

INTERNATIONAL COMPARISON OF WHEAT CULTIVATION COSTS 2010–2012

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Abstract

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The report compares costs of wheat production in the European Union and selected world producers. International comparison of wheat production costs has been prepared on the basis of the results of an international network of Agri benchmark Cash Crop for the years 2010–2012, which is organized by Johan Heinrich von Thünen – Institute (VTi) in Germany. Czech Republic is since the year 2008 an official member this network and is represented by the Institute of Agricultural Economics and Information (hereinafter IAEI). The results for the Czech Republic, which are then shared with other participating countries (institutions), are based upon the special investigation of IAEI. International comparison is based on typical farms taking into account regional structure of produced crops, technological and operating procedures, utilization of inputs, size of a farm, and other specifications. The concept of international comparisons is based on the (so called) “typical farms”, which take into account the typical size and structure, the area of market crops, technology and work practices, use of inputs and their quantity, production and other requirements of agricultural production characteristic of the given issues. Production costs are structured as direct and operating. Overall economy evaluations of wheat production also include effect of subventions. The position of the Czech Republic within the European Union is also discussed.

Keywords: agribusiness, competitiveness, direct cost, fertilizers, profitability, wheat, yield

INTRODUCTION

The economics of wheat cultivation in the agriculture holdings/farms is affected by number of external and internal factors. Some of the relevant factors are therefore fully within the competence of the given enterprise (e.g. working practices, technology, variety, etc.), others can not affect enterprise (e.g. climatic conditions, law, rules and regulations of given region). The aim of the farm is to achieve a reasonable return on the expended funds, which in a competitive environment primary means that, the production is in accordance with the minimization of the cost per unit of production. In practice, this means to adapt farming to the given conditions, i.e. selection of suitable variety, optimization of cultivation technology and working practices in accordance with soil and climatic conditions, where the farm is located.

Objectives

With regard to the frequently discussed issue costs and benefits of agricultural primary producers in different regions of the world is the aim of this paper to compare the economy of the cultivation of wheat in the EU with producers from third countries and the Czech Republic's position within the EU. The paper compares the differences in direct and operating costs, in the amount of fertilizers and impact on the yield per hectare in the years 2010–2012. The article is also focused on achieving of realization prices and the total profit in the monitored period. Overall evaluations economy of the cultivation of wheat also includes effect of subventions.

MATERIALS AND METHODS

International comparison of wheat production costs has been prepared on the basis of the results of an international network of Agri benchmark Cash Crop for the years 2010–2012, which is organized by Johan Heinrich von Thünen – Institute (VTi) in Germany.

An official representative of IAEI is entitled to use the data of network partners to for publishing and other scientific activities. The results for the Czech Republic are based on its own investigation of IAEI, which provides collection and proper processing of the primary data. These are unique primary data, which were collected and processed based on a uniform methodology, which allows a direct comparison of the costs and revenues of countries involved in the system. The concept of international comparisons is based on the (so called) “typical farms”, which take into account the typical size and structure, the area of market crops, technology and work practices, use of inputs and their quantity, production and other requirements of agricultural production characteristic of the given issues. In the years 2010–2012 was included in the international comparison of the rapeseed costs production 13 farms from 12 selected countries.

The data base for the comparison of the conditions of plant production of farms, are real results which are compared with the development in a given country. This means that all the practical results of the typical farms undergoing by expert review. In case, that the results in a typical farm adequately does not reflect situation of the commodity and the country hence in the given region, the results are modified considering a given country or region (Zimmer *et al.*, 2011). In the paper are used following economic indicators:

Total costs: costs actually incurred by the farm, depreciation, and calculated opportunity cost. Paid costs: the actual cost of production i.e. costs of purchased seed, fertilizers, crops protection products, costs of machinery, including salaries, rent for land and interests. Based on the definition of VTi, the costs of actual production are the costs in accordance with the accounting profit/loss.

Depreciation represents monetary expression of wear out of fixed assets (buildings, equipment, machinery, etc.) over a certain time period. They express the reduction of value of fixed assets, i.e. amount reduced by the cost of production, thus reducing the profit. From an accounting point of view regards the cost, the financial point of view the company regards the revenue (if reimbursed income production) – are included in cash flow (Synek *et al.*, 2003). Depreciation at this research is taken from the accounting of individual farms and includes linear depreciation of property, machinery and equipment derived from replacement prices rather than purchase prices. Tax depreciation is irrelevant in this case (Zimmer *et al.*, 2011).

