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The financial impact of mad cow disease to public budgets in Czech Republic from 2001–2019

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Abstract

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Population health and food safety is one of the main priorities of the agro-industrial complex and the economic policies of governments. This is also reflected in the health safety of the meat in the event of infectious diseases. Food safety policy is linked to public spending by the state, which also takes responsibility for the health of the population. This paper deals with the analysis of the economic impacts of the Mad cow disease (bovine spongiform encephalopathy - BSE) occurrence in Czech Republic, namely the financial compensations to the farmers whose herds had been affected and the costs of animal killing and carcass disposal in the rendering plant. The data were obtained from the Ministry of Agriculture of Czech Republic, the State Veterinary Administration and the Czech Statistical Office. Original scientific research reflects the period from the first occurrence of the disease to the end of 2019. Between February, 2001 and the end of 2019, a total of 1 977 881 cows were examined and 30 cases of the BSE were detected. Consequently, 4243 cows in cohorts were killed and their carcasses were safely disposed of. The total of the compensations in this period reached EUR 8 013 000. Of these, 80.6% (EUR 6 458 000) were compensations for the value of the killed animals, 12.7% (EUR 1 020 000) for the related costs, i.e., killing, safe disposal of carcasses and the examination for the BSE, and 6.7% (EUR 535 000) for the losses due to non-materialised production. The costs associated with the payment of compensations are therefore significantly lower than if the real effects of the disease on the health of the population were affected. The fact that in the last 10 years the disease has not occurred in the Czech Republic corresponds to the improving situation in EU countries, so the Czech Republic has been recognised as BSE negligible risk country.

Keywords: financial compensation; mad cow disease; bovine spongiform encephalopathy; BSE; cattle; infectious diseases; World Organization for Animal Health

Introduction

The Czech Republic is one of the countries that has managed to recover animal breeding from a number of diseases still occurring in other European countries or the world. With the help of breeders and the consistent supervision of the State Veterinary Administration (SVA), it is possible to maintain a good disease situation in Czech Republic. Country status is granted by the European Commission and the World Organization for Animal Health (OIE).

In the event of the occurrence of an infectious disease on a larger scale, the SVA may apply so-called Emergency veterinary measures, which are aimed at eradicating the disease and healing livestock and wildlife. This activity is associated with public costs, which are covered by the Ministry of Agriculture. It is basically compensation for costs and losses incurred in farms in connection with the occurrence of dan-

gerous infectious diseases. The total number of infectious animal diseases in the Czech Republic ranges from 6 in 2014 to 15 in 2019.

The issue of costs and compensation has not yet been sufficiently analyzed in the world scientific literature, and if so, there dominates literature from the USA or English-speaking countries (Pritchett et al., 2005; Barratt et al., 2019; Casadevall, 2019), or Japan (Sugiura et al., 2006). European scientific papers are dominated by articles from the United Kingdom, where BSE occured first in 1985 (Harling et al., 2004; Brownlie et al., 2006) and in Ireland in 1989 (John & Fishamn, 1997; Birchard, 1999). So there is a scientific gap and demand for a deeper research within EU countries and elsewhere.

Also in Czech and European conditions, it is very difficult to quantify the direct and indirect economic impacts of infectious diseases in livestock. The budget reserve in Czech Republic, which serves to cover these possible and difficult to predict costs in advance, amounts to EUR 2 500 000 every year in the Czech Republic. For the past 20 years, there has been a budget-significant Mad cow disease (Bovine spongiform encelphalopathy - *BSE*).

BSE, along with other diseases such as scrapie in sheep, belongs to the group of transmissible spongiform encephalopathies (*TSEs*). It is a neurodegenerative disease manifested by changes in behavior, impaired movement coordination and always ends in death (Anonymous, 1991).

BSE is relatively less up-to-date because of the fact that the last case of this disease was recorded in Czech Republic in 2009. During the period of the disease in Czech Republic from 2001 to 2009, a total of 30 diseases were recorded. But for more than two decades, the European beef demand was affected by the existence of *BSE* because of its potential danger to human health (Wilesmith et al., 1988). In the rest of Europe, sporadic *BSE* is still present. While in 2017 no case of the classical form of *BSE* was reported throughout the European Union, in 2018 we registered one new one from the United Kingdom.

