

ECOLOGICAL AGRICULTURE AS ONE OF THE PATH OF SUSTAINABLE DEVELOPMENT

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Abstract: The authors deal with the development of organic farming in the Czech Republic. They investigate how the number of organic farms and the volume of ecologically managed land in the Czech Republic are increasing, what is the structure of the land fund, the structure of crop production and ecologically farmed livestock. Statistical data shows that the number of organic farms and the number of hectares of ecologically managed land have increased significantly since 1993. In particular, cereals and forage on arable land are produced. Organic farming applies mainly to cattle and sheep. Consumption of organic food also grows. The article compares data from the Czech Republic and other selected countries. In particular, the data published in the statistical year books are used. The paper also highlights the Czech and European legal norms governing organic farming. The authors believe that, in view of climate and other related changes, a preview of large-scale agricultural production will have to be re-evaluated in the near future, it will be vital to use those environmentally friendly production processes.

Key words: Ecological agriculture, organic farms, ecologically managed land, sustainable development of eco-production, environmental protection.

Introduction

Ecology is a science developing mainly since the second half of the 20th century. However, its beginnings are described even in the works of ancient authors (Aristotle), or later in the works of Carl Linné, Alexander von Humboldt, Charles Darwin and many others. This scientific discipline examines the relation between organisms and environment and the correlation of organisms; it is a way of seeing the world, where emphasis is put on understanding the mutual relations. It is particularly in present days when the negative impact of human activities

on the environment is even more evident people should carefully consider what their interventions on the environment might cause in the near or distant future. The only chance to survive is to change the approach to the economic activity, where the primary and the only criterion cannot be only profit but also aiming the activities in line with the sustainable development methods. This means using such procedures and methods when the needs of current generation are satisfied, and at the same time the possibility to meet the needs of future generations is not endangered. It must be realized that all we have is this planet; and if we destroy it and deplete all the resources (e.g. drinking water), it will be end of living.

As the IPCC (Intergovernmental Panel on Climate Change) stated recently, the research of several dozens of scientists concluded that since the pre-industrial era, the temperatures have risen by one °C. Considering the current way of life and economic activities, the temperature is assume to increase by two more Celsius degrees by the end of the century. This will result in irreversible climate changes with far-reaching and disastrous consequences. (ČTK. 2018)

It is thus necessary to change the production methods in general, including in agriculture. Organic farming means the system with strict and controlled rules, where the guarantor is the Ministry of Agriculture of the Czech Republic.

Methods and research part with discussion of results

The contribution deals with the development and analysis of the number of organic farms, the area and structure of land cultivated in organic farms, production of organic crops, animals and development of the organic food market. For the purposes of the article, mainly the data obtained from statistical yearbooks will be used. The processing of the data into tables and graphs as well as the calculation of the numeral characteristics will be carried out in MS Excel.

In recent years, increasing often there have been phenomena proving that there are climatic changes occurring. A certain chance to adapt to these changes is practising organic farming, as it does not try to adapt the landscape to mass production. The agricultural activities are performed with respect to the specific natural conditions, they do not burden the environment with chemical products and ensures the living conditions of reared animals so that they correspond with their natural needs. The landscape thus remains unspoiled and able to adapt to climatic changes.

According to Epping (2004), environmental protection is important not only for human health but also to sustain stable economic growth in the following years. On the other hand, the issue of ensuring employment and higher living standards for constantly growing world population and do not destroy the environment is one of the most serious problems of world economy. Supporting organic farming is considered one of the most effective ways of improving the relation of agriculture to the environment. However, in the Czech Republic, the support of such activities has been insufficient so far. Agricultural activities can have positive effect e.g. in slowing down rainwater drainage, for example by changing the current drainage through setting small ponds or grassing (Project Sustainable development of the Czech Republic, 2002).

Since the 1960's, there have been warnings concerning the dramatic deterioration of the environment and its limiting effect on the socio-economic development and the condition of

human population. In 1972, a document published by the Club of Rome with a title *The Limits to the Growth* pointed out the limitations and possible depletion of natural resources (Moudrý, 2007).

Akinyemi (2007) is convinced that it is necessary to promote organic farming that is in line with the needs of the animals reared and reduction of chemical products used.