Opportunity costs represent the loss of the use of resources for another alternative. It is not an expense in the accounting sense of the word – they have a subjective meaning and importance and application primarily for businesses, not for tax purposes, based on the so-called managerial concepts of cost (Synek *et al.*, 2003). Opportunity costs at this research are the cost calculated in the amount of foregone revenue of land, labour and capital (in case of own land, family labour and equity). Production costs: costs incurred for the cultivation of cash crops, in a typical farm are divided into direct costs, operating costs and the costs of land.

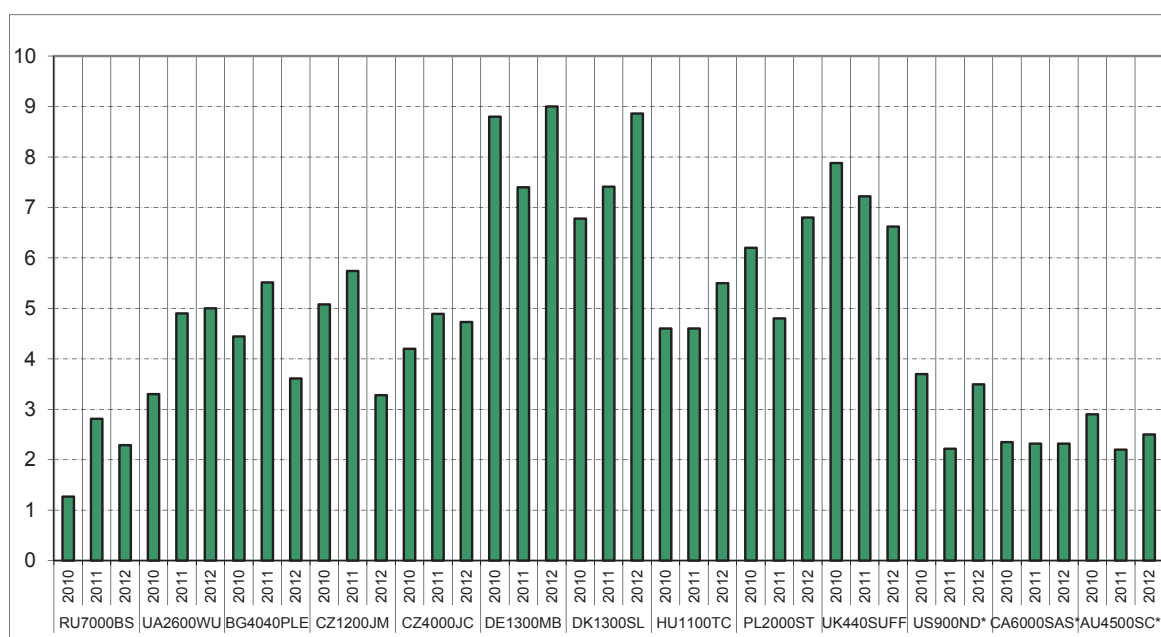
Direct costs can be unambiguously assigned to individual products i.e. determine the so-called calculation unit (Synek *et al.*, 2003). Direct costs at this research include the cost of seeds, fertilizers, means of plant protection, the costs of irrigation and crop insurance.

Operating costs represent cost of ensuring the ordinary business activities (wages, material, etc.), i.e. Non – investment costs (Synek *et al.*, 2003).

Operating costs at this research are including the variable costs of machinery e.g. maintenance, costs of energy (for both machines and drying), interest and depreciation of machinery, cost of services, expenses for hired labour and opportunity costs for family labour. Costs of land: include the rent paid to land owners and opportunity costs of their owners. The opportunity costs of the land owners are calculated according to current land prices in the given typical region. Gross yield is equal to the market price of the commodity plus decoupled payments plus payments linked to production plus other income of special crops (Zimmer *et al.*, 2011). All results in graphs are presented in €/t. This adjustment was made by the department in Braunschweig VTi based on average exchange rates in individual years 2010, 2011 and 2012.

