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Specifics of cost calculation of by-products in crop production in small and medium enterprises

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Abstract

The article examines the specifics of valuing by-products of crop production in the agricultural sector in the legislative conditions of the Czech Republic. The used processing method of valuing by-products in crop production directly determine the internal price with subsequent effects on reporting. An innovation of the procedure for calculating costs of the internal price is proposed, which consists in differentiating the purpose of using the by-product and determining the content of active substances. This leads to the development and refinement of methods of calculation and valuation of by-products and can be recommended for the innovation of teaching calculation methods for business practice.

Keywords: Agriculture, By-products in crop production, Valuation, Calculation, Internal price

Introduction

Agriculture is one of the key human activities, as it serves to feed the human population. The ever-increasing number of people on the planet is leading to increasing food demands on agriculture, namely in a situation where agriculture has nowhere to expand and the land on which the farming activities are carried out is taken up (especially in Europe) for other purposes (industrial zones, residential areas, transport infrastructure). Agriculture itself is inherently a unique sector in that the main aspects of its activities (animals and plants) have a biological nature. It is also influenced by natural conditions and localities where it is carried out. These specifics are also reflected in the financial management of small and medium agricultural enterprises, i.e., in valuation, calculation of the intra-company and sales price of agricultural production and subsequently into company accounting with an impact on the accounting result. The national legislation of the Czech Republic (hereinafter referred to as the Czech Republic) in the field of valuation and calculation of costs of main and secondary production in agriculture also affects the procedure and result of calculation of own costs and valuation of agricultural production created by own activities in small and medium agricultural enterprises. These companies in the Czech Republic are not obliged to keep accounts in accordance with International Accounting Standards (IAS / IFRS).

In the Czech Republic, agricultural production is realized on 4,200 thousand of ha, of which crop production takes for 70% (2,932 thousand of ha). In 2019, agriculture accounted for approximately 2.25% (CZK 141,127 million) of the total GDP of the Czech Republic, of which 56.7% was crop production and 37.42% was animal husbandry (Czech Statistical Office, 2020).

As at 31 December 2019, SMEs accounted for 99.8% of the total number of business entities in the Czech Republic. A similar share of SMEs in the total number of business entities is within the entire European Union. In the agricultural sector, small and medium-sized enterprises in the Czech Republic make up almost 98%. Registered is 26 525 agricultural entities. The share of GDP of the agricultural sector is 2% of total GDP (same in other countries of the European Union). Employees in agriculture make up almost 2-% of the total number of employees. (Straková et al., 2020; Ministry of Industry and Trade of the Czech Republic, 2021; Ministry of Agriculture of the Czech Republic, 2021).

Crop production (hereinafter referred to as CP) is the production of crops for food or other purposes (e.g., textile, pharmaceutical, and energy). In most cases, CP is a joint production, i.e., in addition to the main product, a by-product is also generated (e.g., in the case of cereals, grain is the main product, and straw is the by-product). The valuation of by-products within CP is not methodically regulated in the Czech legislation with regard to the specifics of CP. Production created by own activities is valued in the amount of own (direct and part of indirect) costs. Due to the nature of CP (cereal production), in practice there are problems in determining the exact composition of costs and their value of the main product (grain) and by-product (straw). The by-product of CP is valued mainly on the basis of historical own costs (which are not updated in often agriculture practice) or on the basis of expert estimates. This

approach to and practice for valuing by-products do not reflect the current development of actual costs incurred, and when using the traditional subtraction method, the amount of costs for the by-product is underestimated, and thereby the main product is overestimated. Within the subsequent consumption or sale of the by-product and the main product, this valuation is reflected in reporting the factually correct accounting profit or loss as well as in determining the selling price of the by-product and the main product of CP and subsequently until the recognition of the accounting result (Dvořáková, 2017b; Voltr et al. ,2019).

In general, the valuation issues of production created by own activities in accounting of the Czech Republic are addressed by Act No. 563/1991 Coll., on Accounting, as amended, by Decree No. 500/2002 Coll., which implements some provisions of the Accounting Act for entrepreneurs using the double-entry bookkeeping, and then the Czech Accounting Standards. The International Accounting Standards (IAS/IFRS) have a different approach, and its IAS 41 -Agriculture deals with the issues. In the Czech Republic, companies trading in securities on the European regulated market are obliged to comply with these standards, or their parent company must do so (mostly, these are large agricultural enterprises). This standard stipulates that agricultural production must be valued at the so-called fair value at the moment of initial recognition, i.e., agricultural enterprises value the main and by-products in CP on the basis of market value (Dvořáková 2017a; Buda et al. 2019). The issues of valuing by-products in agriculture are researched by Voltr et al. (2019), Dvořáková (2017b), Sedláček (2010) as well as by Stárová et al. (2016) from the Czech authors. Gonçalves, Lopes & Craig (2017), Kurniawan, Mulawarman & Kamayanti (2014), Rozentale & Ore (2013) and Cavalheiro et al. (2017) belong among the foreign authors who deal with the issues of valuing biological assets according to IAS 41.

