (fertilization, agricultural measures, sprays). The organic feedstuffs contained a lower crude protein content and a higher crude fiber level than conventional ones. A mineral content in these feeds was dependent on the soil conditions to a large extent. The energy value of numerous feeds obtained from the organic farms also appeared to be slightly higher as compared to the conventional ones. To balance the mixtures or dietary units for the animals managed ecologically, special attention should be drawn to the actual content of nutrients in feed components.

Introduction

Organic farming means a management system that activates the natural cultivation practices through unprocessed technologically free means application to ensure sustainable soil fertility and animal welfare as well as high biological value of food obtained in this way [Blair, 2007; CEU, 1999]. At the ecological farm, the interrelations between the soil-plants, plants (feed)-animals and animals-soil are supposed to be maintained [Kőpke, 1994, Bourn and Prescott, 2002]. Therefore, a nutrient content in feedstuffs depends on soil availability, organic farming, appropriate agrotechnics and crop rotation employed [Worthington, 1998].

The objective of the present research was to determine the chemical composition and nutritional value of feeds produced in some ecological farms in Poland, where pig nutrition is based on these natural resources.

Materials and Methods

There was analyzed the chemical composition of feeds obtained from 16 organic farms in Poland. The following feeds were sampled: cereal grains – rye (6 samples), wheat (14), triticale (7),

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[2] as above

spelt (2) barley (15), oats (6); legume seeds – garden pea (5), horse bean (6) and oil plant seeds – flaxes (3), raps (4).The seed samples were also taken from the conventional plants cultivated in the ecological farms surrounding (3–4 samples from each species). In the feed samples, a content of dry matter, crude ash, crude fat, crude fiber and detergent fiber fraction as well as total crude protein and minerals was established according to the procedures described in AOAC [2000]. Besides, the EM content for pigs was calculated [Furgał-Dzierżuk *et al.*, 2003]. The conventional feeds for pigs, just like ecological, were produced under the similar soil-weather conditions, whereas the agrotechnical practices applied differed significantly (fertilization, agricultural measures, sprays). The tables present comparison of mean values for each determination

Results

The organic feedstuff analyses are shown in Table 1. These feeds contain a lower crude protein content and a higher crude fiber level than conventional ones. The analysis of a detergent fiber fraction (Tab. 2) revealed an increased NDF and ADF level in organic feedingstuffs, while

Tab. 1. Content of nutrients (g kg^{-1}) in organic and conventional feed

Feed	Crude protein		Ether extract		Crude fibre	
	Organic	Conv.	Organic	Conv.	Organic	Conv.
Horse bean	235.2	247.5	14.4	14.7	79.1	72.6
Garden pea	215.7	221.3	17.8	17.3	68.1	64.8
Barley	108.7	112.8	19.6	19.5	42.1	39.3
Oat	113.1	115.7	43.9	44.3	147.2	134.5
Linseed	221.2	229.1	321.4	324.2	106.5	105.8
Spelt	114.1	114.1	27.5	27.2	31.2	30.3
Wheat	118.7	124.2	16.3	18.1	29.9	26.7
Triticale	116.9	121.2	14.9	14.2	26.4	24.6
Rye	82.7	86.8	16.3	16.5	21.3	21.4
Rapeseed	214.5	219.2	403.2	411.5	71.3	66.9

Tab. 2. Detergent fiber content In g kg^{-1} of dry matter organic and conventional feed

Feed	Organic			Conventional		
	NDF	ADF	ADL	NDF	ADF	ADL
Horse bean	178,2	45,9	4,05	171,5	44,7	4,18
Garden pea	145,7	51,3	5,25	139,8	48,9	5,52
Barley	174,6	31,5	1,54	156,4	29,8	1,43
Oat	321,5	39,4	3,82	213,7	37,8	3,82
Linseed	295.2	145.8	52.4	285.4	128.4	48.6
Spelt	148.8	35.7	11.8	138.4	32.6	10.9
Wheat	118,5	28,4	4,15	106,1	25,8	3,65
Triticale	122,1	44,1	3,98	102,7	35,3	3,73
Rye	125,4	31,9	3,59	102,1	23,7	2,95
Rapeseed	275.7	134.5	58,2	248.2	129.5	56.7

a declining tendency for an ADL content A mineral content in these feeds (Tab. 3) was subject to the soil conditions to a large extent. As for macro-minerals, a total phosphorus content was the highest, whereas among the micro-elements the highest levels of iron and zinc were noted. The content of the minerals depended on the plant species. The energy value of numerous feeds for pigs (Tab. 4) obtained from the organic farms also appeared to be slightly lower as compared to the conventional ones.

Tab. 3. Crude ash and minerals content in 1 kg dry matter of organic feeds

Feed	Crude ash	P g	Ca g	Na g	Fe mg	Mn mg	Zn mg	Cu mg
Horse bean	41.6	4.28	1.08	0.10	56.2	14.3	57.6	7.48
Garden pea	29.6	3.27	0.89	0.09	68.1	13.7	64.8	5.63
Barley	20.4	2.75	0.49	0.08	69.7	21.8	26.9	2.94
Oat	23.1	3.12	0.65	0.39	51.4	37.9	17.6	3.49
Linseed	34.1	4.96	2.94	0.42	96.6	21.2	59.6	14.4
Spelt	20.3	3.95	0.59	0.15	11.5	51.6	36.3	8.43
Wheat	15.9	2.73	0.72	0.38	49.3	36.4	18.4	2.83
Triticale	16.5	2.92	0.97	0.34	48.4	41.2	17.8	3.14
Rye	16.4	2.54	0.59	0.09	63.2	52.3	26.3	3.04
Rapeseed	38.6	7.15	3.14	0.21	105.4	38.9	37.3	3.33

Discussion

The organic feeds produced in Poland and abroad are supposed to satisfy the common requirements concerning ecologic farming [CEU, 1999]. That applies to both, origin of seeds for cultivation (free from GMO) and agrotechnics [Bourn and Prescott, 2002]. The chemical composition of ecological feedstuffs may differ substantially from the conventional, especially in a content of crude protein and minerals. That arises from the mineral dressing employed in the conventional farming which is banned in the ecological agriculture practices. In numerous studies, conventional feeds were shown to contain a high level of crude protein, mostly NPN. In organic feeds, though, a major content of total protein is made by crude protein [Worthington, 1998]. Elevated concentration of crude fibre and detergent fibre fraction (ADF and NDF) is associated with seed size variation and its formation [Starz, 2004]. Small-sized seeds contain more fibre and less starch that has been confirmed in the present studies. However, a crude fibre content (known to depress digestibility) is inversely proportional to feed energy value. On the whole, the energy value of organic feedstuffs turned out to be slightly lower compared to conventional ones [Furgał-Dzierżuk *et al.*, 2003; Sauvant *et al.*, 2004]. A content of

Tab. 4. Metabolizable energy content in MJ kg^{-1} of dry matter organic and conventional feed

Feed	Metabolizable energy (MJ kg^{-1}) of DM	
	Organic	Conventional
Horse bean	14,1	14,4
Garden pea	15,4	15,8
Barley	13,95	14,3
Oat	12,1	12,6
Linseed	20,8	21,4
Spelt	14.8	14.9
Wheat	15,1	15,6
Triticale	14,9	15,3
Rye	14,3	15,2
Rapeseed	17,2	18.0

feed mineral components is subject to their amount in soil, availability, fertilization and a plant species [Grela, 1996; Kőpke, 1994]. Comparing the values determined for organic feeds and those obtained in the present studies for conventional feedstuffs as well as those reported in other sources [Sauvant *et al.*, 2004], it follows that they are slightly lower in many cases. However, some authors [Bourn and Prescott, 2002; Worthington, 1998; Zollitsch *et al.*, 2004] emphasize higher availability of some components of ecological feedingstuffs to both, animals and humans.

Conclusions

To balance the mixtures or dietary units for the animals managed ecologically, special attention should be drawn to the actual content of nutrients in feed components. Besides, closer co-operation between feed crop producers, especially in agrotechnics, and animal breeders should be promoted to increase nutritional value of feeds.

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THE EFFECT OF ORGANIC RAISING OF FATTENERS ON SOME BLOOD HEMATOLOGICAL AND BIOCHEMICAL PARAMETERS

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Key words: organic raising, pigs, blood, productive traits

Abstract

The objective of the present study was to determine the influence of organic feedstuff (grains and leguminous) supplementation with grains containing protein (II) or a concentrate of a specific herbal mixture including mineral-vitamin premix (III) improving the growing pig nutrition on the blood hematological and biochemical indices. The results of the present study have proven the efficiency of the supplementing mixture (II) used in the nutrition of fatteners at organic farms. The results revealed improved productive traits, an increase in red blood cell parameters together with enhanced blood lipid indices. The use of mineral-vitamin premix with dry herb additive (III) did not have any significant effect on the determined parameters, yet it contributed to augmented productive traits.

Introduction

Ecologic animal raising is based on keeping high standards referring to the animals' wellfare, satisfying the needs adequate to the lifestyle of farm animals, as well as preventing diseases [Blair, 2003]. Hence, special attention is paid to the conditions in the pens where animals are kept, breeding practices and the stock itself. Maintaining the animals' good health should result primarily from aiding their natural immune defense, selecting adequate breeds and raising methods which include allowing the animals free access to outdoor runs and/or pastures [Lund and Algers, 2003]. Feeding animals ecologic meals composed of the materials obtained in the process of ecologic production and from natural non-agricultural substances does not always provide them with the adequate amount of nutrients or mineral components [Brandt, 2001; Partanen et al., 2006; Williams, 2002]. Consequently, it is advisable to supplement feeds with extra ingredients which could compensate for such deficiencies and positively affect the productive traits, as well as the animals' health.

The objective of the present study was to determine the influence of organic feedstuff (grains and leguminous) supplementation with mineral-vitamin premix and specific herbal mixture or a protein concentrate on both the performance and blood hematological and biochemical indices.

