

INFLUENCE OF SELECTED FACTORS ON HERD LIFE AND LIFETIME MILK YIELD OF DAIRY COWS

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Abstract. The aim of the study was to evaluate influence of selected factors (breeding region, animal origin, cattle breed) on cow life span, milk yield and herd life of cows. Cows from pomorskie region had higher ($p < 0.01$) lifetime yield of milk, fat and protein. What's more, these animals had also higher ($p < 0.01$) yield of milk, fat and protein per day of production. Life span of imported animals was longer ($p < 0.05$) than life span of native cows. Polish Holstein-Friesian cows had higher ($p < 0.01$) life time milk yield than other breeds, as well as longer ($p < 0.01$) life span and herd life. Results suggest highly significant influence ($p < 0.01$) of breeding region, animal origin and cattle breed on herd life and lifespan and milk yield.

Introduction. Appropriate level of milk production should result in economic profits for dairy farms. Production intensification helps to achieve this goal. However, farms with high-yield cows must fulfill many conditions essential for increasing economic value of production (e. g. proper level of nutrition or environment). Non-realizing them can effect in various problems (e.g. shortened longevity, decreased fertility or lower content of milk fat and protein). Especially, Holstein-Friesian breed (HF), which is the largest worldwide population of dairy cattle, requires specific conditions i.e. quality forages or herd environment to express their genetic potential without undesirable health disorders. In Poland, crossbreeding of HF cattle with Polish native cows in recent century improved breeding value of national dairy cattle population (Litwińczuk and Barłowska, 2015).

Appropriate milk yield is connected with reproduction traits, and is essential to achieve economic profits (Pryce et al., 2004). High fertility traits are possible to maintain even in high-yielded herds. Therefore, in modern dairy farms the keys of production are adequate level of nutrition and herd management (Frejlach et al., 2015). Unfortunately, low fertility traits increase rate of culled cows, what effects in elevation of costs connected with herd replacement (Roche, 2006). Short herd life is another important issue in dairy cattle breeding. Cows achieve production peak between 2nd and 4th

lactation, which means that culling animals after 2nd or 3rd lactation is unfavorable for producers (Grodzki et al., 1998; Frejlach et al., 2015).

Objective. The objective of the study was to estimate the influence of selected factors (breeding region, animal origin and cattle breed) on herd life and lifetime milk yield of dairy cows.

Materials and methods. Data basis consisted milking records downloaded from SYMLEK system, running by Polish Federation of Cattle Breeders and Dairy Farmers, referred to milk performance of 2138 cows. Selected factors (breeding region, animal origin and cattle breed) were used in multi-factor analysis of variance to calculate cow life span, herd life and lifetime milk yield by following model:

$$Y_{ijkl} = u + A_i + B_j + C_k + e_{ijkl} ,$$

where: Y_{ijk} – value of the trait,

u – average,

A_i – effect of breeding region code ($i=1-2$)

B_j – effect of animal origin ($j=1-2$)

C_k – effect of cattle breed ($k=1-2$)

e_{ijkl} – random error

Results and discussion. Breeding region had significant ($p<0.01$) influence on cow yield, life span and herd life. Cows from pomorskie region had higher ($p<0.01$) lifetime yield of milk (25429.8 kg), fat (1077.2 kg) and protein (855.0 kg) than animals from lubelskie region (Table). Their milk, fat and protein yield per one day of life (11.9 kg, 0.50 kg, 0.40 kg, respectively) was also higher ($p<0.01$). Moreover, these animals had the highest ($p<0.01$) yield of milk (22.2 kg), fat (0.93 kg) and protein (0.74 kg) per day. Comparison of life span and herd life showed that cows from pomorskie region had longer herd life (2014.5 days), but shorter life span than animals from lubelskie region, however this differences were statistically insignificant. Analyzed breeding regions had different conditions of forage production or herd environment, that may be reasons of observed differences. In lubelskie region most cows are kept in cubicle system during the whole year and fed with TMR or PMR system, while in pomorskie region cows are seasonally grazed. Nevertheless, breeders and producers should focus on improving herd environment. It is the easiest and the fastest way to elevate reproduction traits, which are directly connected with milk production (Castillo-Juarez i wsp., 2000). Furthermore, selection for one trait often effects another traits and the responses are different over environments. Then, breeders should consider environment in which breeding values are evaluated when impact of milk production on animal health is known (Windig et al., 2006).