The source of problems is not only traditional agricultural activities, but also the mass production in fish farming. The experts from the University of South Bohemia, the Faculty of Agriculture found out that the high fish density causes significant deterioration in water quality. At the end of the 19th century, the fish density was about 30 per 1 ha of a pond area, while nowadays it is between 700 and 2 000 pieces. Soil fertilizers, deliberate fertilization of ponds and higher temperatures are the causes of eutrophication. The state of South Bohemian ponds can be described as gigantic organic threat. Another problem is soil deposition in ponds, as soil accounts for 1/3 of the pond volume (Dotyk-kapřiny přinášejí zkázu, 2015)

It is necessary to strive for balance in fish farming. The efforts to intensify these activities often result in failing to respect the potential of the ecosystem, where the acceptable fish density is dramatically exceeded (Plamínková, 2000). Organic farming in the Czech Republic is characterised by extensive rearing of beef cattle, goats and sheep in areas less favourable for agriculture. The extent of crop production is gradually increasing. This also helps to maintain employment in economically and geographically peripheral areas. (Ministerstvo zemědělství, 2018)

Organic farming in the Czech Republic is governed by the Act No. 242/2000 Coll., on organic farming as amended and the Regulation No. 16/2006 Coll. of Ministry of Agriculture. Another legal standard is the Decree No. 75/2015 Coll. on conditions of agricultural and climatic measures. M10 is agro environment and climate measure aimed at using agricultural land in accordance with the principles of environmental protection. At European Union level, organic farming is governed by the Council Regulation No. 834/2007 on organic production and labelling of organic products, Commission Regulation No. 889/2008 laying down the rules for the implementation of the Council Regulation No. 834/2007 and Commission Regulation No. 1235/2008 laying down the rules for organic production and labelling of organic products.

An organic farmer can be only a person registered under the Act No. 252/1997 Coll. on Agriculture, as amended. The registration of subjects in the organic farming system in the Czech Republic is covered by the Methodical guideline No. 2/2016. According to this, any operator that prepares, stores or imports from a third country or preparing, storing or markets organic products or products from the transitional period shall be registered at the Ministry of Agriculture and the Controlling system. Every such a person must enter into contract with a control organisation, which is entrusted to carry out control and certification by the Ministry of Agriculture.

All subjects interested in being engaged in organic farming must submit a single application for registration as an entity engaged in organic farming to the Ministry of Agriculture.

This applies also to organic beekeepers, who, however, do not have to be entrepreneurs. Registration takes place only once, when the application is submitted for the first time, when the applicant specifies the activities for which they want to be registered.

A person asking for registration by the Ministry of Agriculture works in so-called transitional period. In the case of arable land and grassland it is two years, while in the case of vineyards, hop fields and orchards it is three years. This period is required before sowing or, in the case of pastures or multiannual feed crops before harvesting in order to be used as feed, in the case of multiannual crops before the first harvest. As of livestock kept under the organic farming, the

transitional period is 12 month for horses and cattle raised for meat production (i.e. at least $\frac{3}{4}$ of their life), 6 months for small ruminants, pigs and dairy cattle, 10 weeks for poultry for meat production (must be in husbandry before being 3 days old at the latest), 6 weeks for poultry for eggs production. Exceptions (e.g. using synthetic vitamins A, D, E for ruminants) are specified in methodical guideline No. 3/2016. Organic farming does not involve painful interventions (e.g. dehorning). These are only exceptionally allowed in the case of individual animals and under specific conditions. Transitional period can be shorter in exceptional cases, e.g. if it is a natural or agricultural area never being treated with products that are not allowed for organic production. The Ministry of Agriculture can also decide on extension of the transition period, e.g. in case a land was contaminated by products not allowed for organic production.

The number of ecologically managed organic farms and agricultural land has increased significantly. Tab 1 shows the development since the establishment of the Czech Republic in 1993.

Tab 1 Number of organic farms and amount of ecologically managed land in the Czech Republic between 1993 and 2016

Year	Number of organic farms	Increase in (%)	Total land area in organic farming in (ha)	Increase in (%)
1993	141	-	15667	-
1996	182	129.07	17022	108.64
1999	473	335.46	110755	706.93
2002	721	511.34	235136	1500.83
2005	829	587.94	254982	1627.51
2008	1946	1380.14	341632	2180.58
2011	3920	2780.14	482928	3082.44
2014	3885	2755.31	493971	3152.93
2016	4243	3009.21	506070	3230.16

Source: Yearbook 2016. Ekologické zemědělství v ČR. 2017. Ministerstvo zemědělství Praha. ISBN 978-80-7434-401-5.

Table 2 shows calculation of area in ha per one organic farm and the basic variables (average, median and standard deviation) of basic organic variables (number of organic farms, total area of land in organic farms in ha and the area per one organic farm). Fig 1 shows time series representing these basic organic variables.

