https://doi.org/10.17221/381/2022-AGRICECON

Recent development of economic indicators on Czech dairy farms

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Citation: Syrůček J., Bartoň L., Řehák D., Štolcová M., Burdych J. (2023): Recent development of economic indicators on Czech dairy farms. Agric. Econ. – Czech., 69: 45–54.

Abstract: A reassessment of factors related to milk production economics is needed because of continuing genetic improvements within the main dairy breeds and changes in farm management and the economic environment. Therefore, in this study, we aimed to evaluate the development of economic indicators between 2016 and 2020 on Czech dairy farms that kept either Czech Fleckvieh or Holstein breeds and that had different average milk yields. We used a questionnaire to obtain data from 66 dairy farms from different regions of the Czech Republic. The farms were divided into four groups according to breed and 2016 milk yield. Production costs increased during the period in all groups by 13% to 17% because of increasing milk yields, the associated higher feed consumption and increasing input prices. We observed a higher annual growth rate of costs per litre of milk on farms with above-average milk yields compared with the groups with below-average yields. The highest profitability before subsidies was achieved on farms with Holstein cows and above-average milk yields. Higher-income over feed costs were consistently observed in groups with higher milk yields. Because of low farm gate milk prices, profitability was significantly lower across all groups during 2016 than in other years.

Keywords: costs; IOFC indicator; milk yield; price; profitability

Raw cow's milk is one of the most important commodities in the world's agricultural markets (Simo et al. 2016). Milk production has a long tradition in the Czech Republic (CR) and has always been considered an integral part of livestock production and the entire agricultural sector. A significant milestone in the development of Czech agriculture was the CR's accession to the European Union (EU) in 2004. Since then, the milk production sector can be characterised by a decrease in the number of milking cows, which, however, is compensated by an increase in milk yield (Zakova Kroupova 2016), which is reflected in the

Supported by the Ministry of Agriculture of the Czech Republic, institutional support MZE-RO0718 and the National Agency for Agricultural Research of the Czech Republic (Project No. NAZV QK1910242).

https://doi.org/10.17221/381/2022-AGRICECON

steadily increasing domestic production of cow's milk, a significant part of which is exported each year (Svatos et al. 2013; Pohlová et al. 2018). Between 2016 and 2020, dairy cow numbers decreased by 2.8%, but milk yields increased by 9.7%, resulting in a 6.6% increase in total milk production (Eurostat 2022). A similar trend of increasing milk production accompanied by diminishing dairy cow numbers has been seen in the EU (Bórawski et al. 2020) and in most developed countries (Buleca et al. 2018). In the EU-27 (28 member states acceded to the EU in the years 1952–2013 without Great Britain), there was a 5.1% decrease in dairy cow numbers between 2016 and 2020, while milk yield and, consequently, total production increased by 9.5% and 3.9%, respectively (Eurostat 2022).

The profitability of production is significantly affected by fluctuations in milk purchase prices in the CR (Rudinskaya and Boskova 2021), as well as in most EU countries (Bełdycka-Bórawska et al. 2021). Milk purchase prices are considered one of the main factors influencing the economic efficiency of milk production (e.g. Syrůček et al. 2019; Bórawski et al. 2021) and reflect the situation in the European and international milk markets (Bełdycka-Bórawska et al. 2021). Price variability is due to fluctuating supply and demand on the market depending on the actual volume of milk on offer and the consumption of milk and dairy products. The economics of production is also significantly affected by the nearly constant increase in input prices and production costs. These production costs have been increasing in recent years both in the CR (e.g. Doucha et al. 2012; Syrůček et al. 2019) and on average in EU countries (European Milk Board 2021), as well as in the United States (USDA 2022).

In addition to profitability, the income over feed costs (IOFC) indicator is also used as a suitable alternative for assessing the economic efficiency of farms (Wolf 2010). IOFC measures milk sales against feed costs (Ribeiro 2008), which are considered the highest cost item (Glavić et al. 2021). Because of the volatility in feed and milk markets, using IOFC appears to be more beneficial than simply evaluating feed costs per cow (Buza et al. 2014).

Economic indicators are also strongly influenced by the breed used and the level of performance within the given breed. As previously reported, there are significant differences between the most commonly used breeds in the CR [i.e. between Czech Fleckvieh (C) and Holstein (H)], both in production and economic indicators (Wolfová et al. 2007). Because of continuing genetic improvements within these breeds and changes in farm management and the economic environment, a reassessment of the factors related to milk production economics is needed. Therefore, our objective in this study was to evaluate the development of economic indicators between 2016 and 2020 on Czech dairy farms that kept either the C or H breed and that had different average milk yields.

