



Original Research Article

Impact of heifers' age at first breeding and first calving on some parameters of economic effectiveness at dairy cattle farms

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ABSTRACT

Keywords

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Production life, Cost,
Number of services per conception

The purpose of the present study was to determine the effect of age at first breeding and age at first calving on economic traits of Bulgarian dairy cattle farms. The survey was conducted in 818 heifers from 7 dairy cattle farms using questionnaires to obtain data about average age at first breeding, age at first calving, average number of lactations, number of services per conception, costs per heifer until calving. It was established that at one of farms only, age at first breeding was 16 months whereas at others it varied from 17.1 to 18.9 months. According to the data, the earlier calving (25.3 months of age) was economically justified from the point of view of longer production life (4.9 lactations) as opposed to heifers which calved after 26 months of age and whose mean production life was from 3 to 3.8 lactations. Age at first calving influenced also reproduction traits as cows calving after the 26th month exhibited higher number of services per conception from 2.7 to 3.7 vs. heifers giving birth up to the 25th month with 2.1 services per conception on the average. At the farm when heifers were bred at youngest age (16 months), the lowest cost was registered (1927 BGN) whereas at the farm when heifers were bred at 18.9 months of age, the expenses made by farmers per animal were the highest (2375 BGN).

Introduction

The intensive rearing of heifers and possibilities for their early breeding becomes an increasingly important issue as the time between their births to the first calving is a period during which no revenues

are generated, but only expenses for feed, housing and veterinary services (Meyer *et al.*, 2004). Operating costs for replacement heifers amount to 15-20% of all costs related to cow milk production at farms (Heinrichs, 1993; Aielli, 1993). In order to reduce these

costs, early breeding of heifers even at first oestrus is often practiced – after the body weight attains 340 kg in Holsteins or 240 kg in Jerseys (Holter, 1976). Heifers are expected to reach this body weight for 12–13 months but when reared on pastures, this could not be realised and the time is extended by several months, particularly when the sward composition is not proportional (Todorov, 2009). The main tendency for the early calving practice is that it results in rapid genetic progress in dairy cattle husbandry and higher cost effectiveness of cow milk production, especially if bull breeders with genetic potential for high yields are used (Fricke, 1997; Pirlo *et al.*, 2000). An additional prerequisite for rapid genetic progress is the artificial insemination with sexed semen, which is justified by higher conception rates (Pursley *et al.*, 1997b). It should be also considered that artificially inseminated heifers give more often birth to female calves thus assisting the genetic progress at farms (Fricke, 2004).

The average age at first calving at dairy cattle farms in the USA during the 1980s was 30 months, varying from 22 to 44 months (Holter, 1976). Milk producers, practicing early breeding and calving, reported better reproduction traits, with better synchronised oestruses and shorter calving intervals (Holter, 1976). The overall number of inseminations in the different categories of heifers was, according to the author, unchanged and despite the slightly higher culling rate in early inseminated animals which was insignificant and did not influence the farm revenue. In support of this statement, the author outlined the production life of early calved heifers which was not changed as compared to cows bred at a later age and which, combined with lower rearing costs, resulted in similar profitability rates.

Roy (1976) demonstrated that the decrease of calving age from 36 to 24 months led to decreased number of replacement cows by 33%, whereas farm profitability increased by 20%. The author recommended calving Holstein heifers at 500 kg live weight as the earlier breeding and correspondingly lower body weight would have a negative impact on first lactation milk yields. According to Bayram *et al.* (2009) early calving of Holstein heifers results in lower first lactation milk yields which is compensated by increased lifetime milk yields. The authors observed that delayed first calving resulted in significant reduction of milk yields and milk fat content until the third lactation. On the other hand, Gergovska (2011) showed that heifers calved between 27 and 30 months of age had the highest milk yields, milk fat content and lactation peak as opposed to those calved before and after that age. Cooke *et al.* (2013) demonstrated that early calved heifers (< 26 months) spent more than 44% of their life until the 5th year producing milk, whereas if calved after that age, had a production life between 18 and 40%. There was a positive relationship between early calving and milk yield, milk fat and milk protein contents (Moore *et al.*, 1991; Gergovska and Yordanova, 2011). This, in the belief of authors, is an additional source for better income which should not be underestimated. The purpose of the present study was to determine the effect of age at first breeding and age at first calving of Holstein heifers on some economic traits at Bulgarian dairy cattle farms.

