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Economic Factors Affecting Milk Production on Dairy Farms Between 2016 to 2020

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Abstract
Due to ongoing improvements in genetic breeding and changes in farm management and the economic environment, there is a need to reassess factors related to milk production economics. This study aimed to evaluate economic indicators between 2016 and 2020 on Czech dairy farms that kept either Czech Fleckvieh or Holstein breeds and had varying milk yields. Data from 66 dairy farms in different regions of the Czech Republic Were collected using a questionnaire. Farms Were categorized into four groups based on breed and 2016 milk yield. Production costs increased by 13% to 17% across all groups due to higher milk yields, increased feed consumption, and input prices. Farms with above-average milk yields showed a higher annual growth rate of costs per liter of milk compared to those with below-average yields. Holstein farms with above-average milk yields Were the most profitable before subsidies. Groups with higher milk yields consistently showed higher income over feed costs. Low farm gate milk prices resulted in lower profitability across all groups in 2016 compared to other years.

Keywords: agriculture, milk production, dairy farm, economic

Introduction

The Czech Republic is an agricultural country with a long tradition of dairy farming. However, the dairy sector has undergone significant changes in recent years due to economic, environmental, and social pressures. To ensure the competitiveness and sustainability of the dairy sector, it is essential to have reliable economic indicators that reflect the current situation and future prospects of dairy farms.

Simo et al. (2016) state that raw cow's milk is a crucial commodity in global agricultural markets. In the Czech Republic, milk production has a long-standing tradition and is essential to the livestock and agricultural sectors. After joining the European Union in 2004, the Czech Republic's dairy industry underwent significant changes, with a decrease in the number of milking cows but an increase in milk yield, leading to a steady rise in domestic milk production. Despite a 2.8% decrease in dairy cow numbers between 2016 and 2020, milk yields rose by 9.7%, resulting in a 6.6% increase in total milk production (Eurostat 2022). This trend is similar in the EU and most developed countries, where dairy cow numbers have decreased while milk yields and total

production have increased. Between 2016 and 2020, dairy cow numbers in the EU-27 decreased by 5.1%, while milk yield and total production increased by 9.5% and 3.9%, respectively (Eurostat 2022).

Rudinskaya and Boskova (2021) have found that fluctuations in milk purchase prices significantly impact the profitability of milk production in the Czech Republic (CR), as is the case in most European Union (EU) countries (Bełdycka-Bórawska et al. 2021). Milk purchase prices are a crucial factor influencing the economic efficiency of milk production (e.g., Syrůček et al. 2019; Bórawski et al. 2021), reflecting the situation in both European and international milk markets (Bełdycka-Bórawska et al. 2021). The variability in prices is due to fluctuations in supply and demand, depending on the actual volume of milk on offer and the consumption of milk and dairy products. Additionally, the economics of production is significantly impacted by the continuous rise in input prices and production costs, which have increased in recent years in the CR (e.g., Doucha et al. 2012; Syrůček et al. 2019), the EU on average (European Milk Board 2021), and the United States (USDA 2022).

The income over feed costs (IOFC) indicator is a viable alternative to assess the economic efficiency of farms, in addition to profitability. IOFC measures the ratio of milk sales to feed costs, which is typically the highest cost item. Due to the volatility in feed and milk markets, using IOFC is more beneficial than solely evaluating feed costs per cow. Economic indicators are also influenced by the breed used and the level of performance within that breed. Notably, there are significant differences between the commonly used Czech Fleckvieh (C) and Holstein (H) breeds in production and economic indicators. To reassess the factors related to milk production economics, this study aims to evaluate the development of economic indicators between 2016 and 2020 on Czech dairy farms that kept either C or H breed and that had varying average milk yields.