MATERIAL AND METHODS

Data. Using a questionnaire, we obtained data from dairy farms in the CR for the years 2016 to 2020. Only farms with either C or H cows that provided complete data throughout the entire evaluation period were included in the study. Overall, we analysed production and economic data from 66 farms from different regions of the CR. The study included data from an average of 36 995 cows per year, which represents approximately 10% of the dairy cow population in the CR (Eurostat 2022).

Methods. We calculated total costs as the sum of all reported cost items. We deducted the value of secondary outputs from total costs and termed this value 'costs after deduction'. We defined secondary outputs of animal production as the value of calves (EUR 114.4 per calf) and manure (EUR 27.8 per cow and year) (Syrůček et al. 2019).

Depreciation included that of cows and other assets. For the study, overheads also included energy costs and the cost of property and cow insurance. We calculated costs per cow according to the average number of cows in a herd within a given year and per 100 L of milk sold according to the sales volume of the dairy. Profit is the difference between milk sales revenue and costs after deductions and does not include subsidies. We determined profitability as the ratio between profit and costs after deductions. We calculated the IOFC in EUR per feeding day according to the following formula:

$$\text{IOFC} = \frac{\left(\text{marketed milk production per year} \times \text{average milk price in EUR per L}\right) - \text{feed costs}}{\text{number of feeding days}} \quad (1)$$

where: IOFC – income over feed costs.

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Table 1. Basic characteristics of farm groups evaluated

Indicators	G1	G2	G3	G4
Number of farms	9	15	21	21
Average agricultural land area (ha)	2 251	1 847	2 024	3 398
Average number of dairy cows	566	472	460	722
Number of dairy cows per 100 ha of agricultural land	25.2	25.5	22.7	21.2
Number of dairy farm workers	11	10	11	16
Dairy cows per worker	53.7	44.9	40.1	44.5

G1 – Czech Fleckvieh – annual milk yield < 7 000 L per cow; G2 – Czech Fleckvieh – annual milk yield ≥ 7 000 L per cow; G3 – Holstein – annual milk yield < 9 500 L per cow; G4 – Holstein – annual milk yield ≥ 9 500 L per cow
Source: Authors' own calculations

We divided farms into four groups (G1–G4) according to the breed (C and H) and milk yield achieved in 2016. The average annual milk yield in the population (ICAR 2021) was taken into account when dividing farms into below-average milk yield [< 7 000 L for C (G1) and < 9 500 L for H (G3)] and above-average milk yield [≥ 7 000 L for C (G2) and ≥ 9 500 L for H (G4)] groups. The basic characteristics of the farm groups evaluated are presented in Table 1.

We obtained farm price and cost data in CZK and subsequently converted them to EUR at the average exchange rate for the period under review of 1 EUR = 26.2 CZK (Eurostat 2022).

Statistical analysis. We analysed data separately according to breed by using a mixed linear model with repeated measures (MIXED procedure of SAS). We structured the final model to determine the combined effect of group × year, with the farm entered as random. We summarised random (co)variances between years within the farm using a residual R matrix (block diagonal with autoregressive covariance structure of order 1). We estimated parameters using the restricted maximum likelihood method. Least squares means of simple effect slices (by group) were calculated, and multiple comparisons were made with *P* values adjusted using the Tukey procedure. We calculated Pearson correlations by using

