

## PRODUCTION OF TABLE POTATOES IN EUROPE – A MULTINATIONAL GROSS MARGIN ANALYSIS

*Søren Marcus Pedersen<sup>1</sup>*

*Jan Bizik<sup>2</sup>*

*Luisa Dalla Costa<sup>3</sup>*

*João Coutinho<sup>4</sup>*

*Frantisek Dolezal<sup>5</sup>*

*Anna Gluska<sup>6</sup>*

### ABSTRACT

This paper examines different cropping practices, cost structures and gross margins for conventional table potato cropping in 6 different regions within the European Union: Czech Republic, Denmark, Italy, Poland, Portugal and Slovakia. Findings from this study show that potato cropping practices varies significantly between the various countries with major differences in yield and costs. Italy and Denmark are the two regions with highest gross margins due to high yields and revenues. Poland is by far the largest potato producing country among the 6 countries. However, the production is primarily based on small scale farming with low yields and economic revenues.

**Keywords:** Table potatoes, gross margins, cropping practices, cost structure

### INTRODUCTION

The accession of 10 new members into the European Union provides an opening and widening of the European market to 25 member countries for food and agricultural products and food commodities. Table potato production and marketing is unique in the sense that the market price of potatoes fluctuates significantly during the season and from year to year and has to be consumed within a relatively short time. Table potato has a low durability compared to other agricultural bulk commodities like cereals and seed crops. Moreover, the cropping season and harvesting time differs with several months between south and north European countries. The market prices of fresh table potatoes can easily double the price of stored table potatoes. In this study we present a comparative gross margin study of potato cropping in 6 European countries. The analysis includes 3 old member countries (Denmark, Italy and Portugal) and 3 new member countries (Poland, Slovak Republic and Czech Republic).

The aim of this study is to analyse the cost structure in various European potato producing countries and to describe the various cropping practices in the 6 member countries. Potato production is to a large extent dependent on sufficient water supplies either from precipitation or irrigation, especially in Southern Europe. It is therefore important to find out which impact does the geographic and difference in cropping practice have on crop yield, quality and eventually gross margins (GM).

### METHOD

The project is divided in two parts. Firstly, an explorative description of the cropping

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<sup>1</sup>*Food and Resource Economics Institute, The Royal and Veterinary and Agricultural University (e-mail: Marcus@foi.dk)*

<sup>2</sup>*State Enterprise (RIIRDLE)*

<sup>3</sup>*University of Udine*

<sup>4</sup>*Universidade de Trás-os-Montes e Alto Douro*

<sup>5</sup>*Research Institute for Soil and Water Conservation*

<sup>6</sup>*Plant Breeding and Acclimatization Institute (IHAR)*



practices and market for potatoes in each participating country, Secondly, a multinational gross margin analysis among the 6 countries for table potatoes. A questionnaire has been prepared and forwarded to colleagues at 6 research institutes in the 6 countries about economic costs and turnover and gross margin for producing table potatoes. The base reference year is 2002 for all countries except for the Czech Republic where 2003 data have been used. All costs are defined according to the same guidelines and principles although it is obvious that there are cultivation practices that may differ between the various countries.

Data for the GM-analysis is based on the following sources from national statistics and data bases: Ministry of Agriculture of the Czech Republic, 2003 and 2004, Research Institute of Agricultural Economics, 2005, Cizek M., 2000, 2003 and 2005, Landbrugets Rådgivningscenter, several years, Central Statistical Office in Poland, 2001 and 2002, INE 2002, Portugal and Statistical yearbook of the Slovak Republic 2002.