Tab 2 Time course of basic organic variables

Year	Number of organic farms	Total area of land in organic farms in ha	Area in ha per one organic farm
1993	141	15667	111.11
1996	182	17022	93.53
1999	473	110755	234.15
2002	721	235136	326.12
2005	829	254982	307.58
2008	1946	341632	175.56
2011	3920	482928	123.20
2014	3885	493971	127.15
2016	4243	506070	119.27
Average	1815.56	273129.22	179.74
Median	829	254982	127.15
Standard deviation	1734.48	197407.12	88.40

Source: Own processing by authors

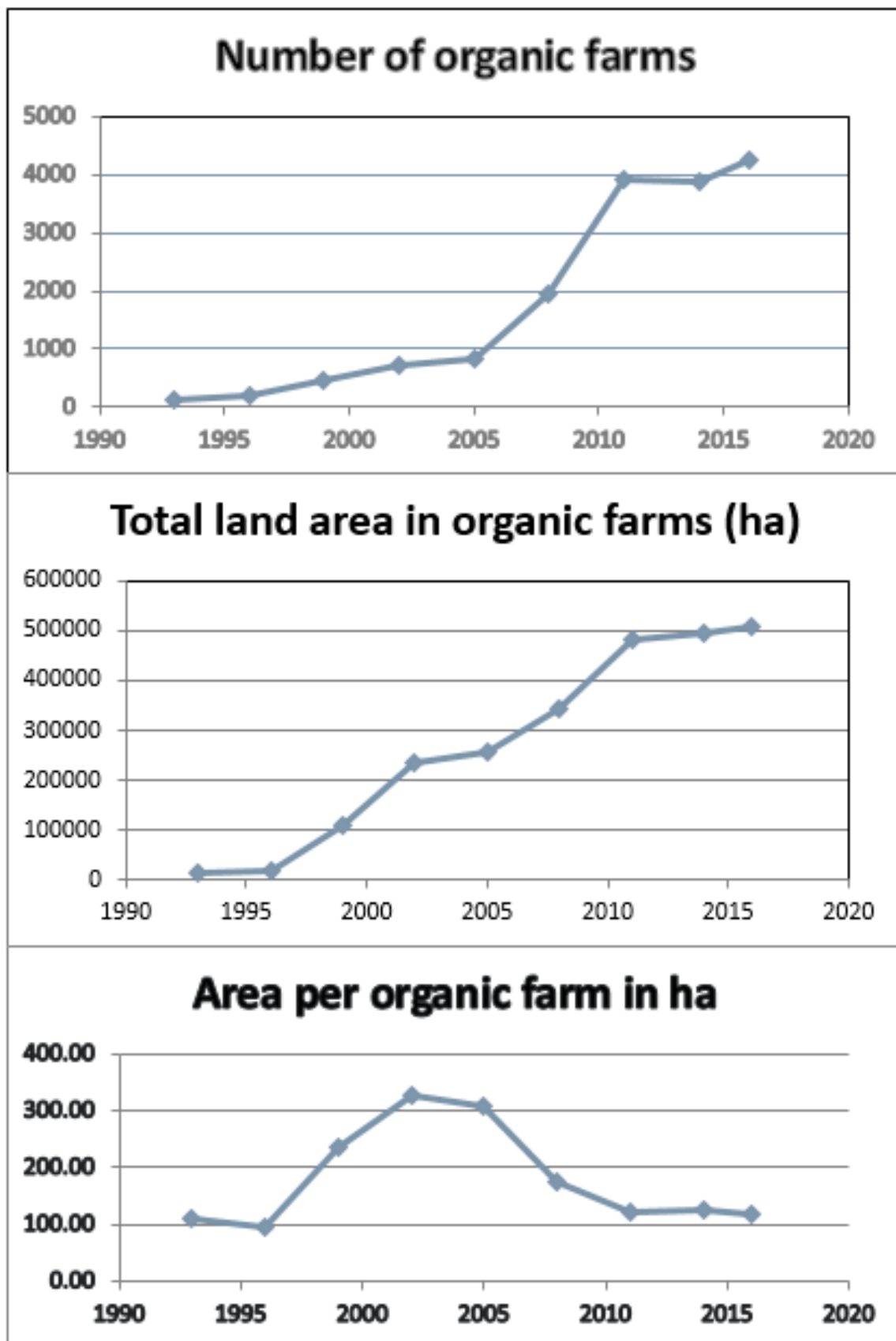


Fig 1 Time course of basic organic variables (Source: Own processing by authors)

The total number of organic farms and overall area of land in organic farm increases. In 1993, one organic farm managed on average 111 ha of land. In 2016 it was on average 119 ha.

The largest area per organic farm was recorded in 2002 (326 ha). According to the data from the Ministry of Agriculture of the Czech Republic, the average values in Europe are about 40 ha. The average values are given in Tab 2.

The following Table 3 shows the development of land fund structure in organic farming.

Tab 3 Structure of land fund (ha) in organic farming in the CR in years 1999 to 2016

Use of land\year	1999	2003	2007	2011	2014	2016
Arable land	13776	19637	29505	59281	56395	66386
Permanent grassland	96044	231683	257899	398061	412644	418255
Permanent crops	359	928	1870	7429	7774	6149
Other areas	576	2747	23616	18157	17158	15280
In total	110755	254995	312890	482928	493971	506070

Source: Yearbook 2016. Ekologické zemědělství v ČR. 2017. Ministerstvo zemědělství Praha. ISBN 978-80-7434-401-5.