Materials and Methods

The experiment was performed on 60 pig growers, PL x PLW crossbred swine assigned into three treatment groups. The animals from the control (I) were fed in compliance with the feeding

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regime at the farm (cereal grains enriched with legume plant mixture and some fish meal). Group II received cereals with a supplementing protein concentrate (15-25%), while group III was given a cereal mixture with an addition of protein feedstuffs (legumes) produced at the farm and mineral-vitamin premix (2.5%) with a dry herb component (2.5%). The herb mixture contained common yarrow (*Achillea milefolium* L.), lyophilized garlic (*Allium sativum* L.) bulbs, great nettle (*Urtica dioica* L.) and rhizomes of wheat-grass (*Agropyron repens* L.). The zootechnical conditions, i.e. ambient temperature, relative humidity and cooling system, as well as the size of pen per pig and pen bedding were identical for the groups and conformed with the recommendations for the ecologic farming. The animals had free access to water and outdoor run. In the experiment marked animals were weighed at the beginning of the research, and then again whenever the feed was changed (2-3 times) and at slaughter. The animals' health, any manifestations of cannibalism and other behavioral features were recorded, as well as veterinary procedures. The consumption of the mixture was controlled by accurate weighing the portions for troughs in individual pens. Digestion examinations were performed on 6 fatteners with the body mass of 45-50kg and 85-90kg, with the use of index method. The fatteners were slaughtered at the mass of 120 kg and their right carcasses were subject to abbreviated slaughter analysis. Blood from the jugular vein for the analytical examinations was collected twice from 6 pigs in each group. In full blood, its hematological parameters were determined and in blood plasma was examined to establish a some biochemical parameters.

The obtained numerical data were analyzed statistically, and the significance of the differences was determined with Duncan's test.

Results

Table 1 presents mean daily gains, feed intake and selected indices of the slaughter analysis.

Tab. 1. Average daily gains, feed intake, kg day, meat content and nutrients digestibility (> ± SD)

Item		Feeding groups					
		I		II		III	
Average daily gains, g		587c	± 34	792a	± 52	718b	± 49
Feed intake, kg day^{-1}		4.17a	± 0.22	3.23b	± 0.21	3.87b	± 0.24
Meat content, %		46.5b	± 3.2	51.2a	± 3.9	50.6a	± 4.1
Digestibility in Grower period (45-50 kg body mass)	Protein	79.2	± 5.1	78.3	± 4.7	80.4	± 5.3
	Fat	49.5b	± 3.1	52.1a	± 3.3	49.7b	± 3.0
	Fibre	17.2	± 2.9	17.4	± 2.5	17.8	± 2.4
	NEf	89.2	± 4.2	89.1	± 5.1	89.5	± 4.9
Digestibility in Finisher (85-90 kg body mass)	Protein	84.2	± 5.6	86.5	± 4.2	85.4	± 4.4
	Fat	64.5	± 5.3	66.1	± 5.1	65.7	± 5.8
	Fibre	47.2a	± 2.4	44.4b	± 2.6	45.8b	± 2.2
	NEf	91.2	± 4.8	92.1	± 5.1	90.5	± 4.4

a, b, c – values in the same rows with different letters differ significantly at $p \leq 0.05$

The blood hematological and biochemical parameters in pigs managed ecologically (Tab. 2, 3) were within the limits of the reference values [Friendship and Henry, 1996; Winnicka, 2004]. Adding an ecologic supplementing mixture to the feeds resulted in higher hematocrit values, and also in an increased number of erythrocytes in the fatteners' blood, in both periods of fattening.

Tab. 2. Content of hematological parameters in the pigs' blood (>± SD)

Item	Body weight, kg	Feeding groups								
		I			II			III		
Ht, %	45–50	32.9^{b}	±	3.23	37.2^{a}	±	1.40	34.5^{b}	±	1.66
	90–95	31.9^{c}	±	1.42	37.1^{a}	±	2.39	35.6^{b}	±	1.41
Hb, g l^{-1}	45–50	110.3	±	4.46	117.8	±	4.30	113.8	±	5.50
	90–95	120.9^{b}	±	5.06	139.9^{a}	±	6.01	131.8^{a}	±	1.98
RBC, 10^{12} l^{-1}	45–50	6.39^{b}	±	0.54	7.27^{a}	±	0.48	7.10^{ab}	±	0.17
	90–95	6.36^{b}	±	0.44	7.33^{a}	±	0.54	6.67^{ab}	±	0.42
WBC, 10^{9} l^{-1}	45–50	21.54	±	3.22	17.10	±	1.94	18.01	±	1.60
	90–95	19.34	±	1.68	17.21	±	2.51	15.02	±	1.18

a, b, c – values in the same rows with different letters differ significantly at $p \leq 0.05$

In both fattening periods the content of total protein and glucose in blood serum was at a similar level in all experimental groups, whereas the content of lipid components, particularly in the first fattening period, was vulnerable to the addition of experimental agents (Table 3).

Tab. 3. Content of biochemical parameters in the pigs' blood (>± SD)

Item	Body weight, kg	Feeding groups								
		I			II			III		
TP, g dl^{-1}	45–50	55.51	±	5.10	53.13	±	5.76	55.77	±	5.90
	90–95	72.17	±	2.08	76.02	±	2.72	73.93	±	2.17
Glucose, mmol l^{-1}	45–50	4.73	±	0.30	4.22	±	0.32	4.46	±	0.41
	90–95	4.34	±	0.17	3.96	±	0.23	4.52	±	0.21
Chol., mmol l^{-1}	45–50	2.02^{a}	±	0.09	1.81^{b}	±	0.12	1.95^{ab}	±	0.10
	90–95	3.12	±	0.21	2.87	±	0.15	2.90	±	0.25
TG, mmol l^{-1}	45–50	0.56^{a}	±	0.10	0.29^{b}	±	0.06	0.69^{a}	±	0.11
	90–95	0.86	±	0.11	0.83	±	0.07	0.85	±	0.09
HDL-chol., mmol l^{-1}	45–50	1.16	±	0.09	1.23	±	0.09	1.15	±	0.05
	90–95	1.54	±	0.05	1.61	±	0.07	1.59	±	0.08
LDL-chol., mmol l^{-1}	45–50	0.61^{a}	±	0.09	0.45^{b}	±	0.13	0.49^{b}	±	0.05
	90–95	1.18^{a}	±	0.19	0.89^{b}	±	0.20	0.93^{ab}	±	0.15

a, b – values in the same rows with different letters differ significantly at $p \leq 0.05$

Discussion

The enhancement of production output in pigs fed an addition of a supplementing mixture and mineral-vitamin premix with a dry herb is confirmed by lower feed intake and higher daily weight gains. This is a consequence of the feed dose which is balanced in a better way, as far as both its nutrients and mineral elements are concerned [Hansen et al., 2006]. On the other hand, the feed supplements used in these studies did not result in relevant differences concerning the digestibility of nutritional components, in either of the fattening periods. The results obtained also show that pigs can be raised ecologically, which leads to higher meat content in the fatteners, by even up to 51.2%. At the same time, it is vital that, apart from adequate balancing of the feeding procedure with the use of the feeds coming from the breeder's own farm, other requirements of the so-called welfare should be met, namely the right size of the pen, access to outdoor runs, etc. [Blair, 2007; Millet et al., 2004]. Properly raised and fed fatteners are quiet and no cases of cannibalism are noted [Lund and Algers, 2003]. All this may also stimulate the functioning of the immune system [Millet et al., 2005]. Better health status of the animals is confirmed by improved indices of red-blood-cell system [Friendship and Henry, 1996]. This was observed in the experiment performed. The analyses of the values of hematocrit, erythrocyte number or hemoglobin content reveal that an addition of an ecologic supplementing mixture (II) to pigs' feed mixture significantly enhanced their value. This was probably related to the presence of some elements participating in erythropoetic processes (copper, iron). Providing the organism with adequate amounts of nutrients also contributed to stimulating lipid transformations. This was manifested by a relevant decrease in the content of both total cholesterol, triacyloglycerols and LDL-cholesterol, especially in the first fattening period.

Conclusions

The results of the present study have proven the efficiency of the supplementing mixture (II) used for the nutrition of fatteners at organic farms. An improvement was noted regarding the productive traits, increased red blood cell parameters, together with the enhancement of blood lipid indices. The use of mineral-vitamin premix with dry herb additive (III) did not have any significant effect on the determined parameters, though it contributed to better productive traits.

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NUTRITIONAL VALUE OF BROCCOLI AND RADISH GROWN BY ORGANIC AND CONVENTIONAL METHODS

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Key words: nutritional value, organic production, conventional production, *Raphanus sativus* L. var. *niger* (Mill.), *Brassicca oleracea* L. conv. *botrytis* (L.) Alef. var. *italica* Plenck

Abstract

This study attempted to measure the nutritional value of broccoli and radish grown by both organic and conventional methods. The trial took place in ČZU Prague- Trója. Broccoli and radish were grown at two different planting spaces, autumn culture in 2007 and spring culture in 2008. Levels of anti-oxidants (carotenoids, vitamin C) were measured, together with the levels of cations. The results have been evaluated statistically. The nutritional value of broccoli and summer radish is influenced mostly by the growing period (spring or autumn). The increase of nutritional value by the ecological way of growing was found out just in the content of carotenoids, however not significantly. The study continues.

Introduction

In recent years, people in the more developed countries have started to take in interest in the nutritional value of their food, including fruit and vegetables. This interest is not confined to just nutritional and rational nutrition specialists, but is also shared by consumers. Nutritional value is influenced not just by the botanical species but also by the growing method, or agricultural system. This raises the question of what effect organic growing methods have on nutritional value. In this article are reported the outcomes of nutritional values which were measured in summer radish and broccoli grown under the organical and conventional growing system.

Materials and Methods

The field experiments were carried out on the organic and conventional trial fields of the Faculty of Agrobiology, Food and Natural Resources, Czech University of Life Sciences Prague (ČZU). The preceding crop on both the organic and conventional plots was green manure (legumen cereals). The culture of broccoli (cv. "Belstar F1") was sown in multipots on 10.07.2007 (harvested on 30.11.2007) and 28.02.2008 (similar cv. "Lucky F1", harvested on 16.06.2008). The summer radish – Japanese hybrid variety – cv. Jarola F1 was sown directly on 15.08.2007 (harvested 22.10.2007) and on 26.03.2008 (harvested 02.06.2008). Two different plant spacing were used. The experiment was replicated three times, each with an area of 10 m^2.