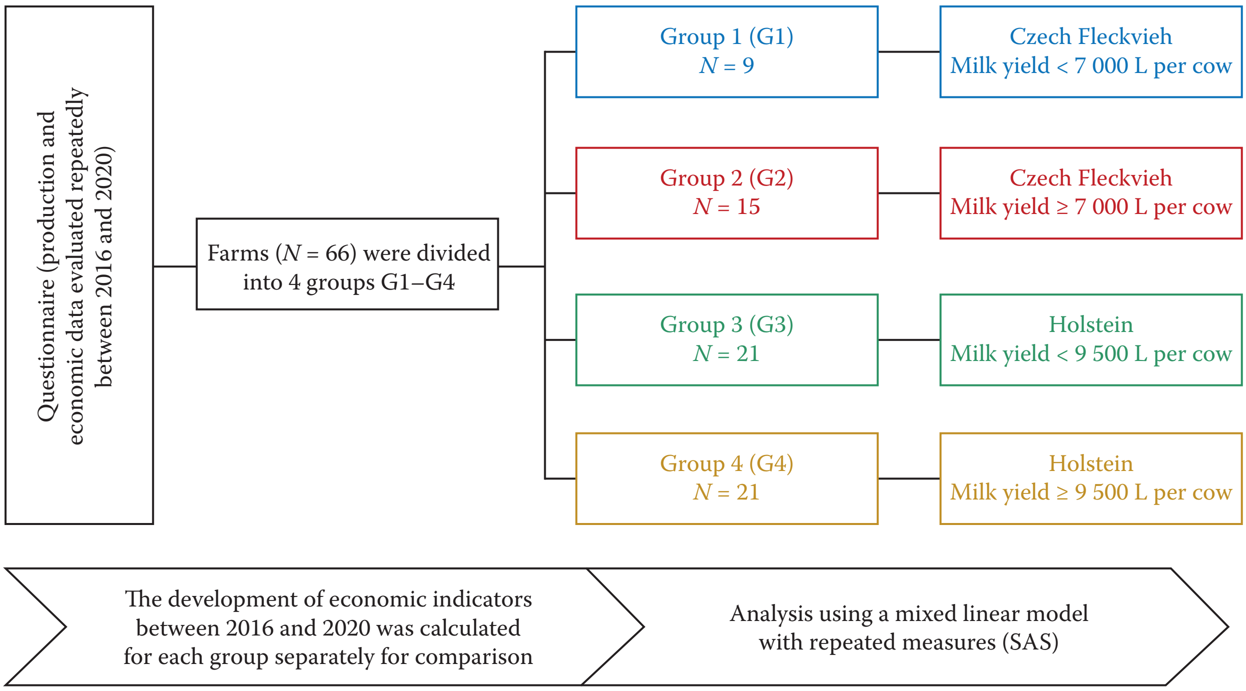

Figure 1. Diagram of data and methods used

Source: Authors' own elaboration

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the CORR procedure of SAS. The overall description of the method used is shown graphically in Figure 1.

RESULTS AND DISCUSSION

Development of milk production costs per cow and year. The main milk production indicators during the period concerned are given in Table 2. In most cases, a tendency for a year-on-year increase in milk yield was recorded in all groups. We observed higher milk yields (P < 0.05) in 2020 than in 2016 in H herds (groups G3 and G4). Despite some year-on-year differences, there was no clear trend in fat and protein content. The farm gate milk price was lowest in 2016 and highest in 2019.

As milk yields have increased, the total milk production costs have also increased (Table 3). Total costs after deduction per cow and year were higher (P < 0.05) in 2020 than in 2016 in groups G2, G3 and G4 by 16%, 17% and 15%, respectively. This increase indicates annual growth rates of 3.9%, 3.9% and 3.7%, respectively. For the G1 group, we observed a significant difference of 17% (P < 0.05) between 2017 and 2020 (growth rate of 5.5%). Based on the data from the whole set, we found a positive correlation between milk yield and costs (r = 0.763; P < 0.001). In all groups, feed costs were the highest cost item (41% to 43% of total costs on average), which is consistent with the findings of many authors (e.g. Glavić et al. 2021). The cost increase associated with higher milk yields is mainly due to greater feed consumption. Still, it is also caused by increasing input prices (feed, labour, investment, energy). Cost increases were particularly evident in 2019 and 2020, with the largest increase in purchased feed costs. The average overall price increase in the CR was 2.2% (Eurostat 2022), indicating that costs per cow per year have increased faster than inflation in the CR during the past five years for the farms assessed.

Compared with the results in our study, results from earlier studies have shown slightly lower annual growth rates for costs per cow per year in the CR. Doucha et al. (2012) reported a yearly cost growth rate of 2.9% between 2004 and 2013, and between 2007 and 2014, the cost growth rate was estimated at 3.2% (Krpalkova et al. 2017). The results of the Institute of Agricultural Economics and Information (IAEI) showed