Materials and Methods

The present study was conducted in 818 heifers from 7 dairy cattle farms. At each farm, survey among farmers using questionnaires was performed aimed at obtaining data about average age at first

breeding (months), age at first calving (month), average number of lactations, and number of services per conception. The questionnaires also collected information for expenses constituting costs per heifer from its birth until calving in BGN by age periods as followed: 0–3; 3–6; 7–14; 15–24 months of age. Data were analysed by STATISTICA software, version 6, Serie: 0802-6 For Windows, 2002.

Results and Discussion

Economic efficiency of dairy cattle husbandry depends on the timely and proper utilisation of biological fixed assets, namely cows (Genchev and Angelova, 1984). With this regard, the replacement heifer programme is particularly important, and its primary goal is to breed these animals at an early age with optimal body weight to achieve easy calving with minimum investments (Fricke, 2004).

The world cattle farming practice has adopted first breeding of heifers at 15-18 months of age with calving between 24.5-27.5 months as a model with optimum economic profit.

Our results with respect to age at first breeding, age at first calving, production life, number of inseminations and costs per heifer are listed in Table 1.

The data show that age at first calving ranged from 16 months (farm A) to 18.9 months (farm B). At all farms expect for farms B and C, breeding was compliant with established global norms. Farms could be classified in a similar way with respect to calving age. Only farm B where cows calved for the first time at 28.1 months could be distinguished from the general tendency. Age at first calving – AFC, is an extremely important economic parameter determining

the profit of cow milk production. According to a number of studies (Fricke, 2004; Bailey and Currin, 2009) the cost of one heifer in the USA varies from \$ 1200 to 1300 (US), and each additional month until calving adds \$ 50 per cow. In Europe, Pirlo (1997) established that costs for heifers calved at 24, 26, 28 and 30 months of age were \$ 2062, \$ 2164, \$ 2290 and \$ 2411, respectively. This trend was supported by the present study, which shows clearly that costs increased proportionally to age at first calving. Costs for heifers in surveyed farms in our study, calculated in US dollars (\$1=1.40 BGN) showed that farmers spent from \$ 1376.4 (farm A) to \$ 1696.4 (farm B). From economic point of view, our results agree with those of Pirlo (1997), and confirmed that delay in age at first calving was not justified as it generated more expenses and respectively, increased the cost per animal. The analysis of results from Table 1 showed that a substantial part of costs incurred by cow milk producers was the non-productive life of heifers. It was established that the practice of earlier calving at farm A resulted in average number of 4.9 lactations, thus these animals could generate more income from produced milk. An additional source of income at the farm is the higher number of offspring to be used either for herd replacement or for sale (Salisbury and van Denmark, 1961). This tendency for additional returns from higher number of newborn calves was also confirmed in sheep by Bonev and Kostadinova (2011). Fricke (2003, 2004) proved that the delay in age at first calving in heifers generated additional costs from higher culling rate, dystocia, and metabolic disturbances. According to the author, the optimum age at first calving of heifers was 24 months. According to Thompson *et al.* (1983), when age at first calving falls below 22 months of age, the incidence of difficult calvings becomes higher, this made the

researchers recommend this age as biological threshold for cattle. In Italy (Pirlo *et al.*, 2000) cattle farmers preferred later calving of heifers as they believed that early calving would have a negative impact on milk yields and lifespan. The quota system regulating cow milk production in the EC could be another reason demotivating farmers to raise more dairy cows at farms (Pirlo *et al.*, 2000). The worries of farmers about early calving of heifers are confirmed by studies (Simerl *et al.*, 1992; Thompson *et al.*, 1983) reporting that cases of difficult calving result in lower milk yield and in general, with impaired reproduction potential (Erb *et al.*, 1985; Simerl *et al.*, 1992; Thompson *et al.*, 1983).