Research Method

Data from dairy farms in the CR for the years 2016 to 2020 was obtained through a questionnaire. The study included only those farms with complete data throughout the entire evaluation period and with either C or H cows. A total of 66 farms from different regions of the CR Were analyzed, representing an average of 36,995 cows per year, which is approximately 10% of the dairy cow population in the CR according to Eurostat 2022. To calculate the total costs, the researchers added up all reported cost items and deducted the value of secondary outputs, which included the value of calves (EUR 114.4 per calf) and manure (EUR 27.8 per cow and year) based on Syrůček et al. 2019. Depreciation of cows and other assets was included in the calculation of costs. Overheads included energy costs and the cost of property and cow insurance. Costs Were calculated per cow based on 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 was determined as the difference between milk sales revenue and costs after deductions, excluding subsidies. Profitability was calculated as the ratio of profit to costs after deductions. The IOFC in EUR per feeding day was calculated using the following formula:

IOFC = ((marketed milk per year X average milk price in EUR per L)/number of feeding days) – feeding cost
where: IOFC – income over feed costs

Farmers were categorized into four groups (G1-G4) based on the breed of their livestock (C and H) and their milk yield for the year 2016. We took into account the average annual milk yield in the population (ICAR 2021) to divide the farms into two groups: those with below-average milk yield [< 7 000 L for C (G1) and < 9 500 L for H (G3)], and those with above-average milk yield [≥ 7 000 L for C (G2) and ≥ 9 500 L for H (G4)]. The characteristics of each farm group evaluated are outlined in Table 1.

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

The farm price and cost data were collected in CZK and later converted to EUR using the average exchange rate of 1 EUR = 26.2 CZK for the studied period (Eurostat 2022). The data was analyzed separately by breed using a mixed linear model with repeated measures, following the MIXED procedure of SAS. The final model was structured to determine the combined effect of group × year, with the farm being entered as a random variable. Random (co)variances between years within the farm were summarized using a residual R matrix, which had a block diagonal structure with autoregressive covariance of order 1. We estimated parameters using the restricted maximum likelihood method. Simple effect slices (by group) were used to calculate least squares means, and multiple comparisons were made using the Tukey procedure to adjust P values. Pearson correlations were calculated using the CORR procedure of SAS. Figure 1 graphically depicts the overall method used.