In developed countries, in the interests of public health, cattle slaughtered 30 months and older have been screened for the presence of ancestors in brain tissue. In Czech Republic, regular animal experiments came into effect on February 1, 2001. As of December 31, 2019, a total of 1 977 881 cattle had been examined, 30 of which tested positive. Only two bovine spongiform encephalopathy outbreaks in 2009 and no case of *BSE* in the past 10 years confirm that the incidence of the disease in Czech Republic has definitely decreased, which is the same as in other EU countries.

As a result of 30 positive *BSE* findings, a total of 4243 cows were killed and their bodies destroyed. Animals selected for killing for each occurrence of *BSE* form a cohort, which is a group of animals born in the same herd within 12 months of the date of birth of the affected cattle.

The method of destroying slaughtered animals has evolved over the years. When *BSE* first appeared in 2001, the animals were killed on the farm and buried within its borders. However, it proved difficult from the point of view of hygiene and hygiene and it was ethically unacceptable. Therefore, the animals were killed on the next five occasions and their carcasses were removed in conventional rendering plants. However, this carries with it the risk of contamination of premises and products. Therefore, the rendering system Asanace Žichlínek Ltd. hired in 2003 by SVA to become a facility specializing in the killing of all *BSE* suspected animals and the processing and disposal of their carcasses in the following years. The meat-and-bone meal produced was then burned in the cement plants (Anonymous, 2008).

In line with the EU‘s common agricultural policy and support for agriculture, the EU provides financial compensation to farmers who have suffered losses as a result of *BSE*. Their division is regulated by Law No. 166/1999 coll. on veterinary medicine and care and on amendments to certain related laws (Veterinary Act), the details of which are set out in Title IX.: Compensation for costs and losses related to dangerous communicable diseases (Anonymous, 1999). This defines compensation for farmers whose herds of cattle are affected by the communicable diseases listed in Appendix 2 of this Act. For the 92 dangerous and communicable diseases identified, the compensation strategy and general breakdown of compensation are described. Czech legislation is fully in line with Regulation No. 999/2001 of the European Parliament and of the Council of May 22, 2001, which lays down rules for the prevention, control and eradication of certain transmissible spongiform encephalopathies, as amended (Pospíšil, 2008).

The first part of the paper is focused on the evaluation of the indemnity policy and quantification of reimbursements provided for farmers according to the Veterinary Act in the period from 2001 to 2019. The total costs were itemised and the cost items broken down to cover the individual operations the farmers were responsible for in the *BSE* management and for which they were subsequently reimbursed.

The second part deals with the calculation of the costs related to the killing and disposal of the animals brought to the rendering plant Asanace Žichlínek Ltd. between october 2003 and 2009. This calculation is divided into two parts. The beginning part of the calculation ends in 2009, because after this year there was no occurrence of *BSE* in the Czech Republic and no kiliing and disposal of animals

in this rendering plant. This second part of the calculation continues after 2009, when there were forcibly decontaminated the specified risk materiál excluded from sale and commercial use. This material is skull, brain, eyes, spinal cord, trigeminal ganglia, dorsal root ganglia and vertebral column as specified in Regulation (EU) No. 999/2001 laying down rules for the prevention, control and eradication of certain transmissible spongiform encephalopathies.

This work builds on previous research results of the effects of BSE, which were published at the end of the disease in the Czech Republic (Pospíšil, 2009). The presented results reflect the whole period from 2001 to 2019 and analyze all related costs.

Material and Methods

The main method used in the first part was the assessment of legislation, ie legal acts, regulations and implementing rules, and their application to the incidence of *BSE* in Czech herds. In addition, the relevant EU legislation was analyzed and compared with the relevant legislation of Czech Republic.

The further method of economic evaluation was the deep analysis of statistical data related to the costs of the *BSE* eradication in the czech republic; this information was provided by the Ministry of Agriculture of Czech Republic (Saksún, 2019). Subsequently, the data was related to the individual cost compensation items, as specified by the Veterinary Act. These data and methods were intercorporated within the paper in order to get possibly the most accurate and best results regarding costs related to *BSE* occurence.

Total costs by the Veterinary Act included the cost of killing or slaughtering sick and suspect animals, the cost of killing or slaughtering the animal, the cost of cleaning, disinfecting, disinfecting and exterminating the farm and its facilities and equipment, the cost of mandated vaccination, protection zones, surveillance zones and other restricted zones, and compliance with the measures within a specified observation period before the end of the emergency veterinary measures and the reintroduction of animals on the holding.