Permanent crops include vineyards, hop fields and orchards. It follows from the table that the volume of ecologically managed arable land in the monitored period increased to 481.89 % compared to the situation in 1999, the volume of permanent grassland increased to 435.48 %, in the case of permanent crops it was 1 712. 81 % and the area of other lands in the monitored period increased to 2 652.77 % compared to the situation in 1999.

The table also show a long term prevalence of permanent grassland. According to the data from the Ministry of Agriculture of the Czech Republic, orchards prevail in permanent crops areas (85 % of the permanent crops areas).

Of the total number of 4 243 organic farms in the Czech Republic, the highest share was in 2016 in the South Bohemian region (624, which is almost 15 %). The second highest share was in Plzeňský region with 475 farms (11 %), then Moravian-Silesian region with 390 farms (9 %), Zlínský region with 370 farms (almost 9 %). The lowest share was recorded in Pardubický region (169, which accounts for less than 4 %) and the City of Prague (13, which is 0.3 %).

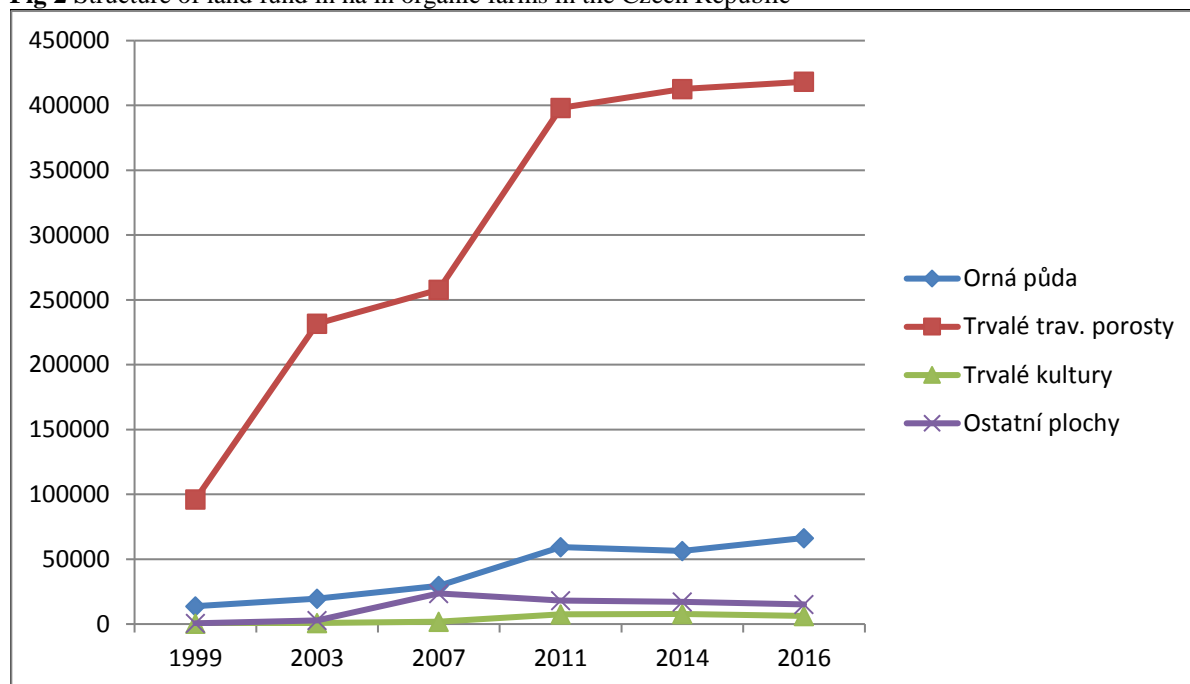
Table 4 shows basic characteristics (average, median and standard deviation) of structural variables. Fig. 2 shows the time course in the monitored period.

Tab 4 Characteristics of structural variables in Czech organic farms

Use of land\year	Average	Median	Standard deviation
Arable land	40830	42950	22561.63
Permanent grassland	302431	327980	129839.26
Permanent crops	4084.83	4009.5	3400.21
Other land	12922.33	16219	9178.51
In total	360268.17	397909	161098.73

Source: Own processing by authors

Fig 2 Structure of land fund in ha in organic farms in the Czech Republic



Source: Own processing by authors. Legend: orná půda – arable land, trvalé trav. porosty – permanent grassland, trvalé kultury – permanent crops, ostatní plochy – other land

The highest numbers and the sharpest increase are recorded in the case of permanent grassland. There is a slight increase also in the area of arable land. The average values are shown in Tab 4. The following Table 5 shows the structure of plant production in organic farms in 2016.

