BIOACADEMY 2009 – PROCEEDINGS
2nd Scientific Conference

BIOAKADEMIE 2009 – SBORNÍK
2. vědecká konference

Organic Farming - A Response to Economic and Environmental Challenges

Ekologické zemědělství - odpověď na hospodářské a environmentální výzvy

Bořivoj Šarapatka (ed.)

IFOAM EU GROUP




BIOACADEMY 2009 – PROCEEDINGS

BIOAKADEMIE 2009 – SBORNÍK

Organic Farming – A Response to Economic and Environmental Challenges

Ekologické zemědělství – odpověď na hospodářské a environmentální výzvy

24. – 26. 6. 2009

Lednice na Moravě, Czech Republic

Lednice na Moravě, Česká republika

Bořivoj Šarapatka (ed.)

Bioacademy 2009 – Proceedings

Bioakademie 2009 – sborník

Organic Farming – A Response to Economic and Environmental Challenges
Ekologické zemědělství – odpověď na hospodářské a environmentální výzvy

Bořivoj Šarapatka (ed.)

Scientific Committee / vědecký výbor

Chairman / předseda
Bořivoj Šarapatka (Czech Republic)

Members / členové
Radoslav Bujnovský (Slovakia)
Bernhard Kromp (Austria)
Daniel Neuhoff (Germany)
Jaroslav Pražan (Czech Republic)
Otto Schmid (Switzerland)
Jiří Urban (Czech Republic)
Atle Wibe (Norway)

Translation / Překlad Ina Leckie, Jim Leckie
Technical editor / Technická redakce Milan Matoušek, Lucie Košťálová
Published by / Vydal Bioinstitut, Křížkovského 8, 771 47 Olomouc, www.bioinstitut.cz
Printed by / Vytiskl Reprotisk s. r. o., Šumperk

Text in its original form without correction / Text neprošel jazykovou úpravou

1st Edition / 1. vydání

Olomouc, 2009

ISBN 978 -80-904174-8-9

Dear colleagues and friends of organic farming,

We meet for the ninth time in the beautiful setting of Lednice. The aim of the first year was to focus the event primarily on practical themes. Over the years, however, Bioacademy has attracted a growing number of practitioners from research organisations as well as from direct agricultural production. For this reason the programme has gradually changed and with increasing intensity we have discussed the solution to requests and the focus of contributions to achieve a benefit for both practical work and exchange of scientific information. The result of this came to fruition last year when participants in Bioacademy had the opportunity to attend a Conference for Practice and the inaugural year of the Scientific Conference. This was attended by 81 specialists and a total of 34 themes were presented in 3 sections. The scientific committee of the conference and the organiser – Bioinstitut evaluated the whole event as highly beneficial. We have therefore prepared a Scientific Conference for you again this year. Almost 100 participants have applied to this conference and there will be 23 presentations, again in 3 sections. One of the sections, as in the Conference for Practice, focuses on soil quality. We have therefore prepared a workshop on this theme where both practical specialists and research specialists will debate questions on the evaluation of soil quality in organic farming.

Unlike last year's publication, the Abstract Proceedings that you are now holding features only contributions to the Scientific Conference. These are given as full versions in English. Abstracts are then given in Czech at the back. Before you begin reading I would like to thank everyone who was involved in the organisation of Bioacademy. Their logos are shown on the back cover of the publication. The level of the Scientific Conference is guaranteed by the Scientific Committee, which, in cooperation with a team of colleagues from scientific institutes in many European countries, has undertaken a considerable task in putting together the programme and opposing contributions. I believe that with their help, which is greatly appreciated, we can look forward to next year's event, when Bioacademy will celebrate its 10th anniversary.

Once more, on behalf of the Organisational and Scientific Committee, I welcome you to Lednice and hope that the time you spend in this pleasant atmosphere will enrich you with new knowledge and that you will enjoy the hospitality of South Moravia and the composed landscape in the grounds of Lednicko-Valtický area with its natural and architectural beauty.

I sincerely believe that the event will fulfil your expectations and that you will continue to support Bioacademy in the future.

Prof. Dr. Bořivoj Šarapatka
Chairman of the Scientific Committee

THE NDICEA MODEL: A SUPPORTING TOOL FOR NITROGEN MANAGEMENT IN ARABLE FARMING

BURGT, G.J.H.M. VAN DER[1] & TIMMERMANS, B.G.H.[1]

Key words: nitrogen, model, mineralization, leaching

Abstract

Nitrogen use efficiency is an important item in organic farming. Modelling nitrogen dynamics can help to understand the impact of alternative agronomic practices and thus assist in decision making. In three examples in the Netherlands, the role of the NDICEA model is demonstrated. It is concluded that NDICEA is an easy to use and helpful tool for optimizing nitrogen efficiency and minimizing losses.

Introduction

Nutrient management is a key factor in organic agriculture. For some nutrients a balance approach will do, but for nitrogen this is not sufficient. Availability and crop demand should be synchronized as close as possible for optimal efficiency and minimal losses. Because of the number and complexity of processes involved, a model approach can be useful. In this paper we present aspects of the use of the NDICEA model in optimizing nitrogen management by means of three examples.

Methods and results of the three examples

For the description and interpretation of the nitrogen dynamics in different situations we used the NDICEA model (Nitrogen Dynamics In Crop rotations in Ecological Agriculture, Burgt *et al*., 2006a). This model describes soil water dynamics, nitrogen mineralization and inorganic nitrogen dynamics in relation to weather and crop demand. Crop yields are used as input, making the model target-oriented which is distinctive from most other nitrogen models (Kersebaum et al., 2007). The model includes a two-layer soil model and calculations are based on time steps of one week. NDICEA has been used in the Netherlands by farm advisory services (Burgt *et al*., 2006b) and in research (Cuijpers & Hospers-Brands, 2009) and in the UK for analysing nitrogen dynamics in organic crop rotations (Burgt *et al*., 2006c).

In two of the following examples the model was used as decision support tool in arable farming, one on tactical and one on strategic level. The third case is connected to strategic questions in nitrogen use efficiency and is derived from a research project.

For these three examples, all agronomic data relevant for NDICEA on soil and soil water, fertilization, crop and green manures were gathered. This was done for at least three years: the year in which measurements took place, and the foregoing two years. The model performance

[1] Louis Bolk Instituut, Hoofdstraat 24, NL 3972 LA The Netherlands, E-Mail g.vanderburgt@louisbolk.nl, Internet www.louisbolk.nl

was checked by soil inorganic nitrogen measurements, three or more per season, and expressed as RMSE (Wallach & Goffinet, 1989) for measured and simulated soil mineral nitrogen. If the RMSE was beneath 20 kg N ha^{-1} model performance is considered to be acceptable (Burgt, 2006a).

First example: tactical decision in practice of arable farming

At the biodynamic farm 'Loverendale' (51°.34'34 N, 3°.34' 55 E) the nitrogen dynamics of six fields are modelled. At the field 'Iepenoord' the crop sequence was 2007 barley (whole plant silage) and Italian ryegrass green manure; 2008 potato and black radish/vetch green manure; 2009 beetroot. Last manure application took place in August 2007, 25 tons per hectare of cattle deep litter manure. The farmer feels unsure about the beetroot crop: does it need additional fertilizer to realize the expected yield of 50 tons per hectare?

The simulated and measured level of soil inorganic N is given in figure 1. In this figure, weather data up to march 2009 are from a nearby meteo station; the rest of the 2009 weather data are average regional data.

The simulation of the nitrogen dynamics of this field is adequate (RMSE = 12,6; n = 4). The other five fields had comparable results (not shown, RMSE's between 4,0 and 21,0). The simulation of the 2008 beetroot crop, yield 70 tons ha^{-1} (not shown), indicates a calculated shortage of 40 kg ha^{-1} nitrogen. The predicted available nitrogen in an 'average' year allows a reasonable yield, and this crop has shown in 2008 the potential for a higher yield, even when the NDICEA simulation showed a nitrogen shortage. The calculated shortage could be explained by a deeper root system than modelled or by a lower nitrogen content of the crop or the crop residues. Both possibilities could be checked in future. This information made the farmer decide to reject an additional fertilizer application.

Second example: strategic decision in practice of arable farming.

The organic arable farm 'Tongelaar' (51°.42'.57 N, 5°.46'.37 E) is considering the presence of winter wheat in the rotation. Weed control and nitrogen efficiency might be improved by the replacement of winter wheat by green manure in autumn/winter followed by spring wheat. Nitrogen measurements and NDICEA simulations were available from four fields with winter

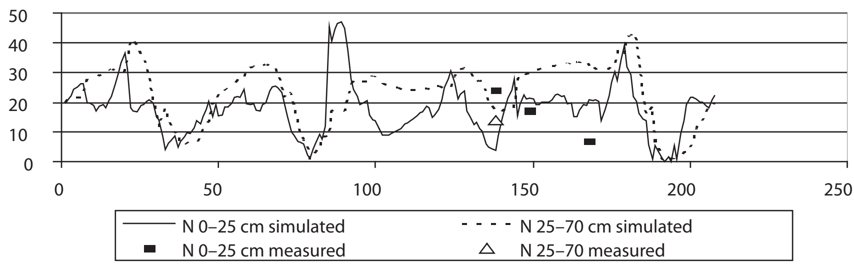

Figure 1: Simulated (lines) and measured (labels) soil inorganic nitrogen. X-axis: week number, 0 = 1 January 2006. Y-axis : kg ha^{-1}.

wheat (P1, P2, P5 and P9). The simulation was sufficiently accurate (RMSE of the four fields together was 12,5; n=12).

Based on this information a simulation was done, replacing a winter wheat crop by a green manure crop followed by spring wheat. The farmer assumed that winter and summer wheat yield would be equal and that the black radish/vetch crop would produce 2200 kg dry matter ha^{-1}. N content of the cathcrop was 82 kg ha^{-1}. The simulations shows that leaching was reduced but the reduction in N losses was much lower than 82 kg ha^{-1} for several reasons. Part of the catch crop N-content (26 kg) is fixed by the Vetch, not extracted from the soil. The increased N-release after incorporation of the catch crop increases soil inorganic N level and enhances both denitrification and leaching. After the grain harvest, soil N level is higher in case of spring wheat, increasing the risk of leaching after the main crop. Based on this information, the farmer has decided to change his rotation in favour of spring wheat: less weed problems, less leaching, higher N availability with potentially higher yield or increased protein content, closed green cover of the field during winter and additional organic matter application to the soil.

Third example: strategic design of crop sequence; research project.

To assess nitrogen use efficiency in courgette cultivation, a comparison study is done at the organic farm of Rozendaal in Strijen (51°, 45'.24 N, 4°, 29'.49 E). Three precrop/fertilizer treatments were studied. 1: Precrop cabbage, autumn ploughing, courgette crop with 120 kg N-total in Vinasse as pre-planting fertilizer. 2: Precrop grassclover, spring ploughing, no fertilizer. 3: Precrop grassclover, spring rotary cultivation, no fertilizer. Soil mineral N was monitored five times, two of which at two depths. The treatments were modelled, resulting in RMSE 8,8, 15,5 and 10,6 for the treatments respectively (n=7 for each treatment). Results are shown in figure 2.

Courgette yield of the three treatments were 33107, 27907 and 32847 kg ha^{-1} respectively with an obviously lower yield for grassclover and ploughing (treatment 2). Precrop cabbage and 120 kg N fertilizer (treatment 1) resulted in the same yield as precrop grassclover without fertilizer and with rotary cultivation (treatment 3). The difference between ploughing and rotary cultivation is not accurately simulated in the modelled nitrogen mineralization, simply because soil cultivation is no variable in the model. The measurements in mineral N tend to show a lower level in case of ploughing. This is reasonable: the decomposable material is brought deeper in

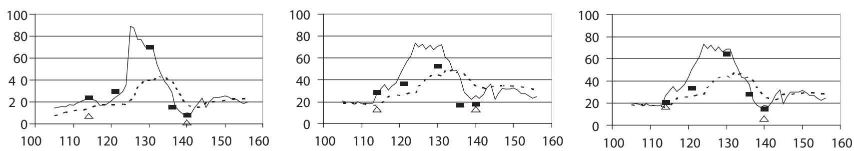

Figure 2: Simulated (lines) and measured (labels) soil inorganic nitrogen. X-axis: week number, 105 = 1 January 2008. Y-axis : kg ha^{-1}. Treatments: 1 (left), 2 (middle), 3 (right). Solid line and squares: 0–30 cm, simulated and measured. Dotted line and triangles: 30–60 cm, simulated and measured.

the soil and is less mixed with the soil compared to rotary cultivation, so mineralization could have been be hampered.

It was concluded that grassclover precrop can save fertilizer application, and that the type of soil cultivation is of mayor importance for the next crop, whether this was due to the nitrogen dynamics or to the soil structure. Based on these results the farmer decided to combine treatment 1 and 3 to optimize the cultivation of courgette following grassclover and rotary cultivation, using a limited fertilizer gift.

Discussion

The use of NDICEA is relatively simple: it can be downloaded from the internet for free, and all information needed to model a field or rotation can be acquired in a talk with the farmer or can be estimated (Burgt, 2006a). The only exceptions are mineral N measurements needed for validation. In all three examples presented, the simulations of soil mineral nitrogen matched sufficiently with the measurements. No calibrations or changes in the default model parameters were needed, indicating that the default model parameters are adequate for these circumstances. Nevertheless a check with at least four soil inorganic N measurements, spread over a growing season, should be part of the procedure before the model can be used as decision support tool.

The use of a dynamic model is interesting, not only because of the many processes it unites, but also because it reveals effects both short-term and long-term effects of an interference (Christiansen *et al.*, 2006). In the second example discussed above it became clear that less leaching in short terms might be followed by more leaching and other losses later. This also plays a role in the third example: with grassclover as precrop the production can do without fertilizer, but after harvest leaching of nitrogen is much higher in case of the grassclover precrop.

Conclusions

In the three cases presented, decision making is supported by the outcome of the NDICEA model calculations. The simulations add information to what was known already. Except for additional soil mineral N measurements, all data needed as input for the model can be deduced from the farmer in spoken form, making the use easy.

References

- Burgt G.J.H.M. van der, Oomen G.J.M., Habets A.S.J. & Rossing W.A.H. (2006) : The NDICEA model, a tool to improve nitrogen use efficiency in cropping systems. Nutrient Cycling in Agroecosystems 74: 275–294.
- Burgt G.J.H.M. van der, Topp C.F.E., Watson C.A., Oomen G.J.M. & Rossing W.A.H. (2006): Predicting soil nitrogen dynamics for an organic rotation using NDICEA. Aspects of Applied Biology 80: 217–223.
- Burgt G.J.H.M. van der, Oomen G.J.M. & Rossing W.A.H. (2006): The NDICEA model as a learning tool: field experiences 2005. In Proceedings European Joint Organic Congress, 30–31 May 2006, Odense, Denmark, 236–237.

- Christiansen J.S., Thorup-Kristensen K. & Kristensen H.L. (2006) Root development of beetroot, sweet corn and celeriac, and soil N content after incorporation of green manure. Journal of Horticultural Science & Biotechnology 81 (5): 831–838.
- Cuijpers W.J.M. and Hospers-Brands, M. (2009): Hulpmeststoffen – effect van gespreide mestgift op stikstofdynamiek in de bodem. Louis Bolk Instituut, Driebergen, 34p.
- Kersebaum K.Ch., Hecker J.-M., Mirschel W. & Wegehenkel M. (eds) (2007): Modelling water and nutrient dynamics in soil-crop systems. Springer, Dordrecht, 266 p.
- NDICEA software: http://www.ndicea.nl.
- Wallach D. & Goffinet B. (1989): Mean squared error of prediction as a criterion for evaluating and comaring system models. Ecol. Modell. 44: 209–306.

GROWTH AND YIELD PATTERN OF MUSTARD CROP DURING CONVERSION FROM CONVENTIONAL TO ORGANIC FARMING

SINGH, P.K.[1], KUMAR, V.[2], SINGH, S.[3], SINGH, M.[4] & SHUKLA, V.K.[5]

Key words: Organic farming, Trichoderma, Composting, Neem formulations

Abstract

An experiment was performed to investigate the effect of the organic farming practices on the growth, yield and disease control of the mustard plants during the process of conversion of the conventional field into the organic field. Mustard plants grown on the organic field amended with the green manure, compost, neem formulation and Trichoderma biopesticides showed a decrease of upto 17 % in the seed germination in the 1st and 2nd year of conversion and increase upto 26 % from 3rd to 5th year of conversion over the control. Initially the yield data shows a decrease of 22 % in the first two year and after third year an increase upto 33 % over time of conversion was reported with respect to the control. At the start of organic farming practices initially there is decrease in the growth and yield which gradually increases over time towards sustainable growth.

Introduction

Organic farming is the old concept which was widely practiced in India but for increasing yield and decreasing crop diseases farmers have widely used the chemical fertilizers, weedicides, pesticides, growth hormones etc. Increasing consciousness about the conservation of the environment as well as health due to harmful impact of agrochemicals, peoples are moving towards the organic farming. Inputs are the major determining force for fertility, crop production and disease control in the organic agriculture. Mustard is the most important oil crop mainly grown in the nothern part of India. It is attaked by various fungal pathogens (*Alternaria, Albugo, Peronospora, Sclerotinia*) and pests (aphids, bugs and sawfly) which causes failure of crop. For controlling these diseases harmful agrochemicals are being used. As a result, there is decrease in soil fertility, crop yield and also insects are being resistant against these agrochemicals. Therefore the quantities of pesticides and chemical fertilizers are being increased regularly. Disease occurence was reported less in organicallly managed farms as compared to the conventional farms (Bruggen and Termoshuizen, 2003).

1 Department of Botany, Christ Church College, Kanpur, U.P., India 208001,
E-Mail pawan_24singh@yahoo.co.in
2 Department of Botany, Christ Church College, Kanpur, U.P., India 208001
3 R & D Department, Hiran Biotech, 66 Turner Road, Cantt., Kanpur, U.P. 208004, India
4 Department of Botany, D.D.U. Gorakhpur University, Gorakhpur, U.P. 273001, India
5 R & D Department, Hiran Biotech, 66 Turner Road, Cantt., Kanpur, U.P. 208004, India

The present experiment was designed to evaluate the pattern of growth, yield and disease control of the mustard crops by using organic inputs during the process of the conversion to organic from the conventional.

Materials and methods

Field trials were conducted for four successive years 2005–2009 at Kanpur, India in irrigated lands. Field blocks of 0.5 acre were prepared for organic as well as for the conventional practices. Buffer crop was raised in the fields bordering to the plots with conventional practices.

Experiment was started by sowing the organic fields with the Sesbenia for the purpose of the green manuring. The field was prepared by ploughing the green manure and adding fully composted cow dung @ 200kg/plot, prepared at the farm. Mustard seeds were treated with Trichoderma biopesticide @ 10 gm/kg of seed and sown in the fields @ 2.5 kg seeds/plot in the ploughed field. In control plots NPK fertilizer was added @ 20 kg/plot. The seeds were treated with the Captan fungicide @ 2gm/kg before the sowing of the seeds.

An area of 1x1 meter in all the plots were demarcated and sown with 100 seeds of mustard to study the germination % in the successive conversion year. Control were the plots in which were managed conventionally.

At flowering stage the organic plots were treated with the neem formulation@1000 ml/acre. In the control plots chemical insecticide Monochrotophos was sprayed for the protection against the aphids. All the treatment and the control were in triplicates. Control plots were separated with appropriate buffer crop. After harvesting the crop the organic fields were amended with the green manure and compost twice in a year to maintain the soil fertility where as in control only chemical fertilizers were used.

Results

The result obtained shows that there was 17 % decrease in germination in first year of conversion which reduced to 8 % in the second year. From third to fifth year there was increase in germination ranging from 10–26 % (Figure 1).

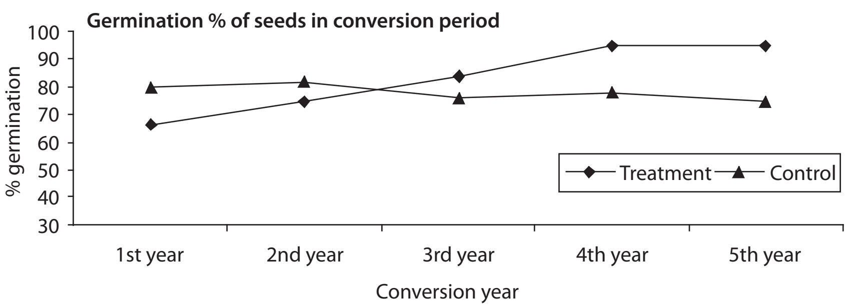

Figure 1: Showing % germination of mustard seeds sown in control and treated plots

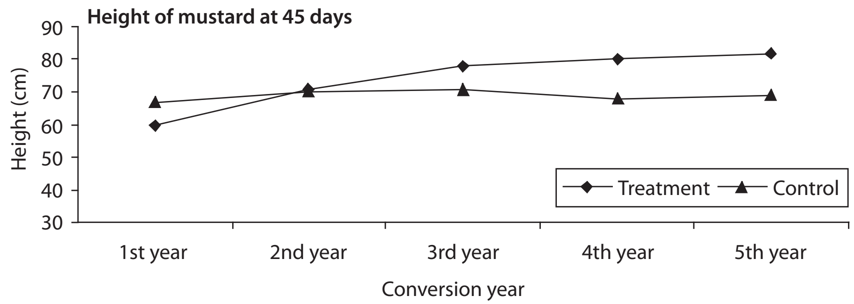

Figure 2: Showing height of mustard seeds sown in control and treated plots

Increase in growth was recoded in the mustard plants after completing the one year of conversion period. In first year there was decrease of 10 % in the growth of mustard plants but after second and upto fifth year there was a sequential increase of 1–18 % in the growth of plants sown in the organic field as compared to the seeds grown in the conventional plots (Figure 2).

The yield data shows that initially there was decrease of 22 % in first year and 7 % in the second year in the yield of mustard seeds sown in the conversion plots as compared to the control plots. From the third year an increase in the yield was reported ranging from 13–33 % over the control plots (Figure 3).

Discussion

Agricultural practices in which organic fertilizers are applied provide sustainable development by minimizing the losses to environment, increasing soil microbial population, humus content and ultimately improving health of soil. An increase in growth and yield of plant has been reported

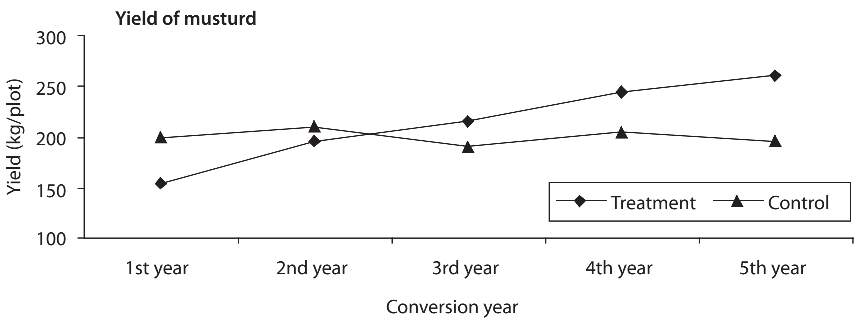

Figure 3: Showing yield of mustard seeds sown in control and treated plots

in various studies conducted to evaluate the organic practices. Gomma and Mohamed (2007) reported an increase in growth and yield using bio-organic fertilizers in guar. Application of bio-organic fertilizers have positive effects on the growth and yield. Amany et al 2002, Abdel – Wahab and Said (2004), Gomma and Khattab (2003) reported that using bio and organic fertilizers there was an increase in yield of triticale, bean and roselle pink over control plants. Steven et. al (2000) in their studies found that use of cultural practice, crop rotation and application of organic chemicals decrease the disease and increases yield. Crop rotation was considered as an important parameter in the organic farming for disease control and crop productivity. Perters S.E (1994) and Neera et al (1999) reported that initially there is decrease in the crop productivity for 1 – 4 years. After this period there is gradual increase in the crop productivity which increases with time duration during the period of conversion. Chemical fertilizers are fast source of nutrition and when their use is stopped in organic farming during conversion period, the eroded soil takes time to improve its fertility. The increase in the growth and yield get sustained due to the addition of the organic inputs.

Conclusions

The present study clearly shows that initially there is decrease in the growth and yield of the mustard crop during the conversion period from the conventional to the organic. This decrease is temporal and with time there is regular increase in the growth and yield of the mustard which is sustained. The organic farming method provides a sustainable growth and development when applied in a better way.

References

- Amany A. B., Gomma A. M. (2002): The integrated system of bio and organic fertilizers for improving growth and yield of triticale. Egypt Journal of Appli. Sciences. 17: 512–523.
- Abdal Wahab A.F., Said M.S., (2004): Response of faba bean to bio and organic fertilization under calcareous soil conditions. Egypt Journal of Appli. Sciences. 19: 305–320.
- Bruggen A.H.C., Termoshuizen A.J. (2003): Integrated approaches to root disease management in organic farming systems. Australian Plant Pathology. 32 (2) 141–156.
- Gomma A.M., Khattab M.E., (2004): Productivity and quality of early maturated light and dark colour roselle varieties under bio-organic farming compared to usual chemical; l fertilization treatment. Egypt Pharmaceutical Journal. 3: 107–121.
- Gomma A.. M, Mohamed. H. Magda. (2007): Application of Bio – organic agriculture and its effect on Guar (Cyamopsis tetragonoloba) Root nodules, forage, yield and yield quality. Journal of Agri. Sciences 3 (1): 91–96.
- Neera P., Katano, M., Hasegawa, T., (1999): Comparison of rice yield after various years of cultivation by natural farming. Plant Prod. Sci., 2: 58–64.
- Perters S. E. (1994): Coversion to low farming input systems in Pennsylvania, USA: An evaluation of the Rodale Farming Systems Trials and related economic studies. In Economics of organic farming (Eds Lampkin, N.H. and Padel S.) CAB, Wallingford, U.K., 1994: 265–284 pp.
- Steven T.K., Garkell, M., Fouche, C., Smith, R., Mitchell, J., (2000): Plant Disease management for organic crops. Vegetable Research Information Centre. www.vric.ucdavis.edu 1–6 pp.

CATCH CROPS TO REDUCE WIREWORM DAMAGE IN MAIZE

BRUNNER, N.[1], TRSKA, C.[1], HANN, P.[1] & KROMP, B.[1]

Key words: catch crops, wireworms, natural pest control, maize, buckwheat

Abstract

Wireworms (Coleoptera: Elateridae) increasingly damage potato, maize and field vegetables in both organic and conventional farming. The Austrian research project "New approaches to regulate wireworms, with a special emphasis on organic farming" aims at finding preventive and non-chemical control measures. The objectives are to develop a risk assessment system and to investigate alternative methods of pest control. In a field study in 2008, catch crops were tested as a means of reducing wireworm damage in maize, based on the concept that fast-growing plants attract wireworms and keep them off the main crop. On a wireworm infested field in Upper Austria, buckwheat and wheat were sown by hand between the maize rows. The control treatment was maize without a catch crop. 4 replicates of each of the 3 variants were applied in randomised blocks. In the treatment with buckwheat the wireworm damage was lowest (11 %), compared to the variants with wheat (16 %) and without catch crop (27 %).

Introduction

Wireworms (*Coleoptera, Elateridae*) are the soil-dwelling larvae of click beetles. Their larval stage lasts up to 5 years. During this time a number of harmful species, mainly of the genus *Agriotes*, feed on potatoes, maize and other field crops causing remarkable damages. In Austria, wireworm damages have been increasing during the past few years. In potato, wireworm damage causes reduced yield quality and thereby financial losses especially in organic farming, where the price level is higher than in conventional farming. In maize, the feeding holes on the sown corn or on the stem base of the seedlings and young plants stop plant growth, which can cause enormous yield losses.

Currently, the Austrian project "New approaches to regulate wireworms, with a special emphasis on organic farming" is run by Bio Forschung Austria in cooperation with the Institute of Plant Protection, University of Agriculture in Vienna and the Institute of Ecology, University of Innsbruck. Implying the knowledge and experience of interested farmers, it aims at revealing the causes for wireworm damage in potato and maize. Therefore the relevance of site-related factors (soil and landscape structure) as well as cultivation-specific factors (crop rotation, manure and soil cultivation) for wireworm damage is evaluated. On the basis of these data, in order to avoid damages, a risk assessment system is developed. As means of actively controlling wireworms, catch crops and soil cultivation are investigated in field tests; the aim is to prevent or at least reduce damage. Foraging wireworms are attracted to carbon dioxide emitted by germinating and growing plant roots: This is the basic concept of so-called catch crops.

[1] Bio Forschung Austria, Rinnböckstraße 15, 1110 Wien

Fast- growing plants are sown between the maize rows, as an alternative food source, to attract wireworms and keep them off the main crop. In a field study in 2008, a catch-crop trial with buckwheat and wheat strips sown between maize rows was performed in Upper Austria.

Materials and methods

The field site is situated in Kirchheim (Innviertel, Upper Austria). After 20 years of permanent grassland the field was ploughed in February 2008. After ploughing, many wireworms were visible in the soil indicating a high wireworm incidence. On 5 May maize was sown. On 6 May, buckwheat and wheat were sown as catch crops. The stripes were 10 to 15 cm wide and sown by hand (about 4 g/m^2) between the maize rows. 4 replicates of each treatment were applied in a randomised block design. The 12 plots were each 25 m long and about 3 m wide (5 rows of maize, distance between the rows: 70 cm). Plant and soil samples were taken from randomly chosen spots within the middle 3 maize rows on 27 May and 3 July, without sampling the same spots twice. For evaluating wireworm densities, 6 soil samples (15 cm in diameter, 10 cm in depth) per plot were taken and hand-sorted for wireworms. In each plot 3 soil samples were taken in the maize rows and another 3 nearby in the catch crop. The control plots without catch crops were sampled likewise. For estimating wireworm damages, in each plot the maize plants were counted along 4 m transects in the rows. The number of wireworm damaged plants was evaluated by digging out the wilting and undersized plants and checking their roots and stem base for wireworm feeding holes.

For statistical analysis, differences between the treatments, regarding the percentages of damaged maize plants were tested by 1-factorial ANOVA. Percentage data were transformed by arcsin-function ($p' = \arcsin \sqrt{p}$) (Köhler et al 2002).

Results

The results for the wireworm damage evaluation of the maize plants are shown in Figures 1 and 2. Wireworm damage occurred in all three treatments. In July there were more gaps in the maize stand and the percentage of damaged plants was higher than in May.

The highest amounts of damaged plants were found in the control plots, with 5 % on 6 May as well as with 27 % on 3 July. In the wheat treatment 2.5 % of the maize plants were damaged in May and 16 % in July. In the buckwheat plots the maize stand was least thinned out and the percentage of damaged maize plants was lowest, though the differences between treatments were not significant (ANOVA: $F = 2.2$; $p = 0.17$).

On 3 July, the total drop out rates (wireworm plus unidentified damages) of maize plants were estimated and compared to the initial stand densities from May. Again, the lowest damages occurred in the buckwheat treatment, although no significant differences between the treatments were found (ANOVA: $F = 2.1$; $p = 0.18$).

The total number of wireworms in the soil samples was low. In May, a total of 80 wireworms (a mean of 1.1 per sample) and in July 35 wireworms (a mean of 0.5 per sample) were revealed from the soil samples. In the control more larvae were counted in the maize rows than between the rows, in May as well as in July (Figure 3). The highest number of wireworms was found in the wheat treatment in May.

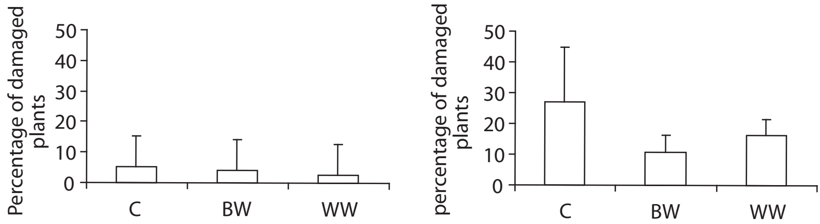

Figure 1: Percentage of maize plants damaged by wireworms on 27 May (left) and on 3 July (right) plus standard deviation for the treatments control (C), buckwheat (BW) and winter wheat (WW).

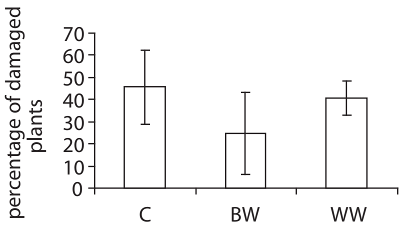

Figure 2: Percentage of total drop out rates of damaged maize plants counted on 27 July compared to 27 May and standard deviation for the treatments control (C), buckwheat (BW) and winter wheat (WW).

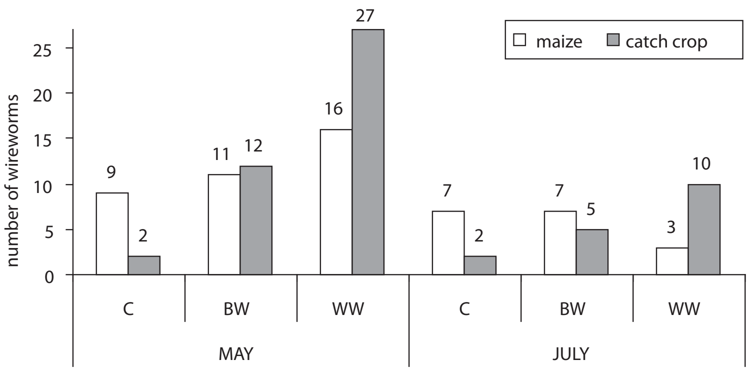

Figure 3: Number of wireworms from soil samples in the maize rows and in the catch crop per treatment in May and in July. C = control, BW = buckwheat, WW = winter wheat

Discussion

Successful trials, using catch crops to detract wireworms from the main crop, were carried out in Canada and in Germany: Stripes of wheat, sown between strawberry plants, reduced the percentage of damaged strawberry plants from 43 % to 5 % (Vernon et al. 2000). In Germany, pyrethroid- incrusted wheat, sown between potato rows, reduced the damaged potatoes by 74 % (Zellner 2004). Different catch crops were tested in Nordrhein-Westfahlen with no positive effect on the potato quality; anyway the overall wireworm damage in the trial was low (Schepl & Paffrath 2007). In maize, the seedlings and young plants are most affected by wireworm-feeding; older plants most often survive the attack. So it makes sense to sow an attractive, fast growing catch crop at the same time as the maize. In this trial the wheat did not grow well and, maybe therefore, no effect on the maize plants could be seen. The buckwheat was growing well and the lowest number of damaged maize plants was counted in this treatment.