Table 2. Main milk production indicators

Indicator	Unit	Group	2016	2017	2018	2019	2020	SEM
Annual milk yield	L / cow	G1	6 484^{ab}	6 403^{a}	6 828^{b}	6 807^{ab}	7 204^{b}	166
		G2	7 777	7 941	8 138	7 923	8 220	162
		G3	8 763^{a}	8 795^{a}	9 051^{ab}	9 041^{a}	9 432^{b}	170
		G4	10 219^{a}	10 435^{ab}	10 573^{ab}	10 417^{a}	10 821^{b}	175
Annual milk sales	L / cow	G1	6 270^{ab}	6 185^{a}	6 585^{b}	6 597^{ab}	6 994^{b}	176
		G2	7 526	7 739	7 920	7 720	8 019	172
		G3	8 484^{a}	8 547^{a}	8 813^{a}	8 824^{a}	9 209^{b}	180
		G4	9 945^{a}	10 193^{ab}	10 301^{ab}	10 155^{a}	10 586^{b}	186
Protein	%	G1	3.59	3.62	3.62	3.62	3.61	0.03
		G2	3.55^{a}	3.60^{ab}	3.59^{ab}	3.63^{b}	3.60^{ab}	0.03
		G3	3.43	3.43	3.42	3.44	3.43	0.02
		G4	3.37^{a}	3.38^{ab}	3.38^{ab}	3.43^{b}	3.39^{ab}	0.02
Fat	%	G1	4.10	4.07	4.03	4.03	4.08	0.04
		G2	4.09^{a}	4.01^{ab}	3.93^{b}	3.99^{ab}	4.02^{ab}	0.04
		G3	3.91	3.93	3.88	3.91	3.94	0.04
		G4	3.80	3.77	3.78	3.86	3.84	0.04
Milk price	EUR / 100 L	G1	26.35^{a}	33.46^{b}	33.65^{bc}	34.36^{c}	33.68^{bc}	0.26
		G2	26.14^{a}	33.32^{b}	33.28^{b}	34.23^{c}	33.42^{b}	0.25
		G3	25.31^{a}	32.71^{b}	32.72^{b}	33.58^{c}	32.52^{b}	0.18
		G4	25.36^{a}	32.64^{b}	32.82^{b}	33.79^{c}	32.55^{b}	0.19

$^{a, b, c}$ values within a row with different superscripts differ significantly at P < 0.05; SEM – standard error of the mean; G1 – Czech Fleckvieh – annual milk yield < 7 000 L per cow; G2 – Czech Fleckvieh – annual milk yield ≥ 7 000 L per cow; G3 – Holstein – annual milk yield < 9 500 L per cow; G4 – Holstein – annual milk yield ≥ 9 500 L per cow

Source: Authors' own calculations

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Table 3. Costs and profit before subsidies in EUR per cow and year

Indicator	Group	2016	2017	2018	2019	2020	SEM
Feed costs	G1	851	877	960	1 024	1 048	57
	G2	1 148	1 132	1 156	1 283	1 310	56
	G3	1 212^{a}	1 258^{a}	1 254^{a}	1 338^{ab}	1 405^{b}	50
	G4	1 333^{a}	1 342^{a}	1 392^{ab}	1 468^{bc}	1 531^{c}	51
Labour costs	G1	297	350	327	336	334	36
	G2	400	380	410	451	466	35
	G3	426	420	433	460	492	30
	G4	389	399	413	415	437	31
Depreciation	G1	380	351	380	420	408	36
	G2	348	348	354	358	381	35
	G3	411	430	447	434	475	31
	G4	452	453	451	455	473	32
Veterinary and breeding costs	G1	133	137	136	144	147	12
	G2	122	118	126	145	154	12
	G3	185	191	189	208	222	13
	G4	186^{ab}	179^{a}	193^{ab}	208^{ab}	226^{b}	13
Overheads	G1	348	308	338	395	367	61
	G2	384	374	402	408	408	60
	G3	408	436	409	419	465	45
	G4	487	525	555	529	515	47
Total costs	G1	2 219^{ab}	2 154^{a}	2 348^{ab}	2 521^{b}	2 500^{b}	97
	G2	2 619^{a}	2 645^{a}	2 768^{ab}	2 960^{b}	3 020^{b}	95
	G3	2 916^{a}	3 026^{ab}	3 068^{ab}	3 186^{b}	3 369^{c}	88
	G4	3 103^{a}	3 203^{ab}	3 339^{bc}	3 447^{cd}	3 557^{d}	91
Total costs after deduction	G1	2 083^{ab}	2 015^{a}	2 211^{ab}	2 380^{b}	2 358^{b}	96
	G2	2 470^{a}	2 498^{a}	2 620^{ab}	2 812^{b}	2 875^{b}	94
	G3	2 773^{a}	2 881^{ab}	2 928^{ab}	3 048^{b}	3 231^{c}	88
	G4	2 956^{a}	3 060^{ab}	3 194^{bc}	3 303^{cd}	3 412^{d}	90
Profit	G1	–429^{a}	54^{b}	4^{b}	–114^{ab}	–5^{b}	91
	G2	–502^{a}	80^{b}	17^{b}	–169^{ab}	–198^{ab}	89
	G3	–625^{a}	–87^{b}	–44^{b}	–83^{b}	–236^{b}	77
	G4	–438^{a}	267^{b}	185^{bc}	127^{bc}	35^{c}	79