The analysis presented in the second part was based on account records provided by the rendering plant Asanace Žichlínek Ltd. (Nicák, 2019). It included an evaluation of the whole process consisting of animal killing, carcass mechanical processing, heat treatment, sterilisation, drying, hammer-mill pressing and pulverisation, and dispatching of the processed material. The costs of transporting the animals to be killed at the rendering plant were not included. These costs were borne by the farmers who were subsequently reimbursed by the Ministry of Finance in accordance with the Veterinary Act. The gebinning part of the cost calculation is analyzed in the time period 2001-2009, when the captured animals and their cohorts were spent in the rendering plant. The second part of the cost calculation covers the years 2010-2019, when only the specified risk material of the tested and killed animals was liquidated at the rendering plant. For the purpose of analysis it is calculated at the rate of 55 kg per 1 animal. All costs in Czech crowns (CZK) considered in this paper were converted into euro at the rate of 25 CZK/EUR.

The content and method of the thesis is a continuation of the previous articles of the authors, which dealt with this issue and have already been published (Pospíšil, 2009; Pospíšil, 2015). This work is a deeper analysis of the costs associated with the occurrence of BSE in the Czech Republic in the period of almost 20 years.

Results

From 2001 to 2011, all killed animals, suspect animals, dead animals, animals from the so-called necessary slaughter, reassigned animals and animals from normal slaughter were compulsorily tested in the age categories up to 24 months, 24-30 months and over 30 months. Because *BSE* has not been reported in Czech Republic for 10 years and Czech Republic is among the countries with negligible BSE risk, from 2011 testing is still ongoing only of suspect animals, dead animals and so-called necessary slaughter animals in the age categories up to 48 months, 48-72 months and over 72 months. Table 1 shows the number of animals tested for BSE in the Czech Republic between 2001 and 2019 and number of disease occurrences in individual years. For this reason, the table shows the decreasing number of animals tested after 2011.

The data show that the last occurrence of *BSE* in our country occurred in 2009, and only in two small farms. According to the OIE, Czech Republic is currently a *BSE* negligible risk country.

Table 2 shows the compensations for all costs spent in relation to the *BSE* between 2001 and 2019. The total of compensations in this period reached EUR 8 013 000. The average occurrence was 1.58 *BSE*-positive animals per year, the average costs per 1 *BSE*-positive animal were EUR 267 100, and the average costs per 1 cohort of animals (killing and carcass disposal) were EUR 1 889.

Of these, EUR 6 458 000 were compensations for the value of the killed animals, EUR 1 020 000) for the related costs, i.e., killing, safe disposal of the carcasses and examination for the *BSE*, and EUR 535 000 for the losses due to the non-materialised production.

Table 1. Number of animals tested for *BSE* and positive *BSE* animals in the period 2001 to 2019

Year	Number of tested animals	Number of *BSE* positive animals	Year	Number of tested animals	Number of *BSE* postitive animals
2001	114 146	2	2011	97 848	0
2002	175 435	2	2012	54 794	0
2003	210 456	4	2013	36 057	0
2004	200 873	7	2014	18 293	0
2005	170 857	8	2015	20 096	0
2006	174 470	3	2016	15 516	0
2007	160 420	2	2017	20 158	0
2008	157 269	0	2018	21 732	0
2009	156 472	2	2019	26 534	0
2010	146 455	0	Total	1 977 881	30

Source: SVA; 2019

Table 2. Total costs (in EUR thousand) associated with 30 *BSE* cases in the period 2001 to 2019

Period	Number of herds by cohort size	Number of animal killed	Value of animals	Killing	Safe carcass disposal	Examination for *BSE*	Related costs*	Observe. of emerg. veter. measur.	Non-material production	Total
2001 to 2019	A. 109	219	383.4	8.6	39.9	16.0	3.8	0.0	5.0	456.7
	B. 17	854	1 164.5	16.2	90.1	65.7	6.3	4.0	97.4	1 444.2
	C. 15	3170	4 910.1	55.1	321.2	350.8	27.0	15.3	432.6	6 112.1
	∑ 141	4243	6 458.0	79.9	451.2	432.5	37.1	19.3	535.0	8 013.0

Source: Mze CR; own processing

A = 1 – 10 animals in a cohort; B = 11 – 100 animals in a cohort; C > 100 animals in a cohort

* Costs related to killing and safe disposal of carcasses and farm decontamination

The number of cohorts is not in agreement with the total of 141 herds affected, as shown in Table 2. This is because there were instances when an animal from the original cohort was transferred or sold to another herd. Its new keeper, having to comply with the Emergency Veterinary Measures, then had this cows killed and thus one cow was reported in association with two or more herds.