Table – Influence of breeding region, animal origin and cattle breed on life span, herd life and milk yield per 1 day of utilization

Specification	Region						Origin						Breed					
	Lubelskie			Pomorskie			Imported			Native			PHF			Others		
	N=1151		SE	N=987		SE	N=248		SE	N=1890		SE	N=2003		SE	N=135		SE
	LSM	SE	LSM	SE	LSM	SE	LSM	SE	LSM	SE	LSM	SE	LSM	SE	LSM	SE	LSM	SE
Lifetime milk yield (kg)	19699.6 ^A	442.21	25429.8 ^A	596.85	20935.1	914.08	22529.9	400.00	22935.3 ^A	384.62	13585.2 ^A	1016.35	572.5 ^A	43.34	34.73	53.51	51.31	0.37
Lifetime fat yield (kg)	826.8 ^A	19.08	1077.2 ^A	25.93	863.2	39.33	952.8	17.34	967.3 ^A	16.68	465.4 ^A	13.02	1565.4 ^A	53.51	720.6 ^A	18.88	7.7 ^A	0.16
Lifetime protein yield (kg)	666.5 ^A	14.95	855.0 ^A	20.24	712.6	31.25	758.9	13.53	772.9 ^A	13.02	465.4 ^A	13.02	1565.4 ^A	53.51	720.6 ^A	18.88	7.7 ^A	0.16
Life span (days)	2014.5	27.37	2000.5	28.03	2143.2 ^B	63.72	1991.6 ^A	20.53	2040.2 ^A	20.44	1565.4 ^A	53.51	720.6 ^A	18.88	7.7 ^A	0.16	0.013	0.013
Herd life (days)	1115.0	24.89	1141.9	26.44	1187.8	55.00	1119.5	19.19	1154.8 ^A	18.88	720.6 ^A	51.31	0.37	0.016	0.016	0.016	0.016	0.016
Milk yield per 1 day of life (kg)	9.3 ^A	0.13	11.9 ^A	0.16	9.5 ^A	0.30	10.6 ^A	0.12	10.7 ^A	0.11	7.7 ^A	0.37	0.016	0.016	0.016	0.016	0.016	0.016
Fat yield per 1 day of life (kg)	0.39 ^A	0.006	0.50 ^A	0.007	0.39 ^A	0.013	0.45 ^A	0.005	0.45 ^A	0.005	0.32 ^A	0.016	0.016	0.016	0.016	0.016	0.016	0.016
Protein yield per 1 day of life (kg)	0.31 ^A	0.005	0.40 ^A	0.006	0.32 ^A	0.010	0.36 ^A	0.004	0.36 ^A	0.004	0.26 ^A	0.013	0.013	0.013	0.013	0.013	0.013	0.013
Milk yield per 1 day of utilization (kg)	18.6 ^A	0.15	22.2 ^A	0.16	19.1 ^A	0.39	20.4 ^A	0.12	20.3	0.12	19.5	0.47	0.016	0.016	0.016	0.016	0.016	0.016
Fat yield per 1 day of utilization (kg)	0.76 ^A	0.007	0.93 ^A	0.007	0.76 ^A	0.015	0.85 ^A	0.005	0.84	0.005	0.81	0.019	0.019	0.019	0.019	0.019	0.019	0.019
Protein yield per 1 day of utilization (kg)	0.62 ^A	0.005	0.74 ^A	0.005	0.64 ^A	0.013	0.68 ^A	0.004	0.68	0.004	0.66	0.015	0.015	0.015	0.015	0.015	0.015	0.015

$p < 0.01$ dla A; $p < 0.05$ dla a

Animal origin highly significant influenced on cow yield. Therefore, native cows had higher ($p < 0.01$) milk, fat and protein yield per one day of life and production (10.6 kg and 20.4 kg, 0.45 kg and 0.85 kg, 0.36 kg and 0.68 kg, respectively) than imported ones. Life span of imported animals (2143.2 days) was longer ($p < 0.05$) than life span of native cows as well as their herd life (1187.8 days), however, no statistical differences were observed.