$^{a, b, c, d}$ values within a row with different superscripts differ significantly at $P < 0.05$; SEM – standard error of the mean; G1 – Czech Fleckvieh – annual milk yield < 7 000 L per cow; G2 – Czech Fleckvieh – annual milk yield ≥ 7 000 L per cow; G3 – Holstein – annual milk yield < 9 500 L per cow; G4 – Holstein – annual milk yield ≥ 9 500 L per cow
Source: Authors' own calculations

a slightly greater annual growth rate in costs during the same assessment period (2016–2020) as that of our study (IAEI 2022). For the 145 to 150 farms evaluated in the CR, IAEI reported a cost increase per cow of 21% for the entire four-year period, corresponding to an annual cost growth rate of 5.0%. Dairy operations of a similar size with herd management methods similar to those in the CR are found in Slovakia, for which Michaličková et al. (2014) reported an increase in milk production costs of 6.4% per year for 22 to 27 farms between 2007 and 2011, which is higher than in our study because of the rise in feed costs between 2010 and 2011.

Data from the European Milk Board show an average cost increase for 26 EU countries (excluding Greece and Cyprus but including the United Kingdom) between 2016 and 2019 of EUR 4.56 per 100 kg of milk, which means 11.2% in total and an average of 3.6% per year (European Milk Board 2021). According to the

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Farm Accountancy Data Network (FADN) database (FADN 2022), between 2016 and 2020, the total costs of dairy farms in the EU-27 increased by 13.3% and 3.2% on average per cow and year, respectively, which is slightly lower than the results in our study. Germany, France, the Netherlands, Italy and Poland are among the biggest milk producers in the EU each year. These five countries accounted for 67% (Eurostat 2022) of total EU milk production in 2020, and their annual average growths in cost per cow and year were 4.2%, 1.7%, 2.8%, 3.1% and 2.6%, respectively, between 2016 and 2020 (FADN 2022). Of 25 EU countries (excluding Greece and Cyprus), 22 had higher cost increases than inflation during the period (Eurostat 2022).

Feed and labour costs. In all groups, feed costs were the highest cost item (41%–43% of the total on average) (Table 3), which is consistent with those from many other reports (e.g. Glavić et al. 2021). In addition, the increase in feed costs also had one of the highest growth rates among those for all cost items. In groups G3 and G4, the rise in feed costs between 2020 and 2016 was statistically significant ($P < 0.05$) and at the borderline of significance for G1 ($P = 0.05$). We observed a positive relationship between feed costs and total costs in all groups ($r = 0.805$; $P < 0.001$ for the whole data set). In particular, the cost of purchased versus self-produced feeds increased greatly (34.9% *vs*. 6.8%). Self-produced feeds are valued at an intra-company price, which generally does not reflect the market price. The increase in feed costs was caused not only by greater feed consumption related to higher milk yield [there was a correlation ($r = 0.740$; $P < 0.001$) between milk yield and feed costs for the whole data set] but also by the increase in unit prices of feedstuff. Over the years, average prices per unit of forage and concentrates increased by 22.2% and 10.2% on the farms analysed. Even on average across the country, there is an apparent increase in the price of feed components. For example, the prices of soft wheat, barley and oats increased by 15%, 7% and 29%, respectively, between 2016 and 2020, and the price of haylage increased by 25% (Eurostat 2022).

In this study, for the various groups, labour costs per cow per year in 2020 were numerically higher by 12% to 16% (i.e. increased by 3.0% to 4.0% per year) than in 2016. Previously published articles in which the authors assessed the development of labour costs in the CR reported slightly lower growth rates. Krpalkova et al. (2017) reported an increase in labour costs of 2.4% per year between 2007 and 2014, and Syrůček et al. (2019) reported increases of 2.3% and 1.6% per year between 2012 and 2017 for C and H breeds, respectively. However, according to the current IAEI results (IAEI 2022), the growth rate between 2016 and 2020 was 3.5% per year and, thus, was similar to our findings.

Between 2016 and 2020, average wages in the whole agrarian sector in the CR increased by 30% (i.e. by an average of 7.9% per year) (ILOSTAT 2022). That is faster than the growth rate of labour costs in our study. Across the EU countries, the average hourly wage in the dairy sector increased by 3.5% per year between 2016 and 2020 (FADN 2022). The average number of staff members decreased by 2.3% in our study, probably because of increased automation and labour efficiency, which may partly explain why, despite faster wage growth in the agrarian sector as a whole, labour costs increased less on the farms evaluated.