It should be taken into consideration that the delayed breeding of heifers has negative economic consequences for farmers. A part of obligatory costs are related to biological needs of animals, namely the necessary amounts of milk for normal development during the first months of calves' life, followed by roughages needed for proper development of their digestive system. Meeting the biological needs of animals is essential for the optimum economic results through early breeding and early calving. Data reported by Cooke *et al.* (2013) show that early breeding and calving at an age < 26 months require adequate feeding until 15 months of age and average weight gain over 0.75 kg. The authors believe that the feed costs during that period were fully justified as they reduce the non-productive life of cows and generate faster revenues. With this regard, our results indicated non-reasonable use of possibilities for more rapid generation of income from animals. Data presented by Gergovska (2009, 2011) demonstrate that the first calving in about 34% of Black-and-White cows in Bulgaria occurs relatively late – at 27-30 months of age. Panayotova *et al.* (1997) and Popova (2003) outlined that the practice of relatively late breeding of

heifers in Bulgaria (at 16–18 months of age) was mainly a result of inadequate feeding. The authors suggest that the lower age limit for breeding Holsteins could be 1 months of age. This was confirmed also by Fricke (2004) stating that the most important thing for Holstein heifers is the adequate body weight (550–650 lbs) at first breeding.

The data of the present study demonstrates that feed costs, being among the most important expenses, varied considerably among farms. Its price depends on whether it is purchased from crop producers or was produced at the farm, as well as on climatic features and soil fertility in the region. Other significant differences were observed with respect to electric energy and fuel costs, which depended on the farm capacity and energy efficiency of the adopted production system.

It should be emphasised that farm A, where the age at first breeding, respectively age at first calving were the lowest, incurred the lowest costs per heifer – 1927 BGN as compared to the other farms. Earlier calving generated fewer costs for the farmer and also, increased the productive life of the cow. Productive life and revenues from milk produced by replacement heifers as stated by Head (1992) were the highest if they calved first between 23 and 25 months of age. In our study, only heifers at farm A fell within this age range, indicating an optimum utilisation of the biological potential of animals. That is why, it could be logically assumed that surveyed farms expect for farm A, did not extract maximum profit from milk production. This could be corrected through improved nutrition for faster attainment of desired body weight so that heifers could calve at 23–24 months of age, outlined by Pirlo *et al.* (2000) as being the biologically optimum age for obtaining maximum income from dairy cattle farming.

Table.1 Age at first breeding and calving of heifers and cost per heifer until calving

| № | Farms | Number of subjects | Age at first breeding (months) | Age at first calving (months) | Average number of lactations | Average number of services per conception | Cost per heifer until calving (BGN) |
|------------------------------|--------------|---------------------------|---------------------------------------|--------------------------------------|-------------------------------------|--|--|
| 1 | A | 88 | 16.0 | 25.3 | 4.9 | 2.1 | 1927 |
| 2 | B | 62 | 18.9 | 28.1 | 3.1 | 3.7 | 2375 |
| 3 | C | 60 | 18.2 | 27.3 | 3.2 | 3.2 | 2288 |
| 4 | D | 346 | 17.1 | 26.7 | 3.3 | 3.0 | 1988 |
| 5 | E | 137 | 17.1 | 26.3 | 3.8 | 2.7 | 2137 |
| 6 | F | 53 | 17.3 | 26.8 | 3.0 | 3.7 | 2002 |
| 7 | G | 72 | 17.4 | 26.6 | 3.5 | 2.8 | 2104 |
| Average for all farms | | 818 | 17.2 | 26.6 | 3.5 | 3.0 | 2117 |

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