Treatment of organic trial field: Broccoli and summer radish were grown in compliance with the legal requirements and directives laid down for organic produce (Act No.242/2000). Immediately

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after sowing of radish and planting of broccoli were used non-woven textile covering. The preparation Ferramol Schneckenkorn was used in the broccoli against slugs.

Treatment of conventional trial field: On the basis of the soil analysis, the conventional plot was fertilized with P, K and Mg. In the broccoli the herbicide Stomp 400SC was used to control the weeds, Sumithion Super and Karate were used against pests and Mesurol Schneckenkorn was used against slugs. In the summer radish Gramoxone was used before sowing and Pirimor, Decis 2,5 EC, and Actellic 50 EC were used against pests.

Analyses of nutritional value: Vitamin C was determined reflectometrically by the RQ Flex method (Merck), mineral content by capillary isotachophoresis (Boček *et al.*,1986), and carotenoids by quantitative colorimetry (Holm, 1954).

Statistical evaluation was done by analysis of variance with determination of significance at level P=0.05 with using of statistical program Unistat (version 4.5)

Results

Average values for the antioxidants – vitamin C and carotenoids – are in Table 1 (broccoli) and in Table 2 (summer radish). The content of vitamin C in broccoli, compared with the variants of organic and conventional production, was not significantly different. The content of vitamin C in both the organic and conventional plots was much lower in the autumn harvest of 2007 compared to the summer harvest in 2008. Similarly, levels of carotenoids in spring sown crops were higher than those sown in the autumn of 2007, under both growing systems, both organic and conventional. Vitamin C levels in summer radish were significantly higher under the conventional growing system compared to the organical growing system, and also in spring culture in 2008. The levels of carotenoids showed a similar variation, but the results are not significant.

Tab. 1: Levels of dry matter, vitamin C and carotenoids (in fresh matter) in organic and conventionally grown broccoli

Year/spacing (m)	Dry matter (g.kg^{-1})		Vitamin C (mg.kg^{-1})		Carotenoids (mg.kg^{-1})	
	E	K	E	K	E	K
2007 0,6 x 0,5	150	157	690	879	5,92	3,88
0,5 x 0,5	152	152	693	954	6,13	4,28
2008 0,6 x 0,5	98	100	758	753	15,07	13,92
0,5 x 0,5	91	105	823	783	13,85	15,08

Note: E- organic production, K- conventional production, 2007- autumn culture, 2008 spring culture

Tab. 2: Levels of dry matter, vitamin C and carotenoids (in fresh matter) in organic and conventionally grown summer radish

Year/spacing (m)	Dry matter (g.kg^{-1})		Vitamin C (mg.kg^{-1})		Carotenoids (mg.kg^{-1})	
	E	K	E	K	E	K
2007 0,20x0,35	65	73	147	181	0,66	0,53
0,30x0,35	70	77	165	198*	1,14	0,55
2008 0,20x0,35	62	66	189	248*	0,78	1,15
0,30x0,35	60	64	186	232*	0,52	1,01

*significantly different (P=0,05) between organic and conventional production

The average content of minerals is shown in Tables 3 and 4. In broccoli the levels of K were significantly higher in autumn culture. In spring culture the levels were significantly higher under the conventional growing system. As with the broccoli, K levels in summer radish are affected by the growing period, but not significant.

Sodium can have high levels in food, so a high value in vegetables is assessed negatively. Higher levels were found in broccoli grown under the organic system, but in summer radish the situation was the opposite, although the results are not conclusive. Broccoli also shown conclusive higher influence of spring growing term on higher Na content.

Organic broccoli grown in the autumn has lower levels of Ca. In summer radish was probative influence of the term of growing.

The content of Mg was significantly higher in broccoli and also in summer radish in autumn culture, influence of variants was not conclusive.

Tab. 3: Levels of minerals in organic and conventionally grown broccoli (in fresh matter)

Year/spacing (m)	K ($mg.kg^{-1}$)		Na ($mg.kg^{-1}$)		Ca ($mg.kg^{-1}$)		Mg ($mg.kg^{-1}$)	
	E	K	E	K	E	K	E	K
2007 0,6 x 0,5	5313	5189	96	69	225	253	349	391
0,5 x 0,5	5321	5282	86	74	218	346	366	317
2008 0,6 x 0,5	3637	4332*	295	164	296	273	227	222
0,5 x 0,5	3757	4000	228	167*	271	261	210	210

*significantly different (P=0,05) between organic and conventional production

Tab. 4: Levels of minerals in organic and conventionally grown summer radish (in fresh matter)

Year/spacing (m)	K ($mg.kg^{-1}$)		Na ($mg.kg^{-1}$)		Ca ($mg.kg^{-1}$)		Mg ($mg.kg^{-1}$)	
	E	K	E	K	E	K	E	K
2007 0,20x0,35	4037	3859	153	152	246	263	184	222
0,30x0,35	3563	3833	135	197	221	240	165	198
2008 0,20x0,35	3710	3439	163	177*	177	170	116	124
0,30x0,35	3608	3492	164	177*	176	171	118	132

*significantly different (P=0,05) between organic and conventional production

Discussion

Woese *et al.*(1995) evaluated 26 studies in which the content of vitamins in organically and conventionally grown vegetables were compared. With exception of leaf vegetables, there were no conclusive differences in the vitamin C content. In the same way Tauscher *et al.* (2003) and many others have shown that levels of vitamin C can be higher in organically grown leaf vegetables. However, in our experiments, higher levels were found in those grown conventionally. The lower levels vitamin C when autumn grown can be explained by the differences between cultivars, but also by the lower light intensity in the autumn. Decreased light intensity was higher in the organic growing, there were plants grown under textile covering. Seung (2000) and others argue that higher light intensity during the growing period increases the content of vitamin C in plants. The published literature usually states that the content of carotenoids is higher in organic growing systems, for example, Leclerc *et al.* (1991) and Pither, Hall (1990). Higher levels of carotenoids in organic produce were observed in our experiments in the autumn and spring grown broccoli and in autumn sown summer radish. The differences of dry matter content between the two growing systems were not significant. Mineral levels, such as Fe, K, Na and Mg, are mostly higher in organic crops (Tauscher *et al.* 2003, Knight 1990), but in our experiments the conclusive influence of the growing period was shown. The differences between the two growing systems (organic and conventional) were minimal. Similarly, plant density had no effect on the nutritional values of the plants.

Conclusions

From the evaluation of the chosen nutritional components – vitamin C, carotenoids and the mineral elements K, Ca, Mg and Na for the organic and conventional growing systems we can say that the nutritional value of broccoli and summer radish is influenced mostly by the growing period (spring or autumn). The increase of nutritional values by the ecological way of growing was found out just in the content of carotenoids. The study continues.

Acknowledgments

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THE CONTENT OF THE BIOACTIVE COMPOUNDS IN FRESH AND PICKLED RED PEPPER FRUITS FROM ORGANIC AND CONVENTIONAL PRODUCTION

HALLMANN, E.[1], REMBIAŁKOWSKA, E[2],

Key words: organic red pepper, conventional red pepper, pickling process, bioactive compounds

Abstract

The sweet red pepper is a good source of vitamin C, flavonoids especially rutin also carotenoids: capsorubin, capsantin, beta-carotene and lutein. For experiment were use two cultivar of sweet red pepper from organic and conventional cultivation. The obtained results of fresh red pepper showed that organic fruits contained more vitamin C, rutin, lutein also dry matter. Conventional pepper contained more beta-carotene and lycopene. The pickled organic red pepper contained more vitamin C and lutein in comparison to conventional one. The sensory analysis show that organic pickled red pepper have a higher notes of spices and pepper odour also acetic, spices, sweet and pepper flavour.

Introduction

The primary rule of the organic agriculture is plant production without synthetic mineral fertilizers and pesticides. the natural fertilizers as manure, compost, also green manure are widely used. The natural insect predators and plants extracts are used for plant protection. The sweet red pepper is a good source of vitamin C, flavonoids (especially rutin), also carotenoids: capsorubin, capsantin, beta-carotene and lutein (Haytowitz *et al.* 1984). The poignancy of the red pepper fruits is caused by an alkaloid – capsaicine. Several experiments have proved that fruit and vegetable from organic production contained more antioxidant compounds as flavonols, carotenoids and vitamin C (Hajslova *et al.* 2005, Hallmann and Rembialkowska 2007, Toor and Heeb 2006). Every method of vegetable processing has a negative impact on the bioactive substances content, but most studies concern the conventionally processed products. There are very few studies on the nutritive value of the organically vegetable preserves. Therefore it has been found useful to compare the bioactive compounds levels in organic vs. conventional red pepper pickles.

Materials and Methods

Two cultivars of sweet red pepper (Ożarowska and Roberta) from organic and conventional cultivation have been used in this experiment. The red pepper fruits were cultivated in two certified organic farms and two conventional neighboring farms. The fertilization and plant

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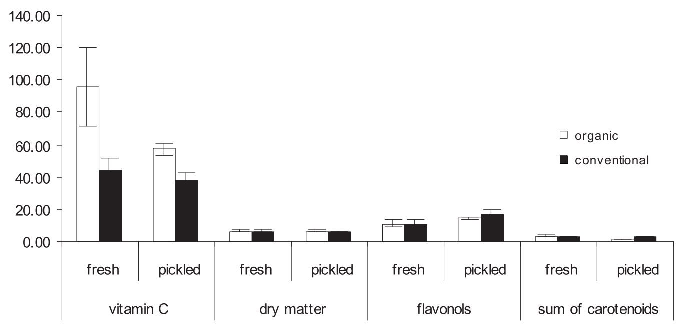
[2] as above

protection in the experimental farms have been organized according to the organic and conventional farming rules. The fully ripe red pepper fruits were collected in this same stage of maturity in organic and conventional farms and freeze-dried (to keep their nutritive quality). The chemical analyses of dry matter (PN-A-75101-03: 1990), vitamin C (PN-A-75101-11: 1990), flavonols (Strzelecka *et al.* 1978) and carotenoids (Saniawski i Czapski 1983) have been carried out in fresh peppers. Next the pickled red pepper has been prepared of the fresh produce, and after four months the QDA sensory evaluation and chemical analyses of the preserves have been completed. The results of those qualitative characteristics of fruit were statistically calculated with ANOVA test at $\alpha = 0.05$.