Development of milk production costs per litre of milk. Because of the increased milk yield, the costs per litre of milk sold had a slower growth rate in our study than the cost per cow per year (Table 4). We observed statistically significant differences ($P < 0.05$) between 2016 and 2020 in total costs only in the group of high-yielding H cows (G4). The annual growth rates in costs after deduction per litre of milk were 0.6%, 2.4%, 1.8% and 2.0% in groups G1 to G4, which were slightly lower than the annual inflation rate in the CR, an exception being the rate for group G2. Milk production increased less by 2020 for farms with above-average milk yields in 2016 (G2 and G4) than for groups starting with below-average milk yields (G1 and G3). The largest increase in milk yield occurred in group G1. Even though higher total costs substantially offset this increase, the growth rate in costs per litre was, therefore, the lowest among the groups evaluated.

Between 2007 and 2014, the annual growth rate in cost per litre of milk for Czech dairy farms was 1.2% (Krpalkova et al. 2017). The IAEI's reported growth rate from 2016 to 2020 of 1.7% was similar to the results of our study (IAEI 2022). Moreover, according to data from FADN, cost growth averaged 1.3% per year in the EU-27 between 2016 and 2020 (FADN 2022), which was similar to the average inflation rate in these countries (Eurostat 2022). The cost growth was slightly higher (at 2.2%) between 2016 and 2020 in the United States, according to the U.S. Department of Agriculture (USDA 2022).

Development of profitability and the IOFC. The level of profitability and the IOFC depend on milk purchase prices. There was a clear positive relationship between the milk price and profit per cow and year or per litre of milk ($r = 0.500$ and $r = 0.499$, respectively;

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Table 4. Costs and profit before subsidies in EUR per 100 L of milk sold

Indicator	Group	2016	2017	2018	2019	2020	SEM
Feed costs	G1	13.64	14.27	14.70	15.53	15.07	0.76
	G2	15.23	14.63	14.61	16.61	16.36	0.74
	G3	14.27^{ab}	14.71^{ab}	14.19^{a}	15.12^{b}	15.25^{ab}	0.42
	G4	13.37^{ab}	13.10^{a}	13.45^{a}	14.39^{b}	14.36^{b}	0.43
Labour costs	G1	4.76	5.68	5.01	5.24	4.91	0.56
	G2	5.33	4.91	5.20	5.88	5.85	0.55
	G3	5.16	4.98	4.97	5.25	5.41	0.35
	G4	3.90	3.92	4.03	4.12	4.13	0.37
Depreciation	G1	6.02	5.65	5.77	6.32	5.81	0.48
	G2	4.65	4.51	4.50	4.64	4.74	0.47
	G3	4.86	5.05	5.03	4.91	5.16	0.31
	G4	4.55	4.46	4.41	4.51	4.49	0.32
Veterinary and breeding costs	G1	2.11	2.20	2.07	2.20	2.12	0.17
	G2	1.62	1.52	1.58	1.88	1.93	0.17
	G3	2.19	2.25	2.17	2.39	2.42	0.14
	G4	1.88	1.76	1.87	2.05	2.14	0.15
Overheads	G1	5.59	5.08	5.21	6.09	5.22	0.80
	G2	5.09	4.82	5.04	5.21	5.04	0.78
	G3	4.85	5.17	4.68	4.79	5.12	0.50
	G4	4.96	5.22	5.47	5.25	4.93	0.52
Total costs	G1	35.58	35.12	35.92	38.47	36.00	1.25
	G2	34.78	34.17	34.97	38.25	37.66	1.23
	G3	34.55	35.54	34.85	36.15	36.75	0.87
	G4	31.26^{a}	31.46^{ab}	32.49^{abc}	33.99^{c}	33.64^{bc}	0.90
Total costs after deduction	G1	33.39	32.85	33.82	36.31	33.96	1.24
	G2	32.79	32.27	33.10	36.33	35.85	1.22
	G3	32.86	33.84	33.25	34.58	35.24	0.87
	G4	29.79^{a}	30.05^{ab}	31.09^{abc}	32.57^{c}	32.27^{bc}	0.89
Profit	G1	−7.04^{a}	0.61^{b}	−0.18^{b}	−1.95^{b}	−0.29^{b}	1.26
	G2	−6.65^{a}	1.05^{b}	0.18^{b}	−2.10^{ab}	−2.44^{ab}	1.24
	G3	−7.56^{a}	−1.13^{b}	−0.53^{b}	−0.99^{b}	−2.72^{b}	0.85
	G4	−4.43^{a}	2.59^{b}	1.74^{b}	1.23^{b}	0.28^{b}	0.87

$^{a, b, c}$ values within a row with different superscripts differ significantly at $P < 0.05$; SEM – standard error of the mean; G1 – Czech Fleckvieh – annual milk yield < 7 000 L per cow; G2 – Czech Fleckvieh – annual milk yield ≥ 7 000 L per cow; G3 – Holstein – annual milk yield < 9 500 L per cow; G4 – Holstein – annual milk yield ≥ 9 500 L per cow