Tab 5 Structure of crops production on organic farms in the Czech Republic in 2016

Crops	Number of organic farms	Organic production in tonnes
Cereals	625	64 898
Legumes	117	4 758
Roots	185	2 488
Oilseeds	64	1 797
Fresh vegetables, melons, strawberries	93	917
Fodder grown on arable land	1 064	87 759
Orchards	530	5 201
Vineyards	85	3 234
Hop fields	4	10

Source: Yearbook 2016. Ekologické zemědělství v ČR. 2017. Ministerstvo zemědělství Praha. ISBN 978-80-7434-401-5.

The table shows that of the total number of organic farms in 2016, 14.7 % grew cereals, 2.75 % grew legumes, and 4.36 % grew roots. Oilseeds were grown in 1.50 %, fresh vegetables, melons and strawberries in 2.19 %, fodder on arable land in 25.07 %, orchards in 12.49 %, vineyards in 2 %, and hop fields in 0.09 % of all organic farms.

Table 6 shows the production of crops per one farm. Fig. 3 shows the structure of this production using pie chart.

The highest crop production per one organic farm is in the case of cereals (103.84 t) and fodder on arable land (82.48 tonnes). The lowest share is for hop fields (2.5 t) and orchards (9.81 t).

Tab 6 Crops production per one farm

Crops	Crops production per one farm in tonnes
Cereals	103.84
Legumes	40.67
Roots	13.45
Oilseeds	28.08
Fresh vegetables, melons, strawberries	9.86
Fodder grown on arable land	82.48
Orchards	9.81
Vineyards	38.05
Hop fields	2.50

Source: Own processing by authors

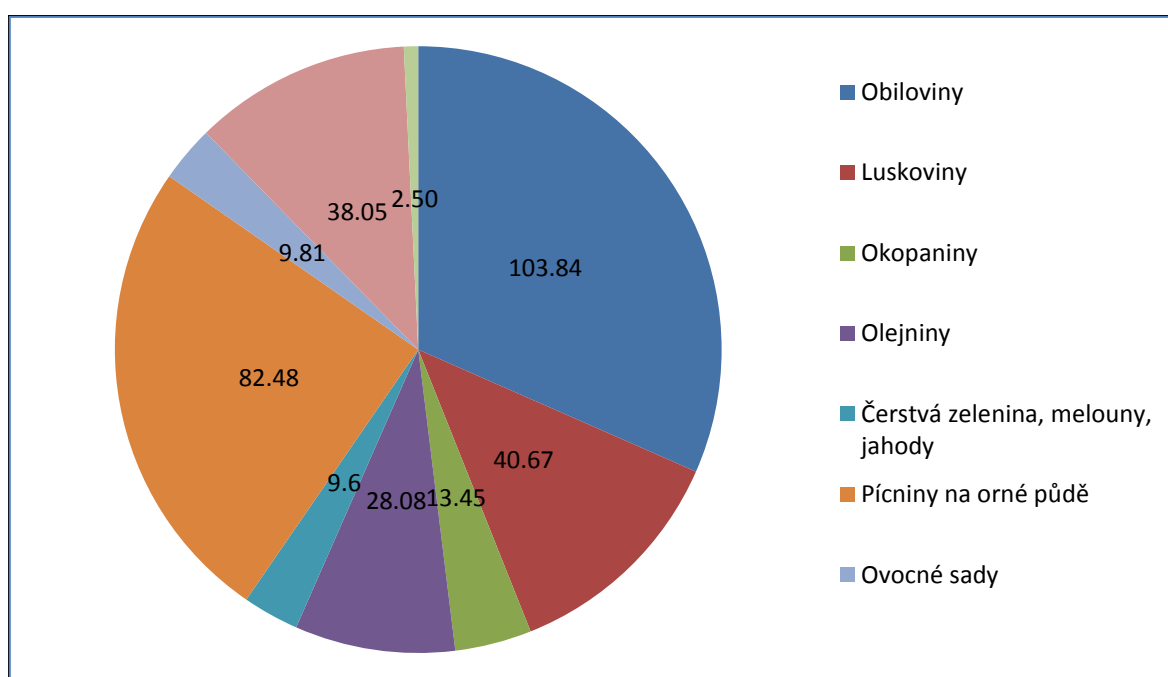


Fig 3 Structure of crop production per organic farm. Source: Own processing by authors

Legend: obiloviny – cereals, luskoviny – legumes, okopaniny - roots, olejniny – oilseeds, čerstvá zelenina, melouny, jahody – fresh vegetables, melons, strawberries, pícniny na orné půdě – fodder on arable land, ovocné sady – orchards, vinice – vineyards, chmelnice – hop fields

Tab 7 shows the number of organically raised animals in organic farms in the Czech Republic in 2016.

Tab 7 Number of organic animals kept in organic farms in the Czech Republic in 2016

Animals	Number of organic farms	Number of organically raised animals
Horses	753	7039
Cattle	2254	246684
Sheep	956	101022
Goats	300	9229
Pigs	37	1942
Poultry	79	41808
Rabbits	3	47
Bees (number of swarms)	5	80
Other animals	99	385
Fish (in thousands)	3	85765

Source: Yearbook 2016. Ekologické zemědělství v ČR. 2017. Ministerstvo zemědělství Praha. ISBN 978-80-7434-401-5.