Results

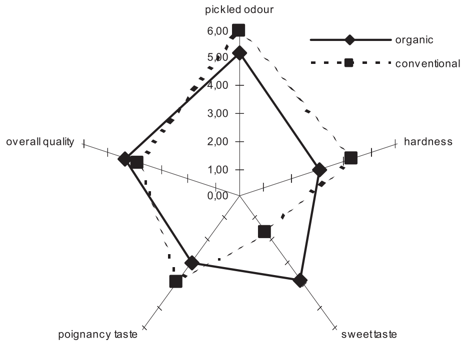
The results obtained are presented on fig.1.

Fresh red pepper fruits from organic production contained significantly more vitamin C and sum of the carotenoids than conventional one (fig.1). Other differences between fresh peppers from organic vs. conventional production were not significant. The processing of red pepper fruits has changed their chemical properties. The level of vitamin C and carotenoids has decreased after the processing, while the level of the flavonols has increase; dry matter content stayed at the similar level. The content of vitamin C was still significantly higher in the organically produced pickled peppers, while the level of the carotenoids sum was higher in the conventional pickles (opposite to the fresh peppers). The content of dry matter and flavonols hasn't differed significantly between the pickled products from two production systems. Differences between the cultivars were in the pickled peppers similar to those observed in the fresh produce. The



p-value	vit. C.		dry matter		flavonols		sum of carotenoids	
cultivation	fresh	pickled	fresh	pickled	fresh	pickled	fresh	pickled
	<0.0001	<0.0001	n.s.	n.s.	n.s.	n.s.	n.s.	<0.0001

Fig.1. Chemical parameters of fresh and pickled red pepper from organic and conventional production



p-value (pickled odour) (hardness) (sweet taste) (pungent taste) (overall quality)
cultivation 0.05 0.001 0.000 0.05 0.023

Fig.1. Chemical parameters of fresh and pickled red pepper from organic and conventional production

sensory analysis has indicated that conventional pickled red pepper had higher notes for pickled odour, hardness and poignant taste. The organic red pepper was characterized by higher notes for sweet taste and overall quality (fig 2).

Discussion

In the literature there is only few research studies comparing the nutritional value of organic vs. conventional bell pepper, but there is no information about chemical properties of pickled red pepper fruits. The organic fresh red pepper contained significantly more total polyphenols than conventional fruits (del Amor *et al.* 2008). In a presented experiment only flavonols as a part of these phytochemicals have been determined: fresh organic red pepper contained significantly more flavonols in comparison to the conventional one (fig.1), while in the pickled peppers no significant difference has been found. The same results concerning the flavonols have been found by Chassy *et al.* (2006): organic fresh red pepper contained 4.58 mg 100 g^{-1}. f. w. and conventional only 3.70 mg 100 g^{-1}. f.w. Similar results were received by Perez-Lopez *et al.* (2007), who showed that full ripe organic bell pepper contained more (105 mg 100 g.f.w.) total polyphenols than conventional (only 82.13 mg 100 g^{-1}. f. w.). In a presented paper clearly higher content of vitamin C has been found in red peppers from organic cultivation than from conventional one. These results are similar to the own results obtained in another experiment (Hallmann and Rembialkowska 2007) with sweet red pepper and by Chassy *et al.* (2006), who found 20.35 mg 100 g^{-1}. f.w. vitamin C in organic and only 16.85 mg 100 g^{-1}. f.w. in conventional fresh bell pepper. The taste of pickled red pepper fruits is depending on flavonols, total sugars, dry matter and organic acids content. The higher note for poignant taste was strongly correlated with the higher flavonols' content. For the conventional pickled fruits a correlation coefficient was + 0.73 and for the organic only +0.10. Auerrswald *et al.* (1999) also has indicated strong correlation between the sensory attributes and chemical composition of tomato fruits.

Conclusions

Organic fresh red pepper contained significantly more vitamin C and sum of carotenoids in comparison to the conventional one.

The pickling process of pepper fruits has changed the chemical properties of fruits: organic pickled red pepper contained still more vitamin C but less carotenoids than conventional product.

The sweetness and overall sensory quality have been clearly higher for the organic pickled peppers than for the conventional ones.

Additionally the strong correlation between poignant taste and flavonols' content has been observed, especially in the conventional pickled fruits.

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COMPARISON OF THE NUTRITIONAL VALUE OF RED BEET ROOTS FROM ORGANIC AND CONVENTIONAL PRODUCTION

SIKORA, M[1]., HALLMANN, E[2]., REMBIAŁKOWSKA, E.[3]

Keywords: red beet, organic cultivation, conventional cultivation, vitamin C, phenolic acids.

Abstract

Organic food is perceived by the consumers as being high quality and providing the production's safety. There is scientific evidence that allows to assume that organic fruit and vegetables contain more bioactive compounds with antioxidant properties than plant crops from the conventional farming. Therefore it was found useful to conduct presented studies comparing the nutritive compounds content of red beet roots. Experiment was carried out with two red beet cultivars Czerwona Kula and Regulski Cylindryczny from organic and conventional production. The following nutritive compounds were analyzed in roots: vitamin C, phenolic acids, total sugars, reducing sugars and dry matter. The results showed that organic red beet roots contained more vitamin C and phenolic acids in comparison to conventional ones. The applied method of cultivation did not impact the content of dry matter and organic acids. The results indicate the potential beneficial health properties of organic red beets.

Introduction

The quality of food is for many years an object of interest of both scientists and consumers. It results from the growing knowledge about the influence of human nutrition on health. Vegetables from the organic production are characterized by higher contents of dry matter, phenolic compounds and vitamin C compared with the same plants from the conventional system (Bourn and Prescott 2002, Magkos et al. 2003), therefore they can contribute to the health promotion. Results of experiments are not unambiguous and knowledge about the nutritional value of red beets from the organic production is still insufficient. Therefore it was found useful to conduct presented studies.

Materials and Methods

Experiment was carried out at the Chair of Organic Foodstuffs, WULS in 2007. Two cultivars of red beets – Czerwona Kula and Regulski Cylindryczny have been selected to study from four certified organic and four conventional farms, situated in the vicinity of Radom. The following nutritive compounds were analyzed in roots: dry matter by scale method PN-A-75101-03: 1990], vitamin C by Tillmans method [PN-A-75101-11: 1990], phenolic acids by colorimetric

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method (Strzelecka et al. 1978), total and reducing sugars and organic acids as tritable acidity [PN-A-75101-04: 1990]. The results of the above quality features have been statistically calculated with ANOVA test at $\alpha = 0.05$.

Results

The results showed that cultivation method didn't have influence on the content of dry matter in red beet root. In both production systems cv. Czerwona Kula contained significantly more dry matter in comparison to cv. Regulski Cylindryczny (tab. 1).

The level of vitamin C was significantly higher in organically produced beet roots than in conventionally produced ones, but only in cv. Czerwona Kula – in cv. Regulski Cylindryczny the level of vitamin C was very similar in both organic and conventional roots (tab.1).

Red beets from the organic farming also contained significantly more phenolic acids compared with conventional ones (tab.1). In both systems cv. Czerwona Kula contained more phenolic acids compared to cv. Regulski Cylindryczny. Differences in the content of organic acids, total sugars and reducing sugars among studied cultivation systems were not found. There were also no differences between the examined cultivars.

Tab. 1: The content of dry matter, vitamin C and phenolic acid in red beet roots from organic and conventional production.

		dry matter	vitamin C	phenolic acids
cultivation	cultivar	(g / 100 g f.m.)	(mg / 100 g f.m.)	(mg / 100 g f.m.)
organic	Czerwona Kula	15.57	18.85	996.14
	Regulski Cylindryczny	14.26	14.26	794.37
	mean	14.91	16.55	895.25
conventional	Czerwona Kula	15.34	10.76	866.21
	Regulski Cylindryczny	14.22	14.37	739.91
	mean	14.78	12.56	803.06
p-value				
for cultivation		n.s.	0.0001	0.0026
for variety		0.0310	n.s.	0.0001
for interaction		n.s.	0.0000	n.s.

Discussion

In human diet fruit and vegetables are the main source of vitamin C. Presented studies showed the significantly higher content of the vitamin C in roots of red beets from the organic production in the comparison with conventional ones, what confirms the results of Rembiałkowska *et al.* (2005). They found higher content of vitamin C in the organic cultivation of tomatoes. Also Caris-Veyrat *et al.* (2004) found difference in the content of vitamin C in organic tomatoes. However Fjelker-Modig *et al.* (2000) in their research did not find statistically significant differences in the vitamin C content in analysed organic and conventional vegetables.

Phenolic compounds are well-known for their strong antioxidant properties and therefore are called free radical scavengers. In presented analysis red beets from the organic production were characterized by significantly higher content of phenolic acids. Similar results were obtained by Asami *et al.* (2003) and Rembiałkowska *et al.* (2005).

According to the presented results there were no differences in the content of dry matter in red beets from both cultivation systems. Pither and Hall (1990) in their analysis showed the higher content of dry matter in the organic carrot in comparison with conventional one. Caris-Veyrat *et al.* (2004) showed significantly higher content of dry matter in analysed tomatoes from organic cultivation in comparison to conventional.

Conclusions

Organic red beets contained more vitamin C and phenolic acids compared to the conventional ones.

Cv. Czerwona Kula was characterized by higher content of vitamin C and phenolic acids in comparison to Regulski Cylindryczny in both cultivation systems.

Organically produced red beet roots can be recommended in the health promotion as a good source of bioactive compounds.

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Pracujeme pro ekologické zemědělství v Evropě

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Vážení delegáti

Bioakademie 2008,

Jménem IFOAM EU Group mám to potě šení uvítat Vás na již 8. Bioakademii.