The dominant cost item was compensation for the killed animals (80.59%) followed by compensation for non-material production (6.67%). Compensation for non-materialized production is so low because they calculate losses only for the current lactation, further lactation is not considered under Czech law. In terms of volume, the costs for safe carcas disposal (5.62%) and examination for *BSE* (5.39%) follow. Other cost items are generally insignificant (killing of animals, Emergency veterinary measures application and related costs). The following figure shows the relative cost weight of all 30 cases of *BSE* in Czech Republic (Figure 1).

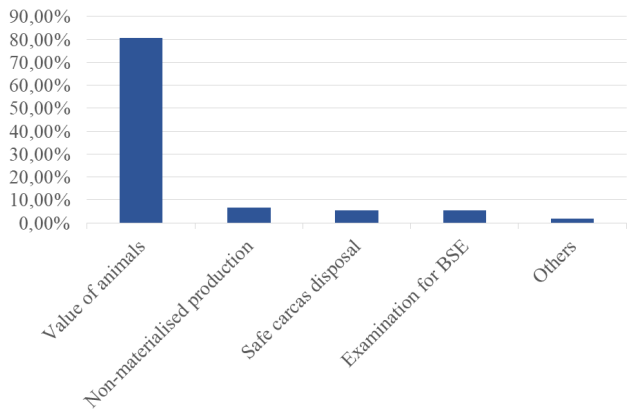

Fig. 1. Relative weights of all 30 BSE cases in the Czech republic from 2001 to 2019 (%)

Source: own processing

In the period from october 2003 to the end 2014, a total of 3 793 cattle were killed and their carcasses destroyed and disposed of at selected and approved rendering plant Žichlínek, co. Ltd. This included 701 cows in 2003; 1 167 in 2004; 1 262 in 2005; 288 in 2006; 131 in 2007, 23 in 2008 and 221 animals in 2009. In the terms of the cohort size, the largest one (7th) included 875 cows, the smallest (27th) had only three animals. The average was 126 animals per 1 cohort. The animals of 27th cohort derived from the *BSE* case detected on 19th December 2007 were gradually identified and destroyed early in 2008. The selected economic items and their distribution in the years 2003 to 2009 are shown in Table 3.

Table 3. Selected costs of *BSE*-related cattle disposal at the rendering plant Asanace Žichlínek Ltd. and their distribution over the period 2001 to 2009 and 2010 to 2019 (in EUR)

		Total
2003	EUR/kg	
	kg processed	415 080
	animal killed	701
	total costs	53 807
2004	EUR/kg	
	kg processed	709 030
	animal killed	1 167
	total costs	91 911
2005	EUR/kg	
	kg processed	812 420
	animal killed	1 262
	total costs	145 684
2006	EUR/kg	
	kg processed	191 046
	animal killed	288
	total costs	35 379
2007	EUR/kg	
	kg processed	79 220
	animal killed	131
	total costs	14 670
2008	EUR/kg	
	kg processed	14 680
	animal killed	23
	total costs	3 534
2009	EUR/kg	
	kg processed	62 660
	animal killed	221
	total costs	18 792
		363 777
2010-2019	EUR/kg	
	kg processed	251 616
Costs for 2010 to 2019		226 454
		590 231

Source: own processing

Table 3 is divided into two time periods, until 2009 and from 2010, because the disease has not occurred in Czech Republic since 2010. After this date, only the specified risk material is decontaminated and is calculated at 55 kg per 1 animal. This materiál is considerd the skull, excluding the jaw, including the brain, eyes and spinal cord of animals over 12 months of age.

From Table 3, it follows that a total of 25 357.60 tons of raw material was processed at costs ranging from EUR 0.15 to EUR 0.90 per 1 kg between 2003 and 2019. The gradual increase in the cost per 1 kg during the time was due to a rise in operation costs including higher wages and increased energy prices. Based on the cost per 1 kg processed material, the total costs associated with animal killing and carcass disposal reached EUR 62 262 in 2003, EUR 106 355 in 2004, EUR 138 111 in 2005, EUR 36 299 in 2006, EUR 15 052 in 2007, EUR 3 670 in 2008 and EUR 18 798 in 2009. The cost of disposing and decontamination of specified risk material since 2010 has reached EUR 226 454. The total costs for the whole period of 2003–2019 amounted to EUR 590 231.