The category of “other animals” includes ponies, donkeys and bison.

Of the total number of 4 243 organic farms, in 2016 17.74 % raised horses, cattle accounted for 53.12 %, sheep 22.53 %, goats 7.07 %, 0.87 % pigs, poultry 1.86 %, rabbits 0.07 %, bees 0.11 %, other animals 2.33 % and fish 0.07 %.

Table 8 shows the animals production per one organic farm. Fig 4 shows the structure of this production using pie chart.

Tab 8 Livestock production per organic farm

Animals	Livestock production per one organic farm – number of capitas
Horses	9.35
Cattle	109.44
Sheep	105.67
Goats	30.76
Pigs	52.49
Poultry	529.22
Rabbits	15.67
Bees (number of swarms)	16.00
Other animals	3.89
Fish (in thousands)	28.59

Source: Yearbook 2016. Ekologické zemědělství v ČR. 2017. Ministerstvo zemědělství Praha. ISBN 978-80-7434-401-5.

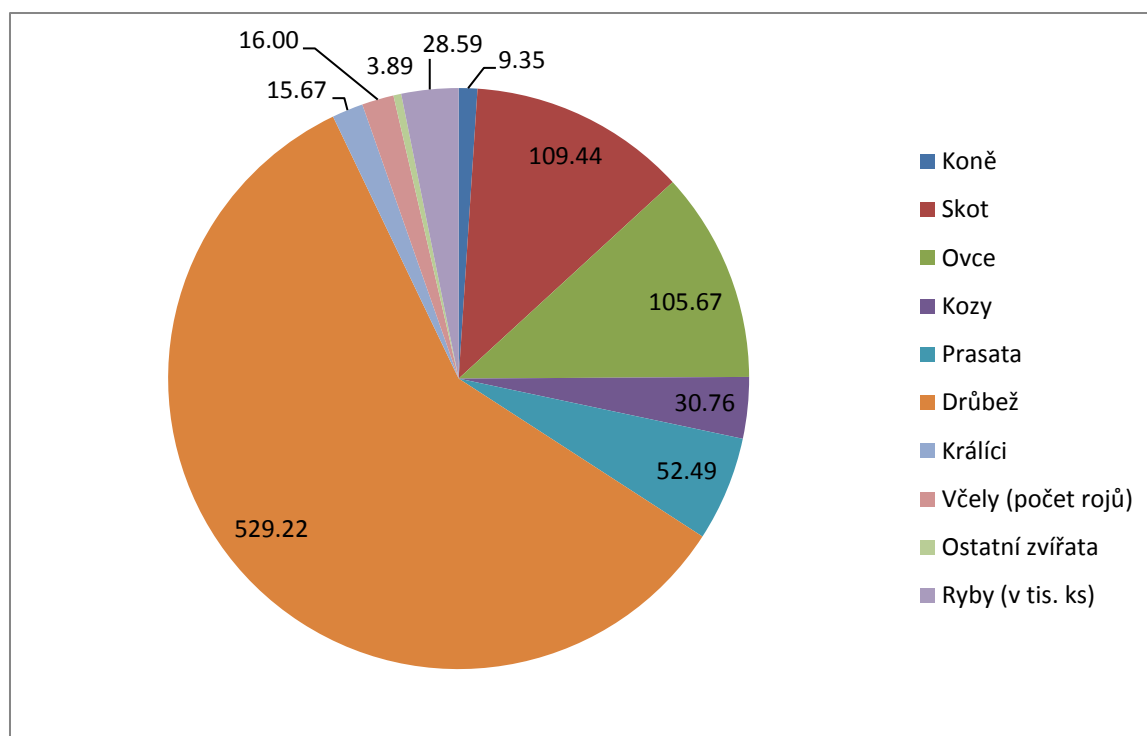


Fig 4 Structure of livestock production per organic farm. Source: Own processing by authors

Legend: koně – horses, skot – cattle, ovce – sheep, kozy – goats, prasata – pigs, drůbež – poultry, králíci – rabbits, včely (počet rojů) – bees (number of swarms), ostatní zvířata – other animals, ryby (v tis. ks) – fish (in thousands of pieces)

The highest livestock production per one organic farm is for fish (52490 pieces) and cattle (109.44); the lowest share is for “other animals” (3.89) and horses (9.35).

According to the survey of the Institute of Agricultural Economics and the information form 2018, in the Czech Republic both the overall turnover of organic food and consumption is growing. The data are given in the table below.