IFOAM EU Group je opět poctěna rolí patrona Bioakademie v tomto roce, který byl na události v biosektoru opravdu bohatý.

Věrna své zažité podobě, se Bioakademie zaměřuje na klíčová témata, s nimiž jsme konfrontováni a jež jsou pro nás výzvou.

> Nová směrnice EU vypracovaná v uplynulých třech letech a nyní schválená, bude znamenat četné podstatné změny jak p výrobce a zpracovatele, tak i pro inspekci a certifikaci. Tato směrnice tvoří nové základy pro ekologické zemědělství a biopotraviny v EU.
>
> Kvalita se stává stále důležitějším faktorem výrobního procesu i finálního produktu. Hned několik nedávných studií dospělo k závěru, že biopotraviny stojí na žebříčku kvality výše. Je to však kontroverzní předmět – jak tedy vypadá nejnovější vývoj v této oblasti?
>
> Naléhavost měnícího se klimatu nás nutí zvažovat rozvoj místních trhů a také podporovat robustnost našich výrobních systémů. Co dalšího bychom se mohli naučit ze zkušeností jiných?

Bioakademie 2008 je skvělou příležitostí pro sdílení informací, získávání inspirace a stimulace při živých debatách.

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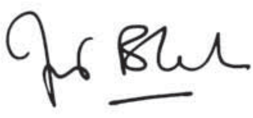

Francis Blake

Prezident IFOAM EU Group

Vážení přátelé, kolegové,

scházíme se na již 8. ročníku Bioakademie, která si od roku 2000 získala příznivce z řad zemědělců, výzkumných i pedagogických institucí, orgánů státní správy a z mnoha dalších odborných organizací. V uplynulých ročnících jsme se zaměřili na řadu aktuálních témat v ekologickém zemědělství souvisejících s rozvojem a podporou tohoto zemědělského systému v EU, nechemickou ochranou rostlin, pěstováním zeleniny, travními porosty v EZ, zdravím zvířat, kvalitou potravin a s dalšími aktuálními tématy.

Bioakademie se postupem let stala místem setkání nejen pracovníků prvovýroby, ale i výzkumníků. To vedlo ke změně charakteru konference v letošním roce a zavedení vědecké části, která se bude zabývat aktuálními otázkami výzkumu.

Pro celou Bioakademii 2008 jsme zvolili široké téma Nové trendy ve vědě a výzkumu ekologického zemědělství. Na praktické konferenci bude v rámci tohoto tématu kladen důraz na přenos aktuálních informací přímo do praxe, na vědecké konferenci si vědečtí pracovníci různých specializací vymění aktuální poznatky výzkumu tohoto zemědělského systému s přesahem do krajinné sféry a jednotlivých složek životního prostředí.

Nechceme ale, aby se na Bioakademii vytvořily dva „tábory", vědecký a praktický. Věříme ve vzájemnou komunikaci, inspiraci, vyslyšení potřeb a názorů jednotlivých skupin. Vždyť nové vědecké poznatky by měly ovlivnit současné ekologické zemědělství a výzkumní pracovníci na druhé straně by měli naslouchat potřebám a problémům praxe. Při této diskuzi můžeme odhalit problémy, které limitují rozvoj ekologického zemědělství a jež bude nutné do budoucna řešit.

Sborník, který držíte v rukou, má více částí. Můžeme ho rozdělit podle jazyků. Na první místo jsme zařadili jazyk anglický, neboť Bioakademie je mezinárodní akcí. To je patrné již z jejího názvu – 8. evropská letní akademie ekologického zemědělství. V rámci jednotlivých jazykových mutací jsou příspěvky řazeny podle programu. Jedná se o plenární zasedání, konferenci A pro praxi (z těchto dvou částí jsou uveřejněny abstrakty) a konferenci B (oponované příspěvky ve struktuře vědeckého článku jsou pouze v anglické části sborníku).

Ještě než se začtete do tohoto materiálu a budete naslouchat jednotlivým přednáškám, chtěl bych poděkovat všem organizacím, které se podílely na přípravách Bioakademie a jejichž loga jsou uvedena na obálce sborníku, dále pak všem členům organizačního týmu i vědeckého výboru konference. Dík patří všem oponentům z různých zemí, jejichž jména zůstávají v anonymitě s ohledem na to, že oponentury vědeckých článků jsou anonymní. Jejich náročné práce si velmi vážíme a přejeme si, aby stejně jako tým organizátorů zůstali i oni nadále našimi spolupracovníky.

Věřím, že se nový model praktické a vědecké konference osvědčí a bude přitahovat stále větší okruh zájemců z řad odborné veřejnosti. Omluvte prosím případné „dětské nemoci" nové struktury, jejíž příprava vyžadovala od organizátorů skutečně velké nasazení. Doufám, že v příjemné atmosféře prožijeme v Lednici tři pěkné dny naplněné nejen odborným programem, ale i řadou doprovodných akcí.

Těším se již nyní na setkání s vámi v roce 2009.

Prof. Bořivoj Šarapatka
předseda vědeckého výboru konference

HLAVNÍ SOUČASNÁ TÉMATA ROZVOJE EKOLOGICKÉHO ZEMĚDĚLSTVÍ V EU V LETECH 2008–2009 Z POHLEDU IFOAM

BLAKE, F.[1]

Klíčová slova: směrnice, výzkum, změny klimatu, CAP (společná zemědělská politika)

Abstrakt

Klíčovým tématem v posledních době je pro IFOAM EU Group revize „biosměrnice" (2092/91). Tři roky analyzujeme, publikujeme, konzultujeme, reagujeme a všeobecně řečeno tlačíme na úřady, aby doplňovaly, pozměňovaly a vylepšovaly novou rámcovou směrnici č.834/2007 (1. fáze) a následně aplikujeme pravidla hry (2. fáze).

V současnosti jsme už ve fázi č.3, která se týká nových oblastí vodního hospodářství, využití mořských řas, a také pěstování a zpracování vína. Rovněž jsme začali zvažovat 4. fázi – dotahovat nedokončené a nedořešené záležitosti včetně norem pro chov drůbeže, revize vstupů s ohledem na nová kritéria, revize zpracovatelských směrnic s ohledem na nové zásady apod.

IFOAM EU Group má v úmyslu vydat začátkem příštího roku publikaci, která bude novou směrnici objasňovat tak, aby jí dokázali porozumět obyčejní investoři. Zatím ještě čekáme na několik posledních odpovědí ohledně partnerství v tomto projektu.

Ze širšího úhlu pohledu koordinujeme platformu výzkumu technologií v ekologickém zemědělství. To je důležité zejména proto, abychom dokázali správně nasměrovat výzkum v EZ v rámci EU a byli schopni ovlivnit program takového výzkumu.

Z ještě širšího hlediska stojíme tváří v tvář globálním problémům se změnami klimatu a hrozivému nárůstu cen ropy i potravin. Ekologické zemědělství může značně přispět k řešení těchto otázek, a proto musíme tím více lobovat za reformu Společné Zemědělské Politiky CAP – abychom zajistili, že bude skutečně podporovat rozvoj vskutku trvale udržitelného zemědělství.

A musíme se také podívat sami na sebe. Jak bychom měli sami sebe změnit, aby způsob života, zvaný „bio" nebo „eko" dokázal optimálně fungovat i ve velmi se měnícím světě? Namísto toho, abychom více či méně kopírovali konvenční systémy, musíme opravdu začít uvádět do praxe biozásad. A protože se paradigma mění v náš prospěch, bude dobré měnit se současně s ním – když to tak uděláme, čeká nás krásná budoucnost.

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VIZE AGENDY VÝZKUMU V OBLASTI BIOPOTRAVIN A EKOLOGICKÉHO ZEMĚDĚLSTVÍ DO ROKU 2025: EKOZNALOSTI PRO BUDOUCNOST

NIGGLI, U.[1], SLABE, A.[2], SCHMID, O.[1], HALBERG, N.[3], SCHLÜTER, M.[4]

Klíčová slova: agenda výzkumu, strategie, perspektivy

Abstrakt

Ekologické zemědělství je produktivní formou zemědělství s nízkými vstupy, které klade zvláštní důraz na trvalou udržitelnost a nabízí novátorské koncepty řešení globálních problémů jako je degradace funkcí ekosystémů (např. úrodnost půdy, biodiverzita, čistota vod), ekonomický propad venkovských oblastí spojený s vylidňováním, zjištění dostatečného množství potravy ve scénářích klimatických změn a také rychle rostoucí požadavky na vysokou kvalitu potravin v rozvinutých a nově se ekonomicky rozvíjejících oblastech světa. IFOAM-EU Group a ISOFAR vytvořily a v srpnu 2008 zveřejnily vizi strategických priorit pro budoucí výzkum. Tuto vizi podpořili četní evropští investoři a občanské organizace.

Strategické priority výzkumu v ekologickém sektoru zahrnují i) životaschopné koncepty pro posílení ekonomiky venkova v regionálním i globálním kontextu, ii) zajištění potravin a ekosystémů pomocí prostředků ekologicky podmíněné intenzifikace a iii) vysokou kvalitu potravin jako základ zdravé stravy a klíč ke zlepšení kvality života a zdraví.

Na základě těchto strategických priorit je v dokumentu vize nastíněna intenzifikace výzkumných činností na regionální, národní i evropské úrovni. Všeobecným cílem výzkumu je podpora ‚předního trhu' evropského potravinářského průmyslu a zlepšení společenského prospěchu a dobra, jaké veřejnosti poskytuje zemědělství. Biopotraviny a ekozemědělské systémy nabízejí jedinečné příležitosti pro soutěživou a trvale udržitelnou budoucnost, kterou mohou výzkumné aktivity dále rozvíjet.

Dokument vize je prvním krokem k nepřetržitému procesu nastavování agendy výzkumu, poháněnému investory i společností. Z tohoto důvodu se v rámci technologické platformy „Organic" uskuteční významné diskuze a zprostředkují se další kroky.