RESULTS

The level of yields per hectare of wheat in the years 2010–2012 at selected typical farms are shown in the Chart 1. In the EU, the yield per hectare in the years 2010–2012 ranged from 3.6 to 9.0 t/ha. The best results were achieved at the farms in Germany, Denmark and United Kingdom (7.2 to 9.0 t/ha). Compared with these countries (within the observed period), farms in the Czech Republic had reached much lower yields per hectare; up to 6 t/ha. In the farm CZ1200JM was due to below the average rainfall during the winter and spring of 2012 a significant annual decline in yields. East of the EU had hectare yields reached from: 1.2 to 5.0 t/ha. Most similar results of states of the former Eastern Bloc (now EU Member States) were observed investigated at the farms in Ukraine. Similarly overseas were observed, the average yields per hectare lower than in the EU and ranged between 2.2 to 3.7 t/ha.



1: The yields of wheat per hectare at the selected farms in the years 2010–2012 (in t/ha)

* *Triticum aestivum* L.

Note: The initial letters of the farms designation are an abbreviation for the country, numbers: area of arable land of farm, the final letters: region

Source: The investigation of IAEI and own data processing based on the database of Agri benchmark Cash Crop

For an overall assessment of the production economics of wheat was used an accounting costs and economic costs of its cultivation and the revenue generated from its cultivation.

These final data on costs and revenues of the farms with the production of wheat enable to identify countries with high or low costs per unit of production and simultaneously declaring what economic / accounting profit per unit of production has been achieved in given country.

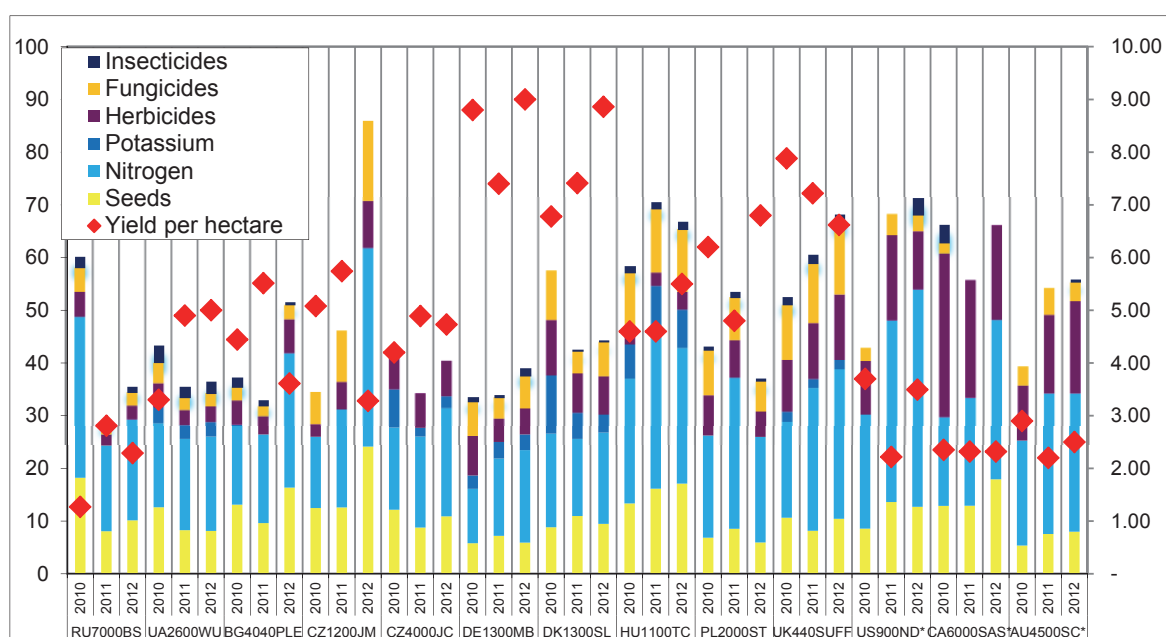
Direct and Operational Costs of Wheat Cultivation

Direct and operational costs, which are a major cost items incurred for the wheat cultivation, allow comparison of the Czech farms, with other farms in the EU and in the rest of the world (Fig. 2, Fig. 4). These costs do not include overhead expenses. The year 2011 was, compared to with the years 2010 and 2012, for the many wheat producers favourable, as the average annual growth in per hectare yields a positive impact on direct costs – which had declined. The lowest direct costs per 1 ton of wheat in the monitored period (in the years 2010–2012) in the EU were monitored in the farm in Germany (48–52 €/t). The highest direct costs per one ton of wheat were issued in Hungary, where these costs ranged from 98–112 €/t of production. Highest direct costs of wheat production incurred in Bulgaria in the year 2012 (over 128 €/t). The annual growth of direct costs in Bulgaria was significantly influenced by the decline yields.