Conclusions

The results, though not statistically significant, are promising. Stripes of buckwheat between the maize rows may reduce wireworm damage. Further tests should be carried out maybe on a larger scale. Different sowing densities and planting dates of the buckwheat should be tested.

Acknowledgments

Thanks to Katharina and Markus Bichler for providing the field site and to the team of Bio Forschung Austria for their work.

References

- Köhler, W., Schachtel, G., Voleske P. (2002): Biostatisik. Springer, 301 p.
- Schepl, U., Paffrath, A. (2007): Wie lässt sich Drahtwurmfraß an Kartoffeln im ökologischen Landbau reduzieren. 9. Wissenschaftstagung Ökologischer Landbau. Archiviert unter: http://orgprints.org/view/projects/wissenschaftstagung-2007.html.
- Vernon, R., S., Kabaluk, T., Behringer, A. (2000): Movement of *Agriotes obscurus* in strawberry plantings with wheat as a trap crop Canadian Entomologist: 132: 231–241.
- Zellner, M. (2004): Neue Ansätze zur Drahtwurmbekämpfung in Kartoffeln. Phytomedizin 34: 56.

INFLUENCE OF IRRIGATION ON ORGANIC SOYBEAN PRODUCTION IN THE DRY REGIONS OF EASTERN AUSTRIA

HOFER, M.[1], SCHWEIGER, P.[1] & HARTL, W.[1]

Keywords: organic agriculture, soybean, cultivars, irrigation, seed parameters

Abstract

In Austria organic soybean is mainly produced in the eastern part of the country due to its temperature requirements. To examine genotypic differences with respect to seed quality under different water conditions a three-year field trial was conducted. Seven soybean cultivars were grown under well-watered conditions versus mild drought stress. Soybean cultivars of maturity groups 00–0 had higher grain yields as well as higher seed protein concentration in comparison to early maturing cultivars (maturity group 000). In all 3 years the cultivar "Essor" achieved significantly higher values (p<0,05) in comparison to "Merlin", additionally "Cardiff" and "Essor" gained significantly higher (p<0,05) protein concentrations compared to "Lambton". Irrigation had a generally positive and highly significant impact (p<0,01) on yield and quality parameters. However, the magnitude of this effect varied between years.

Introduction

In 2007 10 % of the Austrian soybean production area was under organic management (AMA 2007) with a still increasing tendency. Organic soybeans are mainly grown in the relatively dry and warm eastern regions of Austria due to their temperature requirements. Soybeans contain an average protein concentration of 35–40 % and have a high significance as animal feed as well as for human consumption. Due to the high protein concentration in their seeds, soybeans have a high nitrogen requirement. As legumes they have the ability to fix atmospheric nitrogen via rhizobial symbionts. Under optimal environmental conditions most of their nitrogen demand can be covered by N_2 fixation and nitrogen pools in the soil may even be increased (Unkovich and Pate 2000). Extensive nodulation is an important factor for yield as well as protein concentration (Gretzmacher et al. 1994). The efficiency of the symbiosis and consequently soybean yield is additionally affected by choice of cultivar, bacterial strain as well as environmental conditions (Montanez et al. 1995; Ayisi et al. 2000). Of these, especially drought stress has been shown to have severe negative effects on the functioning of the rhizobial symbiosis (Sinclair and Serraj, 1995).

Soybeans scheduled for food production purposes have to meet certain quality criteria. For the production of soymilk or tofu soybeans should contain a minimum of 42 % protein in the seed. However soybeans produced under central-european conditions often have protein values below 40 % due to climatic conditions (Vollmann et, al. 2000) and consequently are outrun by better qualities offered on the international market. Therefore this field study aimed at a productivity

[1] Bio Forschung Austria, Rinnböckstraße 15, 1110 Wien, Austria
E-mail: m.hofer@bioforschung.at, Internet: www.bioforschung.at

analysis of different soybean cultivars grown under well-watered conditions and naturally occuring mild drought stress with respect to their suitability for food processing.

Materials and methods

From 2005 to 2007 field experiments were conducted at 3 field sites in Lower Austria. The average annual air temperature is above 9°C and the average annual precipitation ranges from 500mm to 600mm (Cepuder et al. 1998). A core set of 7 soybean cultivars belongig to different maturity groups was cultivated by commonly used equipment in 4 replications. Plot dimensions were set with 3x10m and a distance between rows of 50cm sown with a seed density of 60 seeds/m^2. Cultivars were inoculated by application of two different rhizobia compounds (*Bradyrhizobium japonicum*) each of with in the recommended concentration. Irrigation took place as required 2–3 times during flowering (developmental stage R2) and the beginning of pod formation (developmental stage R3) by applying an amount of 35mm water respectively. The mature plants were harvested, beans separated from the pods and thereupon further parameters were determined. The protein concentration of ground corn samples was analysed by near infrared spectroscopy (NIRS, Bruker Matrix-IFT-NIR System; Bruker, Ettlingen, Germany) and obtained values were referred to g kg^{-1} dry matter. Statistical data were calculated by using Systat and conducting an analysis of variance followed by a comparison of mean values according to Tukey. The results on the influence of irrigation on cultivar performance are presented as relative data referring to the particular mean value of cultivars grown under natural water conditions with mild drought stress (equates to 100 %).

Results

Tab. 1: Significance of influence factors on analysed parameters.

	Y (kg/ha)	Prot (mg/g)
Year	**	**
Cultivar	*	**
Year * Cultivar	n.s.	**
Year * Irrigation	**	**

Y=yield (kg/ha), Prot=protein concentration (mg/g), [** p<0,01; * p<0,05; n.s. not significant]

The results of the analysis of variance reveal a highly significant annual influence for both parameters ($p<0,01$) as well as a significant influence of the choice of cultivars regarding yield ($p<0,05$) and protein concentration ($p<0,01$). During the observation period cultivar differences varied significantly ($p<0,01$) for protein concentration whereas the parameter corn yield remained unaffected over the years. Irrigation was shown to have a highly significant influence on the oberserved parameters ($p<0,01$) but showing differing impact levels in the 3 years. Analysed cultivars did not differ in their reaction to irrigation.

The cultivars “Essor” and “Lambton” consistently produced above-average soybean yields, whereas the early ripening cultivars “Merlin” and “OAC Erin” had lower yields combined with considerable year-dependent fluctuations particularly in non-irrigated plots. In a direct cultivar comparison "Lambton" ($p<0,01$) and "Essor" ($p<0,05$) produced significantly higher corn yields than the cultivar "Merlin".

Irrigation had a constant positive effect on corn yield (see Fig.1) with an average increase between 31,2 % and 53,2 %. Average soybean yield under unwatered conditions ranged from 2,1 t/ha to 2,4 t/ha, whereas under well-watered conditions soybean cultivars produced a yield between 2,8 t/ha and 3,4 t/ha.

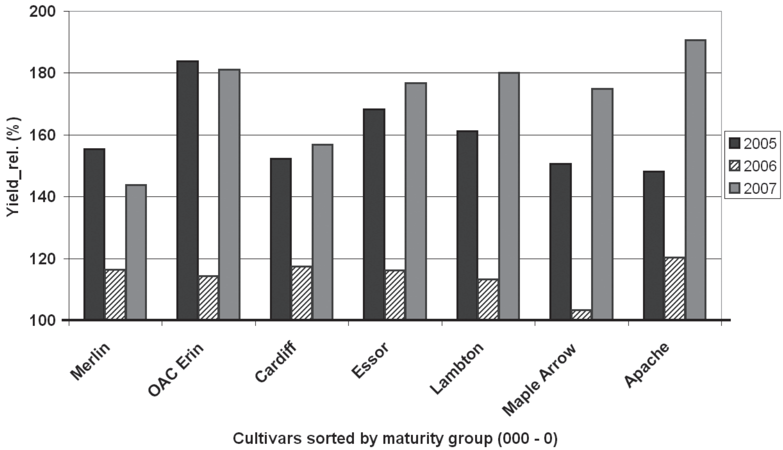

Figure 1: Relative influence of irrigation on corn yield (in %)

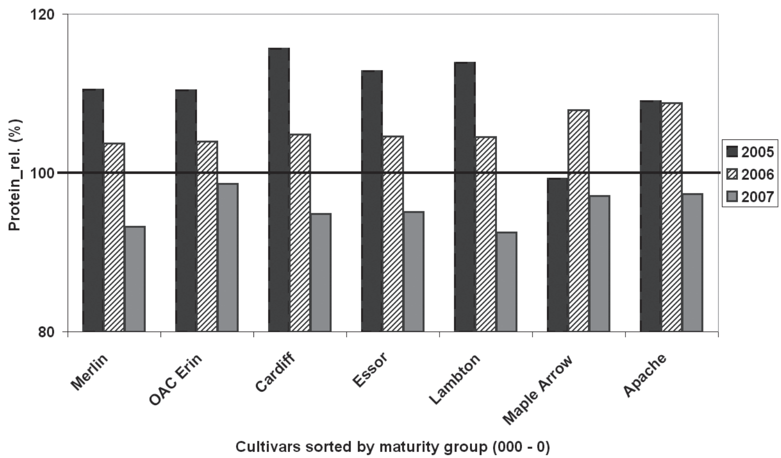

Figure 2: Relative influence of irrigation on protein concentration (in %)

Protein concentrations were influenced by choice of cultivar and year-specific variations (see Table 1) with non-irrigated plots being more affected. The cultivars “Apache”, “Cardiff”, “Essor” and “Maple Arrow” revealed significantly higher protein concentrations in comparison to “Merlin” ($p<0,01$) irrespective of irrigation. Within maturity group 00 “Cardiff” and “Essor” produced significantly higher protein values than “Lambton” ($p<0,05$). In non-irrigated plots the analysed protein concentration ranged from 35,0 % to 37,8 % on average, protein concentrations in well-watered plots ranged from 35,6 % up to 39,2 %.

Discussion

In comparing cultivar performance, soybean cultivars of maturity group 00 produced higher corn yields as well as higher seed protein concentrations in comparison to the early maturing cultivars Merlin and OAC Erin (maturity group 000), whose results tended to fall behind particular experimental mean values and additionally revealed higher fluctuations in yield and protein productivity during the years (Hofer et al. 2008). In all 3 years the cultivar “Essor” achieved significantly higher values ($p<0,05$) in comparison to “Merlin”, additionally “Cardiff” and “Essor” gained significantly higher ($p<0,05$) protein concentrations compared to “Lambton”. Irrigation had a constant positive effect on corn yield (see Fig.1) with an average increase between 31,2 % for the cultivar “Maple Arrow” and 53,2 % for “OAC Erin”. Protein concentration was influenced in a negative way in 2007 (see Fig.2) with a reduction varying between 2- 7 % depending on the cultivar observed. Climatic conditions in 2007 appeared to have had an exceptional influence on the impact of irrigation and therefore seemed to have variably influenced the dynamics of growth for cultivars of different maturity groups.

Conclusions

The results obtained in this study exhibit a better suitability of soybean cultivars of maturity group 00 for field sites under natural water conditions with mild drought stress or where irrigation is not feasible. The impact of irrigation proofed to be highly influenced by climatic characteristics and growth dynamics seemed to be affected to a different degree during the vegetation period. Therefore advanced research focusing on growth parameters of cultivars belonging to different maturity groups has to be conducted in order to identify the crucial characteristics of interactions.

Acknowledgments

This work was funded by the Austrian Federal Ministry for Agriculture, Forestry, Environment and Water Management (Project Nr. 1315).

References

- Ayisi KK, RJ Nkgapele & FD Dakora. 2000. Nodule formation and function in six varieties of cowpea (Vigna unguiculata L. Walp.) grown in a nitrogen-rich field soil in South Africa. Symbiosis 28: 17–31.
- AMA (Agrarmarkt Austria). 2007. Daten und Fakten der Agrarmarkt Austria für den Bereich Getreide und Ölsaaten. Stand: 04.Juli 2007.

- Cepuder P, M Tuller, A Sagerer & J Suda. 1998. Grundwasserschonender Ackerbau im Marchfeld. Stickstoffanalyse bei unterschiedlichen Fruchtfolgen am Standort Fuchsenbigl. BMLF/WWK, Wien.
- Gretzmacher R, N Schahbazian & N Pourdavai. 1994. Einfluss von symbiontischem, organischem und anorganischem Stickstoff auf Ertrag und Qualität von Sojabohnen. Die Bodenkultur 45. 3: 253–267.
- Hofer M, Schweiger P, Putz B & W Hartl. 2008. Produktivität verschiedener Sojabohnensorten im ostösterreichischen Anbaugebiet. Grundlagen zur Züchtung, Vermehrung und Sorten-/ Saatgutprüfung für den Biolandbau. Abschlussbericht: 115–124. BMLFUW, Wien.
- Montanez A, SKA Danso & G Hardarson. 1995. The effect of temperature on nodulation and nitrogen fixation by five Bradyrhizobium japonicum strains. Applied Soil Ecology 2: 165–174.
- Sinclair TR & R Serraj. 1995. Legume nitrogen fixation and drought. Nature 378, 344.
- Unkovich MJ & JS Pate. 2000. An appraisal of recent field measurements of symbiotic N2 fixation by annual legumes. Field Crops Research 65: 211–228.
- Vollmann J, CN Fritz, H Wagentristl & P Ruckenbauer. 2000. Environmental and genetic variationof soybean seed protein content under Central European growing conditions. Journal of the Science of Food and Agriculture 80:1300–1306.

PRELIMENARY RESULTS ON A COMPARATIVE STUDY EVALUATING LANDRACES OF COMMON BEAN *(PHASEOLUS VULGARIS* L.) UNDER ORGANIC AGRICULTURE IN A PROTECTED AREA IN GREECE.

VAKALI, C.[1], PAPATHANASIOU, F.[2], PAPADOPOULOS, I. & TAMOUTSIDIS, E.

Key words: local landraces, dry beans, organic growing conditions, yield characteristics, cooking time

Abstract

Organic farming requires cultivars or landraces that are specifically adapted to this low input cropping system. Six landraces of Greek common dry bean (Phaseolus vulgaris L.) and one from the neighbouring Former Yugoslav Republic of Macedonia (FYROM) were evaluated for different agronomic and physicochemical characteristics under organic conditions in the National Park of the lake Prespes, on the borders of Greece, FYROM and Albania. Significant differences among landraces were found in yield characteristics such as yield plant^{-1}, pod plant^{-1} and seeds pod^{-1} with two of the landraces performing the best. The cooking time was estimated by measuring seed hardness using a penetrometer. There was a considerable variation between the landraces tested with cooking times between 25–45 minutes. Some of the landraces could be a useful resource for the development of organic farming systems in this protected area.

Introduction

Organic farming is increasingly gaining interest in Greece with organic farmers especially in the North part of the country to have tripled in the past few years. However, the research on organically grown land is limited with organic farming relying on the improvements achieved by conventional methods. The use of modern cultivars in the organic context does not imply that these are the best cultivars for the organic cropping system. Indeed, the lack of specifically adapted cultivars or landraces is one of the most important problems (Desclaux, 2005). A major intention of organic farming is to use local varieties or populations that are best adapted to the needs of these forms of agriculture (Lange et al., 2006, N.A.G.R.E.F., 2005). The long-term cultivation of dry bean at distinct microenvironments in Greece, combined with the extensive genetic heterogeneity, led to various landraces with particular genetic and morphological traits (Papoutsi-Costopoulou and Gouli-Vavdinoudi, 2001). In some regions of Greece and FYROM dry bean local landraces are still cultivated, mainly with traditional methods (e.g., harvesting by hands). Compared to commercial varieties, these landraces are less productive and more

1 Scientific partner, Technological Educational Institute of Western Macedonia, Department of Crop Production, 53100, Florina, Greece

2 Professor, Technological Educational Institute of Western Macedonia, Department of Crop Production, 53100, Florina, Greece

variable, but better adapted to the specific pedoclimatic conditions of these restricted areas. Moreover, their product has market desirable quality traits (i.e., easy cooking, tasteful, thin peel). Organic farmers can profit from the physiological and qualitative characteristics of such genetic material adapted to local conditions with possible tolerance to diseases and weed competition. Consumer preferences of high quality product with good physicochemical characteristics are also an important factor when selecting cultivars adapted to organic farming. It is therefore a fundamental concern of an organic management system to evaluate and choose varieties or locally adapted landraces that have constantly high yields with low input (Ghaouti et al., 2008). The objective of this study was to evaluate locally adapted landraces of common dry bean and determine the most adequate type of dry bean fitting the requirements of organic farming in the region of Lake Prespes. The results will contribute to the better exploitation of local plant material and give us important information about the use of particular local landraces of beans concerning their agronomic behaviour, yield and qualitative characteristics of the final dry product.

Materials and methods

Seven landraces of common bean, *Phaseolus vulgaris* L., collected in the last five years (Papadopoulos et al., 2004) in traditional areas of common cultivation in Northern Greece and FYROM were studied (Table 1). Each landrace, cultivated for over 30 years from each farmer avoiding seed mixing, was originally collected (500 g sample) from farmer's stocks. The populations numbered 1, 2 and 3 were collected around Prespa lakes (1:Agios Germanos, 2:Plati, 3:Laimos), population number 4 from neighbouring FYROM (4:Nakolets) and numbers 5, 6, and 7 also from Northern Greece (5:Chrisoupoli, 6:Kastoria, 7:Florina). The experiment was established during the summer of 2008 to the village Pili situated in the traditional area of common bean cultivation close to Lake small Prespa, Greece (40° 50´ 1N, 21° 07´ 2E, 856 m altitude and soil developed during Neogene by lacustrine deposits). The agronomic practices followed those of organic agriculture recommended for the crop in this region. The field was fertilized 2 years earlier with 50 tn per hectare of dry cattle manure. The landraces were planted in a randomized complete block design with four replications. Each replication consisted of seven plots (one for each landrace) and each plot of 4 three meter rows, with plant to plant distance of 60 cm and row to row distance of 70 cm. During the growing period, data related to phenology, yield and yield components and seed characteristics were collected (IBPGR, 1982). Beginning of flowering, end of flowering, physiological maturity, yield and yield components such as pods plant^{-1}, seeds pod^{-1} (determined on twenty pods per plot) and yield (g plant^{-1}). Seeds length, width, and thickness were determined on 20 seed per plot, seed weight (g/100 seeds), water absorption by 12 and 24 hours and hydration coefficient (Bishnoi and Khetarpaul, 1993). Seed coat proportion was determined on 10 seeds per plot, as the ratio in weight between coat and cotyledon expressed in percentage, after removing the seed coat from the cotyledons, both after soaking and keeping them for 24h at 105 °C. Cooking time was determined according to the method described in Illiadis (2001). Sixty seeds from each plot soaked for 12h were placed in a 500 ml conical flask with 350 ml of distilled water. The flasks were placed in a water bath kept at 100 °C. After 15 min of initial cooking, samples of 10 seeds were taken from each flask at 5 min intervals. Using a penetrometer (Sur PNR-6, Berlin, Germany) with loading of 50 g and gravity of 0,5s needle intrusion depth was measured. The seeds were considered cooked when they reached the value of 6 mm. The criterion of 6 mm needle penetration representing fully cooked seeds was derived with a method described in Iliadis (2001). Comparison of means was conducted by Least Significance Test (LSD) after Analysis of Variance (ANOVA), for one-factor randomized complete block design.

Tab. 1: Collecting place, growth habit and seed colour of the 7 landraces evaluated. Altitude, long term average temperature and rainfall of the collecting places.

Landrace	Collecting place	Growth habit*	Seed Colour	Altitude (m)	Mean T °C	Average rainfall
1	Agios Germanos	IV	white	856	11.3	680
2	Plati	IV	white	883	11.5	680
3	Laimos	IV	white	871	11.0	700
4	Nakolets	IV	white	870	11.3	685
5	Chrisoupoli	IV	white	8	15.8	590
6	Kastoria	IV	white	623	12.8	610
7	Florina	IV	white	1010	11.9	580

* IV indeterminate climbing type

Results

In general, the studied populations showed limited variation in the morphological characteristics measured in the present study and no serious disease and pest problems occurred. Hence, we focus here on the yield component results (Table 2). The yield varied considerably with two of the dry bean landraces deserving particular attention since their values were better than the others in two or more yield traits. The landraces from Kastoria and Nakolets had higher yield (g plant^{-1}) with 149,7 and 153,8 g plant^{-1} and also the highest number of pods plant^{-1} with 101,1 and 75,2 respectively. Similarly higher was the number of seeds per pod with 5,01 for Kastoria and 4,96 for Nakolets landraces.

Tab. 2: Mean of the most important seed and yield characteristics of seven dry bean landraces grown under organic conditions in 2008.

Landrace	Pods plant^{-1}	Seeds pod^{-1}	g plant^{-1}	g 100 seeds^{-1}
1	49,6 b	4,04 c	90,2 b	82,5 a
2	55,8 b	4,38 bc	115,5 ab	73,5 bc
3	58,5 b	5,03 a	121,2 ab	68,3 bc
4	75,2 ab	4,96 ab	153,8 a	66,5 cd
5	51,8 b	4,35 bc	91,5 b	68,8 bc
6	101,1 a	5,01 a	149,7 a	58,4 d
7	73,7 ab	4,29 c	132,8 ab	73,9 b
LSD (P<0,05)	39.3	0.61	53.4	7.34

*a-d= means within the same column with different letters are significantly different (P<0.05)

However, both showed the lowest weight in g 100 seeds^{-1}. Generally there was a strong correlation between yield per plant and number of pods plant^{-1} r=0.87 (P<0,01) and the number of seeds pod^{-1} r= 0.56 (P<0,05). In contrast a negative correlation (r= -0,35) was observed between the seed yield plant^{-1} and the seed weight. Most of the tested landraces had a hydration index close to 100 % in 24 h, which indicates that the seeds absorbed as much weight as their dry weight (data not shown). Coat percentages observed in this study were between 7,48–9,01 with the landraces from Laimos and Florina having the lowest and highest means respectively (Table 3). Differences on the cooking time were more prominent. The lowest cooking time of 25 minutes was observed in the landrace from Chrisoupoli and the highest values of 40 and 45 minutes in the landraces from Laimos and Agios Germanos respectively.

Tab. 3: Percentage of coat to sperm of the bean seeds and time of cooking.

Landrace	Coat (%dm)	Time of cooking (min)
1	8,38 ab	45 d
2	8,02 b	32 b
3	7,48 b	40 cd
4	8,65 ab	37 bc
5	8,89 a	25 a
6	8,37 ab	33 b
7	9,01 a	35 bc
LSD (P<0,05)	0.85	6.7

*a-d= means within the same column with different letters are significantly different (P<0.05)

Discussion – Conclusions

Results show limited variation within landraces. The lack of exchange of genetic material between farmers, the traditional way of cultivation (e.g., no mechanical harvesting), and the consecutive inbreeding and selection carried out over the years by each farmer, might have led to increased genetic homogeneity within populations. However, there was a considerable variation between the tested landraces in yield component characteristics, with the landraces from Kastoria and Nakolets having much higher yield plant^{-1}, seeds pod^{-1} and pods plant^{-1}. The positive correlation of yield per plant with the number of pods and the number of seed per pod is in accordance with other reports (Abebe and Brick, 2003) and well explains the higher yields of these two landraces. However, the negative correlation between the size of the seeds and the yield is a fact that has to be kept in mind when choosing the best performing landraces since large-seeded cultivars (more than 70 g per 100 seeds) are preferred by consumers and industry (Piergiovanni et al. 2000). Both the high yielding landraces had seed weights below this level, and especially number 6 had very small seeds. Cooking time is also important for consumers, and should be short to save time and energy. The cooking time varied significantly, with the shortest time obtained for the land race from Chrisoupoli (25 minutes). However, this landrace had a low yield performance. This population had the highest hydration coefficient and this could explain the lower cooking time. Dry bean with high hydration coefficient require generally less cooking time (Castillo et al. 2008).

This preliminary report of agronomic and physicochemical properties of several landraces revealed variability that could lead to the selection of cultivars best suited for organic growing. Nevertheless evaluation in a single environment may not result in high and stable performance in a range of environments due to Genotype x Environment interactions. That induces the need for multi-environment evaluation in different locations or/and years. Well-adapted landraces may be used as source material in breeding programs under low-input conditions.

Acknowledgments

This project is supported from the Special Account for Research Grants of the Technological Educational Institute of Western Macedonia, Greece.

References

- Abebe, A., and Brick, M.A. (2003): Traits associated with dry edible bean (*Phaseolus vulgaris* L.) productivity under diverse soil moisture environments. Euphytica. 133:339–347.
- Bishnoi, S. and Khetarpaul, N. (1993): Variability in physico-chemical properties and nutrient composition of different pea cultivars, Food Chemistry, 47: 371–373.
- Castillo, R. R., Almirall, A. Valero, J., Casanas, F. (2008): Protected designation of origin in beans (*Phaseolus vulgaris* L.): towards an objective approach based on sensory and agromorphological properties, Journal of the Science of Food and Agriculture, 88: 1954–1962.
- Desclaux, D. (2005): Participatory plant breeding methods for organic cereals. In: Proceedings of the COST SUSVAR/ECO-B, Workshop on Organic Breeding Strategies and the Use of Molecular Markers, Lammerts Van Bueren ET, Ostergard H (Eds): 17–23.
- Ghaouti, L., Vogt-Kaute, Z., Link, W. (2008): Development of locally-adapted faba bean cultivars for organic conditions in Germany through a participatory breeding approach, Euphytica, 162:257–268.
- IBPGR, (1982): Descriptors for Phaseolus vulgaris L.. IBPGR Secretariat, Rome.
- Illiadis, C. (2001). Effects of harvesting procedure, storage time and climatic conditions on cooking time of lentils (Lens culinaris Medicus). Journal of the Science of Food and Agriculture, 81:590–593.
- N.A.G.R.E.F. (2005): Organic Agriculture in the Mediterranean: Problems and Perspectives, International Symposium, Book of Abstracts, 9–11November 2005, Chania, Crete, Greece.
- Papoutsi-Costopoulou, H., and E. Gouli-Vavdinoudi. (2001). Improving a local common bean (*Phaseolus vulgaris* L.) population for yield, seed size and earliness. Plant Var. Seeds. 14:25–34.
- Papadopoulos, I., Tokatlidis, I., Tamoutsidis, E., (2004): Environmental effects on phenotypic expression are blunted in greenhouse compared to open field, 4th International Crop Science Congress, 2004 Brisbane, Australia.
- Piergiovanni A.R., Cerbino D., Della Gatta, C. (2000). Diversity in seed quality traits of common bean populations from Basilicata (Southern Italy), Plant Breeding, 119: 513–516.

YIELD AND STARCH CONTENT OF POTATOES FROM CONVENTIONAL AND ORGANIC FARMING

KÁŠ, M.[1], DIVIŠ, J.[2], MATĚJKOVÁ, Š.[3]

Key words: potatoes, organic farming, conventional farming, yield, quality

Abstract

Four cultivars of table potatoes were observed during a three-year field experiment in Lukavec, Czech Rep. Yields and qualitative parameters of table potatoes, such as starch content and tuber size categories, were compared in two different growing systems – organic and conventional. In the study, favourable (clover) and less favourable (wheat) effects of preceding crops on potato yield were observed.

Introduction

Organic farming is a form of agriculture which bans the use of synthetic fertilizers and pesticides, plant growth regulators, as well as genetically modified organisms. As far as possible, organic farmers rely on crop rotation, integrated pest management, crop residues, compost, and mechanical cultivation in order to maintain a healthy soil environment and for the control of pests (Singh et al., 2008). Managing soil fertility is recognized as a cornerstone for maintaining crop production potential (Mallory et al., 2007). Year to year variations in yields are an inherent risk associated with crop production, and many growers rely on intensive mechanical or chemical inputs in order to preserve crop yields in the face of fluctuating environmental conditions (Smith et al., 2007).

Materials and methods

Four table varieties of potatoes belonging to different maturity groups (Adela, Bionta, Ditta, and Magda) were tested in a field experiment during years 2006–2008. The field experiment was carried-out at the Lukavec experimental station, near Pacov (Czech Republic). The soil and climatic conditions are shown in Table 1.

Tab. 1: Description of the Lukavec research area.

Altitude (m above sea level)	620
Soil texture	sandy-loam soil
Soil type	Cambisol
Average annual air temperature (°C)	6.9
Average annual precipitation (mm)	686

[1] Crop Research Institute Prague – Ruzyně, Czech Republic, e-mail: kas@vurv.cz
[2] University of South Bohemia, Faculty of Agriculture, České Budějovice, Czech Republic
[3] Crop Research Institute Prague – Ruzyně, Czech Republic

The cultivars of potatoes were tested in two different growing systems: the organic system (OS) and conventional system (CS), after two different preceding crops: favourable (clover) and a less favourable one (wheat). Potatoes under the organic farming system were grown according to regulation board standard 2092/91; the conventional system was without restrictions. Farmyard manure, at the rate of 30 $t.ha^{-1}$ was applied in both systems after wheat. After clover, manure was not applied. Mineral fertilizers in doses of 100 kg $N.ha^{-1}$, 80 kg $P_2O_5.ha^{-1}$ and 100 kg $K_2O.ha^{-1}$ were used in the conventional treatments. Likewise, potatoes were treated with pesticides. The width of each row was 0.75 m, and the density was 45 000 tubers per hectare. Protection against potato blight (*Phytophtora infestans*) in the organic variants with plot size 10 m^2 was accomplished with an allowed copper preparation. Preparation Novodor with active Bacillus thuringiensis was allowed at market. Registration of this preparation was expired. There is not any registered product against the potato beetle (*Leptinotarsa decemlineata*) in the Czech Republic available for organic farming (Šarapatka et al. 2006). The organic variants were cultivated twice by mechanical tools during vegetation, while herbicides were only used in the conventional plots. The yields of tubers and the starch contents were observed. Seven bunches from each experimental plot were analysed and the total number of tubers were counted. Tubers were divided into three size categories: <3 cm, 3–7 cm, and >7 cm. Results of the field experiment were analysed with STATISTICA CZ 8.0 software. Analysis of variance and the Tukey HSD test were performed.

Results

Significant difference between the conventional system and the organic system in the tuber yields was found Yield reduction under organic management were mainly caused by diseases and pests that reduced the leaf area of the potato plants and limited growth duration. Late blight (*P.infestans*) is the greatest limiting factor in potato production. It was confirmed in 2007, which had dry and hot weather. Potatoes matured at the same time in both systems. A decrease in yield was observed in 2008 with the organic farming system due to the expansion of potato beetles from neighbouring fields. This expansion of the potato beetle could not be regulated by hand collection, and the plants were destroyed. The potato yields for the observed years are shown in figure 1.

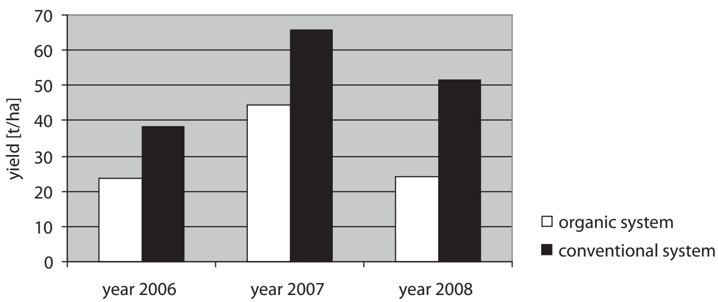

Figure 1: Potato yields in two growing systems in observed years

A significant influence of the preceding crops upon potato yields was found (see Fig. 2 and Tab. 2). The potato yield after clover was about 8 t/ha greater than after wheat amended with manure. We did not observe any significant differences among the varieties used. As it was possible to derive from results, the potato yield can be affected preceding crops in organic and conventional growing system. Potato yields differed in both growing systems. The difference in potato yield after clover and wheat was low in varieties Ditta and Magda and was great in varieties Adéla and Bionta in both growing systems.

Tab. 2: Average values of potato yields after foregoing crop.

Preceding crop	Yield * [t/ha]
wheat	37.47[a]
clover	45.12[b]

*the values for yields, with different letters, are significant at $p \leq 0.05$

Significant differences of the starch content among cultivars were observed (Tab. 3). On the other hand, neither the preceding crop nor the growing system had a significant effect on the starch content. With the organic system, a significantly higher number of tubers in a bunch, and a higher proportion of tubers within the 0 – 3 cm size category were observed. Neither the foregoing crop nor year had any noticeable effect on the number of tubers in a bunch, nor the proportion of tubers being in any special size categories.

Tab. 3: Starch content of potato cultivars.

Cultivars	Starch content * [%]
Adela	11.76[a]
Ditta	11.93[ab]
Bionta	13.08[bc]
Magda	14.28[c]

*the values of starch content, with different letter combinations, are significant at $p \leq 0.05$

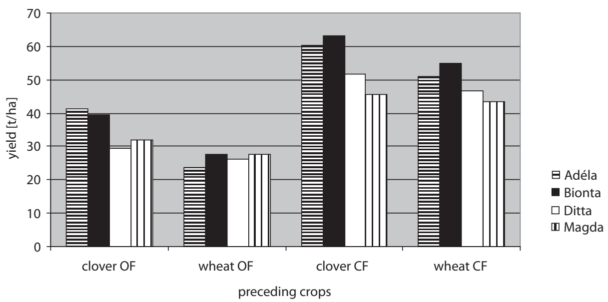

Figure 2: Effect of preceding crops on potato yield in both growing systems

Discussion

The results of our experiment showed a positive influence of use of a preceding leguminous crop (clover), which ensured a higher yield of potatoes under both growing systems when compared with wheat plus manure (Tab. 2). An increase of potato yield is commonly reported as a result the application of organic manure (e.g. Kleinhenz, 2003). Sturz et al. (2003) found that a preceding clover cultivar had no influence upon the studied cultivars of potato. However, some of cultivars showed a significant yield advantage (P = 0.05). During 2002 – 2004, research was carried-out in Poland to compare the marketable yields (that part of the total yield which meets the requirements of market purchasers) of potato tubers from organic plantations, compared to those grown using an integrated system. These results indicated that, generally, the share of marketable yield to the total yield was lower from the organic farming than that from the integrated systems (Nowacki, 2007).

Conclusions

The protection of potato plants against potato blight and the potato beetle in ecological (organic) farming system seems to be the most important condition for success. A high yield attained due to a good foregoing crop may be devalued due to a high proportion of small tubers that produce a less marketable product.

Acknowledgments

This contribution was supported by NAZV Project QG5004.