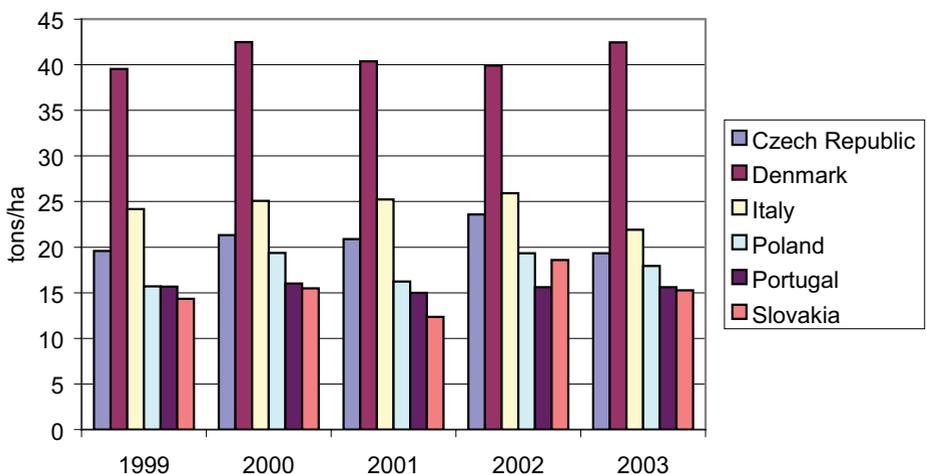
**TABLE 1** *Potato area, yield and production, 2003*

	Potato area harvested, 1,000 ha	Potato production, 1,000 tons	Potato seed production, 1,000 tons
Czech Republic	43	841	100
Denmark	36	1,530	90
Italy	73	1,604	190
Poland	766	13,732	2,050
Portugal	80	1,250	76
Slovakia	26	392	60

Source: FAO statistics, 2004

### Production, area and yields

Poland is by far the largest potato producer in Europe in terms of potato area and total production. However, the potato area has declined with about 40 percent in Poland within the last 5 years.



**FIGURE 1** *Potato yield, tons/ha.*

Source: FAO 2004

In Italy the potato area has declined with about 15 percent, whereas the potato area in Denmark, Portugal and Slovakia has declined between 5 and 10 percent.

In general, there has been a trend towards higher yields in most countries although year 2003 was an exceptional year in particular in the southern part of Europe. Drought and high temperatures have been the main reasons for modest yields in these areas.

Potato yields vary among the six countries depending on crop variety, amount of precipitation and access to irrigation, solar radiation, fertility and soil conditions. In Denmark the average potato yield varies between 40 and 45 tons/ha whereas the average yield in Portugal, Poland and central European countries varies between 12 and 20 tons/ha.

In the following is made a short description of the most common potato management and cropping practices in each region. What is characteristic for various regions regarding irrigation, input application and cultivation?

### **Potato cropping practices in the 6 regions**

In the Czech Republic, new potatoes are frequently grown under gun irrigation in lowlands. Late ware potatoes are grown in all regions but mostly on more elevated and more humid sites and without irrigation. New potatoes in lowlands are planted since the end of February up to the middle of April, depending on weather conditions. Late ware potatoes are planted from the middle of April up to second week of May. Practically all potatoes are fertilised both with mineral fertilisers and with farmyard manure. Spraying of late ware potatoes with pesticides is performed about 8 times during the season, because their growing season is long and the risk of late blight attack increases with the length of the season. Early new potatoes are sometimes grown under a cover of synthetic non-woven fabric to speed up their growth. Early new potatoes are irrigated with self-mowing guns. Some small-size farmers also use fixed or manually transferable sprinklers. The irrigation of late ware potatoes has up to now been attempted in an experimental way on only a few negligible areas.

In Denmark, potato production is mainly carried out on the medium clays to sandy soils in Jutland and the Northern part of Sealand. Commercial/mineral fertilisers are the most common fertiliser for table potatoes, whereas slurry is primarily used for starch potatoes. Slurry and animal manure is usually used in limited amounts for table potatoes due to the timing of the mineralisation process and also due to the taste and quality of the table potatoes. Spraying with herbicides, fungicides etc. are carried out 8 times during the season and some of the fieldwork is carried out by contractors, especially highly specialized tasks such as harvesting and soil separation (Mathiesen, 1999). Although the precipitation level is fairly high in most parts of the country, irrigation is still a common practice among potato producers. Most systems are based on mobile gun irrigation systems with local wells on the fields.