The direct costs include seeds, fertilizers and means of plants protection. The costs of the fertilizers occupy in the structure of direct costs a larger share, than the costs of means of plants protection. In the monitored period had spent the most funds for the fertilizers mainly farm in Hungary (33–42 €/t of wheat production). The highest costs for the means of plants protection were detected in the monitored period in United Kingdom (over 30% of direct costs) and in Poland (nearly 30% of direct costs). The rest of other monitored farms issued for means of plants protection in monitored period about 20% of direct costs.

In the years 2010–2012, was used the highest amount of fertilizers on the farm in Bulgaria; about 10% of direct costs (6.5–9.5 €/t of production). Fig. 3 indicates primary application of nitrogen fertilizers at the all investigated farms during the process of wheat cultivation. The applied amount of fertilizer in the years 2010–2012 showed the great diversity. The differences can be identified rather between farms, not only in the amount of applied fertilizers, but also in the structure of the use of fertilizers. From the Fig. 3 is also evident, that farms in EU apply larger amounts of fertilizer (NPK) per 1 ha wheat area. In contrast, overseas and in Russia the total use of fertilizers was significantly lower.

Within the EU, in the years 2010–2012, was the total amount of fertilizers (NPK) applied to 1 ha of area of wheat highest on the farms in Germany and Denmark. However on the typical farm in Denmark was during the years 2010–2012 achieved a lower or comparable yields per ha than in Germany,

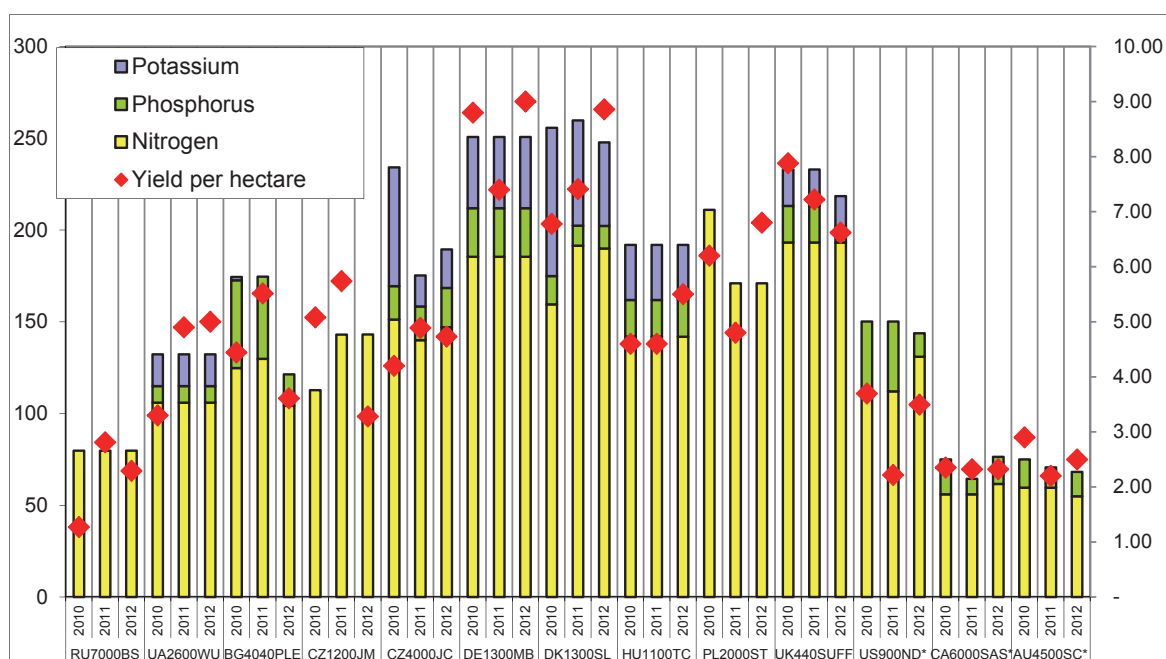


2: The structure of direct costs incurred for the cultivation of wheat (€/t = main y-axis) and yields of wheat per hectare (t/ha = side y-axis)

* *Triticum aestivum* L.