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MEZINÁRODNÍ SPOLEČNOST PRO VÝZKUM EKOLOGICKÉHO ZEMĚDĚLSTVÍ (ISOFAR)

NEUHOFF, D.[1], KÖPKE, U.[1]

Klíčová slova: ekologické zemědělství, výzkum

Abstrakt

Mezinárodní společnost pro výzkum ekologického zemědělství ISOFAR (The International Society of Organic Agriculture Research) založená v r. 2003 v Berlíně usiluje o propagaci, podněcování a podporu výzkumu ve všech oblastech ekologického zemědělství (EZ), a to tím, že zprostředkovává globální spolupráci ve výzkumu, rozvoji metodologie, vzdělávání a při výměně poznatků a rovněž podporuje jednotlivé vědecké pracovníky prostřednictvím členských služeb a zapojuje investory do procesu výzkumu EZ.

EZ se v široké sféře zemědělství a výroby potravin vůbec obrací ke stěžejním tématům budoucnosti celé naší planety. V oblastech trvale udržitelného využití půdy, regionálního rozvoje venkova, environmentálních dopadů, bezpečnosti a kvality potravin, zdraví a také etických a sociálních aspektů zemědělství, ve všech těchto oblastech si výzkum zasluhuje nejvyšší možnou prioritu. Současné i budoucí celosvětové úkoly vyžadují spojený interdisciplinární a proaktivní přístup. V tomto duchu ISOFAR podporuje rozvoj trvale udržitelných ekologických zemědělských systémů po celém světě, a to:

- *podporou jednotlivců v oblasti výzkumu jak těch, kteří se pohybují na poli ekologických systémů obecně, tak i specializovaných odborníků, a to pomocí členských služeb včetně různých akcí a publikace materiálů,*
- *zprostředkováním globální spolupráce ve výzkumu, vzdělávání a při výměně informací,*
- *podporou a povzbuzováním vývoje koncepcí, metodologie a teorie a respektováním étosu v EZ systémech / interdisciplinárním kontextu,*
- *snahou řešit problémy přímo na místě formou péče a budování vztahů na regionální úrovni mezi výzkumnými pracovníky a farmáři,*
- *zlepšováním vědecké preciznosti a kvality výzkumu ekologického zemědělství např. pomocí zapojování odborníků z mezinárodních center výzkumu zemědělství a současně péčí o samou podstatu myšlenky ekologie.*

Více na našich webových stránkách: www.isofar.org

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BIO-QUO VADIS

GEIER, B.[1]

Klíčová slova: ekologické zemědělství, bioprodukce, globalizace, trh, spolupráce a vize

Abstrakt

Když vztáhneme otázku „Quo vadis" (Kam kráčíš) na ekologické zemědělství, vyplyne z ní rázem související otázka: „Odkud to zboží pochází?"

Rychlý růst a celosvětový trh s bioprodukty je skutečnost. Je pravda / Nemůžeme popřít, že tato realita nabízí příležitosti – nejen pro komerční podnikání, ale také pro drobné zemědělce v rozvíjejících se zemích, kteří tak mohou prodávat svoje produkty za patřičnou cenu.

Tento celosvětový pohyb zboží však představuje zkoušku holistických zásad v ekozemědělství.

Prezentace se bude zabývat otázkou, jak by bylo možno zorganizovat ekonomickou expanzi a globalizaci ekologického sektoru zemědělství, aniž bychom museli slevovat z hodnot, díky nimž se ekologické zemědělství označuje za alternativní ekonomický přístup.

Prezentace se zaměří na současný a nedávný rozvoj – především – mezinárodního trhu.

Prezentace rovněž ukáže některé příklady inovativní spolupráce a tvorby synergie.

V neposlední řadě nám poskytne pohled na úkoly a především příležitosti, které se prostírají před celým bio-ekologickým hnutím a jeho ekonomickým sektorem.

Pozadím „vizionářské" části prezentace se pak stane pochopení, že populární slogan „mysli globálně – jednej lokálně" prostě nestačí. Nemůžeme v podstatě ponechat globální aktivity na WTO a na multinárodních společnostech. A naopak – jak úspěšné mohou být naše počiny na lokální úrovni, pokud o nich nepřemýšlíme? To nevyhnutelně znamená, že musíme myslet a také jednat lokálně, regionálně i globálně

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PRODUKCE POTRAVIN A AGROENERGIE V EKOLOGICKÉM ZEMĚDĚLSTVÍ – NEŽÁDOUCÍ NEBO TRVALE UDRŽITELNÉ MOŽNOSTI?

SCHÄFER, W.[1]

Klíčová slova: energetické plodiny, obnovitelná energie, účinnost

Abstrakt

Pěstování plodin je proces, při němž dochází k transformaci sluneční energie na biomasu. V důsledku toho pěstební plocha a intenzita jejího oslunění společně určují agroenergetický výkon naší planety. Pěstební opatření takový fotosyntetický transformační proces podporují. I když ekologická pěstební opatření vyžadují méně energie než běžné zemědělství, celková účinnost zůstává nižší než 1 %. Přesto však agroenergetická produkce zaujme mnoha momenty, v nichž výsledkem je dvojí výhra: fosilní, životní prostředí znečišťující paliva jsou nahrazována palivy environmentálně neutrálními, farmáři dostanou za energetické plodiny lépe zaplaceno a obrat energetiky narůstá díky vzrůstající spotřebě energie potřebné ke zpracování biomasy na palivo. V důsledku toho se také zvyšují příjmy státu z daní. Lepší ceny za energetické plodiny mohou nicméně odstartovat export environmentálního znečištění, neboť vyšší transformační účinnost v tropických oblastech zvýhodňuje intenzifikaci produkce energetických plodin před produkcí potravin. Celková účinnost paliv získaných z energetických plodin však nemůže nikdy konkurovat solárním technologiím. Např. solární kolektory nahrazují fosilní palivo ve sféře výroby tepla s daleko vyšší účinností. I tak ovšem vysoká účinnost technických procesů přeměny biomasy na palivo ospravedlňuje výrobu paliva z organického odpadu a zbytků. Ekologické zemědělství by se tudíž nemělo zaměřovat na pěstování energetických plodin, ale produkovat vysoce kvalitní potraviny, a činit to šetrně vzhledem k životnímu prostředí. Za měřítko udržitelnosti výroby paliv z biomasy se navrhuje energetický přebytek z energetické transformace slunečního svitu na palivo na osobu a metr čtvereční.

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JAK EKOLOGICKÉ JSOU RŮZNÉ AGROENERGETICKÉ KONCEPCE? SMÍŠENÉ PLODINY A VYUŽITÍ ENERGIE

PAULSEN, H. M.[1]

Klíčová slova: smíšené plodiny, olejniny, agrolesnictví, vydatnost zdrojů

Abstrakt

Zvyšování výnosů, omezení energetických vstupů a využití obnovitelných zdrojů energie by mohly pomoci zvýšit nízké hodnoty klimatické efektivnosti v ekologické produkci. Efektivitu rostlinné produkce je možno zvýšit pomocí recyklace živin z bioenergetických procesů na farmách jako je zbytkový materiál z výroby bioplynu, využití popela a pokrutin, stejně jako fixace dusíku pomocí vyšší integrace luskovinových meziplodin nebo podsévaných luskovin pro výrobu bioplynu. Také pořadí různých plodin pro výrobu biomasy a šlechtitelské pokroky by mohly zvýšit efektivitu zdrojů. Relativně vyšší výnosy a efektivnější využití zdrojů nabízejí systémy smíšených plodin. Pro omezení energetických vstupů je zapotřebí pěstebních postupů, které garantují efektivní potlačení plevelů a technicky dokonalé zpracování půdy a řádkovací technologii. Avšak s koncepcí minimálního zpracování půdy je málo zkušeností a mohlo by vyvolat riziko nižšího výnosu. Pěstování agroenergetických plodin na ekofarmách by se mohlo stát klíčem pro omezení emisí skleníkových plynů vznikajících při výrobních procesech souvisejících se zvyšováním výnosů a také pro uchování fosilních energií. Energetické plodiny a jejich pěstování jsou nicméně doprovázeny produktovou diverzifikací. Díky svým vyšším relativním výnosům má koncepce smíšených plodin možnost kombinovat produkci energie a potravin. Je však nutné nalézt rovnováhu jak v ekonomice, tak i v touze po nezávadnosti potravin. Zajímavé možnosti jak splnit tyto požadavky, se nabízejí v agrolesnických systémech a v pěstování smíšených plodin včetně olejnin.

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NÁSTROJE POLITIKY PRO EKOLOGICKÉ ZEMĚDĚLSTVÍ V ZEMÍCH STŘEDNÍ A VÝCHODNÍ EVROPY: MOŽNOSTI A BARIÉRY

HRABALOVÁ, A.[1], WOLLMUTHOVÁ, P.[2]

Klíčová slova: ekologické zemědělství, politické nástroje, platby na plochu, země Střední a Východní Evropy

Abstrakt

Ekologické zemědělství (EZ) zaznamenalo rapidní nárůst v zemích Střední a Východní Evropy (SVE) díky politické podpoře ve formě plateb na plochu, která byla zavedena ve všech zemích SVE již před vstupem do EU. Významná úprava plateb pro EZ se uskutečnila v zemích SVE v roce 2004, v důsledku vstupu do EU, kdy průměrná platba vzrostla na €133/ha z původních €52/ha v roce 2003. Další výrazné zvýšení plateb, zejména pro speciální plodiny, bylo provedeno pro období 2007-13 v SK, LV a CZ. V současnosti je nejvyšší platba na ornou půdu a travní porosty poskytována v SI (€298/ha, €228/ha) a na trvalé kultury a zeleninu v CZ (€849/ha, €564/ha).

Výsledky výzkumu ukázaly, že platby na plochu byly nejdůležitější a v mnoha případech i jedinou podporou EZ v zemích SVE do roku 2004 a dále, že země SVE zaostávají v implementaci politických nástrojů zaměřujících se na stranu poptávky. Současná politika pro EZ upřednostňuje nástroje soustřeďující se na podporu nabídky a není schopna dostatečně řešit hlavní problematické oblasti jako je málo rozvinuté zpracování a marketing bioproduktů, nedostatečný objem a nevhodná struktura bioprodukce či nedostatek profesionálně zajištěných školení či poradenství na takto málo rozvinutých trzích s ekologickými produkty jako jsou nyní v zemích SVE.