Discussion

To reduce the economic impact of the *BSE* on farmers, legal means have been established to reimburse farmers for the losses both direct and related. The latter involve costs of the examination for the *BSE*, transport of animals to a specialised rendering plant, their killing and safe disposal of their carcasses, and cleaning and disinfection of the holding and its equipment, though this procedure is questionable, because the *BSE* is not a truly contagious disease. In addition, the farmer is reimbursed for losses due to the non-materialised production. however, all these compensations cannot completely cover the costs incurred in relation to the *BSE*.

Although early and stringent veterinary precautions were adopted, in the first place a ban on feeding meat and bone meal (MBM) to cattle in 1991, the first case of the *BSE* in Czech Republic was detected in 2001. The most probable cause was an indirect contamination of cattle feed with the imported MBM or with the MBM intended for feeding pigs and poultry and allowed for use before 2003 (Semerád, 2007). In the period from 1st February 2001 to 31th December 2019, 30 *BSE*-positive cases were identified by the active monitoring for the *BSE* involving 1 977 881 cows. The detection was so effective thanks to the well co-ordinated laboratory diagnostic procedures carried out in the laboratories of the State Veterinary institutes in the city of Prague, Jihlava and Olomouc.

In the first place, the producer-consumer relations, usually taking a long time to establish, are destroyed and the return to the market is difficult; also, large costs are necessary to build up the herd again. These costs are difficult to calculate and their compensation cannot be claimed because they are not treated by the legislation. A *BSE* incident is also associated with several adverse consequences, such as a loss of jobs in an agricultural enterprise, which can have a deep impact on rural populations. The ensuing problems in the broadest sense of the word can partly be eased by the commercial insurance policy. The past experience showed that most of the farmers were insured (Abrham et al., 2015). Any

payment of insurance benefit has no effect on the amount of cost compensation based on the Veterinary Act. Since a farmer-insurance company relationship is a business one, it was not possible to find out the information on benefit payments and to include it in this study.

The total amount of compensations paid was EUR 203 704 in 2001, EUR 59 259 in 2002, EUR 1 740 741 in 2003, EUR 1 474 074 in 2004, EUR 3 403 704 in 2005 and EUR 411 111 in 2006. In 2007, it was only EUR 6 278, because the 27th case was an eleven-year-old cow whose cohort included only three animals left due to slaughtering of the other cows. Compensations provided in relation to the 28th *BSE*-positive case detected on 19th December 2007 were paid in March 2008 and reached EUR 50 222. The last two cases of *BSE* occurrence in 2009 cost EUR 402 907.

Since 2009 no *BSE* has been detected in the Czech Republic, but examination of defined groups of animals is still ongoing. Currently, the examination is carried out according to the following scheme: dead animals and so-called necessary slaughter animals in the age categories up to 48 months, 48-72 months and over 72 months and suspected bovine animals infected with *BSE* irrespective of age.

The total costs associated with the *BSE* occurrence in the Czech republic amounted to EUR 8 013 000. The average costs per 1 *BSE*-positive animal during all period 2001 to 2019 were EUR 267 100 and the average costs per 1 cohort of animals (killing and disposal of the carcasses) were EUR 1889.

To ease the negative economic impacts of the *BSE*, the EU provides financial support for all member states. For instance, in 2007 the Czech Republic received EUR 1 640 000 for the active monitoring and EUR 2 500 000 for the eradication (EU-Dg-SAnco, 2006). Since then, financial support has been steadily declining since the last incidence of the disease was recorded more than 10 years ago. In the whole period since the first occurrence of the disease they have reached compensation total EUR 5 545 000.

It is interesting that the amounts of reimbursement presented in the international scientific literature are reported only as the total costs per certain period. This is also the case of Great Britain and Japan, who suffered most. The calculation of cost compensations is based on tables prepared in advance in which, for each cattle age category, the amount of compensation is given without any respect to the animal's actual productivity (Defra, 2007). The British government study has reported that the total net cost of the *BSE* crisis to the Exchequer from 1985 by the end of the fiscal year 2001/2002 reached EUR 4.80 billion, to which the EU contributed EUR 560 million, which is 11.6% (Brinkle, 2002). It is evident that this high sum of money was relevant to the exceptionally high number of the *BSE*-positive cows that had exceeded 187 000 animals by that fiscal year. This sum also included EUR 828 million to compensate for the loss of markets in the EU countries, because the European commission banned beef export in March 1996 (in the USA, import of British beef was banned in the late 1980s). The beef production accounts for about 0.5% of the British gross domestic product and the British beef industry has over 130 000 employees. With the decrease in beef meat prices, the prices of all other kinds of meat increased in the great Britain. This chiefly concerned poultry and lamb meat, which increased in price approximately by 5%, with pork price remaining generally unchanged (Leeming & Turner, 2004). From the first occurrence of the disease in 1985 the *BSE* crisis as a whole is estimated to have cost the Great Britain GBP 5.70 billion (Nelson, 2019).