Most of the Italian potato production (45 percent) is located in 3 regions: Campania, Emilia-Romagna and Abruzzo. Other important areas for cultivation are Lazio, Veneto and Calabria. Every type of production is characterised according to the climatic zone and soil conditions with specific planting and harvest periods. In this matter, there are almost production seasons all over the year. The farm management is typically carried out by farmers family and is usually relatively small holdings. Almost all fertiliser used are commercial/mineral types. Slurry and animal manure are seldom used due to a low diffusion of animal farm holdings. Weed control is generally applied in single treatments, in pre-sowing or, later, after the emergence of the plant. Only in case of severe weed attacks further treatments are required and specific herbicides will be applied. A further weed control is also obtained from ridging. Fungicide are usually largely used (5 or more applications, according to the seasonal requirements), and guided by thresholds values. Soil disinfestations in pre-planting or at ridging is crucial for obtaining a good plant



stand, in fighting against Elateridae and Noctuidae and Colorado Beetles.

Potato production in Poland covers about 10 percent of the total agricultural area and has always been an important crop in Poland produced by many farmers in small scale. Potatoes are semi-subsistence crops used mainly for consumption at home and animal feed with only a relatively small marketable share. Potatoes are often grown on poor sandy soils and yields have been fairly low compared to many neighbour countries. Average yield is about 19 tons/ha and a fairly large share of the production is used directly on the farm. Moreover, a large share of the feed potatoes have been used for pig production although this share have declined in recent years (European Commission, 1998). Most farmers have a plantation area of about 1-2 ha, whereas the farmers who are specialised in producing potatoes for processing usually are much larger at about 50 ha. About 95 percent of the table potato farmers use animal manure for fertilisation in combination with mineral fertilisers and the fertilisation level is about 25 percent of the level used on specialized potato farms. Irrigation is primarily carried out on the specialized farms whereas the small farms have to rely on the annual precipitation. Harvest in full maturity stage is mainly carried out from mid September to mid October. Most common harvest methods are potato harvesters with two-row diggers or simply by picking the potatoes by hands. On the larger farm it is usually harvesters of different types that are applied. Storage facilities include mainly clamps and cellars whereas storage buildings are rare in Poland (IHAR Jadwisin, 2004).

In Portugal, potatoes are grown as spring crops and planted from February. As the rain decreases, from March until September, the potato should be irrigated and traditionally the crop is located in the central and northern regions, where the amount of rain is more significant. Spraying is carried out 3 to 6 times, depending on the year, region and time of the year. Late blight and Colorado potato beetle are important enemies of the crop, originating every year heavy losses, due to lack of control. Moreover, poor irrigation management is responsible for poor yield of the potato in many regions. Usually potatoes are irrigated by furrow irrigation. This is the most common method and it is used for small and for large fields. Sprinkler systems, either mobiles or solid sets are used with medium range sprinkles.

In Slovakia, the production of table potatoes is usually located in regions with medium soils. Most of these areas are in the southern part of Slovakia and irrigated with rain-gun irrigation systems. Planting of potatoes, planting density and harvesting times follows to a large extent the cropping practices in Czech Republic (see above). Commercial and mineral fertilisers are the most common fertiliser for table potatoes, although farmyard manure, in a solid form, is more popular in comparison with slurry. Some fieldwork is carried out by contractors, especially highly specialized tasks such as harvesting and soil separation. Harrowing and ploughing is usually carried out by the farmer himself. Sensitive areas to water deficiencies and areas without the possibility of using irrigation are mostly located in the middle and eastern part of Slovakia. However, even though that the yield for many farmers are fairly modest without irrigation systems, there are also many highly efficient potato farmers. Several farmers use state of the art technologies and growing systems including irrigation with rain gun, linear type and drip irrigation systems.

### **Gross margin analysis**

The following table 2 shows a gross margin analysis for potatoes in the 6 regions presented above. The gross margin usually indicates the revenue farmers have left for fixed costs. Here, in this study GM II indicates the amount left for paying the land rent.

The analysis is based on data provided by project partners in the [www.fertorganic.org](http://www.fertorganic.org) project by following the same guidelines outlined by Food and Resource Economics Institute, KVL.

