

Analysis of productivity indicators in dairy farms

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Abstract: *Analysis of productivity indicators in dairy farms.* The aim of the paper was to analyse the relation of milk yield per cow with a set of production factors on sample data from six dairy farms located in the central region of Poland. The farms, which were the subject of the study, carried out an intensive production, achieving milk yield over the national average. The research showed an increase in milk yield with increasing number of cows in the herd, which, in practice, can lead to increased loads in milking installations in farms keeping more cows.

Key words: farm, milk, area, productivity

INTRODUCTION

Dairy production is one of the key lines of action in the food economy. It is a result of the value, which milk has in the human diet, being a valuable source of protein.

Dairy production is one of the major sources of income for a large number of farms in Poland. However, in the face of changing production conditions, it is necessary to optimise milk obtaining technology on a current basis to reduce costs, increase production efficiency and, at the same time, meet the high quality requirements of raw dairy material.

Improving dairy production is associated with the systematic evaluation of the related technologies and technical equipment [Gaworski and Boćkowski 2012]

as well as of biological production potential expressed as milk yield per cow. Milk yield per cow is an important factor determining the efficiency of milking installations [Gaworski and Leola 2014], including milking robots [Hyde and Engel 2002, Rotz et al. 2003], as well as the efficiency of milk production, therefore it requires a specific analytical approach. In addition, milk yield per cow together with herd size are important factors in increasing revenues from milk production in farms engaged in milk production [Ziętara 2007] and profitability of milk production [Skarżyńska 2012].

The aim of the paper was to analyse the relation of milk yield per cow with a set of production factors on sample data from six dairy farms located in the central region of Poland.

MATERIAL AND METHODS

Six farms specialising in milk production, located in the Łódzkie Voivodeship, were chosen for detailed studies of productivity indicators. The farms were characterised by different breed of cows kept, different number of cows in the herd (from 24 to 118 bovine animals), structure of the herd (share of individual groups of animals), milk yield per cow,

agricultural area and pastures as well as structure of crops and other properties.

In the selected farms, the AT4 utility value assessment was done. Trial milking was done once a day, alternately, in one month in the morning, in another in the evening. Milking in the farms was done each 12 hours, that is, at 6 AM and 6 PM. 12 trial milkings were done over the year. The result of the reported amount of milk from each cow was calculated, by multiplying kilograms of milk from one milking by two.

The milk recording results concerned accurate measurement of quantity of milk from each cow rounded to the nearest 0.1 kg with an electronic milkmeter. In order to analyse the quality of milk further, an individual representative sample for each cow was taken and examined in a specialised laboratory. In the laboratory chemical composition as well as content of bacteria and of somatic cells were determined, in accordance with the guidelines of the ISO Standards.

Information on the amount of milk obtained was recorded in a separate document titled “List of the evaluated cows”

(“Wykaz Krów Ocenianych” – WKO). In this document, in addition to milk yield, the information on inclusion or exclusion of animals from/to herd, calvings, dry cows, etc., were recorded. The entries to the WKO were made based on the event log (WZ) filled in by the farmer.

The information obtained during the milk recording carried out in farms specialising in milk production, was collected, processed and shared via the SYMLEK information system.

RESULTS AND DISCUSSION

Figure 1 shows changes in milk yield per cow in the analysed group of farms depending on number of animals in herd, taking into account the data from 2014.

Summary of the data (Fig. 1) indicates a trend of increased milk yield per cow with increasing number of cows in the herd. Coefficient of determination (r^2), which is about 0.5, however, shows relatively low level of the (polynomial) curve fitting to milk yield data from the farms in question. Therefore, in the next

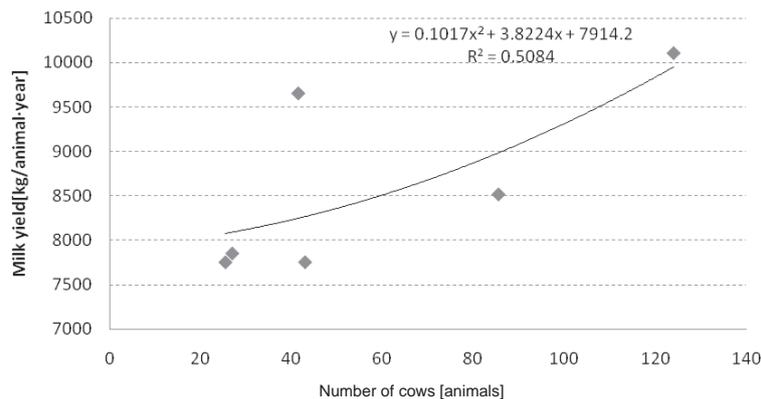


FIGURE 1. Changes in milk yield per cow in the analysed group of farms depending on number of animals in herd, taking into account the data from 2014
Source: Author's elaboration.