References

- Kleinhenz, M. D., Cardina, J. 2003. Compost application effects on weed populations and crop yield and quality in three early-maturing, organically-managed potato (Solanum tuberosum) cultivars. Acta Horticulturae, Issue 19, p. 337–343.
- Makléry, E. B., Porter, G. A. 2007. Potato yield stability under contrasting soil management strategy. Agronomy Journal 99. Issue 2. p. 501–510.
- Nowacki, W. 2007. Marketable yield and storage losses of table potatoes grown using organic and integrated farming systems. Journal of Research and Applications in Agricultural Engineering. 52: 4, 5–9.
- Smith, R. G., Menalled, F. G., Robertson, G. P. 2007. Temporal yield variability under conventional and alternative management systems. Agronomy J. 99: 1629–1634.
- Singh, A. P., Luthria, D., Wilson, T., Vorsa, N., Singh, V., Banuelos, G., S., Pasakdee, S. 2008. Polyphenols content and antioxidant capacity of eggplant pulp. Food Chemistry Volume 114, Issue 3, 1 June 2009, p. 955–961.
- Sturz, A. V., Arsenault, V., Christie, B. R. 2003. Red clover potato cultivar combinations for improved potato yield. Agron. J. 95: 1089–1092.
- Šarapatka, B., Urban, J. et al. 2006. Ekologické zemědělství v praxi, PRO-BIO, Šumperk. (in Czech) 502 pages.

ECOLOGICAL GROWING OF FODDER BEET

HONSOVÁ, H.,[1] & BEČKOVÁ, L.[2]

Key words: fodder beet, varieties, organic farming, yield

Abstract

Six fodder beet varieties and one sugar beet variety were compared in three-year experiments at the ecological area in Uhříněves (in 2005 and 2006 Lenka, Hako, Kostelecká Barres, Jamon, Monro, Starmon and sugar beet Merak, in 2007 Bučanský žlutý válec site of Kostelecká Barres). Variety Hako had the highest yield of bulbs from all varieties in 2005 and 2006. The varieties Bučanský žlutý válec and Hako had the highest yield of bulbs of all in 2007. It turned out, that all tested varieties are suitable for ecological farming. High yields in 2005 were obtained by varieties Monro, Hako and Kostelecká Barres, in 2006 by Hako and Jamon and in 2007 by Bučanský žlutý válec and Hako. Statistically significant differences were determined among years of growing and among varieties.

Introduction

Fodder beet areas in the Czech Republic are still diminishing. This crop could find new use in organic farming. Fodder beet is due to its composition suitable solution of energy deficiency and fiber excess in winter feed rations. Fodder beet in ecological systems of growing is not only a good precrop, but it is first of all valuable feed for young and breeding animals. Its easy digestible pulp, high content of mineral elements and vitamins give it a favourable place in fodder rations of poultry, sows, rabbits and other kinds of small animals. It is also used for cattle in foothills, where quality production of ecological maize silage would be difficult (Šroller – Pulkrábek, 1993). The aim of our research was to compare and to recommend varieties of fodder beet for organic growing based on an evaluation of the productivity.

Materials and methods

In three years experiments (2005–2007) small-plot trials were established (in four repetitions on plots with harvest area of ten square meters) with fodder beet on certified and controlled ecological area of Experimental Station of Department of Crop Production in Uhříněves. Six cultivars of fodder beet were used in experiment – especially volume types (Lenka, Hako, Jamon and Monro) and intermediat type (Kostelecká Barres, Starmon) and sugar beet cultivar Merak (Table 1). Only in 2007 variety Bučanský žlutý válec compensated variety Kostelecká Barres. Row distance reached 45 cm, spacing in row 19 cm.

During vegetation stands were kept in non-weed state by inter-row hoeing and by manual hoeing and weeding in rows. No chemical protection against fungal diseases was used.

---

[1] Czech University of Life Sciences, Faculty of Agrobiology, Food and Natural Resources, Department of Crop Production, Kamýcká 1219, Prague, Czech Republic

[2] As above

Number of plants per plot was determined before harvest. Harvest was performed by manual collection of roots, which were weighed in a field. Average weight of one root was determined and also total yield per hectare was recorded.

The results were evaluated by statistical program SAS using analysis of variance at significance level α = 0,05. Confirmatively different values are marked with different letters (a, b,c, d).

Results and discussion

Yields of roots were strongly influenced by year of growing and by crop density at harvest (Figure 1). Due to timely sowing and favourable weather conditions in 2005 beet emerged well. In 2005 after singling we obtained balanced and high numbers of plants at individual plots. Long winter, late start of spring and drought in the period after sowing in 2006 caused lower emergence. In 2006 total numbers in individual variants were relatively low in order to achieve relative uniformity between plots. In 2007 due to rainfall deficiency in period after sowing the plants emerged slowly and the canopy was off balance.

In 2005 cultivars Monro, Starmon, Hako and Kostelecká Barres reached yields of roots above one hundred tons per hectare, while in 2006 and 2007 none of varieties exceeded this level (Table 1). In 2006 the highest yields were reached in cultivars Hako and Jamon. In 2006 the highest yield of roots reached varieties Hako and Jamon, in 2007 Bučanský žlutý válec and Hako. In average of three years the most yielding cultivar was Hako (Figure 3).

Weight of one root (Figure 2) was determined so by genetic dispositions of varieties and the canopy density and weather conditions. In average of three years varieties Lenka, Kostelecká Barres and Hako had the highest root weight.

Our experiments confirmed that cultivar Hako is very economic and if we can obtain quality seed, which is the first condition for complete stand, and high number of plants per ha (70 – 90 thousands of plants per hectare), cultivar Hako would belong to the best varieties of our assortment. Monogerm French cultivars Monro, Starmon and Jamon, delivered with high quality of seed, are equivalent to domestic varieties.

Fodder beet cultivars even without chemical treatment against foliar diseases provide very good yields ensuring economic efficiency of their growing.

Tab. 1: Yield of sugar beet and fodder beet roots.

Variety	Roots yield (t*ha-1)			
	2005	2006	2007	Average
Merak	83,3 a	37,6 c	69,2 bc	63,4 c
Lenka	90,9 abc	79 ab	86,3 a	85,4 b
Hako	106 cd	91,5 a	89,4 a	95,6 a
Kostelecká Barres	104,3 bcd	61,8 bc		83,1 b
Jamon	88,6 ab	87,5 ab	84,2 ab	86,8 b
Monro	108,9 d	74,6 ab	86,4 a	90 ab
Starmon	106,3 cd	70,1 ab	71,0 c	82,5 b
Bučanský žlutý válec			91,3 a	91,3 ab

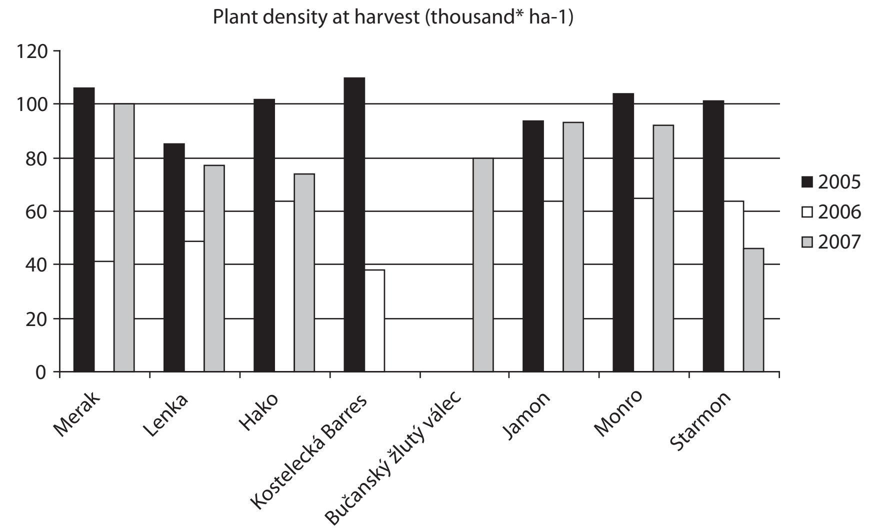

Figure 1: Plant density at harvest (thousand* ha^{-1})

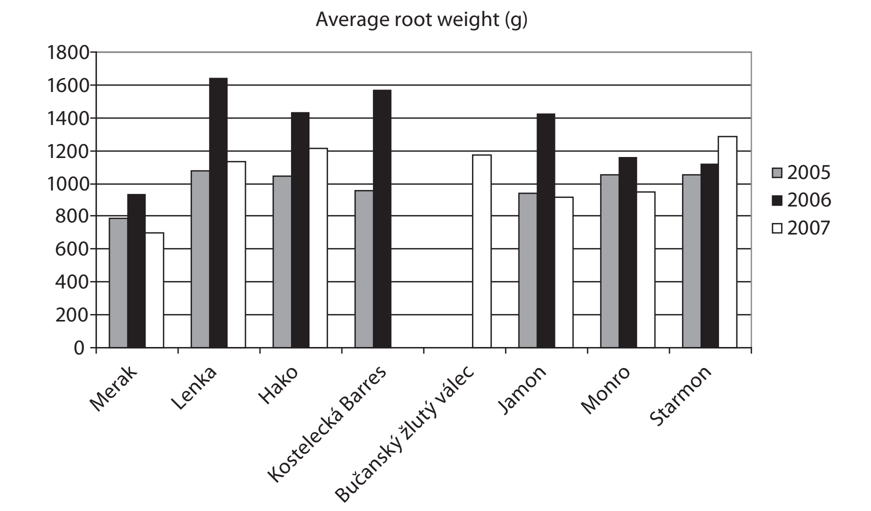

Figure 2: Average root weight (g)

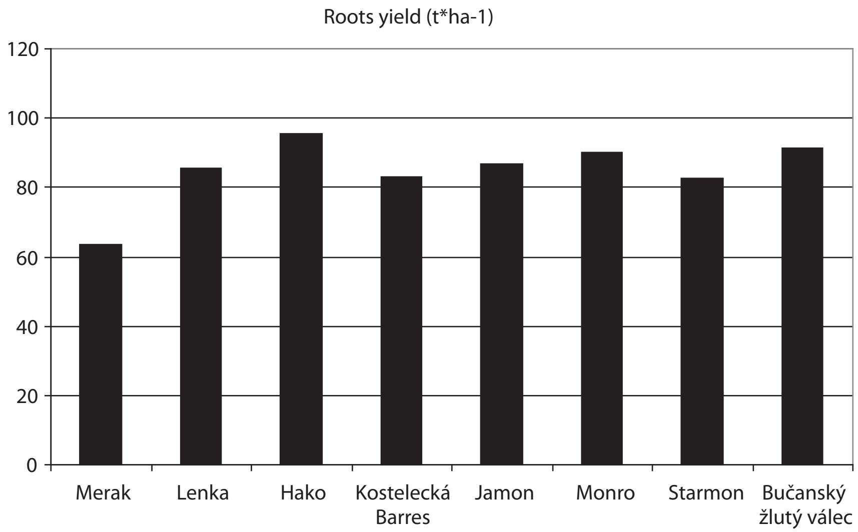

Figure 3: Yields of beet roots in t*ha-1 (average of three years)

Conclusion

In all three years (2005–2007) high yields of fodder beet roots were reached. In average of three years the best yielding cultivar was Hako (95,6 t.ha-1). It confirmed that French cultivars Monro, Starmon and Jamon are very yielding and regarding quality of seed they are suitable also for modern technologies of growing. Evaluated cultivars of fodder beet are suitable also for growing in organic farming. Yields of roots were strongly influenced by year of growing and by number of plants in harvest.

We can say that fodder beet is suitable plant for enlargement of crop rotations in organic farming. However organic grower must count with work-intensive weed control, digging and weeding. Need of hand labor is in organic farming without chemical protection great.

Acknowledgments

Supported by Ministry of Agriculture of the Czech Republic, Grant NAZV No. Q 650034 and research project 6046070901.

References

- Šroller J., Pulkrábek J. (1993): Základy pěstování krmné řepy, Institut výchovy a vzdělávání, Ministry of agriculture CR, Prague, 32 p.

EFFECT OF GRASS MULCH APPLICATION ON TUBERS SIZE AND YIELD OF WARE POTATOES IN ORGANIC FARMING

DVOŘÁK, P.[1], HAMOUZ, K.[1], KUCHTOVÁ, P.[1] & TOMÁŠEK, J.[1]

Key words: grass mulch, potato, yield, soil

Abstract

The aim of this experiment was to evaluate influence of mulching on the tuber yield and on the number of ware potatoes. In organic farming grass mulch for potatoes was used in 2008. For the experiments different ways of mulching (grass mulch after planting, grass mulch after second hoeing) were used and compared with bare soil (control variant). The results showed that grass mulching had positive effect on the yield of ware potatoes and some of the yield-forming components. The yield of ware potatoes was significantly higher by 9.3 t/ha in comparison with control variant. The highest number of ware potatoes was found out in the variant with grass mulch after planting.

Introduction

The effect of organic mulch on tuber yield can have been variable, and this was mainly attributed to differences in climatic conditions. While increase of the yield through straw mulch was frequently found under hot and dry summer conditions (Bushnell and Welton, 1931; Singh et al., 1987). Decrease of the yield under straw mulch has also been reported and was attributed to below-optimum soil temperature (Opitz, 1948) and reduced soil nitrate levels (Scott, 1921). Increasing of the quantity of applied mulch increases the effects on soil moisture and temperature (Scott, 1921; Russel, 1940). Therefore, large application rates of mulch (10 t/ha and more), which were common in previous studies and practice; appear to increase the risk of yield reduction in cooler climates.

Materials and methods

In 2008 field trial was conducted at Experimental station of Department of Crop Production of the Czech University of Life Science Prague-Uhříněves (sugar beet growing region, 295 m a.s.l., average of annual temperature 8.4 °C and annual precipitation 575 mm). Clay-loam cambisol has topsoil deep 250–300 mm, with neutral pH, organic matter content 1.74–2.12 %.

The experimental station in Uhříněves is certified for carrying out the experiments in organic farming.

For the experiments, two pre-germination varieties of early potatoes Finka and Katka were used in the different ways of mulching (grass mulch after planting, grass mulch after second

[1] Czech University of Life Science Prague, Faculty of Agrobiology, Food and Natural Resources, Department of Crop Production, Kamýcká 129, 165 21 Prague-Suchdol, Czech Republic, E-Mail dvorakp@af.czu.cz, Internet www.czu.cz

hoeing) and in the control variant without mulching (bare soil). All variants were provided in four parallel repetitions.

Czech University of Life Science Prague, Faculty of Agrobiology, Food and Natural Resources, Department of Crop Production, Kamýcká 129, 165 21 Prague-Suchdol, Czech Republic, E-Mail dvorakp@af.czu.cz, Internet www.czu.cz

The manual harvest was done 118 days after planting. Harvested tubers were sorted out into four size fractions (under 40, 40–55, 55–60 and above 60 mm).

Post harvest analyses were focused on the determination of the yields from each variant. Summary statistics of the effect of mulching and variety on tubers yield were obtained using Statgrafic Plus 5.1. Statistical analyses were performed using the ANOVA. Means were compared using Tukey test at the level of significance $\alpha = 0.05$.

Results and discussion

The results showed that mulching had affected the yield of ware potatoes and some of the yield-forming components. The highest numbers of ware potatoes were found out in variant with grass mulch after planting (Table 1). In trials of Döring et al. (2005) tuber size fractions were not significantly affected by straw mulching.

These results with grass mulch do not go along with recent experiments with the effect of straw mulch, which did not show any significant yield response of potatoes to straw mulch (Stoner et al., 1996; Edwards et al., 2000).

Tab. 1: Influence of grass mulching on the number and size of tubers (on average of varieties).

Variants	Structure of tubers under hill							
	under 40 mm		40–55 mm		55–60 mm		above 60 mm	
	weight (g)	No.	weight (g)	No.	weight (g)	No.	weight (g)	No.
Bare soil (control)	164.0	7.7	580.8	6.9	124.7	0.8	89.0	0.4
Grass mulch after planting	195.2	8.8	682.0	7.5	214.2	1.5	223.9	1.2
Grass mulch after second hoening	124.1	5.0	624.0	7.5	183.6	1.3	129.4	0.6

The results from precise field experiment proved the significantly positive effect of grass mulch applied after planting on the yield of ware potatoes (Fig. 1). The yield of ware potatoes from the plots with grass mulch used after planting was significantly higher by 9.3 t/ha in comparison with control variant (without mulch). Whereas Döring et al. (2005) show that response of the tubers yield to straw mulch were not significant in any experiments and the trends of mulching effects on yield were evenly distributed (positive trend in five experiments, negative trend in six experiments).

Higher yields under grass mulch have mostly been attributed to increased soil moisture, similarly as shown for straw mulch under arid and semiarid conditions (Singh et al., 1987; Saha et al., 1997; Chandra et al., 2002).

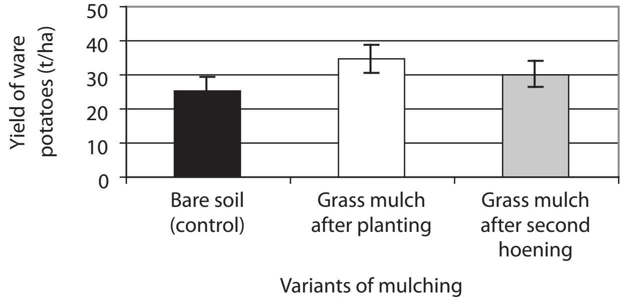

Figure 1: Effect of mulching on the yield of ware potatoes
Note: vertical lines represent minimum significant difference ($HSD_{0.05}$)

Conclusions

The results of the application of grass mulch on the ridge of potatoes from the first experiment year signify fair chance for organic farming because the yield of ware potatoes were significantly higher by 9.3 t/ha in comparison with variants without mulch.

Acknowledgments

This study was supported by the Research Project of the Ministry of Education, Youth and Sports of the Czech Republic, MSM 6046070901, the Project of the Ministry of Agriculture of the National Agency for Agricultural Research No. QH 82149 and Project of CULS CIGA reg. No. 213112 – 2009.

References

- Chandra, S., Singh, R.D., Bhatnagar, V.K., Bisht, J.K. (2002): Effect of mulch and irrigation on tuber size, canopy temperature, water use and yield of potato (Solanum tuberosum). Indian J. Agron., 47, 443–448.
- Döring, T.F, Brandt, M., Heß, J., Finckh, M.R., Saucke, H. (2005): Effects of straw mulch on soil nitrate dynamics, weeds, yield and soil erosion in organically grown potatoes. Field Crops Res., 94, 238–249.
- Opitz, K. (1948): Über den Einfluß von Brachehaltung und Bodenbedeckung mit Stroh auf den Temperaturgang in 30 cm Bodentiefe. Z. Pflanzenern., Düngung, Bodenkunde, 41, 213–222.
- Russel, J.C. (1940). The effect of surface cover on soil moisture losses by evaporation. Soil Sci. Soc. Am. Proc., 4, 65–70.
- Saha, K.U., Hye, A., Haider, J., Saha, R.R. (1997): Effect of rice straw mulch on water use and tuber yield of potato grown under different irrigation schedules. Jpn. J. Trop. Agric. 41, 168–176.
- Scott, H. (1921): The influence of wheat straw on the accumulation of nitrates in the soil. J. Am. Soc. Agron. 13, 233–258.
- Singh, P.N., Joshi, B.P. and Singh, G. (1987): Effect of mulch on moisture conservation, irrigation requirement and yield of potato. Indian J. Agron., 32, 452–454.

BLACK POLYPROPYLENE NON-WOVEN TEXTILE AS MULCH IN ORGANIC AGRICULTURE

DVOŘÁK, P.[1], HAMOUZ, K.[1], KUCHTOVÁ, P.[1], TOMÁŠEK, J.[1] & ERHARTOVÁ, D.[1]

Key words: polypropylene black mulch, soil temperature, soil water potential, weed

Abstract

Black polypropylene textile was used in potatoes by organic agriculture and it had positive effect on soil temperature (in the depth of 100 mm). Slightly higher soil temperatures under black polypropylene mulch in the vegetation period after planting had favourable influence on earlier stands emergence. The soil water potential (in the depth of 250 mm) and also the soil water content have been beneficial for black polypropylene mulch. Significantly lower values of the soil water potentials have been found in the period after planting and at the end of vegetation. Black polypropylene mulch provided favourable temperatures and soil moisture.

Introduction

Black polyethylene mulches are used for weed control in a range of crops under the organic system. The use of black polypropylene woven mulch is usually restricted to perennial crops. Various colours of woven and solid film plastics have been tested for weed control in the field (Horowitz, 1993). White and green covering had little effect on weeds, whereas brown, black, blue or white on black (double colour) films prevented weeds emerging (Bond and Grundy, 2001). There are additional environmental benefits if the mulch is made from recycled materials (Cooke, 1996).

Aim of this research was found favourable growing procedure of the potatoes in organic agriculture. Foil or black mulches textile reduce weed biomass, increase soil temperature and soil water content but their application in praxis is exacting.

Materials and methods

The trial was conducted in year 2008 at Experimental station of Department of Crop Production of the Czech University of Life Science Prague-Uhříněves. The altitude of the site is 295 m a.s.l., the average of annual temperature is 8.4 °C and annual precipitation is 575 mm (detailed information Table 1). The type of soil is brown soil with high nutrient reserve. Texture class of soil is clay loam. Organic matter content is 1.74–2.12 %.

For the experiments were used black polypropylene non-woven textile and comparison with bare soil (control treatment). Two varieties of early potatoes Finka and Katka were used.

[1] Czech University of Life Science Prague, Faculty of Agrobiology, Food and Natural Resources, Department of Crop Production, Kamýcká 129, 165 21 Prague-Suchdol, Czech Republic, E-Mail dvorakp@af.czu.cz, Internet www.czu.cz

All treatments were provided in four parallel determinations. Black polypropylene non-woven textile was covered on form ridges before hand-planting. During the planting were tubers set to prepared holes in demand of spacing (450 mm x 800 mm). Tuber yield with black textile mulch was by 1.4 t/ha lower than control (bare soil).

The results from weed control showed the positive effect of black polypropylene woven mulch on weeds biomass (by 89 % lowest weight of weed biomass in comparison with control variant.

Tab. 1: Temperature and precipitation in experimental periods and longterm average.

Longterm average	Month										
	I.	II.	III.	IV.	V.	VI.	VII.	VIII.	X.	XI.	XII.
Air Temperature (°C)	-2.1	-0.8	3.4	8.2	13.4	16.3	18.2	17.5	8.6	3.2	-0.5
Precipitation (mm)	28	27	31	46	65	74	74	72	41	34	34

Results and discussion

Black polypropylene mulch used in potato stand did not influence soil temperature in the depth of 100 mm (Table 2). Even though in certain periods (Fig. 1) the soil temperature was lower under black polypropylene mulch in comparison with non-mulch variant (control variant).

This is confirmed by results of the Ossom and Matsenjwa (2007) with black polythene mulch, where the highest soil temperature (in the depth of 100 mm) was found in non-mulch variant and the lowest soil temperature was found in grass mulch.

Slightly higher soil temperatures (after planting) under black polypropylene mulch influenced favourably earlier potatoes stands emergence.

Tab. 2: Average month soil temperature (°C) and soil water potential (kPa) in vegetation period 2008 Prague-Uhříněves.

Month	Soil Temperature (°C)		Soil Water Potential (kPa)	
	Bare soil (control)	Black polypropylene woven mulch	Bare soil (control)	Black polypropylene woven mulch
IV.	12.4	12.5	5.7	4.9
V.	15.9	15.6	25.8	21.4
VI.	18.2	18.0	69.3	66.7
VII.	19.2	19.3	44.0	37.5
VIII.	23.0	22.8	61.2	33.3
Average	17.7	17.6	41.2	32.8

The soil water potentials measured in the depth of 250 mm have been according to monthly averages always lower under the black polypropylene mulch (Table 2). Lower soil water potentials signify higher soil water content and use of black polypropylene mulch increased soil water content. Similarly as in soil temperature, also in soil water potentials, there have been periods with more significant differences among experimental variants, i.e. in the period after planting and at the end of vegetation (Fig. 2).

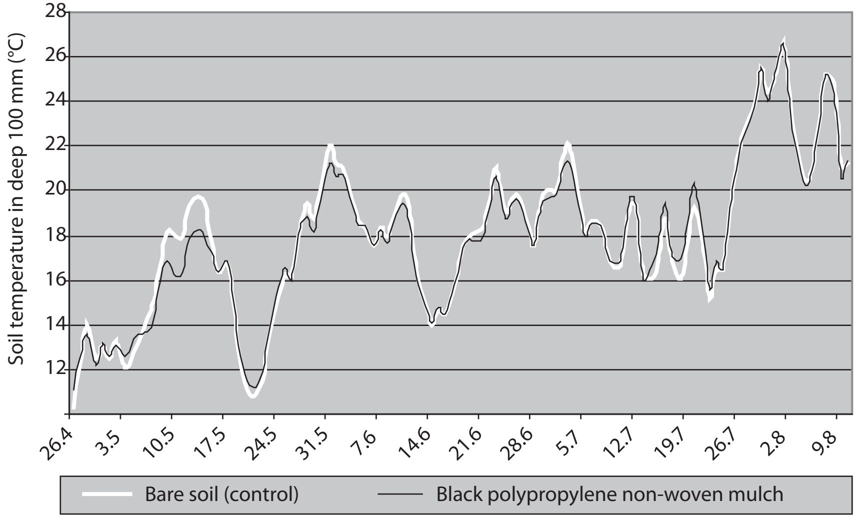

Figure 1: The course of the soil temperatures (°C) in deep 100 mm in crop of potatoes

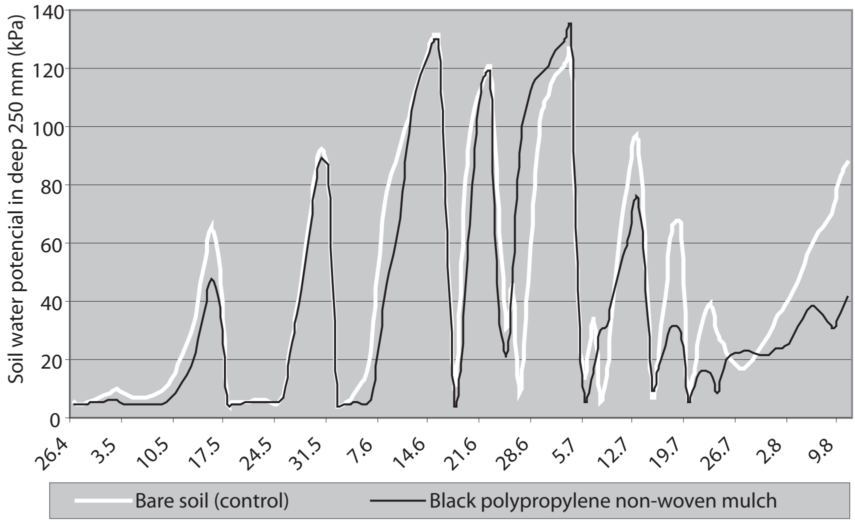

Figure 2: The course of the soil water potential (kPa) in deep 250 mm in crop of potatoes

From evaluated variants (no mulch, grass mulch, black polythene mulch, clear plastic mulch and newspaper mulch) the second lowest soil moisture was found in variant with black polythene mulch (Ossom and Matsenjwa, 2007).

Another important finding, i.e. for organic growers, is that mulch textile significantly regulates potatoes weeding. The results from weed control showed the positive effect of mulching on weeds biomass, where by 89 % lower weight of weed biomass was found in black polypropylene woven mulch in comparison with control variant (bare soil).

Conclusions

Black textile mulch had positive effect on soil temperature (speed up emergence), soil water potential (average by 8.4 kPa lower water potential) and textile mulch thus decrease need of irrigation. Textile mulch significant ability to regulate weeding in the growing technology of potatoes. It is opens up a possibility of its wider use in the system of organic farming.

Acknowledgments

This study was supported by the Research Project of the Ministry of Education, Youth and Sports of the Czech Republic, MSM 6046070901, the Project of the Ministry of Agriculture of the National Agency for Agricultural Research No. QH 82149 and Project of CULS CIGA reg. No. 213112 – 2009.

References

- Bond, W. and Grundy, A.C. (2001): Non-chemical weed management in organic farming systems. Weed Research, 41, 383–405.
- Cooke, A. (1996): Mulch ado about paper. Grower, Nexus Horticulture. Swanley, UK, 126, 17.
- Horowitz, M. (1993): Soil cover for weed management. In: Communications 4rh Conference IFOAM, Non-chemical Weed Control, Dijon, France, 149–154.
- Ossom, E.M. and Matsenjwa, V.N. (2007): Influence of mulch on agronomic characteristics, soil properties, disease and insect pest infestation of dry bean (Phaseolus vulgaris L.) in Swaziland. Journal of Agricultural Sciences, 3 (6), 696–703.

ALTERNATIVE PROTECTION OF POTATOES IN ORGANIC FARMING

TOMÁŠEK, J.[1] & DVOŘÁK, P.[1]

Key words: Colorado beetle, late blight, protection, vegetable extract, organic farming

Abstract

There were tested water extracts from Syringa vulgaris and Pyrethrum parthenium. They did not prove significant differences of decrease of the air attack of Colorado potato beetle (Leptinotarsa decemlineata), the activity of eggs – laying and the occurrence of larvae in comparison to the control. Interesting trends of lower-eggs lying and a lower larvae occurrence were discovered. The liquid spray against the late blight (Phytophthora infestans) did not significantly decrease neither occurrence of late blight or the yield.

The production of the bio-potatoes is only 0,2 % of all potatoes production in the Czech Republic. The aim of this experiment was to try alternative methods of regulation of Colorado potato beetle and late blight (the biggest harmfull organisms of potatoes).

For biological agriculture could be also suitable water extracts. These are possible to use as protection of potatoes against unfavorable factors (Colorado potate beetle and late blight) and increase yield and quality of production.

Materials and methods

The trial was conducted in year 2008 at Experimental station of Department of Crop Production of the Czech University of Life Science Prague-Uhříněves. The altitude of the site is 295 m a.s.l., the average of annual temperature is 8.4 °C and annual precipitation is 575 mm. The type of soil is brown soil with high nutrient reserve. Texture class of soil is clay loam. Organic matter content is 1.74–2.12 %.

Experimental station Uhříněves is certified organic for conductance of experiments in organic agriculture.

Pyrethrum parthenium, *Syringa vulgaris* and *Juglans regia* were chosen as plants, which could have favourable effect on the regulation of the mentioned harmfull organisms. For these purposes were prepared extracts from mentioned plants and subsequently liquids for the application on potatoes in organic farming. During selection these plants were used results and experience publicize from laboratory experiments. The next liquid was used skimmed bio-milk and commercial preparation Bioan or Kuprikol 50 (table 1).

[1] Czech University of Life Science Prague, Faculty of Agrobiology, Food and Natural Resources, Department of Crop Production, Kamýcká 129, 165 21 Prague-Suchdol, Czech Republic (e-mail: tomasek@af.czu.cz)

Tab. 1: Review spray liquids used during experiments in experimental station Uhříněves.

The spray liquids against Colorado beetle – 4 applications per vegetation	
PYR	5 % liquid from *Pyrethrum parthenium.* (300 l/ha)
SYR	5 % liquid from *Syringa vulgaris* (300 l/ha)
The spray liquids against the late blight – 3 applications per vegetation	
CU	Kuprikol 50 (84 % cuprum oxychloride) 1 application = 0,4 kg in 300 l Kuprikol 50/ha
ML	5 % liquid from the skimmed milk (300 l/ha)
JUG	5 % extract from *Juglans regia* (300 l/ha)
B	5 % liquid of preparation Bioan (20 % lecithin, 10 % albumin + milk casein) (300 l/ha)

Results

The liquids used for regulation of Colorado beetle (*Pyrethrum parthenium*, *Syringa vulgaris*) did not prove significant differences in fly-attack of beetles, the activity of laying the eggs and occurrence of larvae in comparison to control (table 2). Though during this experiment were there discovered interesting trends of lower eggs-lying *(Pyrethrum p.* -24,5 % *and Syringa. v.* -19,4 %) and trends of larvae lower occurrence (*Pyrethrum p.* -26,8 % and *Syringa v.* -12,6 %). These liquids were applied from the first beetle fly-attach till ablation tops (interval 7–10 days).

Tab. 2: The influence spray liquids to beetle-occurence (Colorado beetle).

treatment	the number of Colorado beetle for 10 plants	the number of larvae for 10 plants	the nest of eggs for 10 plants
Controle	1,23 a	31,08 a	0,98 a
Pyrethrum	1,42 a	22,76 a	0,74 a
Syringa	1,55 a	27,17 a	0,79 a
(LSD) 0,05	0,5644	14,7	0,173

Note: Means with a different letters are significant for P<0.05

Tab. 3: The influence spray liquids to their final effect on production of consumer bulb (valued during harvest).

Spray liquids	Yield of potatoes (t/ha)
Kuprikol 50	30,8 a
Skimmed milk spray	27,6 a
Juglans regia	26,4 a
Bioan	26,2 a

Note: Means with a different letters are significant for P<0.05

The use of liquids Kuprikol 50, skimmed milk and extract from *Juglans regia* did not prove significant differences in late blight bulb attack and consequently the yield of potatos. The liquid spray against the late blight did not significantly decrease neither occurrence of late blight or the yield. The use of Kuprikol 50 reached the biggest yield.

Discussion

The liquid plants extracts are suitable solution for alternative protection in organic farming (Zídek, 1992). Lamparski a Wawrziniak (2004) found out, that plant extracts from *Geranuim sanquineum* a *Pelargonium hortorum* investigated inhibit feeding and development of Colorado potato beetle. Wawrzyniak et Lamparski (2006) tried extracts from fennel (*Foeniculum capillaceum* Gilib.), garden angelica (*Archangelica officinalis* Hoffm.), common caraway (*Carum carvi* L.), garden lovage (*Levisticum officinale* Koch.) and coriander (*Coriandrum sativum* L.). Under lab conditions there was observed an inhibition of larva and beetle development and decrease in feeding effectiveness of all the extracts tested. The highest antifeedant activity was shown by the extracts from *Carum carvi* and *Archangelica officinalis*. Any preparation in our experiments did not prove significant differences in number of beetles and larvae lying. It is necessary to continue in plants extracts-research.

Acknowledgments

The study was supported by Ministry of Education, Youth and Sport of the Czech Republic, Research proposal No. 6046070901, NAZV No. QH82149 and grant from CULS CIGA reg. č. 213112 – 2009.

References

- Dvořák P., Bicanová E. (2007): Brambory v systému ekologického zemědělství. Sborník Ekologické zemědělství 2007. ČZU Praha, 6.–7. 2. 2007: 131–133.
- Lamparski R., Wawrzyniak M. 2004. EFFECT OF WATER EXTRACTS FROM GERANIACEAE (Geraniaceae) PLANTS ON FEEDING AND DEVELOPMENT OF COLORADO POTATO BEETLE (Leptinotarsa decemlineata Say), EJPAU 7 (2), #01. Available Online: http://www.ejpau.media.pl/volume7/issue2/agronomy/art-01.html.
- Wawrzyniak M., Lamparski R. 2006. EFFECT OF *Umbelliferae (Apiaceae)* PLANT WATER EXTRACTS ON COLORADO POTATO BEETLE (*Leptinotarsa decemlineata* Say) FEEDING AND DEVELOPMENT, EJPAU 9 (4), #23. Available Online: http://www.ejpau.media.pl/volume9/issue4/art-23.html.
- Zídek, T. a kol.: Nechemická ochrana rostlin. MZe. Praha. 1992 ISBN 80-209-0237-6.