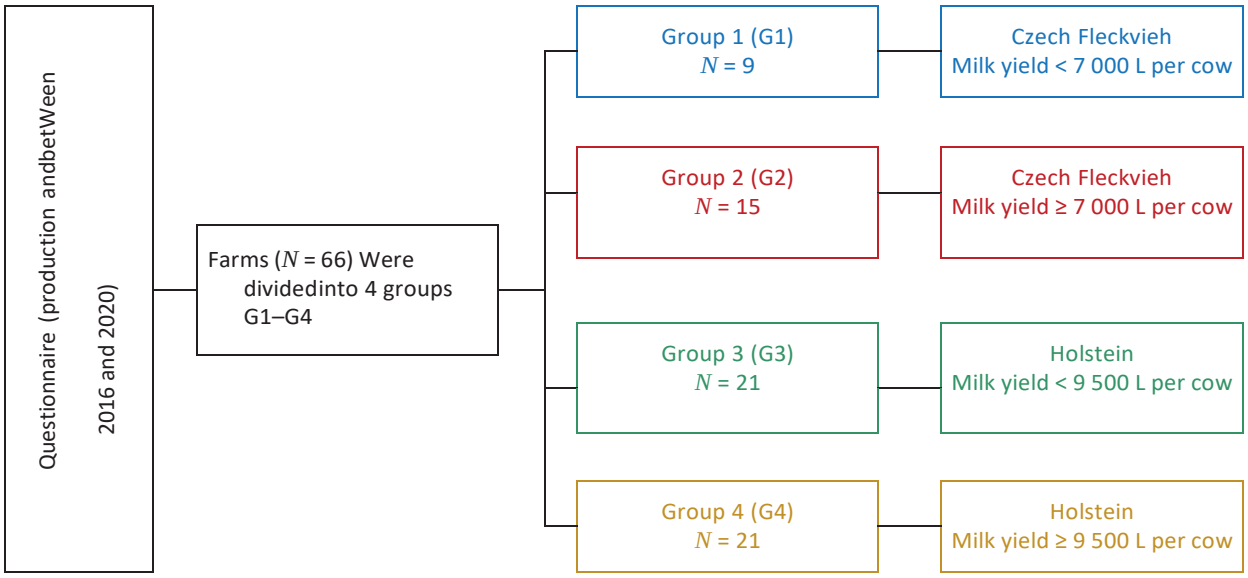


Figure 1: Diagram of data and methods used

Result and Discussion

The main milk production indicators during the period concerned are given in Table 2.

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

The researchers noted a general inclination towards a year-on-year rise in milk yield across all groups, with higher milk yields ($P < 0.05$) in 2020 than in 2016 observed in H herds (groups G3 and G4). Although there were some variations in fat and protein content year-on-year, no definite pattern was evident. The farm gate milk price was lowest in 2016 and peaked in 2019. As milk yields have risen, total milk production costs have also increased (as shown in Table 3).

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

In groups G2, G3, and G4, We observed higher total costs after deduction per cow and year in 2020 compared to 2016 ($P < 0.05$) by 16%, 17%, and 15%, respectively, indicating annual growth rates of 3.9%, 3.9%, and 3.7%, respectively. For the G1 group, a significant difference of

17% ($P < 0.05$) was observed between 2017 and 2020 (growth rate of 5.5%). We found a positive correlation ($r = 0.763$; $P < 0.001$) between milk yield and costs based on the data from the entire set. Feed costs were found to be the highest cost item in all groups, accounting for 41% to 43% of total costs on average, which is consistent with previous studies (e.g. Glavić et al., 2021). The cost increase associated with higher milk yields is mainly due to greater feed consumption but is also caused by increasing input prices such as feed, labour, investment, and energy. We noted that cost increases were particularly evident in 2019 and 2020, with the largest increase in purchased feed costs. Despite an average overall price increase of 2.2% in the CR (Eurostat 2022), costs per cow per year have increased at a faster rate than inflation in the CR for the farms evaluated over the past five years.

In comparison to our study, earlier studies have reported slightly lower annual growth rates for costs per cow per year in the CR. For instance, Doucha et al. (2012) found a yearly cost growth rate of 2.9% between 2004 and 2013, and between 2007 and 2014, the cost growth rate was estimated to be 3.2% (Krpalkova et al. 2017). However, the Institute of Agricultural Economics and Information (IAEI) reported a slightly higher annual growth rate in costs for the same assessment period (2016-2020) as our study, with a cost increase per cow of 21% for the entire four-year period, corresponding to an annual cost growth rate of 5.0% for the 145 to 150 farms evaluated in the CR (IAEI 2022). Similar dairy operations with herd management methods to those in the CR are found in Slovakia, where Michalickova 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 our study due to the increase in feed costs between 2010 and 2011. According to data from the European Milk Board, the average cost increase for 26 EU countries (excluding Greece and Cyprus but including the United Kingdom) between 2016 and 2019 was EUR 4.56 per 100 kg of milk, equivalent to 11.2% in total and an average of 3.6% per year (European Milk Board 2021). Moreover, based on the Farm Accountancy Data Network (FADN) database, 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 of our study. The top five milk producers in the EU, namely Germany, France, the Netherlands, Italy, and Poland, accounted for 67% 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). Among the 25 EU countries (excluding Greece and Cyprus), 22 had cost increases higher than inflation during the period (Eurostat 2022).