stage, a summary of milk yields per cow for three consecutive years (2012–2014) for the analysed farms was provided in order to check, on their basis, the development of the coefficient of determination for a larger set of data. The results are shown in Figure 2.

which, if appropriate forms of nutrition are used, determines the growth of milk yield and differences between farms.

At the same time, the studies found that a growing number of dairy cattle in the herd was accompanied by higher share of pastures in agricultural areas in

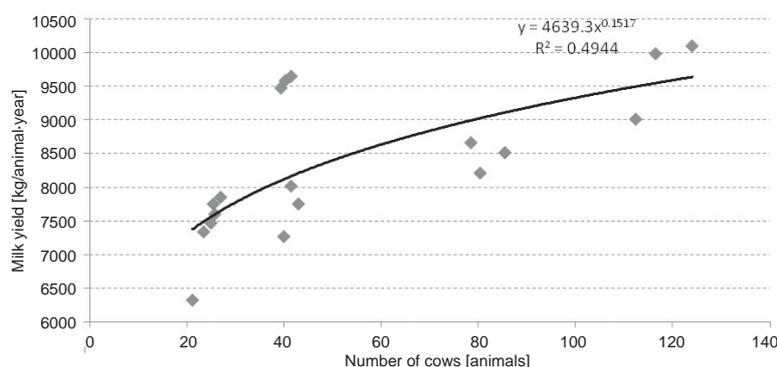


FIGURE 2. Changes in milk yield per cow in the examined group of farms depending on number of animals in herd based on the data from the period 2012–2014

Source: Author’s elaboration.

Results showing the course of changes in milk yield per cow in the examined group of farms depending on number of animals in a herd based on the data from the period 2012–2014 show the change (exponential) curve fitting with a slightly lower value of the coefficient of determination. In order to check the degree of curve fitting, the data from the farm 3 were removed from the farm 3, which resulted in an increase in the r^2 coefficient up to approximately 0.85 (Fig. 2).

The discussed course of changes of milk yield per cow with the increase in number of animals in herd shows considerable polarisation of milk yield in the analysed group of farms. This polarisation may be a result of keeping dairy cattle with different genetic potential,

the farms (Fig. 4). In his study Wilczyński [2012] also found a relation between the quantity of forage from pasture and herd size. In his experiment he noted even twice as big percentage of pastures in the structure of agricultural areas in farms keeping large herds of cattle.

A characteristic feature of the dependence of area of roughage crops and number of cows in the herds in the analysed farms was high coefficient of determination (r^2), which for a linear curve is less than 0.97.

Considering the area of roughage crops, this value was compared to number of animals in the analysed farms, expressed as livestock units (LU), as shown in Figure 5.

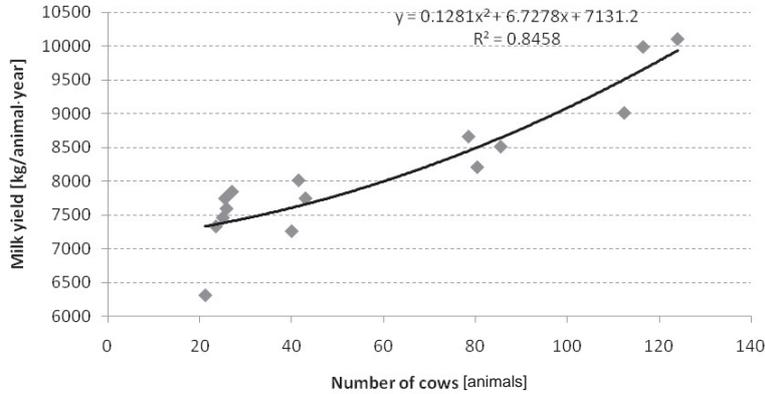


FIGURE 3. Changes in milk yield per cow in the examined group of farms without farm 3 depending on number of animals in herd
Source: Author's elaboration.