Avšak politika EZ se v posledních letech vyvíjí v zemích SVE směrem k více integrované formě podpory a všechny země SVE využily možnost podpořit EZ přes množství dalších opatření v rámci nových plánů rozvoje venkova jako např.: odborné školení, využití poradenství, přidaná hodnota zemědělským produktům nebo podpora nákladů účasti v systémech jakosti z osy 1 anebo diverzifikace zemědělských aktivit či posílení agroturistiky z osy 3. Navíc většina zemí SVE rozpoznala potřebu integrovat tyto politiky do jednoho plánu a implementovaly národní akční plány pro EZ. Je však patrné, že ve všech zemích SVE existuje stále velký prostor pro implementaci dalších politických nástrojů posilujících rozvoj EZ.

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NAŘÍZENÍ RADY EU (ES) 834/2007 A PROVÁDĚCÍ PRAVIDLA PRO EKOLOGICKOU PRODUKCI, ZNAČENÍ A KONTROLU – CO SE ZMĚNÍ?

FLADL, M.[1]

Klíčová slova: ekologická produkce, legislativa EU

Abstrakt

Legislativa EU, týkající se ekologické výroby, značení a kontroly prošla významnou revizí. Nařízení Rady (EHS) č.2092/91 bylo nahrazeno Nařízením Rady (ES) č.834/2007 a vstoupí v platnost 1.1.2009.

Nařízení je doplněno prováděcími pravidly, která formulují technické detaily pro různé oblasti výroby. První balíček prováděcích pravidel byl schválen Stálým výborem pro ekologické zemědělství v červenci 2008. Jejich texty jsou převážně výsledkem přesunu Dodatků NR č.2092/91 beze změny obsahu; byly pouze restrukturovány, a pokud bylo možno, zjednodušeny. K nim bylo připojeno několik nových prvků a právních objasnění, zdůrazňujících zejména welfare, tedy pohodu hospodářských zvířat.

Na cestě je i zvláštní balíček prováděcích pravidel pro import zboží.

Vypracování prováděcích pravidel pro zcela nové oblasti, jakými jsou např. ekologická akvakultura, výroba kvasnic, zpracování mořských řas nebo výroba vína, zabere více času a proto vstoupí tato pravidla v platnost až v pozdějších termínech.

Právní revize je pilířem Evropského Ekologického Akčního Plánu (2004) a jako taková bude prezentována.

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VÝZNAM NOVÉHO NAŘÍZENÍ RADY 834/2007 PRO EKOLOGICKOU VÝROBU A JEJÍ KONTROLU

DIERKES, B.[1], NEUENDORFF, J.[1]

Klíčová slova: ekologická výroba, řízení, Nařízení EU, řízení, kontrola, certifikace

Abstrakt

1. 1. 2009 vstoupí v platnost nové Nařízení Rady EU č. 834/2007 o EZ, které bylo schváleno 2. 7. 2008.

Systém a procedury řízení ekologické výroby byly restrukturovány v rámci obou nových nařízení EU. Budou zavedeny v souladu s požadavky Nařízení ES č. 882/2004. Obě tato nová nařízení EU přinesou do kontroly a certifikace ekologických výrobců některé podstatné a zajímavé změny. Na úrovni farem již nebude k mnohým zásahům zapotřebí předchozí autorizace kompetentními orgány. Podniky, které zpracovávají biopotraviny a biokrmiva, budou muset zavádět koncept takzvaných „biokritických bodů ("organic critical points – OCP"). Tento koncept byl vyvinut v rámci německého výzkumného a rozvojového projektu v r. 2003. Pomocí OCP bude zajištěno, že kontroloři budou při svých inspekcích v procesu zpracování obracet pozornost nejdříve k rizikovým oblastem a zaměřovat se na kritická místa.

Budou rovněž prezentovány výsledky německého výzkumného a rozvojového projektu v rámci Federálního Programu EZ, který má za cíl navrhnout efektivní a výkonné metody a nástroje budoucího kontrolního systému ekologické výroby s ohledem na požadavky Nařízení ES č. 882/2004.

[1] GfRS Gesellschaft fuer Ressourcenschutz mbH / Resource Protection Ltd., Prinzenstr. 4, D- 37073 Goettingen, Germany, E-Mail brigitte.dierkes@gfrs.de, Internet http: //www.gfrs.de

ZAJIŠTĚNÍ KVALITY – JAK SE VYHNOUT REZIDUÍM NA FARMÁCH A V BIOPOTRAVINOVÉM ŘETĚZCI

HEEB, M.[1], WYSS, G.[2], NOWACK, K.[3], SCHMID, O.[4]

Klíčová slova: reziduální hodnoty, zajištění kvality, biopotravinový řetězec, biopotraviny

Abstrakt

Rezidua pesticidů jsou ve výrobě biopotravin citlivým tématem a v image tohoto sektoru hrají rozhodující roli. Právě proto jak kontrolní orgány, tak i výrobci sami potřebují profesionální nástroje a koncepty pro situace, kdy vyvstane podezření, že kvalita určité biopotraviny není v souladu s Nařízením Rady (EHS) č. 2092/91(dodatek III, čl. č. 9).

Kontrolní orgán je povinen posoudit, zda je nutné další zkoumání případu a musí využít své odbornosti a obšírných praktických zkušeností, aby se dokázal rychle dobrat objasnění zkoumaných faktů. Také výrobci a zpracovatelé by měli zavádět a) náležité odebírání a analýzu vzorků ve svém podniku b) postupy pro řešení případů výskytu reziduí ve svých výrobcích. Pro vývoj správných schémat odebírání a zkoumání vzorků je velmi důležité širší pochopení zdrojů kontaminace i kritické body kontroly v EZ a zpracování ekologické produkce, a závisí na něm také profesionální analýza a interpretace případů výskytu reziduí. Když k výskytu reziduí v ekologické produkci dojde, stává se pečlivá interpretace výsledků, jasná strukturální rozhodnutí a předem definované komunikační kanály klíčovými aspekty profesionálního zacházení s takovým případem a zachování image biovýrobků a důvěry v ně.

[1] Research Institute of Organic Agriculture FiBL, Ackerstrasse, 5070 Frick, Švýcarsko, e-mail: marlene.heeb@fibl.org, Internet: www.fibl.org

[2] viz. výše

[3] viz. výše

[4] viz. výše, e-mail: otto.schmid@fibl.org

ZAJIŠTĚNÍ KVALITY, ZJIŠŤOVÁNÍ PŮVODU BIOVÝROBKŮ A JEJICH SLEDOVÁNÍ Z FARMY AŽ NA PULT – MANAGEMENT ŘETĚZCE ZÁSOBOVÁNÍ POTRAVINAMI A PERSPEKTIVY TRHU SE ZEMĚDĚLSKÝMI PLODINAMI

VOLLERTSEN, D.[1]

Klíčová slova: bioprodukty, management řetězce zásobování, polní plodiny, požadavky trhu

Abstrakt

Zatímco v Severní Americe a Západní Evropě požadavky na ekologickou produkci rychle narůstají, v Asii, Jižní Americe a Východní Evropě je poptávka po nich stále slabá to vede k mohutnému toku výrobků v celosvětovém měřítku, k importu i exportu. Taková aktivita není bez rizika, protože zjišťování původu výrobků a sledování jejich cesty od výrobce až na pulty již často není možné.

Kromě ekonomických aspektů a vyhovění zákonem stanovených minimálních požadavků je důležité, aby se odhalovaly a pojmenovávaly nedostatky a rizika v celém řetězci zásobování. Transparentnost původu je stejně významná jako kvalita výroby a uchovávání surovin při transportu a skladování.

Nařízení Rady č. 178/2002 je zákonnou osnovou takových aktivit, avšak nedokáže dostatečně omezit riziko falešného označování biovýrobků a zajistit kontrolu věrohodnosti ekologické výroby.

Jednotliví účastníci zásobovacích řetězců, výrobci, zpracovatelé a obchodníci by měli sami používat lepší systémy smluv a obchodu – s podporou speciálních elektronických informačních systémů, aby v případě problémů byly údaje rychle a snadno dostupné a dohledatelné.

Díky plánovanému budoucímu omezování konvenčních krmiv se v Evropě bude zvyšovat význam pěstování bílkovinných a olejnatých plodin. Mezi nejdůležitější se bude řadit hrách, bob, fazole a sója. Jejich pěstování má na ekologických farmách určité limity a musí být dobře začleněno do optimálních osevních postupů. Vzrůstá rovněž poptávka po obilninách; zde je pro uspokojení poptávky podstatný správný výběr druhů obilovin.

[1] Bioland e.V , Geschäftsleitung Produkt und Markt, Auf dem Kreuz 58, D-86152 Augsburg, Německo, E-Mail dirk.vollertsen@bioland.de. Internet http: //www.bioland.de

PERSPEKTIVY V ODBYTU BIOPRODUKTŮ V ČR, VZNIK ODBYTOVÉ SPOLEČNOSTI PRODEJ – BIO s.r.o.

CHLAD, F.[1], LAČŇÁK, V.[1]

Klíčová slova: odbyt bioproduktů, obiloviny, luštěniny, PRODEJ – BIO s.r.o., směrnice svazu PRO-BIO

Abstrakt

Svazy ekologických zemědělců PRO-BIO a BIOLAND založily společnou odbytovou organizaci v ČR- PRODEJ-BIO, s.r.o.