Tab 9 Development of the organic food market in the Czech Republic in the years 2007 to 2016

Indicator\ year	2007	2009	2011	2013	2015	2016
Overall turnover of organic food including export in billions CZK	1.39	1.98	2.24	2.72	3.73	4.19
Consumption in billions CZK	1.29	1.61	1.67	1.95	2.25	2.55
Consumption per capita and year in thousands CZK	0.126	0.154	0.158	0.185	0.213	0.241

Source: Annual Report, 2016. Statistická šetření ekologického zemědělství. Zpráva o trhu s biopotraviny v ČR v roce 2016. Brno. 2018. Ústav zemědělské ekonomiky a informací

It results from the table that in the monitored period, the overall turnover increased to 301.43 % compared to the situation in 2007. The consumption in billions CZK increased to 197 % compared to the year 2007 and the consumption per capita and year increased to 191.26 %.

Table 10 shows the basic characteristics (average, median and standard deviation) of the indicators given in Table 9. Fig 5 shows the time course in the monitored period.

Tab 10 Monitored indicators - variables

Indicator \ characteristic	Average	Median	Standard deviation
Overall turnover of organic food including export in billions CZK	2.708	2.480	1.070
Consumption in billions CZK	1.887	1.810	0.459
Consumption per capita and year in thousands CZK	0.180	0.172	0.042

Source: Own processing by authors

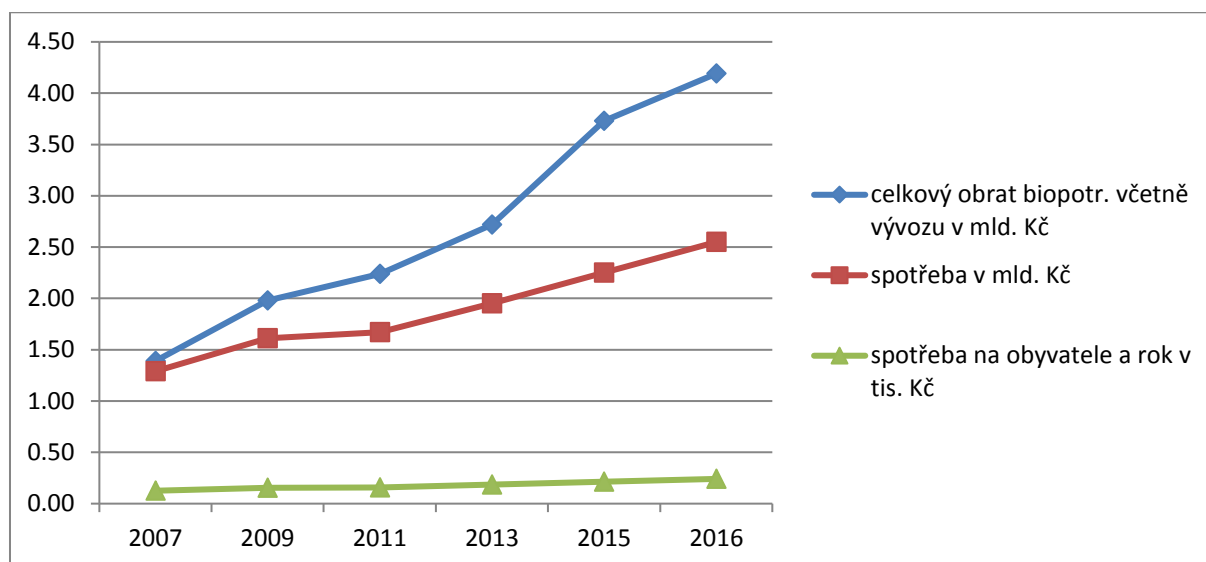


Fig 5 Time course of indicators from Table 10. Source: Own processing by authors

Legend: celkový obrat biopotravin včetně vývozu v mld. Kč – overall turnover of organic food including export in billions CZK, spotřeba v mld. Kč – consumption in billions CZK, spotřeba na obyvatele a rok v tis. Kč – consumption per capita and year in thousands CZK

The overall turnover of organic food increases faster than its consumption. The average turnover for the entire monitored period is 2.71 billion CZK, while the average consumption is 1.89 billion CZK, and average consumption per capita and year is 180 CZK.

This increase follows the trend when in 2016, the global retail organic food market increased to nearly 90 billion USD compared to the situation in 2015 (only 81.6 billion USD). The largest organic food market is in the USA, Germany and France. About 90 % of the world organic food sales is made in North America and Europe. Customers are interested in particular in organically produced eggs, vegetables and dairy products.

As for Europe, the highest organic food consumption per capita was in 2016 in Switzerland (274 EUR), Denmark (227 EUR), Sweden (197 EUR) and Luxembourg (188 EUR) (Statistical survey of ecological agriculture, Report on the organic food market in the Czech Republic in 2016. Brno, 2018; Institute of Agricultural Economics and Information).