According to Table 3, feed costs are the most expensive item in all groups, accounting for 41%-43% of the total cost on average. This is in line with findings from other studies such as Glavić et al. (2021). The increase in feed costs has also had one of the highest growth rates across all cost items. In groups G3 and G4, there was a statistically significant ($P < 0.05$) rise in feed costs between 2016 and 2020, and it was borderline significant for G1 ($P = 0.05$). We noted a positive relationship between feed costs and total costs in all groups, with a correlation coefficient of 0.805 ($P < 0.001$) for the entire dataset. The cost of purchased feeds compared to self-produced feeds has increased significantly (34.9% vs. 6.8%). Self-produced feeds are typically valued at an intra-company price that doesn't reflect market prices. The increase in feed costs was due to higher

feed consumption resulting from increased milk yield (there was a correlation of 0.740; $P < 0.001$ between milk yield and feed costs for the whole dataset) and also due to higher unit prices of feedstuff. The average prices per unit of forage and concentrates increased by 22.2% and 10.2% on the farms analyzed over the years. Even across the country, there has been an apparent increase in the price of feed components, such as soft wheat, barley, and oats (15%, 7%, and 29% respectively, between 2016 and 2020), and haylage (25%) (Eurostat 2022).

Labor costs per cow per year in 2020 were numerically higher by 12% to 16% compared to 2016 for various groups, resulting in a yearly increase of 3.0% to 4.0%. Previous studies by Krpalkova et al. (2017) and Syrůček et al. (2019) reported slightly lower growth rates in labor costs in the CR. Krpalkova et al. (2017) reported a 2.4% yearly increase in labor costs between 2007 and 2014, while Syrůček et al. (2019) reported yearly increases of 2.3% and 1.6% between 2012 and 2017 for C and H breeds, respectively. However, the current IAEI results (IAEI 2022) showed a growth rate of 3.5% per year between 2016 and 2020, which is similar to the findings of this study.

According to ILOSTAT 2022, the average wages in the entire agrarian sector in the CR rose by 30% between 2016 and 2020, with an average yearly increase of 7.9%. This growth rate was faster than the increase in labour costs in our study. FADN 2022 reported that the average hourly wage in the dairy sector across EU countries rose by 3.5% per year between 2016 and 2020. The study found a decrease of 2.3% in the average number of staff members, which may be due to increased automation and labour efficiency, partly explaining the lower growth rate of labour costs on the evaluated farms despite the faster wage growth in the agrarian sector as a whole. The development of milk production costs per litre of milk sold had a slower growth rate in our study compared to the cost per cow per year, owing to the increased milk yield (Table 4).

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

Statistically significant differences ($P < 0.05$) were observed between 2016 and 2020 in total costs only in the group of high-yielding H cows (G4). The groups' annual growth rates in costs after deduction per litre of milk were 0.6%, 2.4%, 1.8%, and 2.0% for G1 to G4, respectively, which were slightly lower than the annual inflation rate in the Czech Republic, except for group G2. Farms with above-average milk yields in 2016 (G2 and G4) had less milk production growth by 2020 than groups starting with below-average milk yields (G1 and G3). Group G1 had the most significant increase in milk yield, but the higher total costs substantially offset this increase, resulting in the lowest growth rate in costs per litre among the evaluated groups. Krpalkova et al. (2017) reported an annual growth rate in cost per litre of milk for Czech dairy farms of 1.2% between 2007 and 2014. The International Farm Comparison Network's reported growth rate from 2016 to 2020 of 1.7% was similar to the results of our study (IAEI 2022). Additionally, according to data from the Farm Accountancy Data Network, 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 those countries (Eurostat 2022). However, the cost growth was

slightly higher (at 2.2%) between 2016 and 2020 in the United States, according to the US Department of Agriculture (USDA 2022)

The development of profitability and IOFC is closely tied to milk purchase prices, with a strong positive correlation observed between milk price and profit per cow and year or per litre of milk ($r = 0.500$ and $r = 0.499$, respectively; $P < 0.001$). In 2016, the EU experienced a surplus of milk, leading to low milk prices in both the EU and CR, which was significantly lower than in other assessed years across all farm groups (Table 2). From 2017 to 2019, there was a significant increase in milk prices ($P < 0.05$). However, the global pandemic in 2020 led to overproduction of milk in the EU, resulting in a year-on-year decrease in milk price instead of the expected increase (Aday and Aday, 2020). Despite this, the annual average remained similar to the levels seen in 2017 and 2018. Among the farms evaluated, groups G1, G2 and G4 achieved the highest positive profitability in 2017 (Figure 2).