V této souvislosti se zástupci obou svazů dohodli na následujících společných cílech:

1. *Zlepšení služeb pro členy svazu PRO-BIO (prodávající i kupující bioprodukty) – odbyt bioproduktů za výhodné ceny, pomoc se skladováním bioproduktů, pomoc s volbou plodin, na které bude v daném roce odbyt, nákup krmiv a surovin pro producenty biopotravin a chovatele, kteří jsou členy svazu PRO-BIO.*
2. *Zlepšení postavení svazu a značky BIOLAND v ČR- zlepšení možností nakoupit bioprodukty a biopotraviny z ČR*
3. *Přednostní postavení českých dodavatelů a odběratelů bioproduktů – členů svazu PRO-BIO: český dodavatel a odběratel, člen svazu PRO-BIO má přednost před zahraničními dodavateli a odběrateli a nečleny svazu PRO-BIO. Členové svazu PRO-BIO- odběratelé budou mít přednost i před odběrateli svazu BIOLAND, resp. obchodních organizací svazu BIOLAND.*
4. *Obchodní vztahy se řídí dle obchodních smluv s volitelnou délkou (preference dlouhodobých vztahů). K obchodu se musí vždy přiložit příslušný certifikát na bioprodukt nebo biopotravinu.*
5. *Cílem společnosti je také propagace svazové směrnice. Tato směrnice byla v lednu 2008 aktualizována podle nejnovější verze svazu Bioland e.V.*
6. *Kromě lukrativních komodit začlení nová společnost i další komodity (např. biohovězí a biojehněčí maso).*

[1] PRODEJ – BIO s.r.o., email: prodej-bio@lit.cz

TECHNOLOGIE PĚSTOVÁNÍ OZIMÉ ŘEPKY (*Brassica napus* L.) V PODMÍNKÁCH EKOLOGICKÉHO ZEMĚDĚLSTVÍ

ŠKEŘÍK, J.[1], NERAD, D.[1], KAZDA, J.[1], KUCHTOVÁ, P.[2]

Klíčová slova: ozimá řepka, ekologická produkce, agrotechnika, výsevky, plevele

Abstrakt

Již od roku 2002 probíhají přesné maloparcelní pokusy s ekologickým pěstováním ozimé řepky na certifikované pokusné stanici ČZU v Praze Uhříněvsi. Zpočátku bylo dosahováno pouze cca 10%-ní výnosové úrovně ve srovnání s konvenčně pěstovanou řepkou. V závislosti na výsledcích jednotlivých let jsme museli postupně upravovat výchozí metodiku. Prvořadě nutná likvidace plevelů mechanickým plečkováním byla umožněna širší meziřádkovou vzdáleností a vyššími výsevky. Testovány byly rovněž přípravky nechemické povahy proti škůdcům a chorobám. V posledních ročnících byly u ekologické řepky za optimálních podmínek dosaženy téměř srovnatelné výnosy s řepkou pěstovanou konvenčně. Pokusně je vyvíjena snaha ověřit zízkané zkušenosti v praxi v podmínkách poloprovozních pokusu. Návazně je na pokusných parcelách ekologické ozimé řepky rovněž zjišťován výskyt škůdců a jejich přirozených regulátorů (Hymenoptera – blanokřídlí). Účelem je zjistit jejich význam pro redukci škůdců a rozdílnost zastoupení v ekologicky a konvenčně pěstovaném porostu. Zejména v období kvetení byly zjištěny významné množství parazitoidů jednotlivých škůdců řepky. Výsledky prokazují vyšší diverzitu ve výskytu parazitoidů, škůdců I v úrovni napadení larev škůdců parazitoidy na ekologickém porostu řepky v prorovnání s konvenčním porostem. V příspěvku jsou rovněž diskutovány konsekvence pro integrovaný systém ochrany před škůdci v olejné řepce.

[1] Svaz pěstitelů a zpracovatelů olejnin, Jankovcova 18, Praha 7, 170 37, www.spzo.cz, e-mail: skerik@spzo.cz

[2] Česká zemědělská univerzita v Praze, www.czu.cz, email: kuchtova@af.czu.cz

ROZVOJ TRŽNÍHO POTENCIÁLU ZELENINY – PŘÍKLAD RAKOUSKÉ FARMY „ADAMAH“

ZOUBEK, G.[1]

Klíčová slova: biovýrobky, management zásobovacího řetězce, polní plodiny, požadavky trhu

Abstrakt

Naši práci charakterizuje slovo "Adamah", hebrejský výraz pro zemědělskou půdu, pro živou půdu, a také pro člověka, neboť naše práce spočívá v pěstování živých produktů na živé půdě, které poslouží jako živá strava pro lidi.

Začali jsme v roce 1997 na našich 70 ha zemědělské půdy s těmito cíli: 1. stát se díky variabilitě výrobků méně závislými; 2. organizovat přímý prodej, aby byla lépe viditelná přidaná hodnota; a 3. dokázat, že naše zemědělská farma může být také pracovištěm.

Již během přechodu na ekologické zemědělství byly vyšlechtěny četné zvláštní zeleninové rarity: 70 různých typů dýní, mnoho různých rajčat, i jinou zeleninu. Abychom byli schopni takovou zeleninu prodávat, zavedli jsme v r. 2002 systém zeleninových dodávek, protože se ukázalo, že není možné prodat všechny tyto výrobky na trzích ve Vídni, které se konají jednou za týden. Proto také každý týden ovoce a zeleninu rozvážíme. Zboží musí být sezónní, regionální a hodně pestré. Zákazníci tak někdy dostanou produkty, které běžně nekupují; recepty jim pak poskytují nápady na jejich využití.

Tento systém umožňuje lepší plánování výroby. V současnosti dostává krabice se zeleninou přes 4000 domácností ve Vídni a okolí. 50 % zboží je z naší vlastní farmy, druhá polovina pochází od biofarmářů, s nimiž funguje dobrá spolupráce. Obilniny prodáváme do biopekárny, která zásobuje farmu čerstvým chlebem a pečivem. Dvakrát ročně pořádáme na farmě slavnosti. V budoucnu bude stále narůstat důležitost komunikace. Další příležitosti vidíme v našem působení na třech trzích ve Vídni a v otevření vlastní prodejny přímo na farmě. V hlavní sezóně u nás pracuje asi 70 lidí a také sezónní brigádníci. Nejvyšší obrat jsme měli v r. 2007 – 5 milionů eur, a ten stále vzrůstá.

Věříme, že v budoucnosti budou muset ekozemědělci převzít zodpovědnost za marketing. To ale neznamená nutně přímý marketing. Klíčové otázky jsou následující: Kdo potřebuje to, co já vyrábím? A co chtějí spotřebitelé? Měli bychom se vyhýbat výrobkům, které jsou anonymní a ztrácejí svou speciální přidanou hodnotu. Naším přístupem / heslem je „Biovýrobky s vlastní biografií.“ To posouvá rodinu, lidi i region do centra. Naše zkušenosti potvrzují, že mnoho spotřebitelů hledá pravdivé informace a transparentní ceny, ale také se ptají na přispění k životnímu prostředí. Plánujeme posilování komunikace i šlechtění místně přizpůsobených chutných odrůd, u nichž nikoli výnos, ale právě chuť je tím hlavním kritériem (pokus s mrkví). Když dokážeme přesvědčit spotřebitele o přidané hodnotě, bude mít ekologické zemědělství před sebou skvělou a jistou budoucnost.

[1] G. ZOUBEK VERTRIEBS-KE G, A-2282 Glinzendorf 7, Rakousko, Email. biohof@adamah. Internet: www.adamah.at

FAKTORY OVLIVŇUJÍCÍ ÚSPĚŠNOST ROZVOJE TRHU S BIOZELENINOU

LICHTENHAHN, M.[1]

Klíčová slova: biovýrobky, zelenina, rozvoj trhu

Abstrakt

Ovoce a zelenina jsou hnacím motorem rozvoje trhu s bioprodukty na lokální úrovni. Bioovoce a biozelenina se prodávají čerstvé a mají velmi omezenou trvanlivost, a tudíž je kontinuita trhu s nimi náročným úkolem. Především ve stadiu, kdy se místní trh s biopotravinami teprve začíná rozvíjet, bývá nabídka z biofarem dosti omezená a biovýrobky zpravidla nejsou pro zákazníka dostatečně atraktivní. To jsou, společně s čerstvostí a kvalitou zboží, ty nejpodstatnější faktory, jež je třeba zvažovat při rozbíhání místního trhu s bio-výrobky od samého začátku.

Když si farmáři a obchodníci uvědomí, že jsou si navzájem partnery na cestě ke společnému cíli, a začne mezi nimi dobře fungovat výměna patřičných informací např. o poptávce na trhu nebo o omezených možnostech produkce vzhledem k místním klimatickým podmínkám, učiní tím velký krok směrem k rozvoji stabilního trhu.

V důsledku takového vzájemného pochopení pak společné plánování produkce přinese oběma stranám mnohem větší jistotu.

Ze strany farmáře musí být k dispozici nezbytné know-how a také i v biopěstitelství nutné vstupy jako je například ekologická ochrana rostlin. Rozvoj trhu navíc paralelně vyžaduje silnou technickou podporu farmářů v podobě nezbytných odborných znalostí výrobních technologií.

Ze strany obchodníka musí výrobky na trhu provázet komunikace. Jednoduché a jasné informace, jimž všichni rozumějí, vytvářejí potřebný zájem o biovýrobky.[1]

[1] Research Institute of Organic Agriculture FiBL, Frick, Švýcarsko

INOVATIVNÍ TECHNOLOGIE OCHRANY ROSTLIN V EKOLOGICKÉM ZELINÁŘSTVÍ, VINOHRADNICTVÍ A OVOCNÁŘSTVÍ

HLUCHÝ, M.[1]

Klíčová slova: ochrana rostlin, inovace ochrany rostlin, ekologické zelinářství, ekologické ovocnářství, ekologické vinohradnictví

Abstrakt

Úspěšná ekologická produkce speciálních kultur (zelenina, víno, ovoce) je podmíněna možností aplikace vysoce sofistikovaného systému ochrany rostlin spojeného s profesionálním poradenstvím. V příspěvku je srovnán systém ochrany révy vinné, jabloní a některých druhů zeleniny ve Švýcarsku, České republice, Maďarsku a na Slovensku. Na příkladu révy vinné jsou vysvětleny vnitřní vazby systému a jeho fungování.

[1] Biocont Laboratory s.r.o., Brno, Czech Republic, E-Mail hluchy@biocont.cz, Internet www.biocont.cz

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