Note: The initial letters of the farms designation are an abbreviation for the country, numbers: area of arable land of farm, the final letters: region

Source: The investigation of IAEI and own data processing based on the database of Agri benchmark Cash Crop



3: The amount of fertilizers for the cultivation of wheat (€/t = main y-axis) and yields of wheat per hectare (t/ha = side y-axis)

* *Triticum aestivum* L.

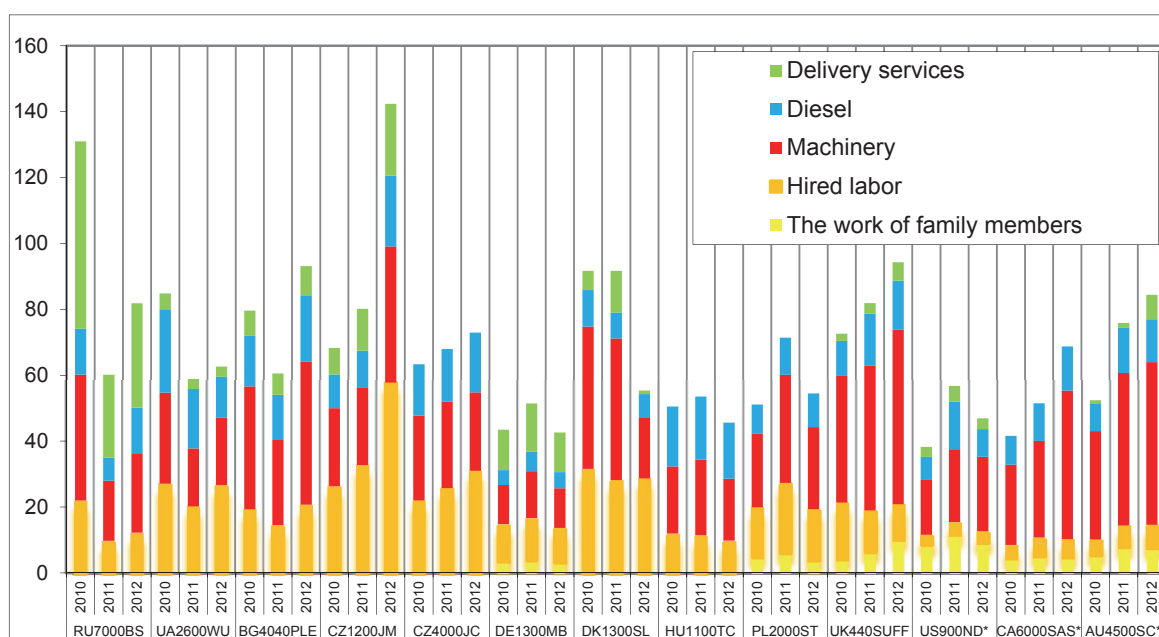
Note: The initial letters of the farms designation are an abbreviation for the country, numbers: area of arable land of farm, the final letters: region

Source: The investigation of IAEI and own data processing based on the database of Agri benchmark Cash Crop

despite identical amount of applied fertilisers. High input costs of fertilizers (in comparison with other countries), does translate into the yields of wheat. On the contrary, the Czech and Hungarian farm had not higher inputs of fertilizers a positive impact on

yields per hectare. Among individual representative farms were observed differences in the prices of pure nutrients in fertilizers (NPK).

Lowest Prices of pure nutrients in fertilizers were monitored in the years 2010–2012 on the East



4: Structure of operating expenses incurred on cultivation of wheat (€/t)

* *Triticum aestivum* L.

Note: The initial letters of the farms designation are an abbreviation for the country, numbers: area of arable land of farm, the final letters: region

Source: The investigation of IAEI and own data processing based on the database of Agri benchmark Cash Crop

(Russia, Ukraine). In contrast, in the Australia was price higher than € 1200/t of pure nutrients (NPK).

Operating expenses incurred in the years 2010–2012 per hectare of wheat showed considerable variability. Within the EU ranged (this expenses) from 130 to 475 €/ha. The highest operating expenses were detected in Denmark and United Kingdom, in the entire monitored period they exceeded 340 €/ha. Operating costs in mentioned countries are mainly incurred due to the high costs of agriculture machinery. Such a high operating costs did not occur in any other investigated country. The other investigated countries showed operating costs at about 320 €/ha. The lowest operating expenses in the EU were founded in Hungary 178–195 €/ha (39–45 €/t). The low operating costs of the Hungarian farms contributed to the low cost of labour and machinery. In Ukraine and Russia oscillated operating costs (in monitored period) from 127 €/ha in the year 2010 to 227 €/ha in the year 2012. at about 350 €/ha. Australian canola producers reached operating costs (in the same period) from 175 to 243 €/ha. Overseas, producers of wheat incurred in the operating costs in the years 2010–2012 from 53 to 116 €/ha.