Cattle breed also effected on dairy cattle production. Polish Holstein-Friesian (PHF) cows had higher ($p < 0.01$) life time milk, fat and protein yield (22935.3 kg, 967.3 kg, 772.9 kg, respectively) than other breeds, as well as longer ($p < 0.01$) life span (2040.2 days) and herd life (1154.8 days). Comparison of animal yield per one day of life points out that PHF cattle milk, fat and protein yield per one day of life (10.7 kg, 0.45 kg, 0.36 kg, respectively) is higher ($p < 0.01$) that values of these traits for other breeds. PHF cows had also higher yield per one day of production, but analysis did not reveal statistical differences.

Previous studies also confirmed influence of cattle breed and country of origin on milk yield and milk components (Czerniawska-Piątkowska et al., 2009; Gnyp, 2012; Czaplicka et al., 2013; Balcerak et al., 2015). According to Balcerak et al. (2015) there are no statistical differences in yields between imported and native cows. Results obtained by Gnyp (2012) defined milk yield of cows imported from France and Netherlands as 25-30% higher than Polish animals. Czerniawska-Piatkowska et al. (2009) suggest that milk production of native cows is higher than milk yield of animals imported from Germany (but statistical differences were not observed).

Analysis conducted by Czaplicka et al. (2013) present lifetime milk yield, fat yield, protein yield for Polish native population (23372 kg, 979.29 kg, 787.64 kg, respectively). However, these results are lower ($p \leq 0.01$) than milk production of cows imported from France, but higher than values observed in the research.

Authors claim that average life span and herd life for native cows of PHF are 1809 and 1338 days, respectively, and their milk yield per one day of life and per one day of production are 12.92 kg and 17.47 kg, respectively. Life span of imported animals was 1904. However, previous studies from Czaplicka et al. (2002) and Czaplicka et al. (2007) revealed that life span of imported cows was longer.

Pokorska et al. (2012), suggested that average life span and herd life are shorter and stated significant differences ($p < 0.01$) between average herd life or life span and reasons of culling. Authors observed also differences in milk yield and protein yield of animals culled for further reasons. In their opinion cows culled due to infertility and reproductive disorders have longer ($p \leq 0.01$) herd life than animals culled because of other reasons. Moreover,

these animals had the highest ($p \leq 0.01$) protein milk (3.58%) comparing to other cows. Cows with metabolic and digestive diseases have the shortest ($p \leq 0.01$) functional longevity among all culled animals.

In turn, results of Polish dairy cattle evaluation system (OWU) for 2015 show that for PHF (black-and-white variety) average herd life last only 3.11 years. Average herd life of dairy cattle breeds evaluated in OWU is 3.07 years which reflect in high number of cows culled at age 5-6 years, according to Polish Federation of Cattle Breeders and Dairy Farmers (PFHBMiPM, 2015). More balanced selection strategy, with functional traits, fertility or longevity included in Polish PHF selection index, shouldn't have negative effect on milk yield and may improve neglected parts of dairy cattle breeding. However, production traits still are more important in PHF selection index (PFHBiPM).

Increased importance of functional traits (e. g. milking speed, temperament) in cattle breeding is connected with their influence on profitability of milk production (Visscher and Goddard, 1995; Miglior et al., 2005). Cow temperament is constant, doesn't change with age (Visscher and Goddard, 1995) and has impact on lifetime milk yield, milk yield per one day of functional longevity (Neja et al., 2015). Therefore, slow milking animals with undesirable temperament are more likely to be culled (Berry et al., 2005). Visscher and Goddard (1995) claim that high correlation between temperament and milking speed is based on similar values given to specific cows by people, because (e.g. milking excitable or aggressive animals takes more time due to more frequent kicking off milking clusters). Studies of Neja et al. (2015), pointed out that calm cows have the highest lifetime milk yield ($p \leq 0.05$) and milk yield per day of life ($p \leq 0.01$). Their results show also that animals scored as calm had longer life span and herd life, but these values were statistically insignificant. Hence, defining relationship between temperament and dairy cows' performance should help to evaluate factors influencing animal welfare on farm.

Close. In summary, higher ($p < 0.01$) lifetime yield of milk, fat and protein had cows from pomorskie region. What's more, these animals had higher ($p < 0.01$) yield of milk, fat and protein per one day of utilization. Life span of imported animals was longer ($p < 0.05$) than life span of native cows. Polish Holstein-Friesian cow had higher ($p < 0.01$) lifetime milk yield than other breeds, as well as longer ($p < 0.01$) life span and herd life. Results suggest highly significant influence ($p < 0.01$) of breeding region, animal origin and cattle breed on herd life and lifetime milk yield.

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