- The research aims to identify, analyze, and evaluate the valuation specifics of by-products in CP. The main goal is elaborated into sub-goals.
- To identify and analyze current practices used to determine the internal price of by-products of the selected product (straw).
- To propose and analyze practices for valuing CP by-products, which would lead to a more precise cost calculation and to determining the price of own costs of by-products.
- To compare the proposed valuation practices with the traditional practices of valuing CP by-products.
- To evaluate, verify and discuss practices used to value by-products of CP in terms of the demanding nature of obtaining data and calculating the internal price.
- Contribute to the development and refinement of methods and techniques for calculating the costs of by-products in crop production based on the purpose of using the by-product and determining the active substance content and documenting that this approach is also suitable for innovation in teaching and development at university level (i. e. for expanding the content in the teaching of calculation methods and techniques in the subject of agricultural economics).

Materials and Methods

The methods of qualitative research were mainly used to deal with the given issues. The secondary sources and internal materials of the examined company (the internal guidelines for valuation and preliminary calculation of the internal price and the resulting calculations in CP for the last 5 years, 2016-2020) were analyzed using the desk research method. Furthermore, interviews were conducted with the manager, agronomists, and employees of the financial department of the agricultural enterprise. Controlled structured interviews, concerning the methods of determining the internal price for by-products within the CP and for the purpose of further use of production, took place as face-to-face and online meetings from September to December 2020.

The examined company, which provided data and information, is a medium-sized agricultural enterprise, a joint-stock company, which is engaged in agricultural, both crop and livestock primary production in the Czech Republic (hereinafter referred to as the CR) for more than 20 years. The obtained data were processed and evaluated in the form of a case study in the following steps:

(1) The description of the current practice of determining the internal price of feeding straw,
(2) a proposal for setting the internal price of feeding straw on the basis of the average market price,
(3) a proposal for setting the internal price of feeding straw on the basis of the subtraction calculation method &
(4) a proposal for setting the internal price of bedding straw on the basis of the content of active substances,
(5) comparison of the results of a case study for the internal price of feed and bedding straw.

Results

The current practice of setting the internal price of feeding straw

The value of the by-product (feeding straw) is deducted from all the costs actually incurred in producing the given cereal (identified market price). By-products are valued on the basis of internally set prices, which are based primarily on historical expert estimates. Using this calculation and valuation practice leads to an inaccurate determination of the internal price of the main product. In 2020, the company set the internal price for 1 ton of straw at CZK 800 (expert estimate). The company uses this practice because determining the costs that would be incurred only in relation to grain (main product) and those only in relation to straw (secondary product) cannot be obtained from the agricultural information system of the company, for all the costs are related to both products.

The proposal for setting the internal price of feeding straw on the basis of the average market price

One possibility is the valuation of feeding straw on the basis of the reproduction purchase price (identified market price) in the given period. In 2020, market prices per 1 ton of straw for feeding purposes ranged between CZK 900 and 4,400 (as found by the survey of market supply). Based on the frequency of occurrence of individual prices and their values, it is possible to determine the average price per 1 ton of straw, and the average price determined in this way is 2,034 CZK/t. The produced straw could be valued at this amount and deducted from the total costs incurred in producing the given cereal and thus determine the internal price of the main product (grain).

The proposal for setting the internal price of feeding straw on the basis of the subtraction calculation method

As stated by Dvořáková (2017b), the subtraction method of cost calculation can also be used to determine the internal price. This calculation method is based on a breakdown of the total costs of production of the given crop by the fixed proportion of the main product and by-product, in case of wheat, that is 88% of cost is for grain and 12% for straw. The total costs of wheat production in 2020 were CZK 2,307,972 (478 tons of grain and 130 tons of straw were harvested; in money terms, the amount of CZK 2,031,015 is for grain and the remaining amount of CZK 276,957 is for straw). When recalculated per 1 ton of straw, the internal price of straw amounts to CZK 2,123.