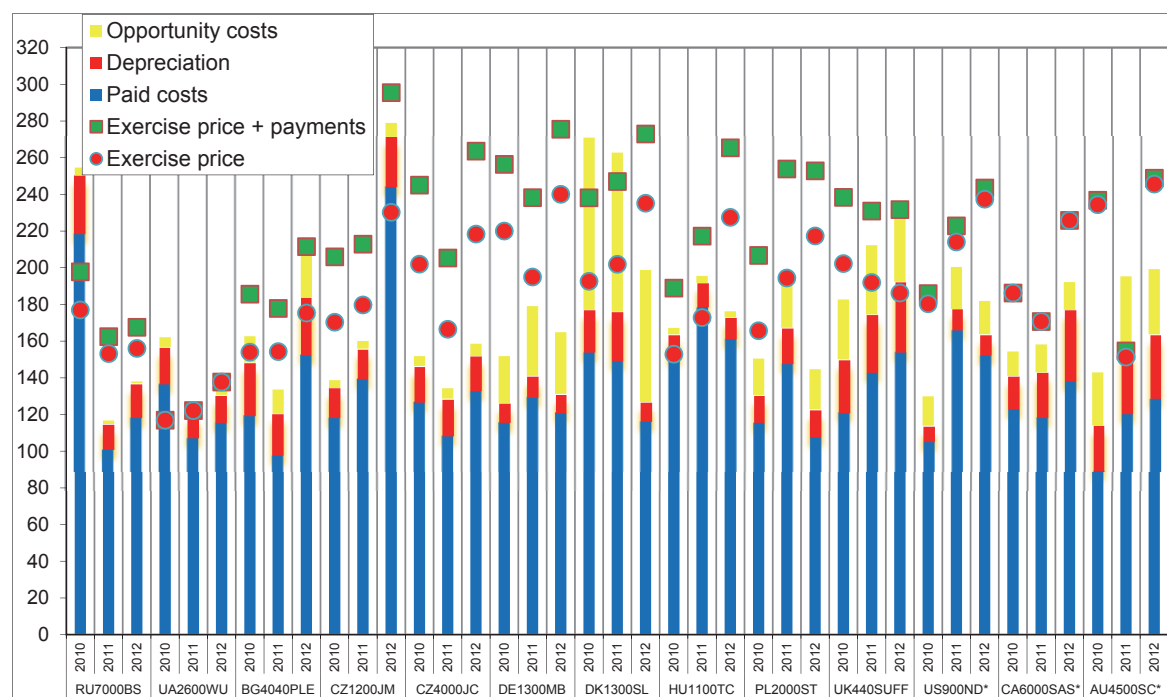
By allocating operating expenses to 1 ton of wheat production occurs (due to differences in yields per hectare) significant differences (in operating expenses), see Fig. 4. The highest operating expenses per 1 ton of wheat production were in more than half of typical farms incurred in the year 2012. In a given year were the highest spending per 1 ton of the rapeseed production at the farm in the

Czech Republic (CZ1200JM). This was primarily due to very low yields per hectare achieved at these farm. The higher operating expenses in the year 2012 on the Bulgarian farm and in UK were caused by the high costs of machinery modernization.

The investigation of farms (see Fig. 4) indicates significant differences (during the years 2010–2012) in operating expenses due to changes in costs of work and costs of machinery. The differences are significant in comparison of given farms, but also in each investigated farm in different years. In assessing of operating expenses, we must not forget that in the investigated farms showed the cost of family labour, this is fact mainly at the farms in former Eastern bloc, except farms in Poland and Denmark. Labour costs were in the EU and in the East on average higher than overseas, both on 1 ha and 1 ton of wheat production. In the international comparison, some of the investigated farms are characterized by a low share of supply of services, i.e. the most of the work is carried out “in-house”. Farms in Poland, Hungary, in the Czech Republic (CZ4000JC) do not use the service at all and all work is performed for their own account.