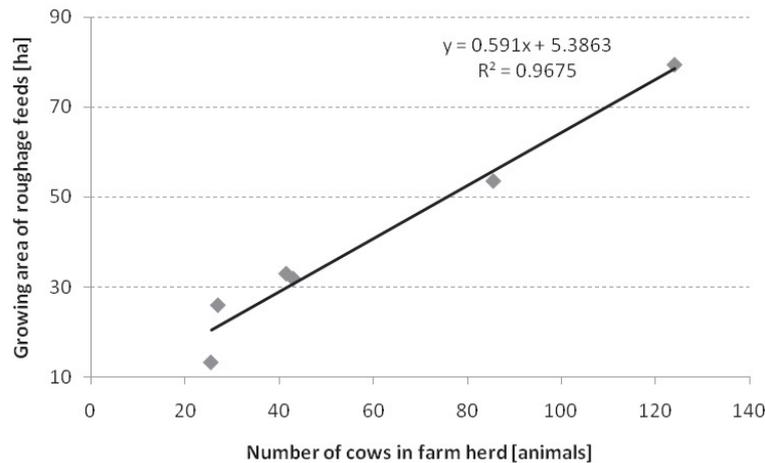


FIGURE 4. Changes in the area of the roughage crops with the increase in number of cows in the herd on the example of the analysed farms
Source: Author's elaboration.

Figure 6 shows a relation of milk yield per cow with the area of roughage crops in the analysed farms.

The comparison of milk yield per cow in the analysed farms by breed of animals in the herd is shown in Figure 7.

The h-f cows are characterised by the highest milk yield among the analysed breeds. Gnyp et al. [2006] described the

h-f breed as eminently milky type of use, where milk yield can come to 16,000 kg per year.

Mańko [2007] in his study found that increase of milk yield contributes to reduction of the unit production cost, which optimises cost of own labour and is reflected in the revenues of farms.

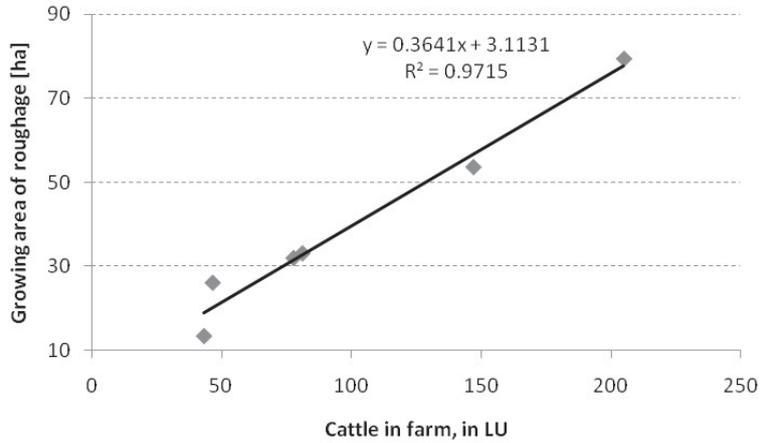


FIGURE 5. Changes in the area of the roughage crops with the increase in number of cows in the analysed farms
Source: Author's elaboration.

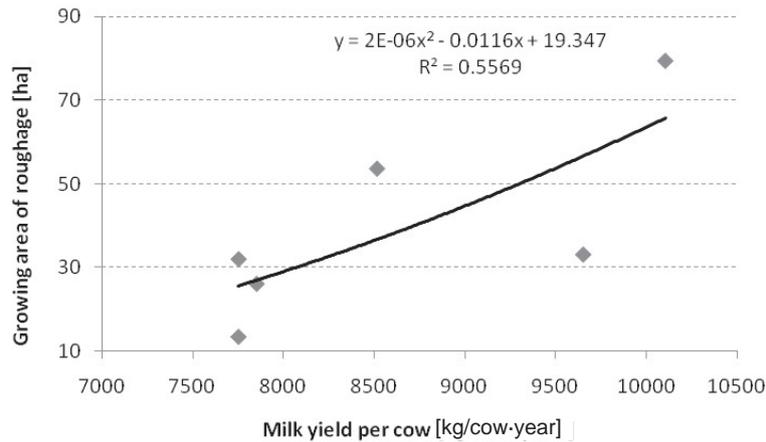


FIGURE 6. Changes in the area of the roughage crops with the increase in number of cows in the analysed farms
Source: Author's elaboration.