ORGANIC FERTIFICATION AS AN ECO FRIENDLY MANAGEMENT OF RICE DISEASE *MAGNAPORTHE GRISEA*

THARSHANI N.[1] & MIKUNTHAN. G[1]

Keywords: Rice blast, Disease indices, Disease severity, organic rice, fertification

Abstract

Rice blast is a belligerent plant disease caused by Magnoparthe grizae (Pyricularia oryzae) occurs in rice production areas all over the world and is one of the most common diseases in South Asia. Plant health conditions play a vital role in eco friendly disease management of rice blast. A field study was conducted using most popular rice cultivars AT 401 and H4 during 2007 and 2008 at Navally, Jaffna, where rice blast is a serious problem every year. The objective was to determine the effect of fertification by the effluent water from the toddy distillery unit on rice blast severity. Results exhibited that, there was significant difference between effluent water treated and control in paddy fields. Effluent water treated field was produced more than 31 % and 25 % yield in AT 401 and H4 respectively. Blast incidence was observed AT 401-control (DI =32.2), AT 401-fertification (DI=12.0), H4-control (DI =52.4), and H4-fertification (DI=22.0) and "p" value of organic fertification on blast (0.0002) was highly significant and at 95 % confidential level. There was negative correlation between blast (-0.128) and number of tillers. These findings would be useful in developing an integrated rice blast management, as part of a holistic organic rice production approach.

Introduction

Rice blast disease caused by Magnoparthe grizae has been a major disease of Rice (Oryza sativa L.) worldwide; particularly in warmer growing areas characterized by an average temperature in the month above 270 C. Rice blast causes severe damage under the conditions of cool summer and nitrogen deficiency. High humidity (>92.5 %), leaf wetness and temperature (24 to 30 °C) are favorable conditions for disease development (Picco and Rodolfi, 2002). Rice blast can be found during the whole growing season. Pathogens can cause severe damage to rice crops that often lead to reduced crop yield and quality. The use of large amounts of fungicide can effectively control most crop diseases and decrease the loss in crop production. However, pesticide increases costs to growers while environmental problems may be incurred to soil, water, air and ecological systems (West et al., 2003). Plant health conditions play a key role in farm pest management and crop protection (Everitt et al., 1994).

In Jaffna Navally distillery unit play a major role in palmayrah toddy value addition process next to Thikkam distillery. The effluent water from distillery is organic with high level of minerals and nutrients. In fertificated paddy field low level of pest incidence was observed and there was no any systematic study conducted in rice diseases (DM, 2007). This research was conducted to understand and quantify the relationship between rice blast disease and effluent water.

[1] Department of Agricultural biology, Faculty of Agriculture University of Jaffna, Sri Lanka, Tharshanig@yahoo.com

Hypothesis testing

- H1: Distillery effluent water significantly reduces rice blast diseases at 95 % confidential level.
- H0: Distillery effluent water not significantly reduces blast disease at 95 % confidential level

Materials and methods

Study site

The experiment was conducted at the village of Navally, Jaffna. The study site is located with an average annual rainfall is 1200 mm. The growing season is generally short and lasts for 120 days. The mean annual temperature is 27.9 °C and the mean temperatures in October and February are 28.3°C and 26.5 °C, respectively.

Pre flooded fertification and seedling

Fertification is the process of applying fertilizer via irrigation water. Effluent water from the distillery was kept in the sewage pit for a period of 10 to 15 days to keep down the temperature to 26–28 °C. Then it was channeled to the research plot as organic fertification. Fields were flooded with the effluent water while control plots were treated with water. After 21days field were ploughed and seedling were planted. Planting density was 25 seedlings/m^2.

Measurements of Rice blast disease

Disease severity was determined by estimating the percentage of infected surface area of rice leaves in the laboratory.

0 No incidence
1 Small brown speck of pin head size
2 Large brown specks
3 Small, roundish to slightly elongated, necrotic grey spots, about 1–2 mm in diameter, with brown margin
4 Typical blast lesions elliptical, 1–2 cm long, usually confined to the area of the 2 main veins infecting less than 2 % of the leaf area
5 Typical blast lesions infecting less than 10 % of the leaf area.
6 Typical blast lesions infecting less than 11–25 % of the leaf area.
7 Typical blast lesions infecting less than 26–50 % of the leaf area.
8 Typical blast lesions infecting less than 51–75 % of the leaf area and many leaves dead.
9 All leaves dead

- Symptoms were recorded and was quantified in to disease indices (DI =∑ni X i)/(N X imax), i = 0–9, imax = 9, n = no. of plants, N = total number of plants) (Sharma R. C and. Duveiller. E 1990).

Data analysis

A randomized complete block design was used and treatments were replicated five times. Percent leaf surface lesions was estimated, and recorded and transformed in to disease indices and ANOVA was performed to determine the fertification impact on rice blast. The data collected in the experiment were subjected to analyses of variance (ANOVA), hypothesis testing and LSD in SPSS 14 Package. The means were separated by LSD Test at = 0.05 and the results were interpreted accordingly.

Results

Tab. 1: Disease index of fertificated and control fields.

Cultivars	Control	Fertification field	Significance
AT 401	32.2	12	*s
H4	52.4	22	*s

*s- significant for P<0.05

In hypothesis testing (Table1) F tested value was greater than F criticals, ‘p‘ value was 0.00247. Thus there is no any reason to reject hypothesis at 95 % confidential level. That effluent fertification significantly reduced the rice blast in field.

Tab. 2: Number of tillers per plant for H4 And AT 401.

Cultivars	Control	Fertification field	Significance
AT 401	3.75	10	*s
H4	4.25	10.75	*s

* significant for P<0.05

Discussion

Fertificated field produced significantly higher yield than control. There were 0.128 negative correlations between number of tillers and disease incidence that it revealed increase disease incidence will decrease number of tiller formation. Application of distillery water increase the soil nitrogen availability through increase the nitrification microbes. Disease severity of control was found in the scale of 5.5 with 15 to 20 percentage leaves were damaged while fetificated field in the scale of 1.82 with 3 to 4 percent leaves were damaged. Disease index of control and fertificated field was LSD at p< 0.05 revealed there was a significant difference between control and fertificated field. The treated plants while showed more than 31 % and 25 % yield in AT 401 and H4 respectively.

Conclusions

H4 and AT 401 varieties showed reductions in disease severity due to distillery effluent water fertification. This underlines the importance of applying fertification to reduce grain yield losses due to rice blast when fungicide is either unavailable or too costly, a situation frequently encountered by resource-poor farmers in Jaffna. This will lead the organic rice production as a sustainable crop cultivation practices. These findings may be useful in developing an integrated rice blast management program in Jaffna, and elsewhere, as a part of holistic crop management approach. Future resrch should be conducted to identify the nitrification microbes.

References

- Everitt, JH; Escobar, DE; Summary, KR; Davis, MR. 1994.Using airborne video, global positioning system, and geographical information system technologies for detecting and mapping rice diseases. Southwestern Entomologist.; 19 (2): 129–138.
- Picco, AM; Rodolfi, M., 2002 Pyricularia grisea and Bipolaris oryzae: a preliminary study on the occurrence of airborne spores in a rice field. Aerobiologia.; 18 (2): 163–167. doi: 10.1023/A: 1020654319130.
- West, JS; Bravo, C; Oberit, R; Lemaire, D; Moshou, D; McCartney, HA. 2003The potential of optical canopy measurement for targeted control of field crop diseases. Annual Review of Phytopathology.; 41 (1): 593–614. doi: 10.1146/annurev.phyto.41.121702.103726.

STABILITY OF THE YIELD POTENTIAL OF WINTER WHEAT IN ECOLOGICAL AGRICULTURE

PETR, J.[1], MIČÁK, L.[1], ŠKEŘÍK, J.[1]

Key words: ecological agriculture, wheat, yield stability, yield potential

Abstract

During the fifteen-year long observation of ecological experiments conducted according to the rules of IFOAM and the regulations of the Ministry of Agriculture Czech Republic, the yields of winter wheat were evaluated as an indicator of the production potential of an ecological growing system. The average yield of 28 varieties during the period of 1994 to 2008 was 6.42 t/ha, the standard deviation of ± 1.13 t, with the variation coefficient of 17 %.

The yield of wheat in ecological agriculture is formed by the productivity of the ear, i.e. the number of grains and its mass. It is also associated with the dynamics of the nitrogen release, which is highest during the period of the generative organs formation. Varieties with high ear productivity were shown to be suitable for ecological agriculture.One of the criteria of the system sustainability is a permanently good level of available nutrients in the soil. The variation coefficient of the contents for individual nutrients is 10.2–19.5 %. There was no reduction in the contents of available nutrients during the entire period, which indicates that the ecological system of farming was not depleting the soil. The sources of nutrients come form intensive weathering, atmospheric fallout, mineralisation of organic matter in the soil following the pre-crops, and symbiotic fixation of nitrogen by legumes and pulse crops.

Introduction

One of the goals of ecological agriculture is the maintenance of soil fertility. There is a lot of evidence this agricultural system has a character of sustainable agriculture. For instance, Lehocká *et al*., (2008) reports the results of a positive influence of ecological agriculture on the soil pH and on the increase in organic matter in the soil, as well as on the microbiological activity in the soil. Šarapatka *et al.* (2008) also demonstrated a higher proportion of organic matter and thus a higher occurrence of epigeon fauna and greater biochemical soil activity. The research of these and other authors also confirmed the influence of ecological agriculture on the biological activitity in the soil and the occurrence of different groups of edaphon and epigeon. Experiments conducted by Fliessbach *et al*. (2006) over a period of 21 years on ecological as well as conventional plots, similarly confirmed the favourable effects of ecological farming on the biological activity of the soil and its production potential.

---

[1] Czech University of Life Sciences Prague, Czech Republic, Faculty of Agrobiology, Food and Natural Resources, Institute of Crop Sciences CZ 165 21 Praha 6-Suchdol, Kamýcká 129, E-Mail jpetr@af.czu.cz
The study was supported by Ministry of Agriculture project QG 50034 and MSM 604 607 0901.

This study presents the results of ecological farming over a period of 15 years on the production potential of the soil and contents of available nutrients, including mineral nitrogen in the soil. We intend to verify the hypothesis that ecological agriculture is a sustainable system of farming.

Materials and methods

Following an interim period, we have been establishing varietal and agricultural technology experiments with selected crops since 1993. The Station is certificed for ecological agriculture and is inspected every year. The plots are located in a fertile sugar beet region with an average altitude of 295 m and a production potential of the soil being 84 points, which is a very high value. The topsoil contains medium to moderate amount of humus with the content of 1.74 to 2.12 %. The average annual temperature of the air in this area is 8.45°C, and the average total precipitation reaches 575 mm.The experiment pre-crops were either red clover (*Trifolium pratense*) or a pulse crop-cereal mixture for green manure.

The reserves of available nutrients in individual years have been continuously evaluated according to Mehlich as good. The mineral nitrogen content has been determined by an extract in 1 % KCl and by the photometric method using the Skalar equipment. We have an opportunity to judge the effect of long-term ecological farming on the maintenance of the production potential of soils and the nutrients reserves in the soil. We are documenting the production potential by the winter wheat yields and the contents of available nutrients in the soil.

Results and Discussion

The results of the varietal experiments with winter wheat are presented in Figure 1, which shows the yields ranging from 4.37 do 8.55 t/ha. The average yield of the 28 varieties observed annually for the entire experimental period was byl 6.42 t/ha, with the standard deviation of

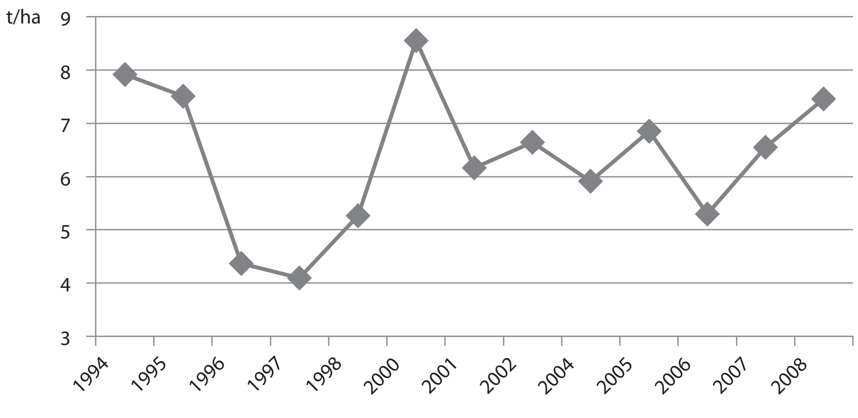

Figure 1: Yields of winter wheat varieties in ecological agriculture from 1994 to 2008

1.13 t and the variation coefficient of 17 %. It is certainly possible to consider these results as a proof of the ecological farming system's sustainability.

The results of yield structure of winter wheat suggest, that the yields are based on a high productivity of the ear. For ecological farming it is, therefore, necessary to select varieties with this yield formation character. An explanation is provided by the dynamics of the available nitrogen release from the soil, which is, depending on the type of pre-crops and ploughed in postharvest debris, as well as green manure, moved into the later period when it supports the formation of generative organs (see Figure 2).

Figure 2 shows that intensive relese of nitrogen started on 15.5. and culminated by the end of June and beginning of July, which happens to be the period of the establishment of the number of the grains and their filling, as well as of the support of the photosynthetic activity of the upper part of the plant and the ear. Thin stands also (through more light, water, nutrients, etc) create via autoregulation of the yield elements the conditions for the establishment of a greater number of the bases for the spikelets, florets and future grains. This is associated with the compensation of the yield elements, when with a small number of plants, tillers and ears a higher number of grains is formed and their mass is also greater.

In the experiments described above there was a stable and good supply of nutrients. The variation coefficient for the phosporus content was 14.1 %, while for potassium it was 19.5 % and for magnesium 10.2 %. During the entire duration of the experiments the P content remained (except for 1994) in the category of good supply (average of 98,8 mg/kg), the same applied to potassium (average 199 mg/kg of soil), while for magnesium the content was satisfactory (131,5 mg/kg of soil) within a permanent range of 120 – 150 mg/kg of soil. The ratio of K/Mg was also good – 1.5.

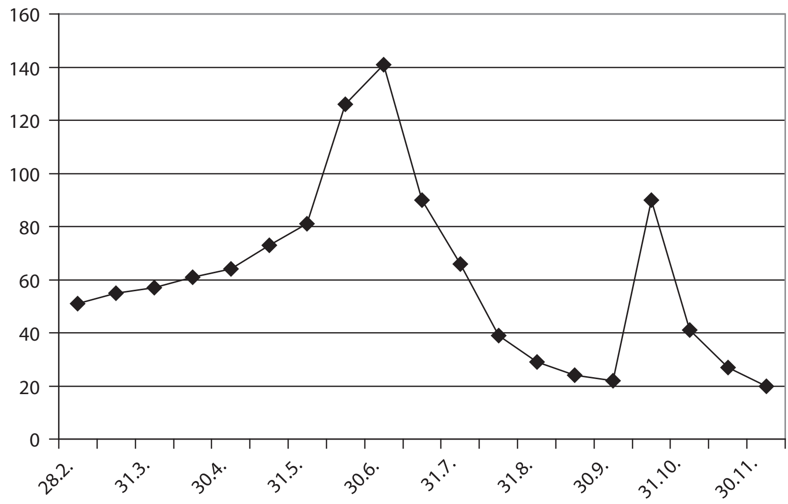

Figure 2: The content of mineral nitrogen in the soil in kg/ha to the depth of 60 cm

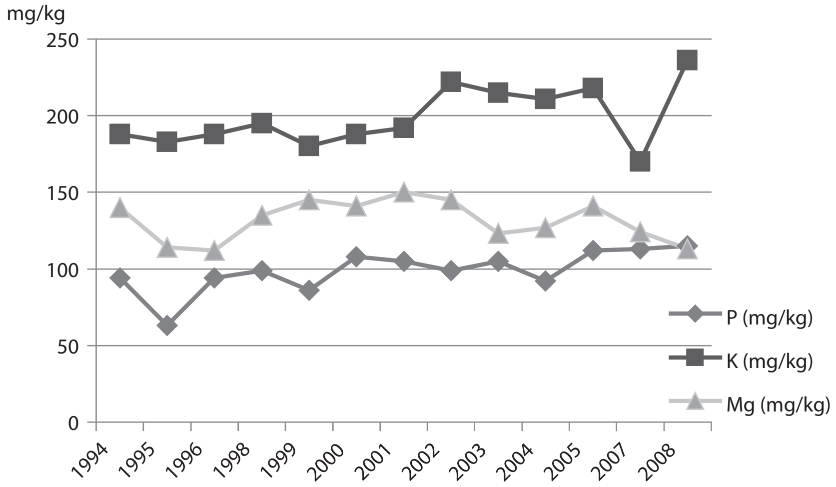

Figure 3: Contents of available nutrients in the soil between 1994–2008

During the fifteen year experiment there has been no decrease in the contents of available nutrients (Figure 3). It is therefore now possible to confirm with these results the veracity of the hypothesis and also that ecological agriculture does not "plunder" the soil. However, this requires that the cultivating system respects all prescribed principles. In experiments we use the value of legumes as pre-crops and the importance of green manure in improving the soil. This also determines the quantity of available nitrogen and the dynamics of its release.

During the fifteen year experiment there has been no decrease in the contents of available nutrients. We can mention weathering as a source of nutrients. Šarapatka *et al.* (2006) state that under the conditions in the Czech Republic the weathering process releases on one hectare 3 kg P, 12 kg K, 48 kg Ca and 13 kg Mg. Under the conditions of our experiments these figures were even higher, as the soil had a permanently neutral pH 6.8 and it is aired by regular ploughing and several mechanical treatments, which reinforces this process.

The high flow of organic matter into the soil determines high formation of carbon dioxide and organic acids, which significantly support the release of nutrients. Large quantities of nutrients were released by the decomposition of the postharvest debris of the pre-crops and green manure (red clover and mixture of pulse crops). There is a high level of nitrogen fixation in these crops, which represents up to 150 kg N after clover and up to 70 kg N after pulse crops. Apart from this, the pre-crops also release 10–20 kg of P, 15–40 kg of K, and 60–100 kg of Ca. Towards the total balance we must also add the atmospheric fallout which provides 20 kg mineral nitrogen, 5 kg of P, 8 kg of K and 15 kg of Mg.

Šarapatka *et al.* (2008) confirmed in our experiments the significance of the flow of organic matter into the soil for the development of the epigeon fauna and the biochemical activity of the soil. Thus he confirmed the significance of the long term ecological experiments for a comprehensive view of the agroecological system of ecological agriculture.

References

- Fliessbach, A., Oberholzer, H., Gunst, L., Paul, M.: Soil organic matter and biological soil quality indicators after 21.years of organic and convential farming. Agricultural Ecosystems and Environment. Vol.118, Issues 1–4,January 2007, p. 273–284.
- Lehocká, Z., Klimekova, M., Bielikova, M.: Selected soil quality indicators in a loam degraded chernozem on loess unter organic and conventional management. Proceedings of Bioacademy 2008. New developments in science and research on organic agriculture. Lednice na Moravě 3.–5. 9. 2008 p. 82.
- Petr, J., Vavera, R., Mičák, L.: Yield formation in wheat (Triticum aestivum L.) in ecological agriculture. Scientia Agriculturae Bohemica 39, 2008 (3): 245–251.
- Šarapatka, B., Laška, V., Mikula, L., Čáp, L., Petr, J.: Selected biological and biochemical characteristics of soil in long-term organic farming experiments. Scientia Agriculturae Bohemica, 39, 2008, (2): 212–217.
- Šarapatka, B., Urban, J. et al.: Organic agriculture in practice. (In czech) Pro-Bio Šumperk 2006. 502 p.

SOIL ECOLOGICAL FUNCTIONS – THEIR SOCIETAL IMPORTANCE AND ECONOMIC VALUATION

BUJNOVSKÝ, R.[1] & VILČEK, J.[2]

Key words: soil, soil functions, economic valuation

Abstract

Similarly as ecosystem soil provides many services and goods that in soil science are named as soil functions. Sustainability of societal development requires maintenance of soil quality and soil functions – especially the ecological ones. Principles and results of economic valuation of selected soil ecological functions are presented. Preliminary average values of selected ecological functions of agricultural soils in Slovakia are based on previous index evaluation of these functions and defined assumptions and represent 5300 € per hectare for water retention, 4300 € per hectare for filtration of risk elements and organic pollutants and 4000 € per hectare for transformation of organic pollutants, respectively. Valuation of soil and its ecological functions seems as possible way for improvement of soil protection especially in modification of soil price at its permanent sealing but financial values should not to be used as a ground for forming ethical values, which are imminently connected with human approach towards soil and its degradation, and which are essentially needed by global society.

Introduction

Soil as an environmental component plays an important role in biomass production and functioning of ecosystems as well as for human life quality and thus primarily influences the development of society. This fact is mentioned in papers and documents since the last decade of the previous century (e.g. Council of Europe, 1992; European Commission, 2006).

Similarly as ecosystem, soil provides many services and goods (de Groot et al., 2002) which in soil science are named as soil functions. Besides biomass production, which can be evaluated economically, the soil provides other ecological functions that are priceless for the society. Recently, the elaborated proposal of EU Frame Directive on soil protection (European Commission, 2006) considers the following ecological, socio-economic and cultural soil functions:

- biomass production, including agriculture and forestry
- storing, filtering and transforming of nutrients, substances and water
- biodiversity pool, such as habitats, species and genes
- physical and cultural environment for humans and human activities
- source of raw materials
- acting as carbon pool
- archive of geological and archaeological heritage.

[1] Soil Science and Conservation Research Institute, Gagarinova 10, 827 13 Bratislava, Slovak Republic, E-Mail r.bujnovsky@vupop.sk, Internet www.vupop.sk

[2] Soil Science and Conservation Research Institute – Regional workplace, Raymanova 1, 080 01 Prešov, Slovak Republic, E-Mail j.vilcek@vupop.sk, Internet www.vupop.sk

The sustainability of societal development requires maintenance of soil quality and soil functions – especially the ecological ones. Besides definition of basic principles for evaluation of selected soil functions it is necessary to search also ways for economic valuation (pricing) that can be considered with regard to modification of agricultural soil taxation.

Materials and methods

This paper is orientated on evaluating the importance of soil functions for the society and benefits from selected environmental functions of agricultural soils. The economic valuation is based on general evaluation of soil functions through accessible or basic set of indicators often called "minimum data set" of indicators (e.g. Doran, Parkin, 1994) that can embrace soil as well as site parameters. Individual ecological soil functions are placed into a hierarchical system of soil function values. Subsequently suitable frame method of economic valuation is chosen. Economic valuation of selected environmental soil functions is based on a previous index evaluation of agricultural soils (Bujnovský et al., 2009). This index evaluation isranked into 5 classes, based on existing or derived soil parameter data, accessible from databases of Soil information system of Soil Science and Conservation Research Institute, Bratislava. The assumptions used as starting point for economic valuation are introduced in Table 2 in the following section of this paper.

Results and discussion

In Table 1, the soil use in relation to the development of human society and soil functions is illustrated in simplified form.

Tab. 1: Societal interests linked with soil use and societal values as starting point for sustainable societal development.

Societal values relevant to soil	Societal interests relevant to soil use
Ecological values corresponding with water storage, substances immobilisation and transformation, buffering soil changes (pH), biodiversity pool	Maintenance of soil quality and other affected environmental issues
Social values corresponding with biomass production and partly with other ecological functions	Provision of sufficient amounts of safe food as contribution to the creation of good health state of population Maintenance of potential possibility for alternative soil and landscape use
Socio-economic values corresponding with soil functions as space for economic activities of humans (source of raw materials, space for infrastructure and residential development) and with biomass production	Development of economically oriented activities With aim to promote regional development, employment, living and economical standard of people

It is necessary to mention that in given system economically oriented societal interests usually dominate despite the fact that society claims for many ecological and social values of soil and landscape. Preference to economic interests together with reluctance to search compromise solutions is often manifesting in soil degradation.

Living conditions and subsequently quality of human life directly or indirectly depends on the accessibility of environmental services that usually have non-monetary value (de Groot et al., 2002). As introduced by Scott et al. (1998), services represent properties of ecological and soil functions from which human derive the benefits. While production function (biomass production) brings utility values, many soil ecological functions can be ranked into regulative functions of the environment (e.g. Daily, 1997; de Groot et al., 2002; Hawkins, 2003).

Economic valuation of selected soil functions – in analogy to ecosystem services – represents indirect market economic valuation of selected regulation soil services (expressed by ecological functions) which can be based on estimation of *i)* saved or avoided costs due to provision of given soil function or *ii)* replacement of costs relating with returning damaged soil into original state or quality. So the values of most soil ecological functions are classified as use indirect non-consumptive use values. Economic valuation of selected soil functions is based on assumptions introduced in Tab. 2. Preliminary average values of selected ecological functions of agricultural soils in Slovakia are based on previous index evaluation of these functions and defined assumptions and represent 5300 € per hectare for water retention, 4300 € per hectare for filtration of risk elements and organic pollutants and 4000 € per hectare for transformation of organic pollutants, respectively.

Buday et al. (2006) estimated the replacement costs resulting from positive externality of agricultural landscape (protection against floods, prevention against water erosion, absorption of SO_2 and NO_2 and disarming of organic wastes) at 440 to 560 € per hectare. Linkeš et al. (1996) introduced the non-production soil functions of Slovakia at 780 € per hectare. The presented estimation of values of ecological soil functions in our paper (Bujnovský et al., 2009) significantly exceeds the existing estimations mentioned above.

Tab. 2: Frame for economic valuation of selected soil ecological functions.

Soil function	Benefit or remediation saved costs
Water storage capacity	Soil is regarded as reservoir. Average costs of artificial basins are considered to be 2 € per 1 m^3.
Immobilisation of pollutants	Soil is regarded as water treatment plan and price of waste water collection approximately 0.80 € per 1 m^3 is taken as price for the soils category with very high capacity for substances immobilisation. This price is equally divided for risk elements and organic pollutants. Although the unit price for both types of pollutants is the same, there are spatial differences in index values for them.
Transformation of organic pollutants	It is assumed that the very high ability of soil to transform the organic pollutants can be identical to costs for soil decontamination (over 1000 $\mu g.kg^{-1}$ PAH). Average PAH content in soils of Slovakia is around 200 $\mu g.kg^{-1}$. The assumed costs for decontamination are 20 € per tonne and 0.1 m soil layer is assumed.

The valuation of soil and its ecological functions is considered a possible way for improvement of soil protection especially in modification of soil price at its permanent sealing. In spite of that, in accordance with Sciama (2007), financial values should not be used as a base for forming ethical values, which are imminently connected with human approach towards soil and its degradation, and which are essentially needed by global society.

Conclusions

Economic valuation of soil ecological functions offers the broader view on real importance and subsequently the value of the soil for the society. Estimated economic value of selected soil ecological functions is considered as contribution to the improvement of soil protection especially in modification of soil price at its permanent sealing.

Acknowledgments

This work was supported by the Slovak Research and Development Agency under the contract No. APVV-0124–06 and RTD project "Multifunctional soil use" supported by Ministry of Agriculture No. 2006 UO 27/090 03 03/090 03 19 as well as APVV projects No. 0124–06.

References

- Buday, Š., Chrastinová, Z., Gubová, M., Fáziková, M., Kusá, Z., Petrášová, V. et al. (2006). Rural development and changes of food verticals in the context of Slovakia integration into EU. VÚEPP, Bratislava, 231 p. (in Slovak).
- Bujnovský, R., Balkovič, J., Barančíková, G., Makovníková, J., Vilček, J. (2009). Assesment and economic valuation of ecological functions in agricultural land of Slovakia. VÚPOP, Bratislava, – in press (in Slovak).
- Council of Europe (1992). Recommendation No. R (92) 8 of the Committee of ministers to member states on soil protection. Council of Europe, Brussels, 4 p.
- Daily, G.C. (ed.) (1997): Nature's services: Societal dependence on natural ecosystems. Island Press, Washington, D.C., 394 p.
- de Groot, R.S., Wilson, M.A., Boumans, R.M.J. (2002). A typology for the classification, description and valuation of ecosystem functions, goods and services. Ecological Economics 41: 393–408.
- Doran, J.W., Parkin, T.B. (1994). Defining and assessing soil quality. In Doran, J.W., Coleman, D.C., Bezdicek, D.F., Stewart, B.A. (eds.): Defining soil quality for a sustainable environment. SSSA Spec. Pub. No. 35, 1994, p. 3–21.
- European Commission (2006). Proposal for a directive of the European Parliament and of the Council establishing a framework for the protection of soil and amending Directive 2004/35/EC. COM (2006) 232 final. European Commission, Brussels, 30 pp.
- Hawkins, K. (2003). Economic valuation of ecosystem services. University of Minnesota, 42 p.
- Linkeš, V., Bielek, P., Juráni, B., Bujnovský, R. (1996). Benefits from non-production functions of the soil and its agricultural use. (Study report) VÚPÚ, Bratislava, 16 p. (in Slovak).
- Sciama, Y. (2007). Towards a planet-wide ethic. A talk with Dominique Bourg. Research EU No. 52: 16–17.
- Scott, M.J., Bilyard, G.R., Link, S.O., Ulibarri, C.A., Westerdahl, H.E. (1998). Valuation of ecological resources and functions. Environmental Management 22: 49–68.

SOIL MICROBIAL COMMUNITIES AND ACTIVITIES UNDER ORGANIC AND CONVENTIONAL VEGETABLE FARMING IN WEST JAVA, INDONESIA

MOESKOPS, B.[1], SUKRISTIYONUBOWO[2], BUCHAN, D.[1], SLEUTEL, S.[1], LENITA HERAWATY[2], EDI HUSEN[2], RASTI SARASWATI[2], DIAH SETYORINI[2] & DE NEVE, S.[1]

Key words: soil quality, microbial biomass, enzyme activity, PLFAs, Indonesia

Abstract

We compared the effect of organic and conventional farming practices on soil microbial dynamics in West Java, Indonesia. A secondary forest was included as natural reference. Parameters measured were dehydrogenase and β-glucosidase activity, microbial biomass C (MBC) and microbial community composition by phospholipid fatty acid analysis. A strong negative impact of intensive chemical fertilizer and pesticide use on soil enzyme activities was demonstrated. Organic management with an emphasis on compost application was able to restore the soil microbial community and its functions in a short time span of two years. Enzyme activities were correlated with soil organic matter content and pH. β-glucosidase activity under organic management approached that under forest, while MBC and dehydrogenase activity were significantly higher under forest. The composition of the soil microbial community strongly differed between forest and cultivated soil, and a clear difference in composition was also observed between conventional and organic farming. Dehydrogenase activity and C16:1ω5c, marker fatty acid for arbuscular mycorrhizal fungi, appeared particularly suited as indicators for the impact of agricultural management on the soil microbial community.

Introduction

From the seventies on, vegetable production rapidly expanded in Southeast Asia. This resulted in the multiplication of inputs. Throughout tropical Asia vegetables are heavily fertilized, and even more serious is the overuse of pesticides (Rerkasem, 2005). In Indonesia and in the tropics in general the on-going land degradation has not been well documented from the microbiological viewpoint. Nevertheless, the soil microbial community plays an important role in maintaining soil fertility. The objective of this research was to examine the effect of organic vegetable production on soil microbial community composition and on soil enzyme activities, as compared to conventional production systems in the humid tropical climate of West Java.

[1] Department of Soil Management, Ghent University, Coupure Links 653, 9000 Gent, Belgium, E-mail: Bram.Moeskops@UGent.be

[2] Indonesian Soil Research Institute, Jl. Ir. H. Juanda 98, Bogor 16123, Indonesia

Materials and methods

At three locations in West Java, further referred to as Cisarua1, Cisarua2 and Ciwidey, an organic and a conventional farm were selected. A secondary forest, situated in Ciwidey, was included in the study to obtain reference values under natural conditions. All soils were Andisols. At the organic farm in Cisarua2, a distinction was made between plots that had been organically cultivated for 20 years and plots that had been converted from conventional management only two years before the sampling. At each location topsoil samples (0–15 cm) were taken under two crops on both organic and conventional farms during the dry season (May-September) of 2007. Samples were analyzed for organic C (OC) and total N content (TN), pH-KCl, microbial biomass C (MBC), dehydrogenase and β-glucosidase activity, and phospholipid fatty acids (PLFAs).

Results

As Andisols are characterized by a high soil organic matter content, the fields had high OC and TN contents. OC contents ranged between 2.66 and 5.06 % on organic farms, and between 1.95 and 3.30 % in the conventional fields. TN contents ranged between 0.29 and 0.49 %, and between 0.22 and 0.37 % on the organic and the conventional farms respectively. In Cisarua1 and Ciwidey the OC and TN contents were significantly higher under organic agriculture compared to conventional. In Cisarua2 on the other hand, TN contents were significantly lower in the organic fields. Since OC contents were comparable with the conventional fields, this resulted in a significantly lower C/N ratio on the conventional farms. Also in Ciwidey the C/N ratio was significantly lower under conventional than under organic management, but on the latter fields the C/N ratio was again lower than under secondary forest. pH-KCl was 5.17 ± 0.35 under secondary forest, 5.27 ± 0.22 under organic management, and 4.51 ± 0.62 under conventional management. In Cisarua1 and Cisarua2, pH values were significantly higher ($P \leq 0.01$) under organic horticulture compared to conventional, but not in Ciwidey.