In this respect the costs may be regarded as reasonable estimates for common table potato practices in the various countries. A comparison between countries should always be regarded with some reservations. Market prices may vary significantly during cropping season and access to irrigation as well as soil conditions may also have a large impact on the economic revenue. In the Czech Republic the region is divided between the highlands without irrigation (Bohemian-Moravian Highland region) and lowland areas with irrigation. In Denmark, the gross margin analysis may represent all regions in Denmark with sandy loam soils. In Italy it can be related to the Veneto area in the northern part of Italy and in Portugal the gross margin analysis refers to the littoral centre of the country (Mondego and Tâjuz Valley). Finally, in Poland it is in the central part of the country and in Slovakia it is the lowland areas. Despite the differences in cropping practices and uncertainties this analysis might nevertheless give an indication of the cost levels for various cultivation practices in EU. By comparing costs it is possible to establish a picture of the level of mechanisation and input application among different regions. For all regions we have assumed medium soils with common potato cropping practices.

In table 2, variable costs usually relates to the costs of a particular input (e.g. the cost of nitrogen and pesticides). Cost of machinery and labour is based on average annual contracting prices. In this respect it is assumed that these costs (price per unit) include capital costs (depreciation and cost of capital) and labour costs. For instance the cost of distributing mineral fertiliser in Denmark is 15 EUR/ha for one treatment (average cost including labour and capital costs).

The cost analysis should present a typical farming practice in potato specific regions on medium soil types for that region. However, a major difference is that for some regions it is common to irrigate whereas for other regions irrigation is unusual either due to climatic conditions and farm sizes. In this gross margin analysis, irrigation is applied in all countries except for late potatoes in the Czech Republic, Slovakia and Poland. Moreover, animal manure is applied in all countries except for Italy and Denmark.

Findings from this study shows that economic yields are highest in Italy followed by Denmark, whereas the economic yield in Poland and Slovakia is about half the size of Danish and Italian yields. In general, the physical yield is highest in Denmark but the potato prices are fairly modest due to seasonality and market conditions implying that the economic yield is relatively low there.

Animal manure and slurry may be regarded as an internal cost for many farmers, implying that it is difficult to estimate costs for these input. In the Czech Republic the price of animal manure/slurry is about 4,8 EUR per tons, whereas the price in Portugal is assumed to be 35 EUR per tons. Mineral fertiliser prices varies between 0,4 and 0,64 EUR per kg. in all the countries. Differences in levies may explain some of the differences.

Potassium is only applied in large amounts the Italian scenario (200 kg/ha) and the Danish scenario (178 kg/ha). On farm market prices of potassium are significantly cheaper in Italy (0.14 EUR/kg) compared to the other European countries with the highest price in Portugal (0.63 EUR/kg).

In Poland many farmers produce their own seed potatoes, which may explain the low costs. However, the application levels are relatively high in the East European countries despite similar planting densities. The costs of seed potatoes may be high in Czech Republic because the indicated mass of seed potatoes per hectare is high. Milan Cizek shows in (Vokal et al., 2004) that the typical cost of seed for ware potatoes and industrial potatoes is about 822 EUR/ha and 581 EUR/ha in Czech Republic, respectively.

The application of pesticides may depend on the weed pressure and the price of pesticides. In most countries the application levels include several treatments per year. However,