Source: Authors' own calculations

$P < 0.001$). In 2016, there was a surplus of milk across the EU because of its large supply, which was reflected in low milk prices in both the EU and CR. The milk price in 2016 was significantly ($P < 0.05$) lower than in the other evaluated years in all groups of farms analysed (Table 2). The price increased significantly between 2017 and 2019 ($P < 0.05$). Although the price of milk also had been expected to increase in 2020 because of the global pandemic and its effects on consumer behaviour (Aday and Aday 2020), there was, instead, overproduction of milk in the EU that, in turn, resulted in a year-on-year decrease in milk price. Its annual average then remained similar to those seen in 2017 and 2018.

Among the farms evaluated, groups G1, G2 and G4 achieved the highest positive profitability in 2017 (Figure 2). H-breed farms with below-average milk yields (G3) always had negative profitability on average. To-

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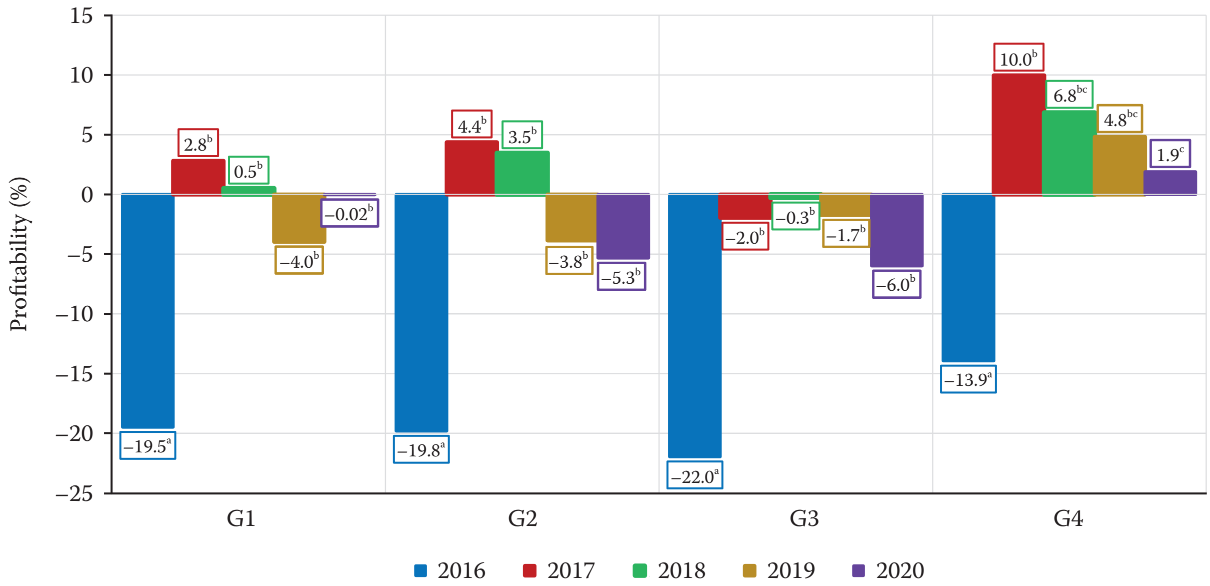

Figure 2. Development of profitability for dairy farms in the Czech Republic

[a, b, c] values within a breed and milk yield group with different superscripts differ significantly at $P < 0.05$; G1 – Czech Fleckvieh – annual milk yield < 7 000 L per cow; G2 – Czech Fleckvieh – annual milk yield ≥ 7 000 L per cow; G3 – Holstein – annual milk yield < 9 500 L per cow; G4 – Holstein – annual milk yield ≥ 9 500 L per cow
Source: Authors' own elaboration

tal costs per cow and year were higher for this group than for G1 and G2 with C cows. The low milk yield compared with G4 with high-yielding H cows resulted in low sales that did not cover the total costs. In contrast, except for the 2016 results, H farms with above-average milk yields (G4) consistently achieved positive profitability. These results confirmed that higher performance in cows with high milk yield potential (G4) is economically more profitable, consistent with results from earlier reports (Syrůček et al. 2019). Profitability before subsidies in the EU (FADN 2022) was also strongly affected by fluctuations in the purchase price of milk and, on average across the 27 EU countries, it was negative in every year from 2016 to 2020 (−26%,