Enzyme activities were strongly depressed under conventional management when compared to the organic fields (Fig. 1). Under organic horticulture, dehydrogenase activity was 3.8 to 6.4 times higher compared to conventional horticulture, while β-glucosidase activity was 1.6 to 2.9 times higher. β-glucosidase activities under organic management approached those under secondary forest. In Cisarua2, two years after conversion to organic farming enzyme activities were comparable to those after 20 years of organic production. This indicates that the microbial community recovers fast after conversion. MBC content was significantly ($P \leq 0.05$) higher under secondary forest than under agriculture. In Cisarua1 and Ciwidey, MBC contents were higher under organic than under conventional farming, but in general not significantly. In Cisarua2, there was no difference in MBC content between organic and conventional farming. Based on the amounts of PLFAs, all microbial groups considered (i.e. Gram-positive, Gram-negative and total bacteria, arbuscular mycrorrhizae and fungi) were represented stronger in organically managed soil than in soil from conventional farms. Analogous to the enzyme activities, PLFA concentrations two years and 20 years after conversion to organic agriculture were comparable in Cisarua2. Largest marker fatty acid concentrations were found under secondary forest. According to Fisher's canonical discriminant analysis of relative PLFA concentrations, the composition of the

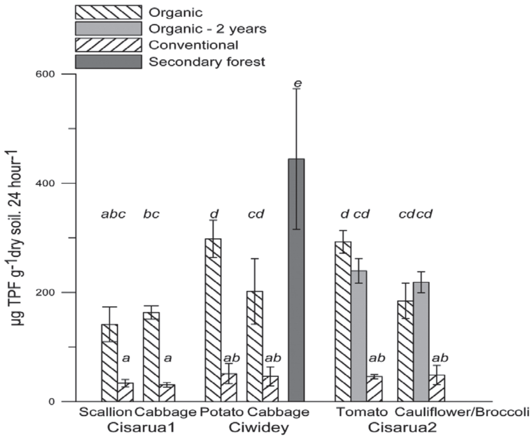

Figure 1: dehydrogenase activity (left) and β-glucosidase activity (right), different letters indicate significant differences (P≤0.05, Tukey's post-hoc test)

soil microbial community strongly differed between forest and cultivated soil. A clear difference was also observed between conventional and organic farming.

Discussion

Conventional management resulted in acidification of the soil. In general pH was too low for optimal vegetable production. The acidification of conventional fields is attributed to the intensive application of mineral fertilizers, mainly ammoniacal N (urea and $(NH_4)_2SO_4$) and superphosphate. The higher pH on organic farms, on the other hand, was probably the result of the intensive use of compost. Compost increases the cation exchange capacity and base saturation of the soil, which results in a higher buffering capacity.

Enzyme activities were significantly correlated with OC content ($P \leq 0.01$) and pH ($P \leq 0.05$). Although higher pH and higher OC contents can potentially explain increases in enzyme activities, the differences between organically and conventionally managed soil remain surprisingly high, certainly when compared to studies conducted in temperate or Mediterranean climates (e.g. Marinari et al., 2006; Fließbach et al., 2007). One of the main reasons for the high differences between organic and conventional management can probably be found in the use of mineral fertilizers, but certainly in the use of pesticides on the conventional fields. In Indonesia, pesticide use is poorly regulated, or existing regulations are not enforced, resulting in excessive pesticide use. This means management differences between organic and conventional farming are much more extreme in Indonesia, and in Southeast Asia in general, than in many other countries, hence the very large differences in enzyme activity.

Differences between organic and conventional horticulture were most pronounced for dehydrogenase activity and the AMF marker fatty acid (C16:1ω5c). These parameters seem therefore particularly suited as indicators for (microbial) soil quality. β-glucosidase activity also had a strong discriminating power, but because of the high correlation between dehydrogenase and β-glucosidase activity, it seems to be a redundant parameter in this case. Dehydrogenase activity also had a stronger correlation with MBC than β-glucosidase activity. With regard to the absolute marker fatty acid concentrations, the differences between organic and conventional management were significant ($P \leq 0.05$) for AMF only in all cases. The findings on the susceptibility of AMF to agricultural management are corroborated by studies of e.g. Bending et al. (2004) and Mäder et al. (2002).

Forest soil and organically managed fields had comparable activities of β-glucosidase. Several researchers have found that cultivated soils in tropical regions that receive substantial organic inputs have maintained similar or higher levels of β-glucosidase and several other hydrolytic enzymes compared to uncultivated soils (Dick et al., 1994; Waldrop et al., 2000). Activities of the intracellular enzyme dehydrogenase and MBC contents, however, remained significantly higher under secondary forest. This suggests dehydrogenase activity and MBC content are more sensitive to disturbance than are hydrolytic enzymes.

Conclusions

Very few studies have been conducted on the impact of management on soil microbiology in the tropics. The extreme differences in management practices between organic and conventional fields were reflected in very strong differences in enzyme activities. Organic management with an emphasis on compost application is able to improve the functions of the soil microbial community in a short time span of two years. Higher microbial activity is a clear indication of improved soil quality, and probably will affect important soil processes for crop growth such as carbon and nitrogen cycling. The composition of the soil microbial community strongly differs between forest and cultivated soil, and a less strong but still clear difference was observed between conventional and organic farming. Dehydrogenase activity and C16:1ω5c, marker fatty acid for AMF, appeared particularly suited to highlight the impact of management on the soil microbial community.

References

- Bending G.D., Turner M.K., Rayns F., Marx M.C., Wood, M. (2004): Microbial and biochemical soil quality indicators and their potential for differentiating areas under contrasting agricultural management regimes. Soil Biol. Biochem. 36:1785–1792.
- Dick R.P., Sandor J.A., Eash N.S. (1994): Soil enzyme-activities after 1500 years of terrace agriculture in the Colca Valley, Peru. Agr. Ecosyst. Environ. 50:123–131.
- Fließbach A., Oberholzer H.R., Gunst L., Mäder P. (2007): Soil organic matter and biological soil quality indicators after 21 years of organic and conventional farming. Agr. Ecosyst. Environ. 118:273–284.
- Mäder P., Fließbach A., Dubois D., Gunst L., Fried P., Niggli U. (2002): Soil fertility and biodiversity in organic farming. Science 296:1694–1697.
- Marinari S., Mancinelli R., Campiglia E., Grego S. (2006): Chemical and biological indicators of soil quality in organic and conventional farming systems in Central Italy. Ecol. Ind. 6:701–711.
- Rerkasem B. (2005): Transforming subsistence cropping in Asia. Plant Prod. Sci. 8:275–287.
- Waldrop M.P., Balser T.C., Firestone M.K. (2000). Linking microbial community composition to function in a tropical soil. Soil Biol. Biochem. 32:1837–1846.

MACROFAUNA INVERTEBRATE COMMUNITIES IN SOILS UNDER ORGANIC AND CONVENTIONAL FARMING: CONVERSION TRIAL IN THE CZECH REPUBLIC

ŠARAPATKA, B.[1], MIKULA, J.[1], TUF, I. H.[1] & LAŠKA, V.[1]

Key words: soil, organic farming, conventional farming, epigeic fauna, soil biota

Abstract

This paper focuses on the evaluation of invertebrate communities on an experimental site in Prague – Uhříněves (CZ) where an organic farming experiment (organic vs. conventional farming) began 14 years ago. Results of research from 2007 indicated that the amount of organic material in the soil environment plays a significant role. This was apparent in the organic variant, especially in soil where wheat was growing after a previous crop of clover leaving a greater amount of crop residue.

This was shown by the number of millipedes which process the available vegetable material. The organic treatment proved positive for spiders in an oilseed crop, possibly due to the lower crop coverage. This result was evident in both evaluated years. Generally our research did not prove any fundamental influence of specific farming systems on the abundance of soil fauna because analysis of data indicated the complexity of the agro-ecosystem and factors influencing the biotic elements.

Introduction

Intensification of agriculture had a remarkable effect on biodiversity and the quality of soil. At present, the impact of agricultural systems on biodiversity is discussed intensely. Arthropods are frequently used as bioindicators for the assessment of landscape and soil quality (Paoletti 1999). Soil organisms are assumed to be responsible for processes within the soil ecosystem, especially the decomposition of soil organic matter and the cycle of nutrients (Wardle and Giller 1997). Some research describes how in organic farming certain groups of invertebrates exist in higher diversity than in conventional farming, e.g.carabid beetles (Kromp 1989, 1999, Langmaack et al. 2001), spiders (Feber et al. 1998) and earthworms (Brown 1999). Other studies, however, show no difference between the two systems of farming,.e.g. Berry et al. (1996) and Blackburn et al. (2001) for centipede communities. The population dynamic of soil organisms in the farming system depends on a range of factors, such as soil characteristics, climate, type of farm management, crop, ploughing and use of pesticides (Debeljak et al. 2007). Physical disturbance of soil, such as tillage, is also a detrimental factor for diversity of soil fauna (Altieri 1999).

[1] Palacký University, Department of Ecology and Environmental Sciences, tř. Svobody 26, 771 46 Olomouc, Czech Republic. E-mail: borivoj.sarapatka@upol.cz

Materials and methods

Evaluation of invertebrate communities was carried out on an experimental site in Prague – Uhříněves, the longest-running trial comparing organic and conventional farming in CZ where conversion to organic farming began 14 years ago.

The research was carried out in a large (12.5 ha) study field, subdivided after the crops were planted and the management system established. We compared 4 plots; 2 with winter wheat and 2 with winter oilseed rape in 2007 and 2008. In the conventional farming treatment, both of these crops were grown following a grain-leguminous mixture, whereas in the organic farming treatment the preceding crop was two-years of clover which was mulched and ploughed in.

In spring and summer of 2007 and 2008, we sampled soil invertebrates on these sites. Of epigeic fauna, we evaluated beetles (Coleoptera), spiders (Araneae), flies (Diptera), harvestmen (Opiliones), centipedes (Chilopoda) and millipedes (Diplopoda). From the soil samples, we evaluated beetles, beetle larvae, centipedes and millipedes. Epigeic fauna was obtained from May to September using sets of formaldehyde pitfall traps (5 traps per plot, checked monthly). Soil biota were heat-extracted by Tullgren funnels (Tuf and Tvardík 2005) from soil samples (7 samples per plot per year, 1/30 m2 area, 15 cm depth). Data was evaluated by ANOVA and χ^2-test.

Results

Tables 1–3 give a statistical evaluation of the total sampling figures from 2007 and 2008 under both organic and conventional managhement. During the two seasons a total of 8204 specimens of soil macrofauna were sampled, (7631 of them by pitfall traps). Beetles and spiders were the most dominant groups and more abundant occurrence was sampled in winter oilseed rape in both methods. Tables 1 and 2 compare the results according to season and system of management. Table 3 compares the results of organic and conventional farming in both of the observed seasons.

Tab. 1: Soil biota and epigaeic fauna in organically and conventionally grown winter wheat and winter rape – differences between seasons (> and < means more and less specimens in 2008 compared to 2007, ≈ means no difference between years).

	winter wheat organic	winter wheat conventional	winter rape organic	winter rape conventional
Coleoptera	<	>	<	<
Coleoptera (larvae)	≈	<	<	<
Araneae	<	<	<	<
Opiliones	≈	<	<	≈
Diptera	<	≈	≈	>
Chilopoda	≈	≈	≈	≈
Diplopoda	<	<	<	≈
Total epigaeic fauna	<	<	<	<
Total soil biota	<	<	<	<

From the results obtained it is not possible to explicitly confirm a treatment effect of the different cultivation systems. By the analysis of data, distinct differences were only found between the two research years. Whereas in 2007 a preference for organic farming was registered in many groups, this was not confirmed in 2008. Only the spiders in the oilseed crop showed a stable preference for the organic system in both years.

Tab. 2: Soil biota and epigaeic fauna in organically and conventionally grown winter wheat and winter rape – differences between variants in 2007 and 2008 (> and < means more and less specimens in the organic variant compared to conventional, ≈ means no difference between variants).

	winter wheat 2007	winter wheat 2008	winter rape 2007	winter rape 2008
Coleoptera	>	<	<	≈
Coleoptera (larvae)	≈	≈	<	≈
Araneae	≈	≈	>	>
Opiliones	≈	≈	>	≈
Diptera	>	≈	≈	<
Chilopoda	≈	≈	≈	≈
Diplopoda	>	≈	>	≈
Total epigaeic fauna	>	<	<	≈
Total soil biota	≈	≈	<	≈

Tab. 3: Soil biota and edaphic fauna in organically and conventionally grown winter wheat and winter rape during both seasons (> and < means more and less specimens in the organic variant, compared to conventional, ≈ means no difference between variants).

	winter wheat	winter rape
Coleoptera	>	<
Coleoptera (larvae)	≈	<
Araneae	≈	>
Opiliones	≈	>
Diptera	≈	≈
Chilopoda	≈	≈
Diplopoda	≈	≈
Total epigaeic fauna	≈	≈
Total soil biota	≈	<

Discussion

The results of the first year of observation showed that the amount of organic matter plays a significant role in macro-edaphon communities. This was mainly evident in a wheat crop in the organic system where the pre-crop of clover left greater crop residue. This was shown by the number of millipedes (in 2007) which process the available vegetable material. Important factors for the higher incidence of centipedes (although not significant) are organic farming, a good range of food and no use of pesticide (Klinger 1992). Due to the lower crop coverage, organic farming proved positive for spiders in an oilseed crop. This corresponds to research by Honěk (1988) describing a lower number of spiders under dense plant-growth. Basedow (1998) describes how spiders in organic farming systems are more varied in species although the difference in abundance between the two farming systems is small. If we were to compare our results with the work of Hole (2005), it can be stated that our research did not prove any fundamental influence of specific farming systems on the abundance of soil fauna. Analysis of data indicated the complexity of the agro-ecosystem and factors influencing biotic elements (high year-to-year variability). In any case it is necessary to pay great attention to the quality of soil and structure of the landscape, applying methods which are considerate to the diversity of organisms in the system.

Acknowledgement

The authors wish to thank the Czech Ministry of Education for supporting their research through grant No. 2B06101 and the Czech Ministry of the Environment for the grant they provided (VaV 1c/4/8/04).

References

- Altieri, M.A. (1999): The ecological role of biodiversity in agroecosystems. Agriculture, Ecosystems & Environment 74: 19–31.
- Basedow, T. (1998): The species composition and frequency of spiders (Araneae) in fields of winter wheat grown under different conditions in Germany. Journal of Applied Entomology 122: 585–590.
- Berry, N.A., Wratten, S.D., McErlich, A., Frampton, C. (1996): Abundance and diversity of benefcial arthropods in conventional and organic carrot crops in New Zealand. New Zealand Journal of Crop and Horticultural Science 24: 307–313.
- Blackburn, J., Arthur, W. (2001): Comparative abundance of centipedes on organic and conventional farms, and its possible relation to declines in farmland bird populations. Basic & Applied Ecology 2: 373–381.
- Debeljak, M., Cortet, J., Demšar, D., Krogh, P.H., Džeroski, S. (2007): Hierarchical classification of environmental factors and agricultural practices affecting soil fauna under cropping systems using Bt maize. Pedobiologia 51: 229–238.
- Feber, R.E., Bell, J., Johnson, P.J., Firbank, L.G., Macdonald, D.W. (1998): The effects of organic farming on surface-active spider (Araneae) assemblages in wheat in southern England, UK. Journal of Arachnology 26: 190–202.
- Hole, D.G., Perkins, A.J., Wilson, J.D., Alexander, I.H., Grice, P.V., Evans, A.D. (2005): Does organic farming benefit biodiversity? Biological Conservation 122: 113–130.
- Honěk, A. (1988): The effect of crop density and microclimate on pitfall trap catches of Carabidae, Staphylinidae (Coleoptera), and Lycosidae (Araneae) in cereal fields. Pedobiologia 32: 233–242.
- Klinger, K. (1992): Diplopods and Chilopods of conventional and alternative (biodynamic) fields in Hesse (FRG). Berichte des naturwissenschaftlich-medizinischen Vereins in Innsbruck, Supplement 10: 243–250.
- Kromp, B. (1989): Carabid beetles communities (Carabidae, Coleoptera) in biologically and conventionally farmed agroecosystems. Agriculture, Ecosystems & Environment 27: 241–251.
- Kromp, B. (1999): Carabid beetles in sustainable agriculture: a review on pest control efficacy, cultivation impacts and enhancement. Agriculture, Ecosystems & Environment 74: 187–228.

- Langmaack, M., Land, S., Büchs, W. (2001): Effects of different field management systems on the carabid coenosis in oil seed rape with special respect to ecology and nutritional status of predacious *Poecilus cupreus* L. (Col., Carabidae). Journal of Applied Entomology 125: 313–320.
- Paoletti, M.G. (1999): The role of earthworms for assessment of sustainability and as bioindicators. Agriculture, Ecosystems & Environment 74: 137–155.
- Tuf, I.H., Tvardík, D. (2005): Heat-extractor – an indispensable tool for soil zoological studies. In: Tajovský, K., Schlaghamerský, J., Pižl, V. (eds.): Contributions to Soil Zoology in Central Europe I. ISB AS CR, České Budějovice: 191–194.
- Wardle, D.A., Giller, K.E. (1996) The quest for a contemporary ecological dimension to soil biology. Soil Biology and Biochemistry 28: 1549–1554.

NUTRIENT CONTENT IN GEOPHAGOUS EARTHWORM CASTS IN ORGANIC CEREAL PRODUCTION

POMMERESCHE, R.[1], HANSEN, S. & LØES A-K.

Key words: *Aporrectodea caliginosa*, *A. rosea,* nitrogen, phosphorous, potassium, soil quality

Abstract

Earthworm casts were collected from two soil depths by litterbags in an organic arable crop rotation, and compared to bulk soil. The aim was to study if casts from geophagous (soil eating) earthworm species (Aporrectodea caliginosa and A. rosea) contained more plant available nutrients than bulk soil, as is well known for detritivorous species that eats plant residues. The average earthworm abundance for three seasons was 229 earthworms m-2 and the average biomass (fresh weight) was 73 g m-2. Significantly higher concentrations were found of all nutrients in casts as compared to bulk soil. On average for the two sites, these differences corresponded to amounts of kg ha-1 y-1, 5.6 for P, 8.9 for K, 5.3 for Mg, 144 for N and 2542 for C. The study indicates that earthworm casts are valuable nutrient sources for plants even in soils where the earthworm fauna is dominated by geophagous species.

Introduction

Earthworm activity is important to improve and maintain soil fertility, nutrient availability and structure (Marinissen 1994, Edwards & Bohlen 1996). Earthworm casts and burrow linings contain more extractable nutrients than the surrounding bulk soil in several studies (Lunt & Jacobson 1944, Graff 1970, Scullion *et al.* 2002). The literature published on earthworm casts from field studies often describes detritivorous species, commonly *Lumbricus terrestris* and *L. rubellus,* or a mixture of species with quite different feeding strategies. Detritivorous species eat fresh and decomposing plant residues. The most common earthworm species in Norwegian agricultural soils, *Aporrectodea caliginosa* and *A. rosea* (Riley *et al.* 2008, Stöp-Bovitz, 1969) are geophageous; they eat their way through the soil and consume organic matter included in the soil they eat. Small particles of partly decomposed plant residues are also consumed by these species, but they do not eat fresh plant residues. These species are also found in Czech soil. Boström (1988) found that daily cast production in g dry weight (DW) for *A. caliginosa* individuals was equal to 0.14 + 2.61 * individual biomass at 15ºC. The level was reduced to 65 % at 10ºC, and 18 % at 5ºC.

Former laboratory studies comparing *L. terrestris* and *L. rubellus* with the geophagous species *A. caliginosa* and *Octolacion cyaneum*, found that the casts of both species contained more nutrients than the soil (Buck *et al.* 1999, Haynes *et al.* 2003). In addition the casts of the detritivorous species had higher concentrations of C, N, P and S than the geophagous casts.

In a study of the impact of soil tillage on earthworm abundance and biology during an organic arable crop rotation, litterbags were used to study decomposition of barley straw by various

[1] Bioforsk, Organic Food and Farming, Gunnars veg 6, N-6630 TINGVOLL, Norway,
E-mail Reidun.Pommeresche@bioforsk.no, Internet: www.bioforsk.no

ploughing depth. During the growing season, earthworm casts accumulated in the litterbags. Because geophagous species dominated in our fields, and the amount of plant residues was lower and/or with lower nutrient content than in the feeding studies referred above, we expected the nutrient content in the casts to be low, and not very different from the level found in bulk soil. In this paper, we present the results of the chemical analyses of earthworm casts from the litterbags and discuss the interpretation of these results in practice.

Materials and methods

During a field experiment studying the effect of ploughing depth in an organic arable crop rotation (Bakken et al., 2009), litterbags were buried at two sites to study the decomposition of barley straw. The soil on site A is a well-drained loam with 3.4 % soil organic matter (SOM) and on site K, a poorly drained silty clay loam with 4.9 % SOM.

The crop grown on the plots with litterbags was oats mixed with peas. The crop was the third year in a simple crop rotation which comprised full season green manure (red clover, vetches, rye grass and phacelia), barley undersown with white clover and oats-peas. No fertilisers or manure were applied during the experiment (Pommeresche *et al*., 2006).

Nylon litterbags were filled with 5 g oven-dried, chopped (5 cm) spring barley straw (*Hordeum vulgare* L.) from the previous autumn, collected in field in spring. The filled bag diameter was 7 cm. A mesh size of 5 mm allowed different kind of soil biota, including earthworms, to enter the content of the bags. In three replicate oat-pea plots at each site, four litterbags were buried at two soil depths, 13 and 25 cm on 25 May 2005, using a manual soil auger. From each plot, two litterbags were gently sampled on August 23 and October 18, 2005. At the same time, bulk soil was sampled from 10–15 and 22–27 cm soil depth ca 10 cm from the litterbag site.

The litterbag contents were dried at 35ºC, and earthworm casts (> 2 mm) were hand sorted and collected. Casts and bulk soil were sifted (2 mm) before analysis. The barley straw in the litterbags was low in nitrogen and high in fibre content and hence is not expected to influence the content of nutrients in the casts notably.

Each litterbag contained between 0.5 and 6 g dry weight (DW) of casts. The minimum amount required for analysis was 5 g. At site A, samples from all plots at the two depths were bulked for each sampling date, resulting in four samples. At site K, much less casts were found and samples from both sampling dates had to be bulked, leaving us with one sample from each soil depth at that site, in total two samples.

In bulk soil and casts, concentrations of ammoniumacetate-lactate (AL) -extractable P, K, Mg, Ca and Na were determined by ICP-ES (Egnér et al., 1960) and total N and C by an autoanalysator. The AL-extraction is the usual method to estimate plant available nutrients in Norwegian soils.

Formula for estimation of earthworm cast production, kg $ha^{-1}year^{-1}$ =

229 worms m^{-2} * (0.63 g/day * 153 days) * 10 000 m^{-2}/ha/1 000 g kg^{-1} = 220 733 kg = 221 tons.

The values in the formula are explained in the results.

Results and discussion

On average for the two sites, the earthworm population over three years (2003, 2004 and 2006) was 229 worms m^{-2} (Bakken *et al.* 2009). The dominant species in both soils were *A. caliginosa* (80–85 % of the individuals) and *A. rosea* (5–15 %). The abundance of detritivorous species was low; 5 % *L. rubellus* and 0–3 % *L. terrestris*. This implies that the dominating share of the litterbag casts was likely produced by *A. caliginosa*. The average biomass of earthworms was 73 g m^2, and the individual weight 0.32 g. We assume earthworms to be active during the growing season, May-September, 153 days. At site A the average soil temperature in 10 cm soil depth was 13.5 ºC, and at site K it was 11.5ºC. Calculated by the formula of Boström (1988), the individual daily cast production by 15ºC was estimated to 0.14 + 2.61 * 0.32 g = 0.975 g DW. For a careful estimate of individual daily cast production, we reduced this value to 65 % due to lower temperature in field = 0.63 g DW. On an area basis, this corresponds to 22.1 kg m^{-2} y^{-1} or 221 tonne casts ha^{-1} DW.

Tab. 1: Nutrient concentrations (NuC) of AL-extractable nutrients and total N and C in earthworm casts and bulk soil from two sites, means of two soil depths (13 and 25 cm). Values are shown for dry soil, ± SE. Average nutrient enrichment (ANE) = average across sites of the values (NuC in casts – NuC in bulk soil) *221 tonne casts ha^{-1} for tot-C and tot-N; divided by 1000 for P, K, Mg, Na and Ca-AL.

NuC	PAL (mg kg^{-1})	KAL (mg kg^{-1})	MgAL (mg kg^{-1})	NaAL (mg kg^{-1})	CaAL (mg kg^{-1})	Tot-C (g kg^{-1})	Tot-N (g kg^{-1})
Site A loam							
Bulk soil	67.8 ±6.4	76.3 ±6.8	155 ±5.8	8 ±1.4	1588 ±28.7	19.3 ±1	1.7 ±0.1
Casts	92.3 ± 14.1	121.0±8.4	182.5 ±9.6	12.5 ±1.3	1818± 90.0	29.3 ±4.0	2.2 ±0.2
Site K clay loam							
Bulk soil	49.5 ± 3.5	89 ± 5.7	165 ±21.2	32.5 ±0.7	1960 ±14.1	40 ±7.1	2.9 ±0.4
Casts	75.5 ±21.9	125 ±7.1	185 ±7.1	43.5 ±2.1	2265 ±262	53	3.7
Paired t-test	p=0.022	p=0.007	p=0.002	p=0.006	p=0.005	p=0.025	p=0.022
ANE kg ha^{-1} y^{-1}	5.58	8.92	5.25	1.71	59.12	2541.50	143.65

The average values of the chemical analysis of the casts and bulk soil are shown in Table 1. For all nutrients, the concentrations were higher in cast than in bulk soil. These results compare well to the laboratory studies of Haynes *et al.* (2002) and Buck *et al.* (1999), but the differences were larger than we expected. A higher concentration of AL-extractable nutrients in the casts is probably a combination of the earthworms selecting soil particles with comminuted plant residues, and a digestible effect on the availability of the soil nutrients as they pass through the worms.

To discuss the practical impact of our results, we estimated the average nutrient enrichment (ANE) in casts as the difference between nutrient concentrations in casts and bulk soil converted to amounts per hectare (Table 1). The average nutrient enrichment (ANE) is remarkably high for total C and N. Much is still unknown about free living N-fixing organisms in soil and it is tempting to ask if such phenomena may have occurred. The ANE values are based on many assumptions and must be interpreted with care. Still they demonstrate that the nutrient levels in casts of geophagous earthworm species are high enough to influence the nutrient supply to crops on field level. In addition to casts, nutrients will be released from decomposition of dead earthworms and cocoons, and excretion of urine and mucus. The amounts of soil passing through geophagous earthworms are very high, and indicate that earthworms may impact their soil environment significantly.

Conclusions

All the tested nutrients showed significantly higher concentrations in casts as compared to bulk soil. The estimated nutrient enrichment by geophagous earthworms was significant, especially for N, and indicates that the casts are valuable nutrient sources for plants.

References

- Bakken, A.K, Brandsæter, L.O., Eltun, R., Hansen, S., Mangerud, K., Pommeresche, R., Riley, H. (2009): Effect of tractor weight, depth of ploughing and wheel placement during ploughing in an organic cereal rotation on contrasting soils. Soil Till. Res. (in press)
- Boström, U. (1988): Ecology of earthworms in arable land. Population dynamics and activity in four cropping systems. Dissertation, SLU, Uppsala, Sweeden.
- Buck, C., Langmaack, M., Schrader, S. (1999): Nutrient content of earthworm casts influenced by different mulch types. Eur. J. Soil Biol., 35, 23–30.
- Edwards, C.A., Bohlen, J.P. (1996): Biology and Ecology of Earthworms, 3 edn, Chapmann & Hall.
- Egnér, H., Riehm, H., Domingo, W.R. (1960): Untersuchungen über die chemische Boden-Analyse als Grundlage für die Beurteilung des Nähstoffzustandes des Boden. Kungliga Landtbrukshögskolans Annaler 26, 199–215.
- Graff, O. (1970): Über die Verlagerung von Nährelementen in der Unterboden durch Regenwurmtätigkeit. Landwirtsch. Fors., 20, 117–127.
- Haynes, R.J., Fraser, P.M., Piercy, J.E., Tregurtha, R.J. (2003): Casts of *Aporrectodea caliginosa* (Savigny) and *Lumbricus rubellus* (Hoffmeister) differ in microbial activity, nutrient availability and aggregate stability. Pedobiologia, 47, 882–887.
- Lunt, H.A., Jacobson, H.G.M. (1944): The chemical composition of earthworm casts. Soil Sci., 58, 367–375.
- Marinissen, J.C.Y. (1994): Earthworm populations and stability of soil-structure in a silt loam soil of a reclaimed polder in the Netherlands. Agric. Ecosyst. Environ., 51, 75–87.
- Pommeresche, R., Løes, A.K., Meisingset, E.L., Hansen, S. (2006): Effects of ploughing depth on the decomposition of barely straw in organically managed soil. Horn, R. Proceedings the 17th ISTRO Conference 2006, 711–716. http://iworx5.webxtra.net/~istroorg/p_publications.htm.
- Riley, H., Pommeresche, R., Eltun, R., Hansen, S., Korsaeth, A. (2008): Soil structure, organic matter and earthworm activity in a comparison of cropping systems with contrasting tillage, rotations, fertilizer levels and manure use. Agric. Ecosyst. Environ., 275–284.
- Scullion, J., Neale, S., Philipps, L. (2002): Comparisons of earthworm populations and cast properties in conventional and organic arable. Soil Use Managem., 18, 293–300.
- Stöp-Bowitz, C. (1969): A contribution to our knowledge of the systematics and zoogeography of Norwegian earthworms. Nytt Mag.Zool., 17,169–280.

SOIL FERTILITY MANAGEMENT IN ORGANIC FARMING

KAPSHTYK, M.[1]

Key words: non-plough tillage, soil organic matter, heavy metals

Abstract

Soil Fertility Management is vitally important for successful development of organic farming technologies. To develop appropriate technologies it is necessary to take into consideration the mechanism of soil fertility self-regulation peculiar to the soils of natural ecosystems which are more fertile comparing with cultivated soils. The essence of sustainable organic farming practices lies in the strengthening of microorganisms' role by the systems of fertilizing and soil tillage in crop rotations. That was a why the impact of both long-term grassland and soil-protective non-plough tillage systems combined with organic fertilising and organic farming on soil properties and soil quality have been studied in experimental stationary field trials. The research questions included evaluation of soil organic matter content and its yearly and seasonal dynamics, accumulation and mobility of heavy metals in trophic chain: soil-plant-animals-human and crop yields. To answer research questions there field and laboratory investigations in two stationary field trials set up on Chernosems have been carried out. It was founded an increase in the humification coefficients of organic substrates and soil organic matter seasonal dynamics by 20–25 % under influence of soil protective tillage. Its simulate a natural process of soil formation provided there is an optimal supply with energy and substances. When the soil protective tillage and organic farming were used only for first several years a crop yields decreased appreciably. On the contrary if organic system based on soil protective tillage are used constantly, for more than 9 years, crops yield increased by 2,0–2,5 t/ha of grain units comparing with initial level. Systematic use of conservation tillage in crop rotations increases the ability of artificially formed phytocaenosis to effect soil formation and to improve the ecological aspects of crop production. The soil protective tillage system based on minimum tillage helps to renovate the soil fertility self-regulation mechanism and the hierarchical discreteness in the soil quality changes. The transition to organic farming should be gradual and proceed through soil protective tillage systems, in a direction of the maximal reproduction of natural processes in agroecosystem.

Introduction

The technological aspects of organic farming (OF) and, first of all, the soil fertility management are not developed sufficiently. From some overviews it can be concluded that to give sustainable reasons to the systems of OF it is necessary to elucidate the laws governing the changes of soil properties, especially Soil Organic Matter (SOM) dynamics, occurring under the influence of farming practices (Shykula et al, 1998). The key to sustainable farming lies in the strengthening of microorganisms' role and SOM dynamic by the systems of fertilizing and soil tillage in crop rotations (Shykula et al, 1998). Furthermore, it is necessary to take into account that the natural turnover of SOM and energy peculiar to natural ecosystems is being disconnected by the

[1] Institute of AgroEcology of Ukrainian Academy of Agricultural Sciences, 12 Metrologichna Str, 03143 Kiev, Ukraine, E-Mail kapshtyk@gmail.com Internet www.agroeco.org.ua

subtraction of substances with yields. Therefore, the system of soil tillage is a dominant factor of influence on the changes of soil fertility and crop yields with an optimal energy supply in a man-controlled process of soil formation (Shykula et al, 1998). It means that the soil tillage with sufficient input of organic substances can simulate the natural processes of soil formation and originate the prerequisites to OF conversion (Kapshtyk et al, 2000). Meanwhile, the depth of tillage and it duration are still not defined properly to various soil &climatic conditions with regards to create more favourable condition for further transition of farmers to OF. Furthermore, the stimulating impact of organic farming and its combination with Soil Protective Tillage (SPT) on the soil to reduce it pollution by heavy metals (HMs) is still not evaluated enough.

Materials and methods

Soil samples for determination of various soil indicators were collected from stationary field trials in Poltava and Dnipropetrovsk regions of Ukraine. On the first field trial (No.1) following treatments of conventional farming system have been used to analyse soil samples: a) conventional plough tillage (CT); b) conservation non-plough tillage system with depth of tillage from 10 to 27 cm depending on crops (NPT_1) c) conservation minimum tillage with depth 5–12 cm (NPT_2) d) long-term grassland (LTG) used for 16 year constantly. In Dnipropetrovsk field trial (No.2) soil samples were taken from the following variants: a) conventional farming (CF); b) conventional + minimum tillage (CMT); c) conventional + direct seeding (CDS); d) organic farming + minimum tillage (OMT). Soil Organic Matter (SOM) content has been determined by combustion of soil samples with concentrates H_2SO_4 in a 1:1 mixture with $K_2Cr_2O_7$. Coefficient of humification (C_h) of plant residues and manure were determined according to Chesnyak (1986). According to this procedure the organic materials in special small nylon bags have been located to the topsoil for 1 year. The concentrations of soluble forms of heavy metals (HMs) have been determined both in soil samples taken from ordinary chernozem and various parts of spring barley and organs of white laboratory rats, which received grain as a feed. The crop yields were evaluated both in two stationary field trials and “Agroecology” private organic production farm in Poltava region converted to OMT with long term usage of conservation minimum tillage to 5–12 cm.

Results

Shallow incorporation of plant residues and manures increases the intensity of humification as compared with ploughing (Table 1). Also, NPT system increased the yearly and seasonal amplitudes of SOM content fluctuation in soil (Fig. 1). On the NPT_2 plots this amplitude was 0.22–0,32 % in layer 0–20 cm while on the plots with CT it was within 0.14–0.20 %, reaching even 0.30–0.37 % on the plots with LTG. The total content of SOM at the CT was sufficiently least comparing with the NPT and LTG variants. When the NPT and OF were used instead of CT and CF only for first several years crops yield decreased appreciably. On the contrary if the OF based on NPT were used constantly, for more than 9 years crops yield increased by 2,0–2,5 t/ha of grain units comparing with initial level. Even in the first three years, the conservation technology instigates a renewal of seasonal cycles of SOM in soil.The changes in content and seasonal cycles of SOM and in crop yields occurs after 5, 9 and 15 years of systematic NPT system. Due to application of OF combined with NPT system for more than 20 years crop yields received from fields were

Tab. 1: Coefficients of humification of residues and farmyard manure (SEM=0.03).