Japan´s outbreak of BSE has cost at least JPY 365 biillion (EUR 3.15 billion) since the beginning of disease occurence. Revenues of Japanese farms have slumped an estimated JPY 131 billion (EUR 990 million). The Japanese government has already spent about JPY 206.4 billion compenmsationg farmers for their losses. Of the total JPY 178.50 billion has been earmarked to compensate farmers and the food industry and JPY 23 billion has been used for incinerating meat-and-bone meal, as the cause of the disease (Reed, 2019).

The beef producing industry in Northern Ireland employs over 5000 workers and the additional 600 000 are employed in the related industrial branches (Caskie et al., 1998). Thus, the rate of employment in this industry has a deep social impact. The costs of re-qualification for workers who had lost their jobs due to the reduced beef production were estimated to be 7.9% of all costs related to the *BSE* crisis (Ferguson et al., 2018).

Spain is fifth in the EU ranking of *BSE* cases registered since 1987, after the United Kingdom, Ireland, Portugal, and France. The number of cows infected by *BSE* in Spain from 2000 to the end of 2019 was 785. The number of cases increased from 82, in 2001, to a peak of 167 cases, in 2003. Four years later, the number had fallen to 36. This evolution of the *BSE* crisis in Spain was consistent with the whole EU situation where the number of *BSE*-infected animals is also declining. The latest disease incidence was recorded in 2016 (OIE, 2019). The total cost of disease incidence in Spain amounting to EUR 198 million.

During the past 20 years, the number of livestock in Russia declined to about one third of its previous 1986 level (Kouidri et al., 2017). According to various estimations Russia is a market of about 143 million consumers but only 30%–50% self-sufficient in beef production; therefore, it is one of the largest beef importing nations in the world

(Karyakina, 2010). Persistent increases of live animal imports made Russia especially vulnerable to the introduction of *BSE* into its national herds. To date, no cases of *BSE* or variant Creutzfeldt-Jakob disease *(vCJD)* have been reported by the Russian veterinary or medical officials respectively (Svetlov, 2009).

Estimates of the cost of BSE in the United States are estimated at approximately $ 5000 million. Of this amount, increase in meat and bone meal prices is $ 8 million, increase in definition of specified risk material is $ 195 million, increase in cost of feeding cattle is $ 637 million, net of loss to rendering and gain to nonruminant livestock feeding $ 53 million and export losses between $ 3.200-4.700 million (Coffey, 2018).

The second part of the paper deals with the costs of animal killing and their carcass disposal in the rendering plant specialised for this purpose. The evaluation was based on the cost per 1 kg of the processed material, which ranged from EUR 0.15 in 2003 to EUR 0.90 in 2019. Between March 2003 and the end 2019, the total of 4 243 bovine animals associated with the *BSE* occurrence were killed there and their carcasses were destroyed and disposed of. This accounted a total of 25 357.60 tons of the processed material. The total costs for the whole period amounted to EUR 590 231. The considerable increase in costs during this period is in agreement with the inflation development (wagepush, energy price increase) in the domestic economy and is also related to the increased financial demands for the hygienic and technological quality of the rendering plant operation (septic and aseptic units, disinfecting fords, separation of processing routes) after Czech Republic joined the EU.

The costs described here did not include the costs of transporting the animals to be killed in the processing plant. These were paid by the farmer, who was subsequently paid by the Ministry of Finance in accordance with Act No. 166/1999 Coll. On Veterinary Care and amendments to certain related laws. These costs varied greatly, depending on the distance between the farm and the recycling plant and on whether the farmers had their own means of transport or had to rent them.