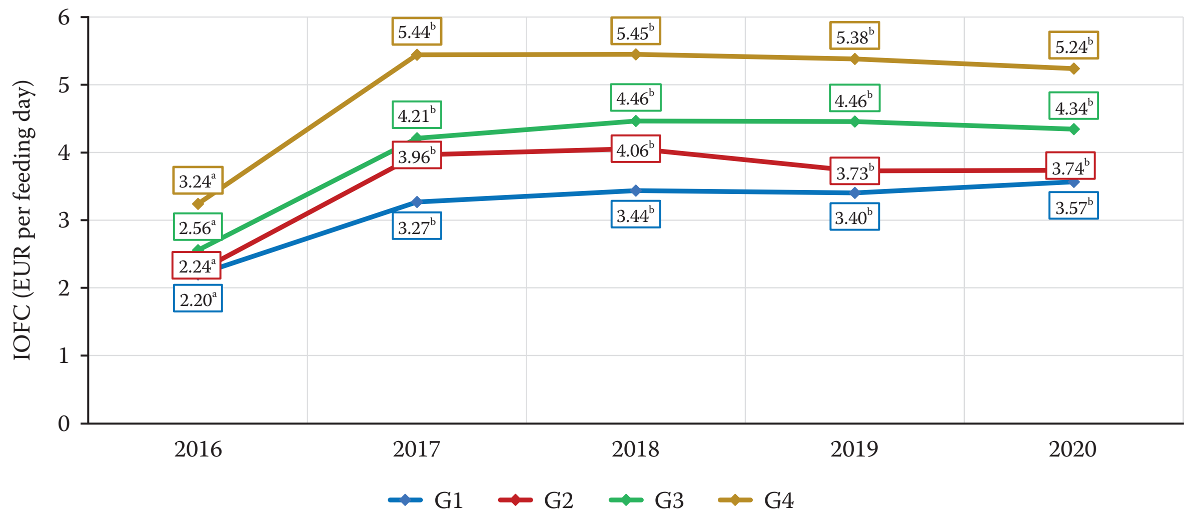

Figure 3. Development of IOFC (income over feed costs) indicator for dairy farms in the Czech Republic

[a, b] values within a breed and milk yield group with different superscripts differ significantly at $P < 0.05$; G1 – Czech Fleckvieh – annual milk yield < 7 000 L per cow; G2 – Czech Fleckvieh – annual milk yield ≥ 7 000 L per cow; G3 – Holstein – annual milk yield < 9 500 L per cow; G4 – Holstein – annual milk yield ≥ 9 500 L per cow
Source: Authors' own elaboration

https://doi.org/10.17221/381/2022-AGRICECON

−13%, −19%, −19% and −20%, respectively). The main reason for the negative and lower profitability in the EU than in the evaluated farms in the CR was higher production costs on average.

In 2016, because of the low milk price, the IOFC was significantly lower ($P < 0.05$) for all farm groups than in the other years analysed (Figure 3). Year-on-year differences in the IOFC between 2017 and 2020 were minor and insignificant. In agreement with the findings of Němečková et al. (2015), within the same breed, a greater IOFC was always observed in the group with higher milk yield. It is evident that the IOFC is related more to milk price ($r = 0.573$; $P < 0.001$) than to feed cost per cow and year ($r = 0.278$; $P < 0.001$).

CONCLUSION

It is clear that milk production costs in the CR and other EU countries have been gradually increasing in recent years because of the increase in milk yields and the associated higher feed consumption, as well as increasing prices for inputs such as feed and labour. In the CR and other EU countries, milk production costs have been gradually increasing in recent years because of the increase in milk yields and the associated higher feed consumption, as well as increasing prices for inputs such as feed, labour, energy and investment. Compared with annual inflation in the CR, the cost increase per cow and year was higher in all the groups evaluated but lower per litre of milk because of increasing milk yields. We observed a higher annual growth rate of cost per litre of milk in the groups with above-average milk yield (G2 and G4) than in those with below-average milk yield (G1 and G3). However, the level of milk yield is approaching its limit. In the future, it will probably be impossible to cover the ever-higher costs caused by inflation with higher milk yields. Although the total costs of the evaluated farms in the CR and, on average, in the EU have clearly increased, no significant upward trend in milk prices has been observed. 2016 has been described as a crisis year for dairy farmers, with low milk prices due to European overproduction causing considerable losses across the sector. In 2020, however, the price was similar to that in 2017, and the average profit before subsidies decreased because of the increasing costs. Economic factors will greatly influence the future development of the dairy sector. Without an adequate level of profit, dairy operations will not be able to develop further, contend with market fluctuations and invest in new technologies. In such a situation, dairy farmers may choose to engage in another business.

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Received: December 16, 2022
Accepted: January 31, 2023