Organic substrates	CT (layer 0–10 cm)	NPT_1 (layer 0–10 cm)	CT (layer 10–20 cm)	NPT_1 (layer 10–20 cm)
Straw of wheat	16.1	16.6	18.0	19.8
Residues of alfalfa	17.8	19.0	19.9	22.0
Manure	15.8	16.2	18.2	20.0

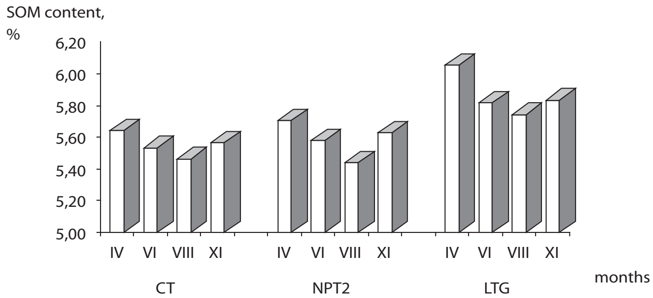

Figure 1: Soil Organic Matter (SOM) content in 0–20 cm layer of soil under influence of land management systems (SEM05=0.05 %)
Source: Shykula, Antonets/Kapshtyk 1998

not lower than 5,0 t × ha^{-1} for grain crops and 40–45 t × ha^{-1} for sugar beet. Cropping systems significantly effected the accumulation of heavy metals (HMs) in soil, plants and laboratory rats. OF proved the most effective, as it favored the reduction in the concentrations of all studied HMs in soil compared with CF. In case of soluble zinc, cooper and cadmium there just trace element's concentration were founded. At the same time the concentration of lead was more essential, occurring as the toxic element and exceeding a critical level for soil in 4–5 times. Lower content of HMs in soil of organically treated plots caused the reduction of their intake by plants. Feeding of relatively clean grain from the variant of OMT to white laboratory rats caused a significantly lower accumulation or HMs in all vitally important organs of these animals.

Discussion

Seasonal cycles of SOM in Chernozems can be explained by the mechanism of soil fertility self-regulation (Shykula et al, 1998). In the period of intensive growth of plants when soil conditions is more favourable for oxidation a part of SOM is mineralized due to tearing-off of lateral nitrogen-containing radicals and consumption by the roots of plants of the nutrients released into soil solution. There is also a parallel process of the synthesis of new molecules and the complication of older ones. This process requires much energy and has to take place only in aerobic conditions. In the next period, plant residues decompose and supply SOM with the fragments of macromolecules lost in the first period. After harvesting the soil is saturated with water and oxidation processes are impeded. In this period of plant residue decomposition intermediate compounds are formed with carboxyl and other functional groups, such as aminoacids, amines and amides. Carboxyls of some earlier formed humic acids are substituted by nitrogen – containing functional group. At the same time there is an accumulation of newly-formed humic substances in autumn, spring and winter when no free energy comes to the soil. Seasonal dynamics of SOM was higher that its possible formation by 80 %. We explain this phenomenon by the contribution of root exudates and microbe biomass of the soil and by the mechanisms of CO_2 transformation in soil humus. The process is self-regulated and optimizes the conditions of humus formation in soil. These processes are very pronounced in natural ecosystems and agroecosystems with systematic use of NPT (Shykula et al, 1998). This systems model a natural process of soil formation provided there is an optimal supply with energy and substances (Shykula et al, 1998; Kapshtyk et al, 2000). The soil conservation system based on minimum tillage, organic fertilising and green manuring helps to renovate the soil fertility self-regulation mechanism and the hierarchical discreteness in the soil quality changes. The hierarchical changes in content and seasonal cycles' amplitudes of SOM and in Crops Yield have been occurred after 5, 9 and 15 years of systematic non-plow tillage. By the beginning of second period the ability for Soil Fertility Self-Regulation is attributed to the chernozem of virgin land.

Conclusion

Soil-protective tillage can be an effective way to the reproduction of fertility of degraded soils. The transition to organic agriculture should be gradual and proceed through conservation crop production systems, in a direction of the maximal reproduction of natural processes in agroecosystems. The development of the technologies of organic farming should also take into account the time factor and the principle of the hierarchical stepwise changes in soil fertility and ecosystem productivity in accordance with the achieved level of soil self-regulation. Organic farming practices favor a noticeable decontamination of soil and lower the mobility of HMs in tropic chain: soil – plant – animal. Soil conservation cropping system with the application of farm and green manure help to improve soil fertility self-regulation. Seasonal cycles of SOM characteristic for virgin soil become apparent in cultivated one. By the beginning of the second period of hierarchical changes the soil's ability for fertility self-regulation becomes more evident. Under such circumstances the transition from conservation crop production systems to the soil protective organic farming can be possible.

References

- Chesnyak, G.Ya. (1986): K methodike opredeleniya coefficiyenta humificaciyi rastitelnych ostatkow i navoza v chernozemach tipichnych Lesostepi v usloviyach zerno-sveklowichnogo sevo-oborota. Agrochimiya i pochvovedeniye. 49: 79–85.
- Ponomaryova, V.V., Plotnikova T.A (1980): Humus i pochvoobrazovaniye. Nauka, Sanct-Peterburg, 323 p.
- Kapshtyk, M.V., Shykula, M.K.& Petrenco, L.R. (2000) Conservation non-plough systems of crop production in Ukraine with increased reproduction of soil fertility. In: Soil Quality, Sustainable Agriculture and Environmental Security in Central and Eastern Europe: NATO Science Series, Vol.69, Kluwer Academic Publishers, Amsterdam: 267–276.
- Shykula, M.K., Kapshtyk, M.V. et al. (1998): Widtvorennya rodyucosti gruntiw v gruntozachysnomu zemlerobstvi. Oranta, Kyiv, 670 p.

ETHICAL ORIENTED ACTIVITIES GOING BEYOND ORGANIC STANDARDS IN EUROPEAN ENTERPRISES/FARMS FROM DIFFERENT THEORETICAL PERSPECTIVES

GÖSSINGER, K.[1], HAMETTER, M.[2] & FREYER, B.[3]

Key words: Communication arguments, differentiation process, ethical values, marketing

Abstract

This article deals with ethical activities that are going beyond the organic regulations (referred to as 'organicPlus' in this study) and their communication strategies practised by organic farms and enterprises. The results are based on a qualitative survey of 100 organic small and medium-sized enterprises/farms in five European countries. Their engagement can be perceived in a certain sense as an opposite trend of the ongoing conventionalisation process in the organic sector. The organicPlus activities are related to the three classical sustainability dimensions extended by a cultural dimension. All enterprises/farms represent unique approaches with more or less professional communication strategies and a local or regional orientation. Therefore they have the potential to contribute to social capital, to build new local networks and to influence local structures. The organicPlus activities and the communication arguments are diverse as well as the motivations behind them. Open questions are if these organicPlus activities have the potential to contribute to a change of values and organic practices in the national and international context.

Introduction

Originally, reasons for converting to organic farming were mostly farming problems, ecological and environmental reasons, health/disease and idealistic reasons (Fischer 1982). The remarking point of this new paradigm of agriculture was that farmers and consumers created a new agricultural practice. After Austria's accession to the European Union in 1995, the number of converting farmers increased due to the offered subsidies. In addition to that, the distribution of organic products in conventional supermarkets led to a stronger demand. Mainly farmers in mountainous regions of Austria converted to organic farming, often motivated by more favourable economic conditions. However, the widely held view that new entrants convert *only* for financial reasons and do not engage with the values of organic agriculture could not be confirmed (Padel 2008). Professionalisation, commercialisation and economisation processes changed the movement from a grass root-type to an established form of European agriculture. Nevertheless, the total number of Austrian organic farms has stagnated for some years, while consumer demand for organic products has increased at the same time. All over Europe a general trend that more and more farmers, processors and traders modify the organic approach to make

[1] University of Natural Resources and Applied Life Sciences (BOKU), Institute of Organic Farming, Gregor-Mendel-Strasse 33, 1180 Vienna, Austria, E-Mail Katharina.goessinger@boku.ac.at

[2] As Above, E-Mail Monika.hametter@gmx.net

[3] As Above, E-Mail Bernhard.freyer@boku.ac.at

money in a stagnating conventional food market can be noticed. As a result, sustainability of the organic movement in all its dimensions is endangered: e.g. fair prices, biodiversity, the relation between farmers and consumers. The term "conventionalisation", frequently used in scientific discussions (e.g. De Wit & Verhoog 2007), is related to actors in the organic food chain that use the original ideals of the organic farmer movement for their own economic purposes. This phenomenon follows the concept of "free rider" behaviour/attitude (Olson, 2004). To strengthen the organic movement, IFOAM started a debate for redefining organic principles and values (Luttikhold, 2007). This process has led to the finalisation of four overarching ethical principles: health, care, fairness and ecology. Also farmers and especially SMEs dealing with organic products were searching for the expression of a specific quality of organic agriculture – activities going beyond the guidelines (referred in this study as organicPlus) that are often linked to an ethical background. It can be concluded that the organic sector is in an ongoing differentiation process (Freyer, 2008a) with sector-specific characteristics. Our interest was to get a deeper understanding of organicPlus, therefore our research questions were:

- What are the characteristics of the organicPlus activities and how do these activities relate to the dimensions of sustainability?
- What are the background and the consequences of organicPlus approaches by giving theoretical explanations?

Materials and methods

Our findings are based on empirical data from 100 organic SMEs in five different European countries (Austria, Germany, Great Britain, Italy, Switzerland) (Padel and Gössinger, 2008)[4]. Relevant criteria for the sample were the company size and the existence of written documentation of the companies´ organicPlus activities and involvement in production or processing of organic food. Data collection was based on a semi-standardised questionnaire and written material of the enterprises (websites, product labels, folder etc.) and in some cases additional telephone interviews.

Results and discussion

In total 72 different communication arguments were identified that related to organicPlus activities (Table 1). We categorized them into the classic dimensions of sustainability extended by a cultural dimension (Brocchi, 2007) and further in 16 sub-dimensions. No country-specific characteristics could be noticed.

4 The overall framework of the study is the CORE Organic project „Farmer Consumer Partnerships", that aims to strengthen the market position of organic companies sticking to higher standards than the organic guidelines.

Tab. 1: OrganicPlus dimensions, sub-dimensions and number of companies*.

Economic dimension	Fair price – farmer oriented (14); Fair price- farmers and consumers (10); Added value in the region (24).
Ecological/environmental dimension	Biodiversity (25); Landscape (17); Resources (26); Animal Welfare (17).
Social dimension	Family farms & farmers in need (16); Care farming (25); Social projects & charity (22); Working conditions of employees (12).
Cultural dimension	Local & regional (41); Communication & information (18); Rural customs/ traditions & originality (13); Individual attitudes (14).
* In brackets: number of companies using communication arguments of the specific sub-dimension Source: Padel/Gössinger 2008	

The impulses to engage in organicPlus activities are diverse:

- Unease with the current erosion of values in the organic movement and therefore a personal interest and motivation to express a specific "way of organic" Improving the strategic positioning of the enterprise/farm in the market place
- How organic companies promote these activities can be expressed in three different approaches:

Professional marketing and communication approach

- "Home-made" marketing and communication approach, often practised by farms/enterprises with a direct consumer contact; can be explained by different reasons a) to show individuality or b) lack of knowledge in marketing/communication or c) lack of time and finances
- Renunciation of any marketing activities which can be explained by the argument that ethical attitudes and activities should not be marketed

As regards the organicPlus activities, they are related to the

- Personal situation of the farmers (e.g. fair prices for farmers, family farms and farmers in need)
- Internal farm situation (e.g. biodiversity on the farm)
- Cooperation of market partners (e.g. fair prices for farmers and consumers)
- Landscape as a whole (e.g. biodiversity and natural resources)
- Society as a whole (e.g. added value in the region)
- Social services – young, old, disabled people (e.g. care farming, social projects & charity)
- Societal values (e.g. rural customs/traditions & originality)

There was no company representing an overall structured approach following the four dimensions of sustainability. The arguments are categorized into those which are related to their personal "cosmos (farm/enterprise)" (1,2), those referring to other groups (3), and finally those which are related to common societal goods (4–7). Arguments follow on the one hand intrinsic or egocentric ethics, on the other hand mainly altruistic respectively bio-centric ethics (Freyer 2008b). There are several activities which are also practised in conventional food chains: e.g. fair trade elements, care farming, specific landscape-related activities or the protection of cultural traditions. The organicPlus activities, which are driven by individual motivations, are influenced and formed by external structures and also affect structures (Giddens, 1997). We identified interactions, dependencies and relations among the actors and the networks where the activities are embedded:

- The fair price concept is an independent approach if a company is involved in direct marketing; but the fair price concept needs structures along the whole food chain if products are transferred e.g. to a dairy and to supermarkets.
- Landscape-oriented activities are sometimes related to nature conservation organisations and are embedded into a general concept – the farm is part of a group related to a specific network.
- Care farms are often embedded in specific associations, administered by governmental institutions, often dependent on subsidies; practice is a deal between agricultural necessities, personal needs of "clients" and the governmental preconditions.
- Social projects & charity are often activities outside of organic enterprises/farms, e.g. a social project is financed.

Activities which focus on more than the own farm and have a regional orientation are able to create social capital ("to take care for the strange", see Offe 1999). They establish new communication platforms and interactions between different societal movements (e.g. care farming, landscape-oriented biodiversity). Some of these activities are limited to the farmer itself, some also open new perspectives for consumers. Furthermore, organicPlus has the potential to create new pathways for the organic movement as a whole. In a broader sense there is a potential for new societal bottom-up impulses in a local/regional or even international context.

Conclusions

OrganicPlus approaches show that apart from conventionalisation trends in the organic sector, there are also contrary practices which go beyond the organic guidelines, demonstrating that there is a potential to deepen the organic quality by following ethical pathways. OrganicPlus approaches itself comprise a range of different practices. Besides, organicPlus approaches offer a potential for local or regional oriented markets and can contribute to a new regionalisation (Giddens, 1997, 183). However, the approaches require concerned and well-informed consumers. Further research should contribute to broader and deeper insights in organicPlus approaches and their societal effects and interactions with other systems.

Acknowledgments

The authors gratefully acknowledge funding from the Federal Ministry of Agriculture, Forestry, Environment and Water Management of Austria for the financial support for the CORE Organic Project "Farmer Consumer Partnerships".

References

- Brocchi, D. (2007): Die Umweltkrise – eine Krise der Kultur. In: Altner, G., Leitschuh-Fecht, H., Michelsen, G., Simonis, U. E., Weizsäcker, E. U. V. (eds). Jahrbuch der Ökologie 2008. München, C.H. Beck, p. 115–126.
- Fischer, R. (1982) Der andere Landbau. Dissertation ETH Nr. 6636: Das Selbstbild von biologisch wirtschaftenden Bauern. Verlag Madliger Schwab, Zürich, 261p.
- Freyer, B. (2008a): The Differentiation Process in Organic Agriculture (OA) – between capitalistic market system and IFOAM Principles. In: IFOAM, ISOFAR (eds.), 16th IFOAM Organic Congress; Cultivating the Future Based on Science, Vol. 2; 16th IFOAM Organic Congress; June 16–20, 2008. Modena, Italy, 374–377.

- Freyer, B. (2008b): IFOAM principles in the light of different ethical concepts. In: IFOAM, ISOFAR (eds.), 16th IFOAM Organic Congress; Cultivating the Future Based on Science, Vol. 2; 16th IFOAM Organic Congress; June 16–20, 2008. Modena, Italy.
- Padel, S., Gössinger, K. (eds.) (2008): Farmer Consumer Partnerships. Communicating ethical values: a conceptual framework. CORE Organic Project Series Report.http://orgprints.org/11028/01/CORE_FCP_Vol1_Final_31_July.pdf.
- Padel, S. (2008) Values of organic producers converting at different times: Results of a focus group study in five European countries. Int. J. Agricultural Resources, Governance and Ecology, 7 (1): 63–77.
- For further references please contact the authors.

FLOWERING PLANT STRIPS AS POTENTIAL HOST PLANTS FOR NATURAL ENEMIES (COCCINELLIDAE AND SYRPHIDAE) IN THE CZECH REPUBLIC

KOPTA, T.[1] & POKLUDA, R.[1]

Key words: flowering strips, natural enemies, ladybeetle, hoverflies

Abstract

Flowering plants play an important role in providing alternative food (pollen, nectar) and a place for resting or reproduction for the natural enemies of pests in agroecosystems. It is very important to select plant species that maximise the benefit to the parasitoid and which at the same time will not give support to the pest. In our experiment the attractiveness of selected flowering species (Anethum graveolens, Tagetes patula, Centaurea cyanus, Calendula officinalis and Vicia faba) to natural enemies of aphids–ladybeetles and hoverflies (Coccinellidae and Syrphidae respectively) was examined. All natural enemies observed visiting, resting or feeding on the flowering plants were counted together. We can consider Centaurea cyanus as an attractive host plant for ladybeetles (Coccinellidae) and Anethum graveolens as an attractive host plant for hoverflies (Syrphidae). The abundance of these natural enemies on the other plant species was insignificant.

Introduction

Highly intensive agricultural production systems lead to the simplification of agricultural landscapes, and the subsequent removal of non-crop habitat causes a decline in biodiversity. Agricultural intensification creates unsuitable conditions for natural enemies (Pfiffner 2006; Bianchi et al. 2006). Many studies have shown that natural enemy populations are higher and pest pressures lower in complex landscapes with a high proportion of non-crop habitats (Bianchi et al. 2006; Alomar et.al 2006). The use of non-crop habitats in agroecosystems to provide floral resources for enhancing natural enemy activity is increasingly common (Ambrosino et al. 2006). For example, in Switzerland the wild flower areas sown in arable landscapes are part of an agro-environmental programme (Flückiger, Schmidt 2006). This method of supplying beneficial organisms, by providing an appropriate habitat and alternative food sources, is one of the most powerful ways to minimize economic damage to crops from pests (Altieri 2005). According to Pfiffner (2006), such an infrastructure should ideally offer suitable food for adult natural enemies, an alternative prey or host organism, and shelter from adverse conditions.

Wackers (2005) points out that many insect carnivores that can play a role in the suppression of pests require nectar or pollen during their adult life. The provision of these additional food sources in agroecosystems could be a simple and effective way to enhance the effectiveness of biological control programmes Wäckers (2006). However, some authors have pointed out that the use of flowering strips might not always be a successful tool to use in the biological control of

[1] Mendel University of Agriculture and Forestry in Brno, Czech Republic

crop pests. Winkler et al. (2006) indicates that the indiscriminate use of nectar plants in flowering field margins can sometimes enhance pest pressure in agricultural systems. Pfiffner et al (2009) also showed that floral treatment using a multiple-species mixture did not consistently improve the control of *Pieris rapae* and *Mamestra brassicae* by parasitoids. Winkler (2005) suggests that, for field edges, plant species should be selected that maximise the benefit to the parasitoid and have no, or only weak, benefits for the pest.

A wide knowledge of insect-flower relations is therefore needed to be able to determine which plants are going to be suitable. In order to find suitable combinations of plants for flowering edges, van Rijn (2006) suggests firstly identifying which enemies can be effective against a specific pest, and then which flowers are attractive for these natural enemies, and to provide them with suitable food. Flowering plant species classified as beneficial for potential insect pests should of course be discarded. In our experiment the attractiveness of selected flowering plant species (*Anethum graveolens, Tagetes patula, Centaurea cyanus, Calendula officinalis* and *Vicia faba*) for the natural enemies (ladybeetles, hoverflies) was examined.

Materials and methods

This small-scale field trial was held in an organic open field located at the Horticultural Faculty of Mendel University (Brno) in Lednice (Location: 48°47′54.502″ N, 16°48′0.39″ E, Czech Republic). The flowering plant strips were sown on 27th of May 2008. The flowering strips were designed with an area of 13.5m^2 (1. 5 m wide, 9 m long) with three replications. The distance between replications was 7 m. The following flower species for the mixture were chosen: *Anethum graveolens, Tagetes patula, Centaurea cyanus, Calendula officinalis* and *Vicia faba*. All fields were managed with no chemical inputs and were hand weeded. The experimental field was surrounded by a field of alfalfa. Due to the dry climate the field was irrigated. Among the observed natural enemies, the ladybeetles (Coccinellidae) and hoverflies (Syrphidae) only were counted.

Two plants from each species in every replication were randomly selected and marked with a stake (30 plants in total). Natural enemy visits to the plants were recorded by visual observation (during 1 minute) of each of the marked plants simultaneously. Observations were performed once a week from July to September in the year 2008, always between 9 and 11 a.m. when irrigation was not taking place. All the observed natural enemies were counted together as visiting the plant, resting or feeding on the flower. The impact of the natural enemies on pests was not evaluated in this trial.

Results

The aim was to identify suitable plants for creating an effective mixture of flowering plants as a source of natural enemies of aphids. Thus, all the plant species in this trial have already been identified as being potentially suitable sources of pollen or nectar for beneficial insects. Our interest was particularly focused on ladybeetles (Coccinellidae) and hoverflies (Syrphidae). Species from these families are native in Czech agroecosystems and serve as important natural enemies of several species of aphids (Rod et al. 2005).

The appearance of all natural enemies in the observed plants differed over time. The following data shows the flowering period of selected plants (Table 1) and the total numbers of ladybeetles and hoverflies seen on selected plant species during observations made from weeks 27 to 38 (Figure 1).

Flowering period

Tab. 1: Main flowering period of selected species.

week	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40
Anethum graveolens						■	■	■	■	■					
Tagetes patula					■	■	■	■	■	■	■	■	■	■	■
Centaurea cyanus				■	■	■	■	■	■	■	■	■	■	■	■
Calendula officinalis				■	■	■	■	■	■	■	■				
Vicia faba	■	■	■	■	■	■									

* Main flowering period is defined as the period when at least one plant has more than 1/3 of its possible flowers open.
** After week 38 observations of insects ceased because of the absence of natural enemies

According to Winkler (2005), *Anethum graveolens* and *Centaurea cyanus* are plants which flower simultaneously, and the other flowering species were presumed to also have a similar flowering period. Our observations show that *Vicia faba* has a flowering period earlier than the other species, which makes it useful as the first potential food source for natural enemies in the flowering strips. van Rijn (2006) reported that the main flowering period in *C.cyanus* lasted about 16 weeks, but here we observed it to be about 3 weeks shorter. This period, of course, is going to be influenced by the sowing date and by the particular definition of flowering employed. Further, according to van Rijn (2006), *V.faba* is useful for attracting beneficial insects from week 25 until week 32, a total of 8 weeks. In our experiment only a few plants of *V.faba* emerged and, in addition, were damaged by aphids at an early stage and by mould later on. The flowering period was nearly the same, from week 26 to week 31, in total about 2 weeks shorter.

Attractiveness of flowering plant species

Centaurea cyanus was recommended by Winkler (2005) as a plant visited by the hymenopteran parasitoid but not by the herbivores in the case of a brassica crop. *C.cyanus*, together with *Calendula officinalis* and *Anethum graveolens*, is included in a mix of annuals designed to give a continuum of available nectar and pollen for bees (Orsolini 2009). Furthermore, in a fruit orchard the greatest numbers of predatory bugs (anthocorids) were found on *C.cyanus* (Fitzgerald and Solomon 2004). In the research of Alomar et al. (2006), *C.cyanus* was identified as an insectary plant that may be used to enhance the numbers of predatory bugs and hoverflies.

In our field experiment *C.cyanus* was most frequently visited (48 times) by ladybeetles (Coccinellidae) and considerably less (9 times) by hoverflies (Syrphidae). From the family Coccinellidae the most frequent species observed was *Coccinella septempunctata* and *Adalia bipunctata*. The presence of ladybeetles on *C.cyanus* was observed mainly in the early part of the season (from week 27 till 32). In this period many flowers were still not open and ladybeetles were seen on the flower buds instead of on open flowers. This was most probably due to the

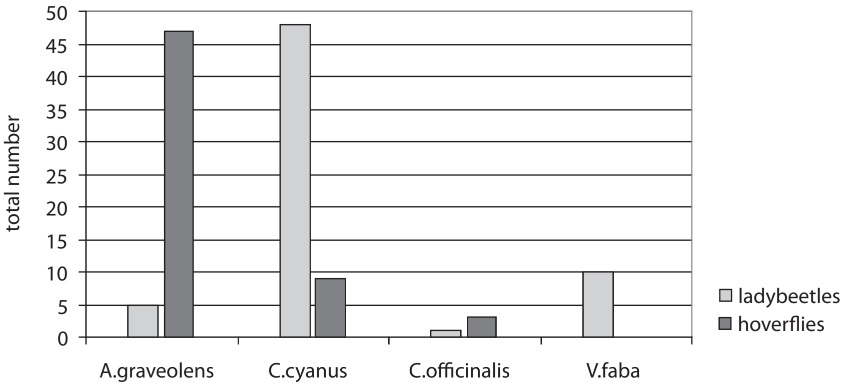

Figure 1: Total number of natural enemies observed on selected flowering species from week 27 to 38.

extrafloral nectar which is produced by *C.cyanus* (Winkler 2006). According to this author, extrafloral nectar can be an important source of carbohydrates for insects. The production of certain amounts of extrafloral nectar was also confirmed by the presence of ants foraging for nectar on the flower buds. As mentioned by Heil (2001), ants forage preferentially on plants with extrafloral nectaries.

Winkler (2006) considered ***Anethum graveolens*** as especially suitable for parasitoids. An advantage of this species is the presence of exposed nectaries which provide a more concentrated nectar than the hidden nectaries. In our experiment this plant was visited mostly by hoverflies (47 times, followed by ladybeetles 5 times). Therefore, *A.graveolens* was identified as being attractive for hoverflies.

In ***Vicia faba*** we noted a certain amount of ladybeetle activity (10 visits) at the beginning (week 27 till 29), but all of them were foraging on aphids rather than flowers. In this case, *V.faba* can evidently serve as an aphid reservoir for beneficial insects. A similar idea has already been mentioned by Alomar (2006), who stated that the co-occurrence of the predator and pest in flowers may also confer some potential for reducing pest populations and so prevent problems from developing. Even if van Rijn (2006) recorded some attractiveness of *V.faba* for hoverflies, in our experiment no hoverflies were seen on this plant.

Tagetes patula was not visited by either ladybeetles or hoverflies. ***Calendula officinalis*** was visited infrequently by ladybeetles (once) and hoverflies (three times), from which little can be concluded.

Later on (from week 33) almost only honey bees were observed as foraging on the open flowers (mostly in *C.cyanus*). The absence of the previously observed natural enemies might be explained by two factors. First, the natural enemies found a better food source. Second, there was competition for the available food resources between bees and the other beneficial insects, as reported by Lee and Heimpel (2003) and Winkler (2005).

Conclusions

In the given circumstances (plant mixture, environmental conditions) *Centaurea cyanus* can be considered as an attractive food source for ladybeetles (Coccinellidae) and *Anethum graveolens* as an attractive food source for hoverflies (Syrphidae). In the case of *Vicia faba*, the ladybeetles were attracted by the presence of aphids, and not by pollen or nectar. In other plant species we didn't observe any preferences on the part of selected natural enemies (hoverflies, ladybeetles). However the importance of certain flowering species as host plants for other natural enemies has still to be investigated. It has to be mentioned that at least once during our observations some other beneficial insects were seen on our flowering plants, e.g. lacewings (Neuroptera) and parasitic hymenopterans (Ichneumonidae), which are also important natural enemies of pests in agroecosystems.

Acknowledgments

This work was supported by Project GF 4195 of the Ministry of Agriculture, Czech Republic.

References

- Alomar et al.: Selection of insectary plants for ecological infrastructure in Mediterranean vegetable crops. In: Landscape Management for Functional Biodiversity. IOBC/WPRS Bulletin Vol. 29 (6) 2006. p. 5–8.
- Altieri, M.A.; Nicholls, C.I. Fritz, M.A.: Manage your insects on your farm. A guide to ecological strategies. Beltsville: Sustainable Agriculture Network. 2005. 119 p.
- Bianchi, F.J.J.A.; Booij, C.J.H.; Tscharntke, T. 2006 Sustainable pest regulation in agricultural landscapes: a review on landscape composition, biodiversity and natural pest control. Proceedings of the Royal Society B. 273: 1715–1727.
- Flückiger, R.; Schmidt, M.H.: Controbution of sown wildflower areas to increase aphid control: from local to landscape scale. In: Landscape Management for Functional Biodiversity. IOBC/WPRS Bulletin Vol. 29 (6) 2006. p. 41–44.
- Lee, J.C.; Heimpel, G. E.: 2003.Nectar availability and parasitoid sugar feeding. 1st International Symposium on Biological Control of Arthropods, Honolulu, HI, 14–18 January 2002.
- Moonen, C. et al: Field margin structure and vegetation composition effect on beneficial insect diversity at farm scale: a case study on an organic farm near Pisa (Italy) In: Landscape Management for Functional Biodiversity. IOBC/WPRS Bulletin Vol. 29 (6) 2006. p. 77–80.
- Pfiffner, L.; Luka, H.; Schlatter, M.; Lichtenhahn, M.: Wildflower strips to reduce lepidopteran pests in cabbage crops. In: Landscape Management for Functional Biodiversity. IOBC/WPRS Bulletin Vol. 29 (6) 2006. p. 97–99.
- van Rijn, P.C.J.; Kooijman, J.; Wäckers, F.L.: The impact of floral resources on syrphid performance and cabbage aphid biological control In: Landscape Management for Functional Biodiversity. IOBC/WPRS Bulletin Vol. 29 (6) 2006. p. 149–152.
- Wäckers, F.L. et al.: Flower power? Potential benefits and pitfalls of using (flowering) vegetation for conservation biological control. In: Landscape Management for Functional Biodiversity. IOBC/WPRS Bulletin Vol. 29 (6) 2006. p. 161–164.
- Winkler et al.: Strategic use of nectar sources to boost biological control. In: Landscape Management for Functional Biodiversity. IOBC/WPRS Bulletin Vol. 29 (6) 2006. p. 165–168.

PRELIMINARY RESULTS WITH USING SUPPLEMENTARY PLANT PREPARATIONS LIGNOHUMATE B AND SYNERGIN® IN ORGANIC GROWING OF STRAWBERRIES

BOČEK, S.[1], SALAŠ, P.[1], SASKOVÁ, H.[1], PATOČKOVÁ, Š.[1] & MOKRIČKOVÁ, J.[1]

Key words: strawberry, vitamin C, dry matter, Lignohumate B, Synergin®

Abstract

The effects of supplementary plant preparations on the yield, nutritional value and health status of strawberries under the condition of simulated organic cultivation were assessed. Field experiments were established from frigo plants of varieties Honeoye and Symphony in spring 2008. Both humic acid preparation Lignohumate B and biostimulator Synergin® did not influenced marketable yield of strawberries. Honeoye reached the highest yield after the combined application of Lignohumate B+Synergin®. Symphony had the highest productivity after the Lignohumate B application. Combined applications of Lignohumate B+Synergin® increased vitamin C content in fruits but the values were not significantly higher than that of the control. For Symphony, single application of Lignohumate B and Synergin® caused significantly lower vitamin C content in fruits than joint applications of both supplementary preparations. Treatments did not affect dry matter in fruits but Symphony had significantly higher dry matter content than Honeoye. Symphony seemed to be more properly for organic cultivation under the experimental conditions because of significantly higher resistance to root rot.

Introduction

Strawberry production meets a minority interest in the Czech Republic, while there are elaborate organic systems in many other countries. Suitable varieties and providing plant nutrition are premises for the success. Rhainds et al. (2002) recommend the variety Honeoye because of its high productivity, quality and resistance to pathogens. Barth et al. (2002) approve the varieties Honeoye and Symphony for organic production in Austria. In Denmark, Honeoye, Symphony, Pandora, Kent and Cortina were the most promising from total 20 evaluated varieties (Daugaard & Lindhard, 2000). Neri et al. (2002) report usage of humic acid preparation on strawberries. Their application had a positive effect on fruit quality, reduced the number of rotten fruits and increased the sugar content. Rákos (2006) introduces the possibilities of using humic preparation Lignohumate. It supported root development and tolerance to stress factors. Also fruit size, nutritional values and antioxidants content were positively influenced in several crops. Active substances of Lignohumate strengthen cell walls and thus plant resistance to diseases is supported. Zahradníček et al. (2006) have been tested biostimulator Synergin® at several field crops, vegetables and peaches. They proved positive effect of Synergin® on plant growth and productivity.

---

[1] Mendel University of Agriculture and Forestry Brno, Faculty of Horticulture, Lednice, 61300, Czech republic, E-Mail bocek@mendelu.cz, Internet www.mendelu.cz

Materials and methods

Experimental plots were established at Faculty of Horticulture in Lednice (Mendel University of Agriculture and Forestry Brno) in spring 2008. The locality is situated in Southern Moravia (above sea level 180 m, average temperature 9 °C, average year precipitation 517 mm, silty soils). The experiments were conducted as simulated organic system since there was used so far conventional management. The pea was the previous crop. Horse farmyard manure was applied (40 $t.ha^{-1}$) in the beginning of April. No other fertilizers were added. Soil chemistry was following: pH 6.02, P 152.4 $mg.kg^{-1}$, K 289.4 $mg.kg^{-1}$, Ca 2648 $mg.kg^{-1}$ and Mg 365.8 $mg.kg^{-1}$ (Mehlich III).

We used varieties Honeoye and Symphony, both often recommended for organic system abroad. Honeoye (Vibrant × Holiday, USA) is an early short-day variety with a high production. The berries are of medium to large size and conical shape. Skin is very glossy, medium to dark red. Symphony (Rhapsody × Holiday, Scotland) is a late (5 day later than Elsanta) short-day variety. The plants are vigorous and highly productive. The berries are large to medium size, tough, juicy, with good internal colour and slightly raised achenes. Skin is glossy, flavour is very good.