The proposal for setting the internal price of bedding straw on the basis of the content of useful nutrients

Decree No. 377/2013 Coll., which deals with the issues of green manure, states that bedding straw also contains useful nutrients, and these are nitrogen (N), phosphorus pentoxide (P_2O_5), and potassium oxide (K_2O). Their content can be set down by a decree or with the help of performing your own analysis. According to Voltr et al. (2019) the following equation can be used to calculate the valuation of nutrient:

Nutrient valuation=content of the nutrient x price (1)

To calculate the valuation of bedding straw, it is necessary to find out the average market prices of these useful nutrients (they occur in industrial fertilizers). The following Table 1 documents the practice of determining the internal price on the basis of the content of useful nutrients.

Nutrient	Average market price (CZK/kg)	Content of nutrients (kg of substance in 1 ton of straw)	Calculation	Final valuation (in CZK)
N	20.36	5	5 x 20.36	102
P_2O_5	24.18	2.1	2.1 x 24.18	51
K_2O	21.45	9.1	9.1 x 21.45	195
Total	65.99	16.2		348

Table 1: Valuation of bedding straw based on the content of useful nutrients
Source: Own processing, 2021

The nutrient content in 1 ton of straw is valued at the amount of CZK 348 in total. This amount sets the internal price of bedding straw, which is by 132% higher than the existing internal price (set on the basis of the historical expert estimate amounting to 150 CZK/t).

Discussion

The presented case study shows the existing and three potential ways of how to value by-products within CP. Table 2 documents the comparison results of the internal price of straw determined by various methods, including the demanding nature of obtaining data and demanding nature of the internal price.

Method	Price (CZK/t)	Demanding nature of obtaining data	Demanding nature of calculation
Expert estimate	800	Medium	Medium
Average market price	2,034	Medium	Medium
Subtraction method	2,123	Medium	Low

Table 2: The comparison of methods for determining the internal price of feeding straw
Source: Own processing, 2021

When using the existing method of calculation (expert estimation), the value of by-products is underestimated, and the main production is overestimated. When using the proposed calculation methods, a more accurate and fairer valuation of feeding straw is determined, and thus the calculation of costs for the main products (grain) is more precise with the similar demanding nature of obtaining data and calculation as is when using the current method. The following table, Table 3, presents the comparison of the current and proposed method of calculating the internal price of bedding straw.

Method	Price (CZK/t)	Demanding nature of obtaining data	Demanding nature of calculation
Expert estimate	150	Medium	Medium
Valuation method based on useful nutrients	348	Medium	Medium

Table 3: The comparison of methods for determining the internal price of bedding straw
Source: Own processing 2021.

Also, in this case, the valuation based on the historical expert estimate is significantly lower than the internal price determined by the proposed method based on the content of useful nutrients in by-products. With the same demanding nature of obtaining data and with the same demanding nature of calculation, the company would make its calculations of by-products more accurate within CP using the proposed method.

Conclusions

The paper deals with methods designed to specify the valuation of by-products within CP in small and medium-sized agricultural enterprises in the Czech Republic. The issues of valuation were solved using the case study, which included the description of the current method used to determine the internal price of the selected by-product (straw) and three alternative calculations of internal price that reflect the different quality of the by-product and its purpose of use. The proposed methods of calculation and determination of the internal price of by-products in CP represent the options that can be used by small and medium-sized agricultural enterprises not only in the Czech Republic but also in other countries with similar legislation, which lays down the valuation of production created by own activities on the basis of actual or predetermined own costs.

The documented calculations of internal price and the proposed calculation methods represent the basic proposal and stimulus for further research that would lead to the formation of a methodology or standard for the valuation of by-products in CP in terms of specifics that influence the valuation in crop production.

The advantage of the presented approaches to determining internal prices is a differentiated approach to the valuation of by-products based on the purpose of their use and based on the content of useful nutrients in them. A limitation for the use of the proposed calculation methods is the medium demanding nature of data collection and processing for the needs of calculating internal prices in small and medium-sized agricultural enterprises and the general legislation in the field of valuing production generated by own activities in the CR.

The proposed specification of methods and techniques for calculating the costs of by-products in crop production based on the purpose of using the by-product and determining the content of active substances can be used as an innovation in teaching and development at university level; for expanding the content of the curriculum in the teaching of calculation methods and techniques in the subject of agricultural economics.

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