The countries of the European Union countries, including the Czech Republic, import organic food also from third countries. This activity is regulated by the Commission Regulation (EC) No. 1235/2008, laying down the rules for implementing the Council Regulation (EC) No. 834/2007. The list of recognised third countries and recognised control subject verifying the

accordance with the rules of organic production is updated on regular basis. The Czech Republic imports mainly cane sugar from Cuba, food supplements from the USA, processed and canned fruit from India and Ukraine, tea from Japan and the Republic of South Africa, coffee from Brazil and Uganda, cereals and legumes from Ukraine, China and Turkey.

Organic food from the Czech Republic is exported mainly to the European Union countries, especially to Germany (388 mil. CZK in 2015).

Conclusion

In the contribution, the authors focused on the development of organic farming in the Czech Republic. They found out that since 1993 the number of organic farms as well as the total area of land in organic farming has increased significantly. The largest share of the land fund in organic farming was found to be the area of permanent grassland, which corresponds with the finding that as for livestock, cattle is the category which is mainly raised organically. The results also showed that the organic food market grows both in the Czech Republic and globally.

Recently, there have been alarming data concerning the environment. Due to its technocratic view of the world and callousness, the human race plunders natural resources in an unprecedented way. Governments constantly deal with the growth of GDP, an artificial variable that does not consider complex economic activities, and are not concerned in the way people destroy the only environment it has. The authors believe that one of the ways to avert ecological disaster is to change completely the attitude to production including agriculture. While mass production processes make food production cheaper, they result in destroying soil and water resources. Changing the habits and way of life would be expensive and painful, but the governments must understand and convince the public it will be worth it.

References

- Akinyemi, O. M. 2007. *Agricultural Production: Organic and conventional systems*. 1st edition. Science Publishers. 226 Pages. ISBN 9781578085125 - CAT# N00068
- Annual Report, 2016. Statistická šetření ekologického zemědělství. Zpráva o trhu s biopotravinami v ČR v roce 2016. Brno. 2018. Ústav zemědělské ekonomiky a informací. Dostupné na: https://www.uzei.cz/data/usr_001_cz_soubory/rocnkauzei2016.pdf
- ČTK. 2018. Musíme omezit globální oteplování. Jinak přijde katastrofa, varují vědci ve zprávě. [online]. *Aktualne.cz*. [cit. 2018-11-22] Available in: <https://zpravy.aktualne.cz/zahranici/musime-omezit-globalni-oteplovani-jinak-prijde-katastrofa-va/r~61e99b30cad411e8b5b20cc47ab5f122/?redirected=1544106749>
- Epping, R. Ch. 2004. *Průvodce globální ekonomikou*. Praha: Portál. ISBN 80-7178-825-2.
- Dotyk-kapříny přináší zkázu*. 2015. [online]. Web site of Faculty of Agriculture, University of South Bohemia in České Budejovice. [cit. 2018-11-24] Available in: <https://www.zf.jcu.cz/obecne/zf-v-medich/2015/18.12.2015-dotyk-kaprinny-prinaseji-zkazu>
- Law No. 252/1997 Sb., o zemědělství v pozdějších zněních.
- Law No. 242/2000 Sb., o ekologickém zemědělství v pozdějších zněních.
- Ministerstvo zemědělství. 2018. [online]. eAGRI.cz. [cit. 2018-11-25] Available in: <http://eagri.cz/public/web/mze/zemedelstvi/ekologicke-zemedelstvi/ekologicke-zemedelstvi/>
- Moudrý, J. a kol. 2007. *Základní principy ekologického zemědělství*. [online] České Budějovice: Jihočeská universita. Zemědělská fakulta. [cit. 2018-11-10] Dostupné na: http://agroekologie.zf.jcu.cz/upload/PK%20dokumenty/PRSZ%20-%20distancni/Literatura/Z_kladn_%20principy%20EZ.pdf
- Plamínková, J. 2000. Návrat k rovnováze [online]. *Moderní obec*. [cit. 2018-11-12] Dostupné na: <https://moderniobec.cz/navrat-k-rovnovaze>

Project Sustainable development of the Czech Republic, 2002. K udržitelnému rozvoji České republiky : vytváření podmínek : *Svazek 1 : Zdroje a prostředí*. Moldan, Bedřich, Hák, Tomáš, Kolářová, Hana (eds.). Praha: Centrum pro otázky životního prostředí, 2002. 357 s. ISBN 80-238-8378-X.

Statistical survey of ecological agriculture, Report on the organic food market in the Czech Republic in 2016. [online] Brno, 2018; Institute of Agricultural Economics and Information. [cit. 2018-11-10]. Dostupné na: https://www.reportlinker.com/ci02024/Food.html/coverage/Europe:Czech_Republic/since/2016

Yearbook 2016. Organic Farming in the Czech Republic ČR. 2017. Ministerstvo zemědělství Praha. ISBN 978-80-7434-401-5. Dostupné na: http://eagri.cz/public/web/file/588982/rocenka_Ekologickeho_zemedelstvi_2016.pdf