Based on the data from the analysed farms, we can state that growth of livestock density (in LU/100 ha of agricultural area) was accompanied by an increase in milk yield per cow (Fig. 8) and the coefficient of determination was $r^2 = 0.41$.

The presented changes show the different levels of relations between milk

yield per cow and production factors in the analysed farms. At the same time, it is worth mentioning that milk yield per cow is a characteristic, which differentiates the herds not only in terms of individual farms, but also in terms of countries, which has an impact on milk productivity rating in various regions of Europe [Fernandes et al. 2014].

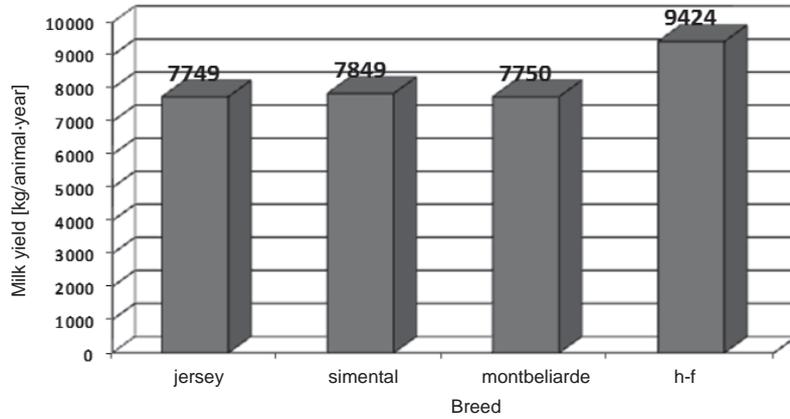


FIGURE 7. The comparison of milk yield per cow in the analysed farms by breed of animals in the herd
Source: Author’s elaboration.

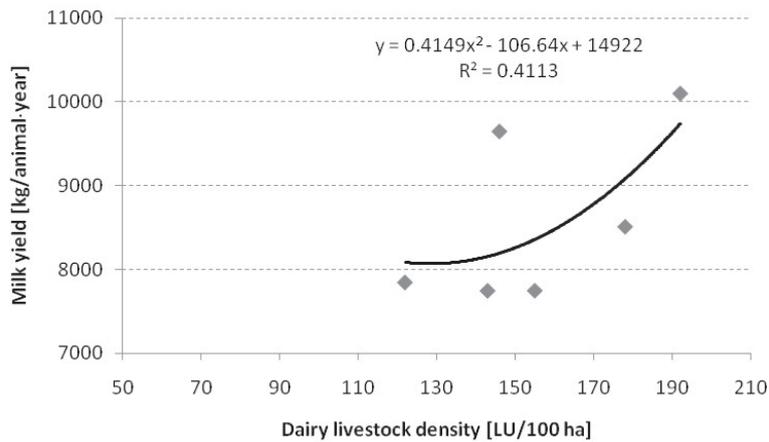


FIGURE 8. Relation of dairy livestock density with milk yield per animal in the analysed farms
Source: Author’s elaboration.

CONCLUSIONS

Based on the results of the research, it was confirmed that increased productivity is not only an effect of a single factor, but a set of factors.

In the study, it was found that the larger the herd the higher is the share of

feeds from pastures in the structure of the agricultural area of the farm.

The farms, which were the subject of the study, carried out an intensive production, achieving milk yield over the national average. This is an important aspect resulting in reduction in unit cost of production in the farm.

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Streszczenie: *Analiza wskaźników wydajności produkcji w gospodarstwach mlecznych.* Celem pracy była analiza powiązań między wydajnością mleczną krów a zbiorem czynników produkcyjnych na przykładzie danych pochodzących z sześciu gospodarstw mlecznych położonych w centralnej części Polski. Gospodarstwa będące przedmiotem badań prowadziły intensywną produkcję uzyskując wydajność mleczną powyżej średniej krajowej. Na podstawie badań wskazano na wzrost wydajności mlecznej wraz ze zwiększaniem liczby krów w stadzie, co w praktyce może wpływać na wzrost obciążeń instalacji udojowych w gospodarstwach z większą liczbą krów.

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