**TABLE 2** Gross margins for table potato cropping 2002, EUR/ha

	CZECH I	CZECH II	DEN-MARK	ITALY	PO-LAND	POR-TUGAL	SLO-VAKIA
First quality:	3080	3490	5145	5455	2500	3000	2358
Secondary quality:	52	30	125	590	185	150	180
<b>Total</b>	<b>3132</b>	<b>3520</b>	<b>5270</b>	<b>6045</b>	<b>2685</b>	<b>3150</b>	<b>2538</b>
<b>VARIABLE COSTS:</b>							
Seed potatoes	802	802	550	705	375	558	806
Fertilizers							
Nitrogen (N)	60	43	100	67	20	52	40
Phosphorus (P)	42	26	30	40	25	19	14
Potassium (K)	24	20	61	28	23	19	15
Pesticides							
Herbicide	67	67	88	47	38	86	48
Fungi- and insecticides	167	56	63	103	51	36	31
Treatment for withering, desiccant 2)	50	50	47		38		58
<b>Other cost:</b>							
Seed treatment with fungicides	25	25	69	120		120	30
Slurry and manure	66	66			200	350	50
Sorting/grading	155	99	983	518	450	500	270
Transport/packing to wholesalers 3)	317	203	295	1295	150	38	225
Variable costs, total	<b>1774</b>	<b>1456</b>	<b>2284</b>	<b>2923</b>	<b>1370</b>	<b>1778</b>	<b>1587</b>
<b>GROSS MARGIN I</b>	<b>1357</b>	<b>2063</b>	<b>2986</b>	<b>3122</b>	<b>1316</b>	<b>1372</b>	<b>952</b>
<b>COST OF MACHINERY AND LABOUR</b>							
Mineral fertilizer distribution	12	12	15	120	25	18	7
Slurry and manure distribution	55	54			100	50	41
Pre-planting cultivation	33	33	20	50	63	17	10
Planting of seed potatoes	71	70	117	170	57	42	36
Ridging	64	63	81	40	45	15	19
Spraying	66	33	190	232	53	89	23
Cutting the top	5	5	66	35	26	35	15
Harvest/potato lifter	113	112	507	700	268	209	242
Transport to farm yard	78	77	134	180	58	18	88
Harrowing (after harvest)	5	5	17	45	20	45	15
Ploughing	35	35	60	75	78	34	44
<b>Other costs:</b>							
Irrigation, fixed costs		74	163	120		132	
Irrigation, variable costs		69	79	120		221	
Fabric cover in CZ		64					4)
Fixed costs 1)	457	444					
<b>Machinery and labour cost, total</b>	<b>992</b>	<b>1150</b>	<b>1449</b>	<b>1887</b>	<b>793</b>	<b>905</b>	<b>540</b>
<b>GROSS MARGIN II</b>	<b>365</b>	<b>914</b>	<b>1537</b>	<b>1235</b>	<b>523</b>	<b>467</b>	<b>412</b>

Czech I is related to potato cropping in the highlands without irrigation, Czech II is on lowlands with irrigation.

- 1) In CZ fixed costs are separated and not distributed on the cultivation practices, all data are from 2003.
- 2) Desiccant is applied to control the tuber skin setting and tuber blight and to facilitate the lifting of tubers.
- 3) Same price used for Czech Republic as for Slovakia
- 4) Fixed irrigation costs in Slovakia: 191 EUR/ha. Variable costs of irrigation (100 mm) 130 EUR/ha.

the price of herbicides varies significantly with relatively high prices in Portugal compared to the other countries.

Fungi- and insecticides application varies between 6-5 times in Denmark, Italy and the Czech Republic and 2-4 treatments in the other countries. Again, the cropping practices may depend on cultural differences and climatic conditions.

In general, the cost of machinery and labour varies between about 800 and 1900 EUR with the highest costs in Italy and the lowest costs in Poland. Spraying, harvest and seed potato planting costs are for instance significantly higher in Denmark and Italy compared to the other countries in this study.

In summary, gross margin II levels varies from about 365 EUR/ha on certain non-irrigated areas, whereas the gross margin II level on irrigated areas in Denmark and Italy may reach levels at about 1200-1500 EUR/ha. These findings may suggest a potential for optimizing cropping practices in several regions with focus on improved irrigation and fertilisation management as well as structural reforms towards larger production units.

## **CONCLUSIONS**

In this paper we attempt to assess cropping practices and cost structure for conventional potato cropping in 6 different regions within EU. Poland is by far the largest potato producing country among the 6 countries. However, the production is primarily based on small scale farming. Italy and Denmark are the two regions with highest gross margins due to high yields and revenues.

Input application varies tremendously among the 6 regions. Most of the East- and Central European countries apply organic fertilisers such as farm yard manure and slurry. However, in Denmark and Italy it is more common to only use mineral fertilisers. Furthermore, potato prices and quality seems to vary significantly which may depend on quality, applications and whether the farmer produces early or late potatoes.

Findings from this study show that potato cropping practices varies significantly between the various countries with major differences in yield and costs. In Portugal and Italy, irrigation is a common practice due to limited precipitation. In Denmark, irrigation is a common practice as well, whereas most of the east and central European countries do not irrigate.

This gross margin analysis is based on average costs in typical potato producing regions. In this respect they do not represent an average estimate for each country. However, the study provides a good indication of cropping practices and economic performance in varies different regions of Europe. Based on these findings it is clear that the implementation of new technology must be adapted to local conditions regarding field size, farm practice, animal production, access to organic farm yard manure and climatic conditions.

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