We used annual double rows hill system with black PE plastic mulch. The centres of hills (double rows) were 0.8 m apart, spacing of plants 0.30×0.25 within the double row. Drop irrigation was installed. Two weeks after planting the furrows were mulched with wheat straw (thick layer approximately 0.03 m). Frigo plants (originated from Goossens Flevoplant B.V., Netherlands) were planted on April 30th. The experiments were set as randomized block design with four replicates per treatment. The plot size consisted of 20 plants. We used the following treatments:

- Lignohumate B. The preparation Lignohumate B is a mixture of salts of humic substances with a high content of fulvic acids. It is an environmental-friendly supplementary plant preparation produced from clean natural raw materials (Amagro Ltd., Czech Republic). The roots of frigo plants were soaked in 1 % Lignohumate B for 2 hours. The foliar applications were made three times (dose 1.0 $l.ha^{-1}$, spray liquid volume 400 $l.ha^{-1}$): firstly two weeks after planting, secondly in the beginning of flowering (BBCH 61) and finally at the end of flowering (BBCH 68).
- Synergin®. Synergin® is a synergistic bioregulator of plant growth, which contains a number of physiologically active substances, namely the natural cytokinin and auxin precursors of organic origin produced from food raw materials (Juwital Ltd., Czech Republic). Synergin® was applied by foliar way in the same time as Lignohumate B in recommended dose 2 l per hectare (spray liquid volume 600 $l.ha^{-1}$)
- Lignohumate B + Synergin®. The doses and timing of application – see treatments 1 and 2, respectively. The foliar apllications were firstly made with Lignohumate B, after the drying the solution on leaves Synergin® was applied.
- Control. Free of any preparations.

The harvests were assigned to Extra Class, Class I or class II according to the marketing standards of the European Union – commission regulation (EC) no 843/2002. Vitamin C content ($mg.kg^{-1}$ of fresh fruits) was analysed by HPLC (sampled of 10 fruit per replicate, during 3rd harvest), dry matter content (%) in fruits was measured after drying at 105 °C until the constant weight (sampled of 5 fruits per replication). Data were statistically processed by ANOVA and Tuckey HSD test ($P<0.05$) using software Unistat ver. 5.1. Number of necrotic plants was analysed by software UPAVplus, ver. 1.06 (Czech Phytosanitary Administration).

Results

The harvest of Honeoye began on the 12th of June and it finished on the 1st of July (total six harvests, interval of three days). The highest marketable yield was observed in plots treated with combined application of the humic acid preparation and the biostimulator (53.5 g per plant), but it was not significant from non-treated control (Tab.1). Vitamin C content was not significantly influenced by the preparations, though the highest values were found after joint application of both preparations as well (773.3 mg.kg^{-1}). Dry matter content was not affected by treatments, it varied from 9.4 % (Lignohumate B+Synergin®) to 9.9 (Synergin®).

Tab. 1: Marketable yield, nutritional values and health status for Honeoye.

Treatment	Marketable yield (g.plant^{-1})		Vitamin C (mg.kg^{-1})		Dry matter (%)		Necrotic plants (%)	
Lignohumate B	48.4	a	696.5	a	9.7	a	37.5	a
Synergin®	51.7	a	683.8	a	9.9	a	36.5	a
Lignohumate B + Synergin®	53.5	a	773.3	a	9.4	a	25.3	a
Control	42.2	a	729.5	a	9.7	a	50.5	a

Different letter between rows indicate significant differences for P<0.05

The harvest of Symphony was carried out firstly on the 19th of June and finally harvest was done on the 7th of July (total five harvests). The results of evaluation of Symphony were rather similar to Honeoye. Only combined application of Lignohumate B and Synergin® significantly increased vitamin C content compared to single use of both substances (Tab. 2).

Tab. 2: Marketable yield, nutritional values and health status for Symphony.

Treatment	Marketable yield (g.plant^{-1})		Vitamin C (mg.kg^{-1})		Dry matter (%)		Necrotic plants (%)	
Lignohumate B	53.7	a	669.0	a	10.8	a	12.7	a
Synergin®	42.1	a	645.8	a	10.3	a	13.5	a
Lignohumate B + Synergin®	44.1	a	749.3	b	10.9	a	9.4	a
Control	38.9	a	707.0	ab	10.5	a	17.9	a

Different letter between rows indicate significant differences for P<0.05

After harvest time, in the middle of July, sudden plant decline was observed, mainly in Honeoye. Root rot complex (caused by *Phytophthora*, *Pythium*, *Rhizoctonia* and *Verticillium* species) resulting on plant dying was assessed according to number of diseased (necrotic) plants at the end of August. The best health status was found in plots treated with Lignohumate B, especially when it was combined with Synergin®. The variety Symphony had significantly lower number of necrotic plants (13.4 %) compared to Honeoye (37.4 %).

Discussion

We submit preliminary one year data obtained from one experimental site, therefore it is difficult to make a generalisation of these results. High percentage of rotted plants could be explained by poor suppressive soil ability. Biologically active soils show naturally sturdiness (Sullivan, 2004). We worked on soils with so far conventional management. Our results confirmed quite susceptibility of the variety Honeoye to crown rot, caused by *Phytophthora cactorum* (Parikka, 2003). On the contrary the variety Symphony proved a good resistance (Kerby & McNicol, 1997). Our results to a certain extent agree with research of Neri et al. (2002), who reported the positive physiological effect of humic acids on strawberries. They assume an indirect effect of foliar application on the whole plant. We get the best results using combination of humid acids with Synergin®. According to Leskinen, Väisänen & Vestergaard (2002) the variety Honeoye has very high vitamin C content, which gets over the 750 $mg.kg^{-1}$.

Conclusions

The preparations did not significantly influenced yield, quality and health status of strawberries. Generally the best results were achieved with combined application of Lignohumate B and Synergin®. After one year evaluation we submit preliminary result get under the condition different to certificated organic plots. The experiments will be continued on fields continuously meliorating with green manure to make soil naturally more suppressive against fungal diseases.

Acknowledgments

This work was supported by funds of the Ministry of Agriculture of the Czech Republic, Project No. QH82231.

References

- Daugaard H. & Lindhard H. (2000): Strawberry cultivars for organic production. Gartenbauwissenschaft. 65 (5), p. 213–217.
- Kerby N.W. & McNicol R.J (1997): Symphony – A New Strawberry Cultivar. Acta Horticulturae. 439, Vol. I., p. 251–252.
- Leskinen M., Väisänen H.M., Vestergaard J. (2002): Chemical and Sensory Quality of Strawberry Cultivars Used in Organic Cultivation. Acta Horticulturae. 567, p. 523–526.
- Neri D., Lodolini E. M, Savini G., Sabbatini P., Bonanomi G., Zucconi F. (2002) Foliar application of humic acids on strawberry (cv Onda). Acta Horticulturae. (594), p. 297–302.
- Parikka P. (2003): Screening for Strawberry Plant Resistance to *Phytophthora cactorum* in a Nutrient Film Technique (NFT) System. Acta Horticulturae. 708, p. 119–122.
- Rákos L. (2006): Lignohumát – huminový přípravek moderního zahradníka. Zahradnictví, 5, p. 59.
- Rhainds M., Kovach J., English-Loeb G. (2002): Impact of strawberry cultivar and incidence of pests on yield and profitability of strawberries under conventional and organic management systems. Biological Agriculture and Horticulture. 19 (4), p. 333–353.
- Sullivan P. (2004): Sustainable Management of Soil-borne Plant Diseases, htttp://www.attra.org/attra-pub/soilborne.html, (accessed 2008–04–03).
- Zahradníček J., Tyšer L., Brixí J. (2006): Poznatky s ověřováním Synerginu a výluhových extraktů tabáku a kopřiv na okurkách a pelargóniích. Zahradnictví. 5, p. 60–61.

TOMATO CULTIVARS TOLERACE TO *PHYTOPHTORA INFESTANS* IN ECOLOGICAL PRODUCTION SYSTEM

KOUDELA, M.[1], CHLADOVÁ V., SUS, J. & SVOZILOVÁ, L.

Key words: tomato, *Phytophtora ifestans*, tolerance, ecological production

Abstract

85 tomatoes cultivars were tested in the light of tolerance to Phytophtora infestans on the field of the company Botanicus Ostrá in 2007. Infection was observed in 8 terms (from 16. July to 25. September). Plants were evaluated using 9 points scale (0 – without symptoms, 8 – perish). Results were statistcally evaluated using ANOVA, culivars were divided into 33 homogenous subgroups. Cultivars Shirley, Riesentraube, Opalka, Vama, Tornádo F1, Black Ethiopian, Broad Ripple Yellow, De Barao Black, Bejbino F1 were significantly the most tolerant; cultivars Verna Orange, Orange Strawberry, Orange Beef Heart, Tomate Rouge Lutescent, Yellow Perfection, Calinago, Orange Queen, Gold Dust, Ida Gold were signifiantly the most sensitive to Phytophtora infestans.

Introduction

The aim of this work was evaluation of tomato cultivars tolerance to *Phytophtora infestan*. The trial was found on the field with vegetables bioproduction of firm Botanicus Ostrá in 2007. 85 cultivars were tested in the light of tolerance to *Phytophtora infestans*. This is one of the most problematical disease on tomato plants. A wide assortment of fungicides is used for treatment in the conventional and integrated vegetable production systems. This possibility is considerably reduced in the ecological system. On that ground, choosing of proper cultivar with higher field tolerance against *Phytophtora infestans* could be suit preventive measure in the plant protection on ecological field. Schwarz et al. (1996) mentioned as proper cultivars with not too dense habitus. Hradil et al. (2000) recomended dripp irrigation like other important preventive measure against this fungi disease, because this way of irrigation reduces leaves wetting.

Material and methods

The growing of tomatoes went ahead according to the metodology of Malý et al. (1996). The growth of tomatoes was found from seedlings, spacing of plants was 100 x 30 cm. Each cultivar was grown in 5 repetitions. Sum total of observation terms is 8 (in 11–12 day´s intervals) – first on 16. July, last on 25. September. Plants were evaluated using 9 points scale (level 0 – without symptoms of *Phytophtora infestans*, level 8 – perish). Results were statistcally evaluated using ANOVA (analysis of variance) with sequential testing. Culivars were divided into 33 homogenous subgroups from the most to least tolerant.

[1] Faculty of Agrobiology, Food and Natural Resources – Department of Horticulture
Czech University of Life Sciences Prague

Results and discussion

Tab. 1: The development of *Phytophtora infestans* on the most tolerant tomato cultivars (point evaluatin from 0 to 8).

	6.7.	18.7.	30.7.	10.8.	22.8.	3.9.	14.9.	25.9.
Shirley	0	0,5	1,1	2,4	3	3,2	3,4	4,4
Riesentraube	0	0,2	1,1	2,6	3,1	3,5	3,6	4,8
Opalka	0	1,6	1,9	2,4	2,7	3,1	3,3	4,8
Vama	0	1,9	2,2	2,2	2,7	3,1	3,2	4,8
Tornádo F1	0	1,8	2,3	2,5	2,7	3	3,1	4,9
Black Ethiopian	0	1	1,8	1,7	2	2,9	3,4	5,1
Broad Ripple Yellow	0	0,3	1	2,1	2,5	3,5	4,4	5,2
De Barao Black	0	0,5	1,6	2,1	2,7	3,7	4,6	5,2
Bejbino F1	0	1,6	1,9	1,8	2,4	3,1	3,3	5,7

The highest level of infection was usually under value 5 (from 0 to 8). The development of *Phytophtora infestans* was slow, there were infected only leaves and stems. Fruits were undamaged and the ripening process went ahead no problems. Vorlíček (2006) describes cultivars Vama and Broad riple yellow tolerant too.

Tab. 2: The development of *Phytophtora infestans* on the least tolerant tomato cultivars (point evaluatin from 0 to 8).

	6.7.	18.7.	30.7.	10.8.	22.8.	3.9.	14.9.	25.9.
Verna Orange	0	1,8	2,3	2,8	3,5	4,5	5,5	6,8
Orange Strawberry	0	1,3	2,2	3,1	3,1	4,2	5,3	6,9
Orange Beef Heart	0	2	2,1	2,3	2,7	4,3	5,8	7
Tomate Rouge Lutescent	0	1,4	1,8	2,5	3,4	4,5	5,4	7
Yellow Perfection	0	1,9	2,2	2,4	3	4,4	5,6	7,1
Calinago	0	1,3	2,2	2,6	3,8	4,6	5,4	7,5
Orange Queen	0	1,5	2,2	2,8	3,7	5,1	6,5	7,8
Gold Dust	0	0,9	1,5	2,6	3,5	4,1	5,5	7,8
Ida Gold	0	0,5	1,6	2	2,7	5,4	6,5	7,8

Development of infection was slow in the beginning, but later, the plants showed higher level of *Phytophtora infestans* infection, some of them perished.

Slow process of infection in the beginning of vegetative period 2007 corresponded with normal precipitation. Expansion of *Phytophtora infestans* in the late stage of vegetative period was occured with increase of precipitation. Rod et al. (2005) mentioned precipitation like main factor influenced expansiont of *Phytophtora infestans*. West et al. (2008) reports of cultivars resistance to other fungi disease of rape too.

Conclusions

There were significant differences in tolerance to *Phytophtora infestans* among 85 tested tomato cultivars.

The most tolerant cultivars against *Phytophtora infestans* were folloving: Shirley, Riesentraube, Opalka, Vama, Tornádo F1, Black Ethiopian, Broad Ripple Yellow, De Barao Black, Bejbino F1.

The most sensitive cultivars to *Phytophtora infestans* were: Verna Orange, Orange Strawberry, Orange Beef Heart, Tomate Rouge lutescent, Yellow Perfection, Calinago, Orange Queen, Gold Dust, Ida Gold.

Acknowledgment

This work was supported by the Ministry of Education, Youth and Sports of the Czech Republic, Project No. MSM 6046070901.

References

- Hradil R., Dostálek P., Jetmarová E., Vlk R., Řezníček V. (2000): *Česká biozahrada*. Fontána, Olomouc, 184 p.
- Malý I., Bartoš J., Hlušek J., Kopec K., Petříková K., Rod J., Spitz P. (1996): *Polní zelinářství*. Agrospoj, Praha, 196 p.
- Rod J., Hluchý M., Zavadil K., Prášil J., Somssich I., Zacharda M. (2005): *Obrazový atlas chorob a škůdců zeleniny střední Evropy*. Biocont Laboratory, Brno, 392 p.
- Schwarz A., Etter J., Künzler R., Potter C., Rauchenstein H.R. (1996): *Obrazový atlas chorob a škůdců zeleniny*. Biocont Laboratory, Brno, 320 p.
- Vorlíček Č. (2006): *Zhodnocení sortimentu rajčat z hlediska odolnosti plísni bramborové* (*Phytophthora infestans*). (Bakalářská práce). ČZU, Praha, 45 p.
- West, J. S. Fitt, B. D. L. Rogers, S. L. White, R. P. Todd, A. D. Latunde-Dada, A. O. Gladders, P. Thomas, J. Booth, E. Jennaway, R. Clarke, M. Padbury, N. Bowman, J. Nightingale, M. Werner, P. Jellis, G. (2008): *Components of resistance to diseases in winter oilseed rape cultivars: CORDISOR*. HGCA Project Report. 2008. 446, 71 pp.

SUSTAINABILITY ASSESSMENT OF ORGANIC AND CONVENTIONAL FARM

VALTÝNIOVÁ, S.[1]

Keywords: farming systems, organic farming, sustainability assessment, nutrient balance, energy balance

Abstract

The aim of the article is to show some differences between the organic and conventional farming system on the bases of 2 farms assessment and the literature. The nutrient and organic matter balance, system productivity and the energy balance were calculated on the basis of farms agronomic records from a 3 years period. For the calculation the software model Repro (Hülsbergen and Diepenbrock 1997) was used. There was a significant difference in nutrients input and structure of applied fertilizers between the farms. Most frequently plus nitrogen (N) and minus phosphorus (P) and potassium (K) balance occurred in both systems. Organic matter balance on conventional farm is low but stable, while on organic farm decreases in time. Results of no farm in any year met the optimum range. Fossil energy consumption was lower on organic farm, but in the case of machinery use and fuels consumption, the organic farm made a higher demand than the conventional one. Also, when the productivity of the organic system was lower, the efficiency of energy use was lower only slightly.

Introduction

Nowadays the demand for sustainable agricultural performance provides a great opportunity for development of organic farming. But that means also a need for sustainability assessment. However, differences in management of these two farming systems are of significant importance and result in different soil properties, density and activity of soil organisms and nutrient dynamics in soil. Also, chemical characteristics of plants and nutrients uptake by them are different in both systems (Stehno 1999, Hülsbergen 2003). In this paper, we present the part of the work dealing with assessment and comparison of the organic and conventional farm, to show some differences between the systems.

Materials and methods

Nutrients (N, P, K), organic matter, energy balances and productivity of organic and conventional farm were calculated in 3 years (2004–2006). The data originate from farms agronomic records. The organic farm represents system with animal production with very

[1] Department of Agrosystems and Bioclimatology, Faculty of Agronomy, Mendel University of Agriculture and Forestry in Brno, Zemedelska 1, 61300 Brno, Czech Republic, e-mail: xvaltyni@mendelu.cz

diverse structure and the conventional farm represents intensive system without animals with narrow crop structure (Table 1).

Used method, Repro (Hülsbergen and Diepenbrock 1997), contains different coefficients in algorithms for organic and conventional farming based on long-term experiments conducted at Martin-Luther-Universität in Halle, Germany (Hülsbergen 2003). This approach was tested for the Czech Republic by Dubec (2004).

Tab. 1: Farms characteristics.

	Organic farm	Conventional farm
Altitude	500–550 m	262–336 m
Average temperature	6.5 °C	8.2 °C
Precipitation	750 mm	520 mm
Soils	cambisols	haplic luvisols
Acreage	293 ha arable land, 190 ha grassland	492 ha arable land
Livestock	cattle (80), pigs (80), sheep (30), goats (6), horses (15)	-
Crops structure	buckwheat, rye, triticale, oats, potatoes, white lupin, cereal-legumes mixtures, onions	spring barley, sugar beet, poppy

Results and discussion

Nutrient balances

The organic and conventional system differ significantly in intensity of nutrients consumption (Figure 1, 2, 3), but nutrients are slightly out of balance in both of them (Table 2), as concluded also by Stehno (1999) and FiBL (2000). Plus N-balance and minus P- and K-balance usually occur. In the Czech Republic, it is also a result of general extensification of agriculture after 1989.

The two systems strongly differ in the structure of fertilisers used (Figure 1, 2, 3). Several authors describe different dynamics of nutrients and life in soil (Stehno 1999, Hülsbergen 2003) but also point out that soil characteristics are strongly affected also by soil type and tillage practices (van Diepeningen et al. 2006), and pedo-climatic characteristics (Pacini et al. 2003).

Tab. 2: Nutrient balances overview (kg N.ha^{-1}).

Balance parameter	Organic farm			Conventional farm		
	2004	2005	2006	2004	2005	2006
N-Balance	18.56	24.77	5.58	43.01	40.10	56.50
P-Balance	1.42	–0.05	–6.29	–1.78	21,00	–1.81
K-Balance	14.89	–23.28	–29.24	–13.54	4.05	–18.64

Organic matter balance

Organic matter is out of balance in both systems (Table 3). On the organic farm appears quite a high instability, caused by changeable crop structure and by management of farmyard manure application. The organic matter balance for the conventional farm is stably low. The only income or organic matter into the soil is plant residues. Organic matter input into both systems is almost the same, but mineralization is much more intensive in the conventional system.

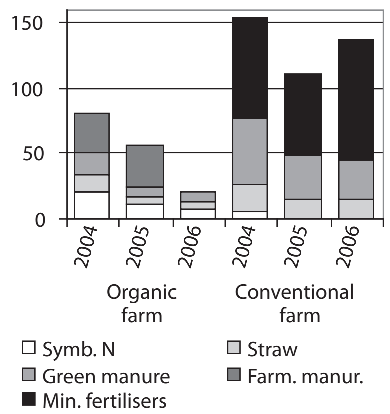

Figure 1: N-input in different fertilisers (kg.ha-1)

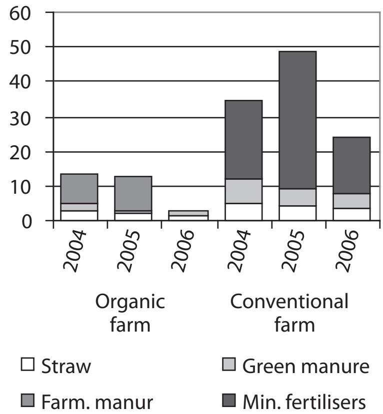

Figure 2: P-input in different fertilisers (kg.ha-1)

According to Stehno (1999), performance in this point depends more strongly on soil tillage practices, but in this study there was much higher dependence on crop structure. Diepeningen et al. (2006) did not find significant differences between systems in the development of the content of organic carbon in soil. But FiBL (2000) presents some slightly better performance of the organic system.

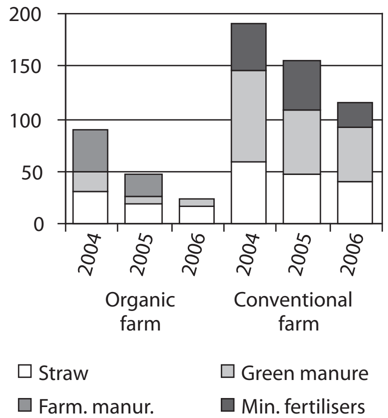

Figure 3: K-input in different fertilisers (kg.ha-1)

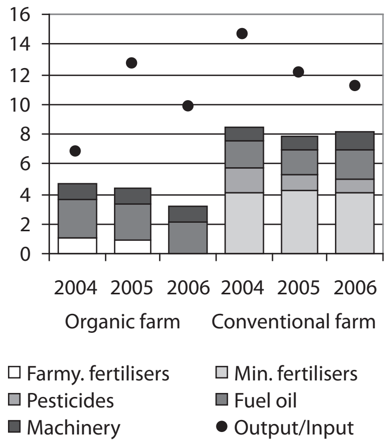

Figure 4: Energy demand (GJ.ha-1) and efficiency of energy use (output/input)

Tab. 3: Organic matter balance (HE.ha^{-1}).

Balance parameter	Organic farm			Conventional farm		
	2004	2005	2006	2004	2005	2006
Gross demand	–0.57	–0.8	–0.49	–1.41	–1.14	–0.82
Org. matter income, total	0.70	0.44	0.16	0.59	0.48	0.45
Balance	0.13	–0.36	–0.32	–0.82	–0.66	–0.37
Supply grade (%)	122.02	54.83	33.53	41.88	42.24	54.54

Energy balance and system productivity

In the presented example, there is a significant difference in productivity between the organic and conventional farm (16 to 26 Grain units (GU) on organic farm and 67 to 70 GU on conventional farm). There is no such high difference of productivity reported in literature. According to Pimentel et al. (2005) the yields are almost equal, FiBL (2000) presents a difference of about 20 %. The presented result is influenced by quite great difference between the compared farms. However, it corresponds with the situation in organic farming in the Czech Republic to a certain extent, when all skills, especially in arable farming are not fully adopted yet.

The conventional farm has higher consumption of fossil energy but energy utilisation is slightly more effective (Figure 4). The points in which the organic farm has higher energy consumption per ha are fuels and machinery, which corresponds with the findings of Delgaard et al. (2003). Very energetically expensive are mineral fertilizers consuming about one half of total energy incomes of conventional farm.

Conclusions

1. The organic and conventional farming system differs in structure and nature of used fertilisers which influence especially nutrients balance. The difference in organic matter balance is affected more by the crop structure, tillage practices and organic matter management.

2. Plus N-balance and minus P- and K-balance usually occur in both systems. The organic farm seems to be instable in organic matter balance, the conventional farm performs at a stable insufficient level of organic matter balance.

3. Fossil energy consumption is lower in organic farming, but in the case of machinery use and consumption of fuels it is lower in conventional one. Productivity of the systems differs significantly, but the efficiency of energy use is only slightly lower in organic farming.

There is a need to monitor longer-term development of indicators to assess the sustainability of performance of the farm.

Acknowledgements

The study was supported by project No. 2406/F4, financed by the Ministry of Education, Youth and Sports of the Czech Republic and project No. QH92242, financed by Ministry of Agriculture of the Czech Republic.

References

- Delgaard T., Kelm M., Wachendorf M., Taube F., Delgaard R., 2003. Energy balance comparison of organic and conventional farming. In: Organic Agriculture: Sustainability, Markets, and Policies, CABI Publishing, OECD.
- Dubec J., 2004. Assessing of farming sustainability (in Czech). Doctoral thesis, Mendel University of Agriculture and Forestry in Brno.
- FiBL, 2000. Organic farming enhances soil fertility and biodiversity. In FiBL Dossier. Nr.1, august 2000.
- Hülsbergen K. J., 2003. Entwicklung und Anwendung eines Bilanzierungsmodells zur Bewertung der Nachhaltigkeit landwirtschaftlicher Systeme. Berichte aus der Agrarwissenschaft. Aachen: Shaker Verlag.
- Hülsbergen K. J., Diepenbrock W., 1997. Das Model REPRO zur Analyse und Bewertung von Stoff- und Energieflüssen in Landwirtschaftsbetrieben. In Hülsbergen K. J., 2003: Entwicklung und Anwendung eines Bilanzierungsmodells zur Bewertung der Nachhaltigkeit landwirtschaftlicher Systeme. Berichte aus der Agrarwissenschaft. Aachen: Shaker Verlag.
- Pacini C., Wossink A., Giesen G., Vazzana C., Huirner R., 2003. Evaluation of sustainability of organic, integrated and conventional farming systems: a farm and field-scale analysis. In Agriculture, Ecosystems and Environment. Nr. 95 (2003), 273–288.
- Pimentel D., Hepperly P., Hanson J., Dous S., Seidel R., 2005. Environmental, Energetic and Economic Comparisons of Organic and Conventional Farming Systems. BioSciance Vol. 55 No. 7, 573–582.
- Stehno L., 1999. Nutrients balance – the fundamental of functional organic farming. 10 years of organic farming (in Czech) [online]. Agris, 22 September 1999 [cited on 15 May 2007]. Available at http://www.agris.cz/vyzkum/detail.php? id=107707 &iSub=566.
- Van Diepeningen A. D., de Vos O. J., Korthals G. W., van Bruggen A. H. C., 2006. Effects of organic versus conventional management on chemical and biological parameters in agricultural soils. In: Applied Soil Ecology, 3, 120–135.

COMMUNICATION, PLACEMENT AND ASSORTMENT OF BRANDED AND NON-BRANDED ORGANIC PRODUCTS IN A DIFFERENT SALES POINTS

KUTNOHORSKÁ, O.[1]

Key words: private brands, brand building, consumer behaviour, communication strategy

Abstract

This contribution deals with the alternative approaches in brand building and brand management in the different points of sale. In the connection with dynamic market changes underlines movement in the consumer behavior and adverts to specifics of the application of marketing approaches in the field of organic products. The communication is one of the integral parts of creation the organic product concept, but the results of the study indicate, that many of producers and traders take no sufficient attention to this fact.

Introduction

The growing share of organic products on the total consumption is one of the most significant trends, which can be identified in the food industry. The organic products market in the Czech Republic is a relatively young branch, first mentioned in 1993. The dynamic development is perceptible and the turn-over additions grow every year since that time.

Organic products represent the specific products category from the point of view of communication with consumer. We have to keep in view the fact of planning and realizing the communication strategy of new organic product. One of the most important parts of the communication strategy is brand building.

Materials and methods

Model of consumer behaviour presents relationships between presumptions to specifics of consumer behaviour, between stimuli, which starts specific consumer behaviour, between course of the decision-making process of consumers and the final results of the process. (Koudelka 1997).

Communication is counted among significant external factors of the model. To push a communication strategy, the classification parameters of quality of the product based on the theory of economics of information is important (Nelson 1970) According to the theory attributes of the product can be divided into following dimensions:

- Much-sought-for: the consumer can make himself sure about the attribute on purchase
- Verifying: the consumer can check the attribute after purchase, by using the product

[1] Institute of Chemical Technology, Department of Economics and Management of Chemical and Food Industry, Technická 5, 166 28 Praha 6, Czech Republic, E-mail olga.kutnohorska@vscht.cz

- Based on the confidence: the common consumer does not know how to appreciate the attribute by the objective methods as for example tasting, the only possibility is to trust to the declarations of the producer, the distributor, the trader, the independent organization etc.

In thoses cases, where the difference in the similar products is based on the specific origin or on the specific process of the production, the importance of the attributes based on the confidence increases. The customer is not able to appreciate the quality directly, he or she only makes up some expectations based on the parameters, which are connected with the product. The parameters are for example the design of the product, price, place of sale etc. The other way, how the expectation can be created, is based on the previous experience with using the product, provided that the product can be identified for example by means of the name of brand. Usually customers are not able to find out objective proofs, which make an appreciation of attributes, relating to processes of production and relating to the impact on the human health, possible. The conviction of existence of the attributes is based on the customers´ confidence and therefore is necessary to make a trustworthy communication. (Grosová 2004).

The effect of the trustworthy resource on the force of arguments was demonstrated on the example of organic food. In the case, when the trustworthy subject is responsible for fact, that food product marked "BIO" was really produced according to the principle of ecological agriculture, the consumers accepted the fact and then they presented their own activities to get more information about the group of the products. (Grunert et al. 1996).

The facts show, that marketing of specific food products, included organic food products, which give the consumer benefits based on the confidence in its existence, can be successful only if it is supported by the strong brands. Strong brands evoking the feeling of the confidence and the feeling of the reliability, with the connection with services and the way of distribution, can help to expand the share of organic food on the market. (Grosová 2004).

Results and Discussion

The study, which was realized in 2008 in Prague, was carried out to analyze ways of distribution and communication in the organic food segment, with a special view to private brands building. (Škvor, J. etc. 2008) The shops, which were selected into the study, represent the main traders of the organic products in Prague. From internet shops have been selected those who replied to the questions.

The points of sale were distributed into the three groups:

- supermarkets, hypermarkets, shops with conventional food,
- special shops with healthy nutrition,
- internet shops (www.biosfera.cz, www.bezlepka.cz, www.e-bio.cz).

The results of the study in the markets, which are included in the group 1 and 2, are shown in Table 1 and Table 2. The results of the internet shops research are summarized verbally.

Tab. 1: Private brands and assortment of organic products in shops.

The name of the shop	Private brand	Assortment of organic food					Place of sale	
		Fruits and vegetables	Milk products	Bread	Meat products	Beverages	Special	Between conventional products
Plus	BioBio	x	x	x	x	x	x	x
Tesco	Tesco Organic	x	x	x	x	x	x	x
Interspar	Natur*pur	x	x	x	x	x	x	x
COOP	-	-	-	x	-	x	x	-
dm	-	-	x	-	-	x	x	-
Matro	Lima	x	x	x	x	x	*	x
Bio Market Vítek	-	x	x	x	x	x	-	x
Albio	-	x	x	x	x	x	-	x
Country Life	Country Life	x	x	x	x	x	-	x

*organic cosmetics

Tab. 2: Availability of information in shops.

The name of the shop	Campaign for sales support	Possibility to get information on organic products from shop assistant	Information about assortment on web pages
Plus	-	-	x
Tesco	-	-	x
Interspar	tasting	x	-
COOP	-	-	x
dm	-	x	x
Matro	-	x	x
Bio Market Vítek	-	x	x
Albio	tasting	x	x
Country Life	tasting	x	x

We can say, that specialized and internet shops dispose with sufficient scope of fresh products while in the other areas the offer is equal in all shops including supermarkets. All distribution channels except of supermarkets prefer products from certain places and offer wide range of local products from Czech eco-farmers, while in supermarkets dominate private brands with no connection to local products.

During the survey there was not detected any campaign for sales support. The best answers for questions were provided by internet shops closely followed by shops with healthy nutrition. In big stores, where conventional products predominate organic ones, staffs was unable to respond questions related to "BIO" in general, neither to present organic products available in the store.

According to the survey, customers use to buy organic food mainly in supermarket chains. Those shops played crucial role in promotion of organic food mainly with implementation of private organic brands. Major part of products sold is imported from other countries. During the campaign there were available leaflets with information about organic products, as well as sales promotion actions took place (tasting, special bargain-packages etc.). When survey went on, there was no information available except of Interspar chain. This chain builds its own strong private brand Natur*pur and starts to dominate the area of organic products.

Conclusions

Dynamic development on the organic market is expected in the future. Originally not so important niche on the foodstuff market turned into dynamically developing segment, with strong customer base that dispose large purchasing power. It is clear, that future development will depend not only on the variety of organic products, but mainly on the effective distribution and communication strategy. When compared to the process in Western Europe, we can expect progressive appearance of new forms of direct sales, enlargement of organic products offer in catering as well as growth in supermarkets chain sales. Strategy of integrated marketing communication, which allows growth of strong and credible brands, is an essential part of future progress in this area. The strong brand of the organic product creates value not only for the producer or the trader of the product but also for customers. From the perspective of the customer the brand facilitates orientation among the products and simplifies interpretation and processing of information. The strong brand enhances confidence in the decision to buy as well as customer satisfaction.

Acknowledgments

This article was published as a part of research intention MSM 6046137306.

References

- Aaker, D.A. (2003): Brand building, Computer Press, Brno, ISBN 80–7226–885–6.
- Belz, M. (2001): Integratives Öko-Marketing: Erfolgreiche Vermarktung von ökologischen Produkten und Leistungen. Deutscher Universitäts-Verlag, Wiesbaden (zugleich Habilitationsschrift Universität St. Gallen, 2000), ISBN 3–8244–9047–1.
- Nelson, P. (1970): Information and consumer behaviour. Journal of Political Economy, 78, 311–329
- Grunert, K.G. et al. (1996): Market Orientation in Food and Agriculture. Boston, MA: Kluwer.
- Grosová, S. (2004): Komunikační strategie nových druhů potravin. Marketing &Komunikace 1/2004, str. 8–10. ISSN 1211–5622.
- Koudelka, J. (1997): Spotřební chování a marketing, Grada Publishing, 1997, Praha, ISBN 80–7169–372–3.
- Kotler, P., Keller, K.L. (2008): Marketing management, Grada Publishing, Praha, ISBN 978–80–247–1359–5.
- Study Potenciál biopotravin na českém trhu (2006): Gfk Praha a Synergy Marketing, Praha.
- Škvor, J. (2008): Marketingová strategie biopotravin, bakalářská práce, VŠCHT Praha.

Vážené kolegyně, kolegové, přátelé ekologického zemědělství,

v krásném prostředí Lednice se scházíme už podeváté. Snahou prvních ročníků bylo zaměřit akci převážně na praktická témata. Tuto akademii však navštěvovalo stále více pracovníků nejen ze zemědělské prvovýroby, ale i z výzkumných organizací. Proto byl program postupně upravován a stále intenzivněji jsme diskutovali o řešení požadavků a zaměření příspěvků tak, aby měly přínos pro praxi i pro výměnu vědeckých informací. Výsledek se dostavil v loňském roce, kdy účastníci Bioakademie mohli navštívit konferenci pro praxi a 1. ročník vědecké konference. Té se zúčastnilo 81 odborníků a celkem bylo představeno 34 témat ve 3 sekcích. Členové vědeckého výboru konference i organizátoři vyhodnotili celou akci jako přínosnou, a proto jsme pro vás připravili druhý ročník. Na ten se přihlásilo téměř 100 účastníků, bude představeno 23 příspěvků rovněž ve 3 sekcích. Jedna ze sekcí, stejně jako část konference pro praxi, je zaměřena na kvalitu půdy. Proto jsme na toto téma připravili workshop, na kterém jak odborníci z praxe, tak z výzkumu, budou diskutovat o otázkách hodnocení kvality půdy v ekologickém zemědělství.