No long-distance transport was needed in one example. It was when the very first *BSE* case was discovered in 2001 in the village of Dušejov in the Jihlava district. All 134 cows of the cohort were killed on the farm and buried in its vicinity. The carcasses were placed four metres deep in the ground and were covered up with a 1.5-to 2-metre layer of soil (Meloun, 2006). Although this method of disposal may seem complicated, the total costs were only EUR 2 866 (hydrogeological expert report EUR 300, wages EUR 478, local transport EUR 1593, fencig EUR 495) (Saksún, 2008), which was much less than what the process of disposal would have cost in a rendering plant. For the sake of public health and also for environmental reasons it was not possible to continue with this method of disposal. Moreover, the cohorts derived from the later *BSE* cases were larger in size that the first cohort buried in Dušejov. For instance, the cohort from the 7th case in 2003 had 875 cows and that from 22nd case in 2005 had 333 cows, and the burial of so many animals would not have been feasible.

The rendering process produces meat and bone meal; one kilogram of raw material gives 0.28 to 0.29 kg of it. In addition, 0.08 to 0.09 kg of animal fat is obtained; the residual fat content in meat and bone meal is 13% to 18% and residual moisture is 2.8%. The meat and bone meal produced is transported to cement works for incineration at the temperature of about 1200°C. One kilogram of meat and bone meal gives about 0.25 kg ash. By the process carried out at the rendering plant and by the subsequent incineration in a cement factory, 30 to 40 kg ashes are produced. The ashes are included in the cement production and become a part of the final product. Considering that the total number of cows killed and disposed of at the rendering plant Asanace Žichlínek till year 2009 was 3 793, the total amount of ashes produced in the cement works was 637 tons. Since 2010, when no new disease was recorded, only the specified risk material has been processed at the rendering plant Asanace Žichlínek with a total weight 251 tons, the total amount of ashes produced in the cement works till the end of 2019 was 75 tons.

The rendering plant paid 5 cents the cement works for 1 kg meat and bone meal to be incinerated, and claimed an equal compensation from the Ministry of Agriculture of Czech Republic. The funds to cover the expenses related to the disposal of meat and bone meal had been included in the state budget (the "general Treasury Administration" chapter) until 2007. From that year on, the funds were no longer available and the meat and bone meal was incinerated in the cement works free of charge. However, the cement works can utilize the caloric power of the meat and bone meal, because its 18 MJ per kg equals to the fuel efficiency of 1 kg lignite (Anonym, 2008). Considering that the current average price of 1 ton of lignite is EUR 16, the total of 712 tons of burnt meat and bone meal contributed about EUR 11 392 to the cement factory's budget.

Conclusion

Healthy and safe food is one of the prerequisites for the health of the population. This is directly related to the health of livestock farming and the production of healthy meat from products of animal origin. For this reason, the Czech state

budget, in the chapter of the Ministry of Agriculture, has an annual budget reserve of EUR 2 500 000 for costs associated with the control of infectious diseases in animal husbandry. The disease with a significant impact on the economy of public budgets is in Czech Republic *BSE*, which first appeared in 2001.

From February 2001 till the end of 2019, the total of 1 977 881 cows were examined and 30 cases of the *BSE* were detected. Consequently, 4 243 cows in cohorts were killed and their carcasses were safely disposed of. The total of compensations in this period reached EUR 8 013 000. Of these, 80.6% (EUR 6 458 000) were compensations for the value of the killed animals, 12.7% (EUR 1 020 000) for the related costs, i.e., killing, safe disposal of carcasses and the examination for the *BSE*, and 6.7% (EUR 535 000) for the losses due to non-materialised production. The average costs per 1 *BSE*-positive animal were EUR 267 100 and the average costs per 1 cohort animal were EUR 1 889. In the rendering plant responsible for killing the infected and cohort animals and safely disposing of their carcasses, the total of 2 342 tons of raw material was processed between March 2003 and 2009, and this cost EUR 363 777. Based on th quality of veterinary care and mainly because the *BSE* disease has not been occured in the Czech Republic for more than 10 years, OIE granted Czech Republic the status of *BSE* nigligible risk country.

The budget reserve of the Ministry of Agriculture is used to pay compensation in the event of infectious diseases of livestock and wild animals. The Ministry of Agriculture and the SVA announce Extraordinary Veterinary Measures, on the basis of which the affected breeders are paid compensation for costs and losses. The least diseases occurred in 2014, namely 6 and the most 15 in 2019. This indicates a long-term stable and favorable disease situation in Czech Republic and a high level of safety in the quality of meat and food of animal origin.

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