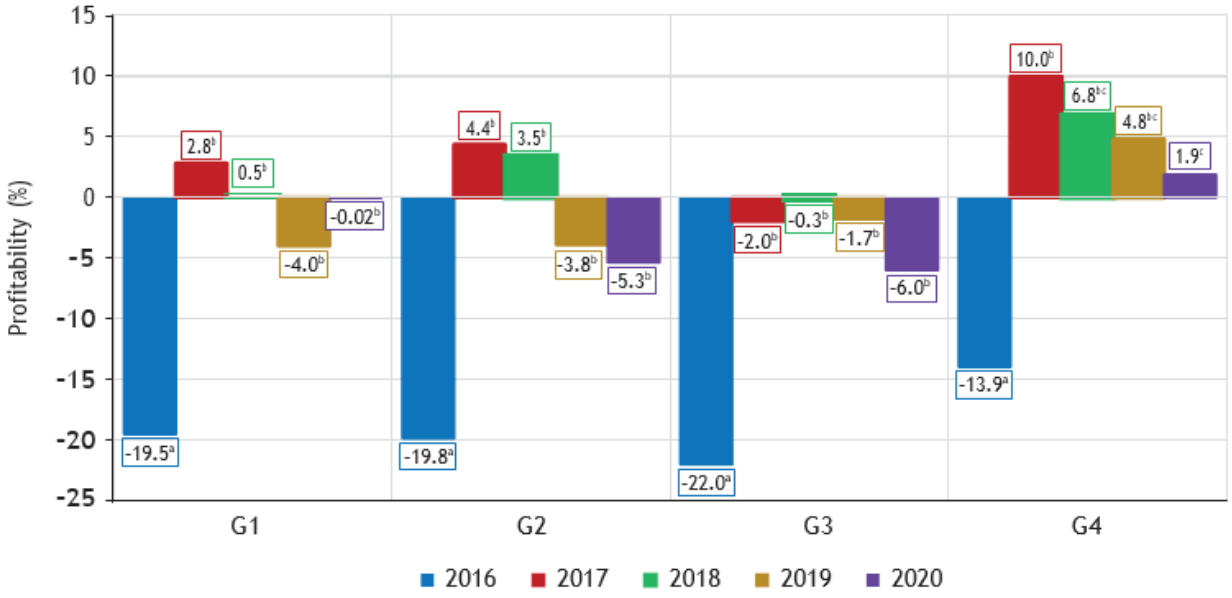
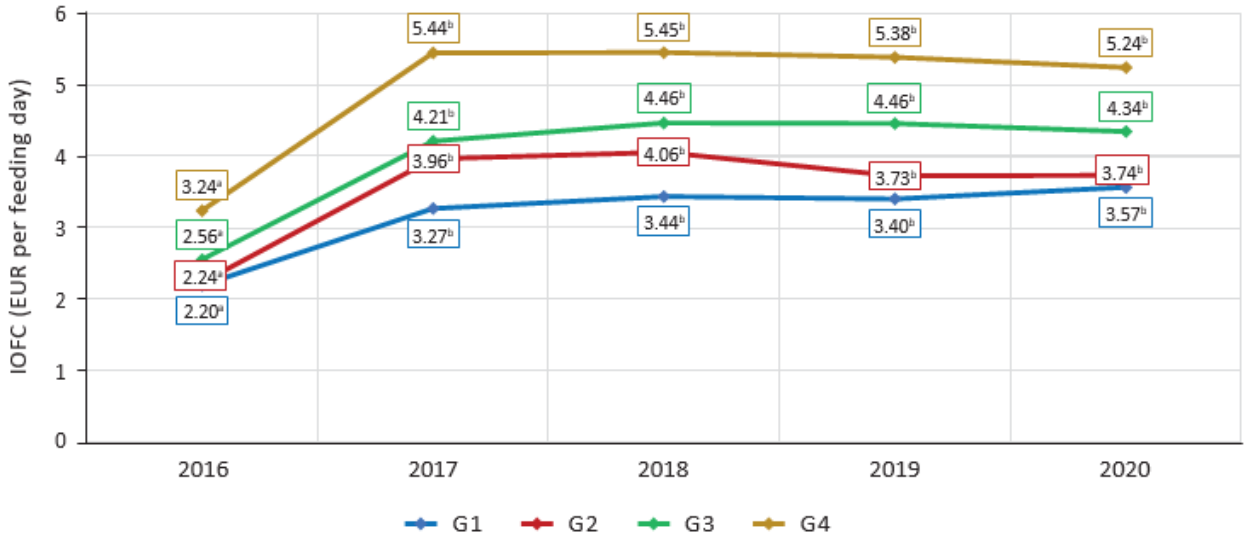