Profit and Cost – Effectiveness of Rapeseed Cultivation

The resulting data on the costs and revenues of the typical farms allow us to declare what outcome on the economic unit of production was achieved in the given country. Fig. 5 shows the overall level of economic costs and revenues including subsidies in selected countries in the years 2010–2012.



5: Gross profit and total economic costs of the rapeseed in the years 2010–2012 (€/t)

* *Triticum aestivum* L.

Note: The initial letters of the farms designation are an abbreviation for the country, numbers: area of arable land of farm, the final letters: region

Source: The investigation of IAEI and own data processing based on the database of Agri benchmark Cash Crop

When comparing the total cost is important to include not only the accounting costs (paid expenses, depreciation and amortization), but also the opportunity costs. The opportunity costs then play an important role in the calculation of economic profit the difference (with respect to the accounting profit) lies on the fact, that it is the difference between revenues and economic costs. The differences arise primarily in case of labour costs items and land, which are (at the farms in post-communist countries) including the paid costs (expenses). The significant part of the workforce consists of employees and the land is mostly hired (high share of rents). Vice versa on the family farms the item of paid expenses includes a smaller proportion of labour costs, these costs are then calculated as an opportunity costs. Similarly, the farm manage their own land, where there is not rent and these “costs” are calculated as the opportunity costs. The opportunity costs also include loss of interest on own financial resources, which are used on farms to finance short or long – term assets.

Results in Fig. 5 indicated (in the years 2010–2012), that in the most of European farms the total revenues (including bounded payments and decoupling) are covering the economic costs (including accounting costs and opportunity costs). However, in a typical farm in Denmark in the years 2010 and 2011 was

detected economic loss. In the year 2012 reaches also this investigated farm in Denmark an economic profit. In the year 2012 the economic loss was also detected in the United Kingdom. The best economic results within the EU in the year 2012 were achieved on the farms in the Czech Republic (CZ4000JC), Germany and Poland, where economic profit exceeded 100 €/t. When not considering the subsidies, which are significantly affecting the economies of European producers, the situation would change only in favour of farms from the Czech Republic (CZ4000JC) and Germany. Farms outside of the EU do not have possibility to use subsidies or only in a limited amount. Therefore, the calculation of economic profit without subsidies and aid does not occur in these farms to difference in the overall result. From countries outside of the EU subsidies were identified only in farms in USA, Australia and Russia. Fig. 5 also shows that if the farm which has not achieved economic profit, whether would be at least the accounting profit. For example, in Russia in the year 2010 the total revenues would not even cover the financial costs, the typical farm showed beyond the economic losses also accounting loss. This is unlike in the typical farm in Denmark, which in the year 2010 and 2011 also reported a negative economic profit, but in case of accounting profits was in the black numbers.

CONCLUSION

The international comparison shows that the farms in the EU states have the intensity of cultivation of wheat higher than in other countries. In the EU has been greater use of fertilizers observed in Germany, Denmark and United Kingdom. Differences between countries can be seen also in the intensity of use of means of plants protection. Typical farms in overseas are spending usually more for means of plants protection than a typical farm of the new or old EU member states or Eastern countries (Russia, Ukraine). Intensification inputs reflected strongly in the old EU member states into the level of the yields than in the new EU member states. In the years 2010–2012 the investigated farms operated with the lower economic profit, or with the economic loss. The lowest economic effect resulting from the high costs of inputs, was achieved (within the EU) at the farm in Denmark, where was in the years 2010–2011 reported a negative economic outcome (without subsidies). The profitability of European producers has been significantly affected by subsidies. After taking into account the differences in subsidies, were the results in economic profit very different in a typical farms in the old EU member states, new EU member states and in the farms overseas.

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REFERENCES

- DAGEVOS, J. C. 2009. *The food economy: global issues and challenges*. 1. ed. Wageningen: Wageningen Academic Publishers.
- SYNEK, M. et al. 2003. *Manažerská ekonomika*. 3. vyd. Praha: Grada Publishing.
- ZIMMER et al. 2012. Agri benchmark Cash Crop 2011. v TI Braunschweig.
- ÚKZÚZ. 2014. *Central Institute for Supervising and Testing in Agriculture, Oilseeds*. [online]. Available at: <http://eagri.cz/public/web/ukzuz/portal/odrudy/seznam-doporucenych-odrudy/x2014/olejniny.html>. [Accessed: 2014-02-03].

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