Sborník, který držíte v rukou, obsahuje na rozdíl od loňského materiálu pouze příspěvky z vědecké konference. Ty jsou v plné verzi v anglickém jazyce, abstrakty jsou pak v závěru uveřejněny i v češtině. Ještě než se do něho začtete, rád bych poděkoval všem, kteří se o organizaci Bioakademie zasloužili. Jejich loga jsou uvedena na zadní straně sborníku. Úroveň vědecké konference je garantována vědeckým výborem, který spolu s týmem spolupracovníků z vědeckých institucí z řady zemí Evropy odvedl nelehkou práci při tvorbě programu a oponování příspěvků. Věřím, že s jejich pomocí, které si velmi vážíme, budeme moci počítat i v příštím ročníku, kdy bude Bioakademie slavit kulaté výročí.

Ještě jednou vás jménem organizačního a vědeckého výboru vítám v Lednici a doufám, že zde prožijete v příjemné atmosféře dny, které vás obohatí o nové poznatky, a že blíže poznáte pohostinnost jižní Moravy a komponovanou krajinu Lednicko-valtického areálu s jeho přírodními i architektonickými krásami.

Věřím, že akce naplní vaše očekávání a že zůstanete jejími příznivci i nadále.

prof. Dr. Bořivoj Šarapatka
předseda vědeckého výboru

ABSTRAKTY V ČESKÉM JAZYCE

(pracoviště autorů jsou uvedena v anglických originálech)

MODEL NDICEA: POMOCNÝ NÁSTROJ PRO MANAGEMENT DUSÍKU V POLNÍM HOSPODÁŘSTVÍ

BURGT, G.J.H.M. VAN DER & TIMMERMANS, B.G.H.

Abstrakt

Efektivita využívání dusíku je v ekologickém zemědělství důležitým faktorem. Modelování dynamiky dusíku nám pomáhá pochopit vliv alternativních zemědělských postupů a tudíž i rozhodovat. Úloha modelu NDICEA je demonstrována na třech příkladech z Nizozemska. Závěrem vyplývá, že NDICEA je jednoduchý a užitečný nástroj k optimalizaci využití dusíku a minimalizaci jeho ztrát.

PROFIL RŮSTU A VÝNOSŮ HOŘČICE V PRŮBĚHU PŘECHODU NA EZ

SINGH, P.K., KUMAR, V., SINGH, S, SINGH, M. & SHUKLA, V.K.

Abstrakt

Provedli jsme pokus v němž jsme zkoumali vliv ekologických metod hospodaření na růst, výnos a napadení chorobami u rostlin hořčice v procesu převodu konvenčně obhospodařovaného pole do systému ekologického zemědělství. Porosty hořčice ošetřené zeleným hnojením, kompostem, neemovým přípravkem a biopesticidy na bázi houby Trichoderma vykazovaly v 1. a 2. roce přechodu pokles klíčivosti semen až o 17 % a ve 3. až 5. roce přechodu nárůst klíčivosti až o 26 % oproti kontrolnímu porostu. Údaje o výnosu pak vykazují pokles až o 22 % v prvních dvou letech přechodu a po třetím roce nárůst až o 33 % vzhledem ke kontrolnímu porostu. Při zavádění ekologických postupů hospodaření růst a výnos plodin nejprve klesá a pak postupně vzrůstá směrem k trvale udržitelným hodnotám.

MEZIPLODINY PRO OMEZENÍ ŠKOD ZPŮSOBOVANÝCH DRÁTOVCEM V KUKUŘICI

BRUNNER, N., TRSKA, C., HANN, P. & KROMP, B.

Abstrakt

Drátovci (Coleoptera: Elateridae) způsobují stále více škod na bramborách, kukuřici a polní zelenině, a to jak v konvenčním, tak i v ekologickém zemědělství. Rakouský výzkumný projekt „Nové přístupy k regulaci drátovců se zvláštním důrazem na ekologické zemědělství" se zabývá alternativními metodami boje proti škůdcům. V terénní studii v Horním Rakousku v roce 2008 byly testovány záchytné meziplodiny jako prostředek k omezení škod způsobovaných drátovcem v kukuřici. Test byl založen na konceptu rychle rostoucích plodin, které budou drátovce přitahovat a hlavní plodina jich zůstane ušetřena. Mezi řady kukuřice na poli napadeném drátovcem byla ručně vyseta pohanka a pšenice. Kontrolním stanovištěm byla kukuřice bez těchto meziplodin. Od každé z těchto tří variant byly vytvořeny čtyři náhodně rozložené bloky porostu. V blocích s pohankou byly škody od drátovců nejnižší (11 %), ve variantě s pšenicí vyšší (16 %) a kukuřice bez záchytných plodin vykázala nejvyšší poškození (27 %).

VLIV ZAVLAŽOVÁNÍ NA PRODUKCI BIOSÓJI V SUŠŠÍCH OBLASTECH VÝCHODNÍHO RAKOUSKA

HOFER, M., SCHWEIGER, P & HARTL, W.

Abstrakt

V Rakousku se biosója pěstuje především na východě země, a to kvůli jejím požadavkům na teplo. Za účelem prozkoumání genotypových rozdílů vzhledem ke kvalitě osiva při různé intenzitě zavlažování byl proveden tříletý polní pokus. Sedm kultivarů sóji bylo pěstováno jednak s hojnou závlahou a jednak s mírně nedostatečnou závlahou. U kultivarů patřících do skupin zralosti 00–0 byl vyšší jak výnos, tak i koncentrace bílkovin, oproti raným kultivarům (skupina zralosti 000). Ve všech třech letech dosáhl kultivar Essor výrazně vyšších hodnot ($p<0,05$) v porovnání s „Merlinem". Navíc „Cardiff" a „Essor" měly výrazně vyšší koncentrace bílkovin ($p<0,05$) v porovnání s „Lambtonem". Závlaha měla obecně pozitivní a velmi výrazný dopad ($p<0,01$) na výnos a kvalitu. Naměřené hodnoty tohoto vlivu se nicméně v jednotlivých letech měnily.

PŘEDBĚŽNÉ VÝSLEDKY SROVNÁVACÍ STUDIE ODRŮD FAZOLU ZAHRADNÍHO (*PHASEOLUS VULGARIS L.*) PĚSTOVANÉHO V SYSTÉMU EZ V CHRÁNĚNÉ OBLASTI V ŘECKU

VAKALI, C., PAPATHANASIOU, F., PAPADOPOULOS, I. & TAMOUTSIDIS, E.

Abstrakt

V ekologickém zemědělství je zapotřebí místních a původních odrůd a kultivarů, které jsou specificky adaptované na pěstební systém s nízkými vstupy. Rozdílné agronomické a fyzikálně-chemické vlastnosti byly zkoumány u šesti původních řeckých odrůd fazolu zahradního (Phaseolus vulgaris L.) a jedné makedonské (Former Yugoslav Republic of Macedonia – FYROM), pěstovaných ekologicky v Národním parku jezera Prespes na hranicích Řecka, FYROMu a Albánie. Mezi jednotlivými odrůdami byly zjištěny výrazné rozdíly, a to ve výnosových charakteristikách jako např. výnos na rostlinu, počet lusků na rostlinu a počet fazolí na rostlinu, přičemž dvě z původních odrůd se ukázaly jako nejlepší. Doba vaření byla stanovena měřením tvrdosti fazole pomocí penetrometru. Jednotlivé testované odrůdy se v tomto ohledu značně lišily – doba vaření se pohybovala v rozmezí 25–45 minut. Některé z těchto původních odrůd mohou být velmi užitečné pro rozvoj systémů ekologického zemědělství v této chráněné oblasti.

VÝNOS A OBSAH ŠKROBU BRAMBOR Z KONVENČNÍHO A EKOLOGICKÉHO HOSPODAŘENÍ

KÁŠ, M., DIVIŠ, J. & MATĚJKOVÁ, Š.

Abstrakt

Během tříletého polního pokusu v Lukavci (Česká republika) byly zkoumány čtyři odrůdy stolních brambor. U vybraných odrůd stolních brambor ve dvou různých pěstebních systémech – ekologickém a konvenčním byl porovnán jejich výnos a kvalitativní parametry jako obsah škrobu a velikostní kategorie hlíz. Ve studii byl sledován vliv předplodin jetele (významná předplodina) a pšenice (méně významná předplodina) na výnos brambor.

EKOLOGICKÉ PĚSTOVÁNÍ KRMNÉ ŘEPY

HONSOVÁ, H. & BEČKOVÁ, L.

Abstrakt

Na ekologické ploše v Uhříněvsi bylo v tříletých pokusech porovnáváno šest odrůd krmné řepy a jedna odrůda cukrové řepy (v roce 2005 a 2006 Lenka, Hako, Kostelecká Barres, Jamon, Monro, Starmon a cukrovka Merak, v roce 2007 Bučanský žlutý válec místo Kostelecké Barres). K nejvýnosnějším odrůdám patřila odrůda Hako, která v letech 2005 a 2006 poskytla nejvyšší hektarový výnos bulev a v roce 2007 ji předstihl jen Bučanský žlutý válec. Ukázalo se, že porovnávané odrůdy krmné řepy jsou vhodné pro pěstování v ekologickém zemědělství. Vysokého výnosu v roce 2005 dosáhly odrůdy Monro, Hako a Kostelecká Barres, v roce 2006 Hako a Jamon a v roce 2007 Bučanský žlutý válec a Hako. Byly zjištěny statisticky významné rozdíly mezi jednotlivými ročníky pěstování i mezi odrůdami.

VLIV POVRCHOVÉHO MULČOVÁNÍ NA VELIKOST HLÍZ A VÝNOS KONZUMNÍCH BRAMBOR V SYSTÉMU EKOLOGICKÉHO ZEMĚDĚLSTVÍ

DVOŘÁK, P., HAMOUZ, K., KUCHTOVÁ, P. & TOMÁŠEK, J.

Abstrakt

Cílem tohoto pokusu bylo zhodnotit vliv povrchového mulčování řádků brambor na výnos a počet hlíz. V pokusném roce 2008 byl na pokusné stanici v Praze-Uhříněvsi použit travní mulč ve dvou pokusných variantách (s aplikací po výsadbě a po druhé proorávce) a porovnáván s porosty bez mulče. Výsledky ukázaly, že povrchové mulčování travní řezankou pozitivně ovlivnilo výnos konzumních hlíz a jejich počet. Výnos konzumních hlíz byl vyšší o 9,3 t/ha v porovnání s porosty bez mulče. Také nejvyšší počet konzumních hlíz byl zjištěn u varianty s mulčem aplikovaným po výsadbě.

ČERNÁ NETKANÁ TEXTILIE JAKO MULČ V EKOLOGICKÉM ZEMĚDĚLSTVÍ

DVOŘÁK, P., HAMOUZ, K., KUCHTOVÁ, P., TOMÁŠEK, J. & ERHARTOVÁ, D.

Abstrakt

Černá polypropylenová textilie byla v roce 2008 použita jako mulč při pěstování brambor v systému ekologického zemědělství na pokusné stanici v Praze-Uhříněvsi. Textilie měla pozitivní vliv na teplotu půdy (v hloubce 100 mm). Nepatrně vyšší teplota půdy pod černým polypropylenovým mulčem po výsadbě měla příznivý vliv na rychlejší vzejití porostů. Nižší sací tlaky půdy (v hloubce 250 mm) a tím vyšší obsah vody v půdě jsou další užitečná zjištění při použití černé mulčovací textilie u brambor (nižší sací tlaky půdy byly zjištěny po výsadbě a na konci vegetace). Černá polypropylenová mulčovací textilie poskytovala při pěstování brambor příznivější teploty půdy pro rychlejší vzejití porostů a zajišťovala lepší vláhové poměry v půdě.

ALTERNATIVNÍ OCHRANA BRAMBOR V SYSTÉMU EKOLOGICKÉHO ZEMĚDĚLSTVÍ

TOMÁŠEK, J. & DVOŘÁK, P.

Abstrakt

Pro ekologické pěstování mohou být vhodné rostlinné extrakty, které je možné použít jako ochranu brambor před nepříznivými činiteli (mandelinka bramborová a plíseň brambor) a nepřímo tak zvýšit kvalitu a výnos sklizených hlíz. Cílem pokusu bylo vyzkoušet alternativní metody regulace mandelinky bramborové. Na porostech ekologických brambor byly testovány vodní extrakty z šeříku (Syringa v.) a z řimbaby (Pyrethrum p.) proti snížení náletu mandelinky bramborové (Leptinotarsa decemlineata).Ty neprokázaly průkazné rozdíly ve snížení náletu mandelinky, aktivity kladení vajíček a výskytu larev v porovnání s neošetřenou kontrolou. Byly však zjištěny zajímavé trendy ve snížení náletu a kladení vajíček u obou přípravků. Postřikové spreje (vodní extrakt z ořešáku královského, ředěné kravské mléko a přípravek Kuprikol 50) proti plísni bramboru (Phytophthora infestans) neprokázaly průkazné rozdíly v napadení plísní bramboru (nezvýšily výnos).

EKOLOGICKÉ PŘÍSTUPY JAKO ŠETRNÝ BOJ PROTI CHOROBĚ RÝŽE *MAGNAPORTHE GRISEA*

THARSHANI, N. & MIKUNTHAN, G.

Abstrakt

Spála rýže je agresivní onemocnění rostlin způsobované pathogenem Magnoparthe grizae (Pyricularia oryzae) a vyskytuje se v oblastech pěstování rýže po celém světě. Je to i jedna z nejběžnějších chorob v Jižní Asii. V ekologicky šetrném boji proti rýžové spále hrají podstatnou roli dobré podmínky pro obecné zdraví rostlin. V Navally, v oblasti Jaffny na severu Šrí Lanky, kde je rýžová spála každoročním závažným problémem, byla v letech 2007 a 2008 provedena terénní studie, která se zabývala nejoblíbenějšími kultivary rýže – AT 401 a H4. Cílem bylo zjistit vliv fertifikace způsobené odpadními vodami z místního lihovaru na závažnost napadení rýže spálou. Výsledky ukázaly výrazný rozdíl mezi rýžovými poli zavlažovanými odpadní vodou a kontrolními poli. Pole s odpadní vodou produkovala o 31 % vyšší výnos u kultivaru AT 401 a 25 % u kultivaru H4. Výskyt spály byl pozorován u kontrolního kultivaru AT 401 (DI =32.2), u kultivaru AT 401 (DI=12.0), u kontrolního kultivaru H4 (DI =52.4), a u fertifikovaného kultivaru H4 (DI=22.0). Hodnota „p" organické fertifikace na spále (0.0002) byla vysoce výrazná a na spolehlivé úrovni 95 %. Tato zjištění budou užitečná při rozvíjení integrované ochrany rýže proti spále v rámci holistického přístupu při pěstování biorýže.

STABILITA VÝNOSOVÉHO POTENCIÁLU PŠENICE V EKOLOGICKÉM ZEMĚDĚLSTVÍ

PETR, J., MIČÁK, L., ŠKEŘÍK, J.

Abstrakt

V patnáctiletém sledování ekologických pokusů vedených podle předpisů IFOAM a předpisů MZe ČR se hodnotily výnosy ozimé pšenice jako jeden z ukazatelů produkčního potenciálu půdy. Průměrný výnos 28 odrůd za období 1994 – 2008 byl 6,42 t/ha, směrodatná odchylka 1,13 t, variační koeficient 17 %. Výnos byl tvořen 270 rostlinami na m^2, počet klasů byl průměrně 407 na m^2, v každém klasu bylo 35,2 zrn a hmotnost 1000 zrn byla 46,6 g.

Výnos pšenice v ekologickém zemědělství je tvořen produktivitou klasu, tj. počtem zrn a jeho hmotností. To souvisí i s dynamikou uvolňování dusíku, která je nejvyšší v období tvorby generativních orgánů (v červnu). Odrůdy s vysokou produktivitou klasu se ukázaly jako vhodnější pro ekologické zemědělství.

Důkazem udržitelnosti systému je setrvale dobrá úroveň obsahu přijatelných živin v půdě.

Variační koeficient obsahu u jednotlivých živin je 10,2–19,5 %. Za celé období nedošlo ke snížení obsahu přijatelných živin, což znamená, že ekologický systém hospodaření neochuzoval půdu. Zdroj živin pochází z mineralizace organické hmoty dodávané zeleným hnojením, z posklizňových zbytků předplodin, z intenzivního zvětrávání, atmosférického spadu, a symbiotické fixace dusíku jetelovin a luskovin.

EKOLOGICKÉ FUNKCIE PÔDY – ICH SPOLOČENSKÝ VÝZNAM A EKONOMICKÉ HODNOTENIE

BUJNOVSKÝ, R. & VILČEK, J.

Abstrakt

Pôda obdobne ako ekosystém zabezpečuje viacero služieb ktoré sa v pôdoznaleckej terminológii nazývajú funkcie pôdy. Okrem produkcie biomasy rastlín, ktorú je možno ekonomicky hodnotiť, pôda zabezpečuje ekologické funkcie ktoré sú pre spoločnosť k nezaplateniu. Udržateľný rozvoj spoločnosti predpokladá udržiavanie kvality pôdy a jej funkcií – predovšetkým ekologických. Príspevok analyzuje význam poľnohospodárskej pôdy pre spoločnosť a následne princípy a výsledky ekonomického hodnotenia vybraných ekologických funkcií poľnohospodárskej pôdy. Priemerné ekonomické hodnoty vybraných ekologických funkcií poľnohospodárskych pôd vychádzajú z predchádzajúceho indexového hodnotenia týchto funkcií a predstavujú 5300 €.ha^{-1} pre schopnosť pôdy akumulovať vodu, 4300 €.ha^{-1} pre imobilizáciu znečisťujúcich látok a 4000 €.ha^{-1} pre transformáciu organických polutantov. Hodnotenie pôdy a jej ekologických funkcií sa ukazuje ako možná cesta pre zlepšenie ochrany pôdy predovšetkým pri modifikácii ceny pôdy pri jej trvalých záberoch. Napriek tomu, oceňovanie nemôže byť použité ako základ pre formovanie etických hodnôt bezprostredne spojených s postojom človeka k pôde a jej degradácii, ktoré globálna spoločnosť tak naliehavo potrebuje.

PŮDNÍ MIKROBIÁLNÍ SPOLEČENSTVA A JEJICH AKTIVITA V EKOLOGICKÉM A KONVENČNÍM ZELINÁŘSTVÍ NA ZÁPADNÍ JÁVĚ V INDONÉSII

MOESKOPS, B., SUKRISTIYONUBOWO, BUCHAN, D, SLEUTEL, S, LENITA HERAWATY, EDI HUSEN, RASTI SARASWATI, DIAH SETYORINI & DE NEVE, S.

Abstrakt

Porovnávali jsme vliv ekologických a konvenčních metod hospodaření na mikrobiální dynamiku půdy na Západní Jávě v Indonésii. Jako přírodní referenční lokalita byl zvolen sekundární les. Měřenými parametry byla aktivita dehydrogenázy a β-glukosidázy, mikrobiální biomasa C (MBC) a složení mikrobiálních společenstev. Měření bylo prováděno pomocí analýzy fosfolipidních mastných kyselin. Na enzymatické aktivitě půdy se projevil silný negativní dopad intenzivního chemického hnojení a používání pesticidů. Ekologické hospodaření s důrazem na aplikaci kompostu dokázalo obnovit půdní mikrobiální společenstva a jejich funkce v krátkém časovém úseku dvou let. Enzymatické aktivity se vztahovaly k obsahu organické hmoty v půdě a pH. Aktivita β-glukosidázy v ekologickém systému se blížila stejné aktivitě v půdě lesa, zatímco aktivita MBC a dehydrogenázy byla v lesní půdě výrazně vyšší. Ve složení půdních mikrobiálních společenstev se projevily výrazné rozdíly mezi lesní a obhospodařovanou půdou a zřetelný rozdíl v tomto složení byl pozorován také mezi konvenčním a ekologickým systémem. Aktivita dehydrogenázy a C16:1ω5c (mastná kyselina pro indikaci arbuskulárních mykorrhizních hub) se ukázaly být obzvlášť vhodnými indikátory vlivu zemědělských činností na půdní mikrobiální společenstva.

SPOLEČENSTVA PŮDNÍ MAKROFAUNY V EKOLOGICKY A KONVENČNĚ OBHOSPODAŘOVANÝCH POLNÍCH KULTURÁCH

ŠARAPATKA, B., MIKULA, J., TUF, I. H. & LAŠKA, V.

Abstrakt

Studie hodnotí společenstva půdních bezobratlých na pokusných plochách v Praze – Uhříněvsi, kde probíhá experiment s hodnocením rozdílů mezi ekologickým a konvenčním zemědělstvím již 14 let. Výsledky výzkumu z roku 2007 ukazují, že jedním z klíčových faktorů, které ovlivňovaly společenstva bezobratlých živočichů, je obsah organického materiálu v půdě. Tento rozdíl byl patrný především v ekologických variantách s pšenicí, kde byl jako předplodina pěstován jetel. Na těchto ploškách byl signifikantně vyšší počet mnohonožek, jejichž početnost ovlivňuje míru dekompozice organického materiálu. Po oba roky, v kterých jsme hodnotili rozdíly v početnosti jednotlivých společenstev na jednotlivých variantách, byl signifintně největší počet pavouků zaznamenán právě na ekologicky obhospodařovaných plochách osetých řepkou, a to z důvodu nižší listové pokryvnosti. Dvouletý výzkum neodhalil až na výjimky zásadní rozdíly v půdních bezobratlých mezi sledovanými zemědělskými systémy, což naznačuje představená analýza dat, která indikovala komplexnost agroekosystému a faktorů ovlivňujících biotické složky systému.

OBSAH ŽIVIN V EXKREMENTECH ŽÍŽAL V POROSTECH BIOOBILNIN

POMMERESCHE, R., HANSEN, S. & LØES A-K.

Abstrakt

Exkrementy žížal byly sesbírány ze dvou různě hlubokých vrstev půdy obhospodařované v systému ekologického střídání plodin a porovnány s ostatní půdou. Cílem bylo zjistit, zda exkrementy geofágních druhů žížal (Aporrectodea caliginosa a A. rosea) obsahují více rostlinám přístupných živin než půda obecně, podobně, jako je tomu u detritofágních druhů, kteří se živí rostlinnými zbytky. Průměrný výskyt žížal během tří sezón byl 229 jedinců na m^2 a průměrná hmotnost čerstvé biomasy byla 73 g na m^2. V porovnání s půdou byly v exkrementech zjištěny výrazně vyšší koncentrace všech živin. V průměru ze dvou lokalit byly tyto rozdíly (v kg ha^{-1} za rok) následovné: 5,6 u P, 8,9 u K, 5,3 u Mg, 144 u N a 2542 u C. Tato studie ukazuje, že exkrementy žížal jsou hodnotným zdrojem živin pro rostliny dokonce i v lokalitách, kde v půdní fauně dominují geofágní druhy.

PÉČE O ÚRODNOST PŮDY V EKOLOGICKÉM ZEMĚDĚLSTVÍ

KAPSHTYK, M.

Abstrakt

Péče o úrodnost půdy je životně důležitá pro úspěšný rozvoj ekologického zemědělství. Abychom mohli rozvíjet tento obor, musíme brát v úvahu mechanismus samoregulace úrodnosti půdy, který je specifický v půdách přírodních ekosystémů. Podstata metod udržitelného ekologického zemědělství spočívá v posilování role mikroorganismů pomocí systému hnojení a obdělávání půdy v rámci střídání plodin. Proto jsme na stacionárních polních pokusech studovali dlouhodobé zatravnění a půdu chránící bezorebný systém obdělávání v kombinaci s organickým hnojením a EZ, a jejich vliv na kvalitu a vlastnosti půdy. Výzkum se zabýval otázkami vyhodnocení obsahu organické hmoty a její celoroční a sezónní dynamiky, akumulace a mobility těžkých kovů v trofickém řetězci půda-rostliny-zvířata-lidé, a také výnosů plodin. K zodpovězení těchto otázek byly provedeny polní i laboratorní průzkumy v rámci dvou stacionárních polních pokusů na černozemi. Byl zjištěn vzestup humifikačních koeficientů organických substrátů a organické hmoty v půdě v rámci sezónní dynamiky o 20 – 25 %, způsobený vlivem šetrného obdělávání půdy. Simuluje to přírodní proces tvorby půdy za podmínek dostatečného zásobování energií a jednotlivými složkami. V prvních několika letech, kdy bylo praktikováno šetrné obdělávání půdy a ekologické zemědělství, výnosy značně poklesly. Když byl ovšem ekologický systém hospodaření, založený na šetrném obdělávání půdy, praktikován nepřetržitě po více než 9 let, výnos vzrostl o 2,0–2,5 t/ha jednotek zrna v porovnání s počátečními hodnotami. Systematické šetrné obdělávání půdy v systému střídání plodin zvyšuje schopnost uměle vytvořené fytocenózy ovlivňovat půdu a zlepšovat ekologické aspekty rostlinné produkce. Systém šetrného obdělávání půdy založený na minimálním zpracování napomáhá obnovovat mechanismus samoregulace půdní úrodnosti. Přechod na ekologické zemědělství by měl být postupný a měl by obnášet systém šetrného obdělávání půdy za účelem maximálního obnovení přirozených procesů v agroekosystému.

ETICKY ORIENTOVANÉ AKTIVITY PŘESAHUJÍCÍ EKOLOGICKÉ NORMY V EVROPSKÝCH EKOLOGICKÝCH PODNICÍCH/ EKOFARMÁCH Z RŮZNÝCH TEORETICKÝCH ÚHLŮ

GÖSSINGER, K., HAMETTER, M. & FREYER, B.

Abstrakt

Tento příspěvek se zabývá eticky orientovanými aktivitami, které přesahují rámec ekologických směrnic (v této studii označovaných jako „organicPlus“) a komunikačních strategií, které používají ekofarmy a ekologicky zaměřené podniky. Výsledky vyplývají z kvalitativního průzkumu jednoho sta drobných a středních podniků/farem v pěti evropských zemích. Tyto jejich snahy je možno v určitém smyslu vnímat jako opak trendu „zkonvenčňování“ organického/ekologického sektoru. Aktivity organicPlus jsou spojeny se třemi klasickými dimenzemi trvalé udržitelnosti života a rozšířeny o dimenzi kulturní. Všechny podniky/farmy reprezentují unikátní přístupy, více či méně profesionální komunikační strategie a také místní nebo regionální orientaci. Proto mají potenciál přispívat ke společenskému kapitálu, budovat nové místní sítě a ovlivňovat místní struktury. Aktivity organicPlus a jejich komunikační argumenty jsou různorodé, stejně jako motivace k nim. Nezodpovězena zůstává otázka, zda tyto organicPlus aktivity mají také potenciál pomáhat měnit hodnoty a ekologické metody i v národním a mezinárodním měřítku.

KVĚTNATÉ PÁSY JAKO POTENCIÁLNÍ HOSTITELÉ PŘIROZENÝCH NEPŘÁTEL (COCCINELLIDAE A SYRPHIDAE) V PODMÍNKÁCH ČESKÉ REPUBLIKY

KOPTA, T. & POKLUDA, R.

Abstrakt

Kvetoucí rostliny hrají významnou roli při poskytování alternativní potravy (pyl, nektar) jakožto i místa pro odpočinek a reprodukci přirozeným nepřátelům škůdců v agroekosystémech. Je velmi důležité volit takové druhy rostlin, které maximálně podporují přirozené nepřátele a zároveň nepodporují škůdce. V tomto pokusu byla zjišťována atraktivnost jednotlivých kvetoucích druhů rostlin (Anethum graveolens, Tagetes patula, Centaurea cyanus, Calendula officinalis a Vicia faba) pro přirozené nepřátele mšic – slunéčka a pestřenky (Coccinellidae a Syrphidae). Do celkového počtu byli zahrnuti přirození nepřátelé, kteří na kvetoucí rostlinu přilétli, odpočívali na ní, nebo konzumovali potravu. Z výsledků vyplývá, že chrpa (Centaurea cyanus) je atraktivním druhem pro slunéčka (Coccinellidae) a kopr (Anethum graveolens) pro pestřenky (Syrphidae). Výskyt těchto přirozených nepřátel na ostatních rostlinných druzích byl nízký.

PŘEDBĚŽNÉ VÝSLEDKY VYUŽITÍ POMOCNÝCH ROSTLINNÝCH PŘÍPRAVKŮ LIGNOHUMÁT B A SYNERGIN ® V EKOLOGICKÉM PĚSTOVÁNÍ JAHODNÍKU

BOČEK, S., SALAŠ, P., SASKOVÁ, H., PATOČKOVÁ, Š. & MOKRIČKOVÁ, J.

Abstrakt

Vliv pomocných rostlinných přípravků na výnos, nutriční hodnotu a zdravotní stav jahodníku byl hodnocen v podmínkách simulovaného ekologického pěstování. Polní pokusy byly založeny z frigo sadby odrůd Honeoye a Symphony na jaře 2008. Oba pomocné přípravky, huminový pereparát Lignohumát B a biostimulátor Synergin®, průkazně neovlivnily tržní výnos. Raná odrůda Honeoye dosáhla nejvyššího výnosu při kombinované aplikaci obou přípravků. Pozdní odrůda Symphony měla nejvyšší výnos u varianty ošetřené samotným Lignohumátem B. Společná aplikace Lignohumátu B a Synerginu® průkazně zvýšila obsah vitamínu C v plodech v porovnání s variantami ošetřenými samotným Linohumátem B a Synerginem®, ale neprůkazně v porovnání s neošetřenou kontrolou. Ošetření přípravky neovlivnilo obsah celkové sušiny v plodech, odrůda Symphony však měla průkazně vyšší obsah sušiny než odrůda Honeoye. Odrůda Symphony se v daných podmínkách jeví jako vhodnější pro ekologické pěstování kvůli průkazně vyšší odolnosti ke kořenovým hnilobám.

ODRŮDOVÁ ODOLNOST RAJČAT K *PHYTOPHTORA INFESTANS* V EKOLOGICKÉM SYSTÉMU PRODUKCE

KOUDELA, M., CHLADOVÁ V., SUS, J. & SVOZILOVÁ, L.

Abstrakt

V polních pokusech prováděných ve firmě Botanicus Ostrá bylo v roce 2007 testováno 85 odrůd rajčat na odolnost k Phytophtora infestans. Napadení touto chorobou bylo sledováno v 8 termínech (od 16. července do 25. září). Rostliny byly hodnoceny podle 9 bodové stupnice (0 – bez symptomů napadení, 8 – úhyn rostlin). Výsledky byly statisticky vyhodnoceny pomocí programu ANOVA, odrůdy byly rozděleny do 33 homogenních podskupin. Průkazně nejvyšší stupeň odolnosti vykazovaly odrůdy: Shirley, Riesentraube, Opalka, Vama, Tornádo F1, Black Ethiopian, Broad Ripple Yellow, De Barao Black, Bejbino F1. Statisticky průkazně nejcitlivější na napadení Phytophtora infestans byly odrůdy: Verna Orange, Orange Strawberry, Orange Beef Heart, Tomate Rouge Lutescent, Yellow Perfection, Calinago, Orange Queen, Gold Dust, Ida Gold.

HODNOCENÍ EKOLOGICKÉ A KONVENČNÍ FARMY Z HLEDISKA TRVALÉ UDRŽITELNOSTI

VALTÝNIOVÁ, S.

Abstrakt

Cílem článku je ukázat některé rozdíly mezi ekologickým a konvenčním systém hospodaření na základě hodnocení 2 farem a literatury. Byly spočítány bilance živin, organických látek, produktivita systému a bilance energie za období 3 let. Pro výpočet byl použit softwarový model Repro (Hülsbergen a Diepenbrock 1997). Byl zjištěn významný rozdíl ve výšce vstupů a struktuře aplikovaných hnojiv. U obou systémů nejčastěji dochází ke kladné bilanci dusíku (N) a záporné bilanci fosforu (P) a draslíku (K). Bilance organických látek pro konvenční farmu je nízká, ale stabilní, zatím co bilance pro ekologickou farmu klesá. Výsledky bilancí žádné z farem v žádném roce nedosahovaly optimálních hodnot. Spotřeba fosilní energie byla nižší na ekologické farmě, ale v oblasti strojů a pohonných hmot má ekologická farma vyšší spotřebu energie než konvenční farma. I když produktivita ekologického systému byla nižší, efektivita využití energie byla nižší jen mírně.

KOMUNIKACE, UMISŤOVÁNÍ A SORTIMENT ZNAČKOVÝCH A NEZNAČKOVÝCH BIOPRODUKTŮ V RŮZNÝCH TYPECH DISTRIBUČNÍCH KANÁLŮ

KUTNOHORSKÁ, O.

Abstrakt

Příspěvek se zabývá alternativními přístupy při budování a řízení značky v různých typech distribučních kanálů. V souvislosti s dynamickými změnami na trhu upozorňuje na měnící se nákupní chování zákazníků a zdůrazňuje specifika uplatňování marketingových přístupů v oblasti bioproduktů. Komunikace tvoří nedílnou součást při vytváření celkové koncepce bioproduktu, ale jak výsledky studie ukazují, mnoho výrobců a distributorů zatím nevěnuje této skutečnosti dostatečnou pozornost.

CONTENT

BLOCK II. – SOIL QUALITY AND DIVERSITY

BLOCK III. – SUISTANABILITY AND DIVERSITY IN HORTICULTURE AND ORGANIC SECTOR

OBSAH

BLOK I. – DIVERZITA V ROSTLINNÉ PRODUKCI EKOLOGICKÉHO ZEMĚDĚLSTVÍ

BLOK II. – KVALITA A DIVERZITA PŮDY V EKOLOGICKÉM ZEMĚDĚLSTVÍ

BLOK III. – UDRŽITELNOST A DIVERZITA V ZAHRADNICTVÍ A DALŠÍCH ODVĚTVÍCH EKOLOGICKÉHO ZEMĚDĚLSTVÍ

PARTNEŘI, SPONZOŘI A SPOLUPRACUJÍCÍ INSTITUCE
/ PARTNERS, SPONSORS AND CO-OPERATIVE INSTITUTIONS

ZÁŠTITA / PATRONAGE

Ministerstvo životního prostředí České republiky

Ministerstvo zemědělství České republiky

Jihomoravský kraj

Mendelova zemědělská a lesnická univerzita v Brně

Zahradnická fakulta

A DALŠÍ / AND OTHERS