Figure 2: Development of profitability for dairy farms in the Czech Republic

On average, H-breed farms with below-average milk yields (G3) experienced negative profitability due to higher total costs per cow and year compared to G1 and G2 with C cows. Despite low milk yields, G4 farms with high-yielding H cows consistently achieved positive profitability, confirming the economic advantage of higher performance in cows with high milk yield potential. These findings align with previous reports (Syrůček et al. 2019). It is important to note that profitability in the EU (FADN 2022) was significantly impacted by fluctuations in milk purchase prices, resulting in negative profitability across all 27 EU countries from 2016 to 2020 (-26%, -13%, -19%, -19%, and -20%, respectively). The primary reason for the lower profitability in the EU compared to evaluated farms in the CR was higher production costs on average.
During the year 2016, due to the decreased milk price, the IOFC was notably lower ($P < 0.05$) for all farm groups in comparison to the other years that were analyzed (as shown in Figure 3).



The IOFC (income over feed costs) indicator for dairy farms in the Czech Republic was examined and Figure 3 presents the results. Analysis of year-on-year differences in IOFC between 2017 and 2020 showed only minor and insignificant variations. Consistent with the findings of Němečková et al. (2015), the group with higher milk yield within the same breed consistently had a greater IOFC. The data also suggests that IOFC is more closely linked to milk price (correlation coefficient $r = 0.573$, $P < 0.001$) than to feed cost per cow and year (correlation coefficient $r = 0.278$, $P < 0.001$).

Conclusion

In recent years, milk production costs have been on the rise in the CR and other EU countries. This is primarily due to the increase in milk yields and associated higher feed consumption, as well as increasing prices for inputs such as feed, labour, energy, and investment. Despite annual inflation, the cost increase per cow and year was higher in all evaluated groups but lower per litre of milk due to increasing milk yields. However, higher annual growth rates of cost per litre of milk were observed in groups with above-average milk yield (G2 and G4) compared to those with below-average milk yield (G1 and G3). Although the milk yield level is nearing its limit, it will likely be impossible to cover ever-increasing costs caused by inflation with higher milk yields in the future. Despite the clear increase in total costs for evaluated farms in the CR and EU on average, there has been no significant upward trend in milk prices. In 2016, dairy farmers experienced a crisis year with low milk prices resulting from European overproduction, leading to significant losses across the sector. However, in 2020, the price was similar to that in 2017, and the average profit before subsidies decreased due to increasing costs. The dairy sector's future development will largely depend on economic factors. Without an adequate level of profit, dairy operations will not be able to expand, cope with market fluctuations, or invest in new technologies. In such a situation, dairy farmers may choose to engage in another business.

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