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Original Contribution

LABOUR PRODUCTIVITY OF DAIRY CATTLE FARMING IN CENTRAL AND SOUTHEAST BULGARIA

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ABSTRACT

A study was conducted on labour productivity in dairy cattle farms that breed Black-and-White cows. The study encompassed 90 farms, thus including 6471 cows. The farms were divided into four groups: small – 8 farms with an average of 3.6 cows; medium – 32 farms with an average of 22.9 cows; large – 32 farms with an average of 74.2 cows; and huge – 18 farms with 185.3 cows per farms.

The results of the study indicated that large and huge farms are distinguished by high labour productivity. The income from production, profit, milk quantities, and the cost of one annual work unit (AWU) and a man-hour were several times higher compared to small and medium farms. Production was organised at a much better technological level, which was a contributing factor towards high-quality and competitive milk production. A recommendation to the small and medium farms would be to grow larger, improve their selection, and develop technologically.

Key words: productiveness, work rate, AWU, income, man-hours, cost, milk.

INTRODUCTION

Labour productivity is one of the most important economic parameters. It defines the efficiency of using human labour in terms of the results of its activity in the venture. Increasing labour productivity also increases the volume of produce, expands the scale of production, reduces costs and improves cost-efficiency (Hristova, 2020) (1).

According to data by money.bg (2) (2019) persons employed in production in Bulgaria were 3633.3 thousand people, and the total number of work hours was 1518.9 million. The structure of employment per economic sectors indicates an increase in the relative share of the industrial and service sectors. Each employed person accounts for BGN 8011.8 of the Gross Domestic Product (GDP), with every worker creating, in average, BGN 19.2 GDP per work hour. The lowest labour productivity could be observed in the agricultural sector – BGN 1469.8 gross value-added (GVA) per worker and respectively, BGN 3.6 per work hour. Even though GDP in Bulgaria has increased from BGN 4874.4 per worker, which, in 2019, was 39.2% more than in 2014, and 37.5% higher per man-hour, this parameter remained mostly unchanged in agriculture, and the value of a man-hour dropped from 3.7 to 3.6 Euro.

Similar findings were established by Stefanov (3) (2010) and Bogdanov (4) (2019).

Bashev (5) (2016) and Bashev et al (6) (2018) believed that the goal of increasing labour productivity in agriculture was to achieve an economic effect, but also greater sustainability in its development and to guarantee food supply.

Dairy cattle breeding have the highest relative share in the formation of GDP and GVA in animal husbandry. This is supported by the facts published by a number of authors (Dimitrov (7), 2012; Stankov et al (8), 2013; Faostat (9), 2008; Farmer (10), 2012, etc.).

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The goal of the present study is to establish the labour productivity at dairy farms that raise Black-and-White cows, as well as the effect of the farm size on said productivity.

MATERIAL AND METHODS

The growth of production as a result of completed work and the rise of work salaries can be traced through labour productivity. The reporting period was 1 year: per an annual work unit (AWU) and per man-hour.

In order to calculate labour productivity, it is necessary to define measurement units, which are: number of employed workers and number of completed work hours.

The number of workers includes owners, workers hired on primary labour contract, workers hired per programmes, etc.

The number of work hours includes real completed hours.

The number of workers in our study was determined on the grounds of data presented in survey cards.

According to the EU's definition, one AWU is equal to the completed work hours by a single worker for the full worktime, as is typical for the country, excluding absent days due to paid leave, illness, or official holidays throughout the year.

It is accepted in Bulgaria that one AWU equals 232 man-days of 8 hours each, or 1856 man-hours in a year. In case a person has worked more or less than 1856 man-hours, their labour is calculated as a percentage of one AWU.

In our study, the workdays were determined per the factual data provided by the farmers. For all farms, the average number of days per employee was higher than the country's average norm of 232 man-days, and was, in average for the farms, 300 man-days. With regard to man-hours, we have accepted that a normal work day lasts 8 hours, as workers often work unregulated work days, very different for the farms defined in terms of their sizes.

Calculating labour productivity included the following methods:

Natural method. This method calculates actual produce volume per worker, or by one person from the firm's roster.

Ptn = Qn / t.

Qn – volume of actual produce

T – production time

Value method. With this method, we use the BGN value of the produce instead of its natural measure (litre, kilogram, etc.).

In our study, we decided to evaluate labour productivity per the value method.

Ptn = Qn / t

Qn – produce volume as value (income, remuneration fund, profit).

T – production time (AWU and man-hours).

(www.uctm.edu/departments/economic/bg)

The study encompassed 90 cattle farms with a total of 6471 cows, divided into four groups in accordance with their size:

- small - 8 farms, with an average number of 3,6 cows
- medium - 32 farms, with an average number of 22,9 cows
- large – 32 farms, with an average number of 74,2 cows
- huge – 18 farms, with an average number of 185,3 cows

RESULTS AND DISCUSSION

A dairy cattle breeding in Bulgaria is notable for its large-scale fragmentation and lowest milk yield per lactation in the entire European Union. Our studies indicated that farm size had a significant impact on labour productivity.

It is apparent from the data in **Table 1** that, in the larger farms, which predominantly use modern technologies in production, the workload of an average worker is significantly higher. Even though the personnel roster of large and huge farms included, alongside the owners, in part or in whole, specialists – zoo engineers and veterinary physicians, while production at medium and small farms is entirely conducted by the farmers, the number of cows per full-time worker was significantly greater. The average number of cows per a worker at a huge farm was 2.1 times greater than the number at average farms, and 1.3 times greater than at large farms. Workers at larger farms are offered better opportunities to use days off and paid leave, whereas workload is nearly whole year-long at small and medium farms. Economic data indicated that the realised income and profits from production were several times higher.

Table 1. *Parameters determining labour productivity depending on the farm's size*

Farm types	Number of farms	Average number of cows per farm	Average number of workers per farm	Total workers	Cows per worker	Total income	Total remuneration fund	Total profit	Work days	Total AWU	Total man-hours
Small	8	3.6	0.2	1.6	-	61 894.7	-	16 576.7	365	584.0	4 672.0
Medium	32	22.9	1.2	38.3	19.1	2 299 944.0	303 121.2	870 201.6	314	12 026.2	96 209.6
Large	32	74.2	2.5	80.0	29.7	8 522 660.0	1 705 006.8	3 481 233.6	302	24 160.0	193 280.0
Huge	18	185.3	4.7	84.6	39.4	13 711 960.8	2 395 915.2	5 830 994.4	281	23 772.6	190 180.8
Total for all farms	90	71.9	2.3	71.5 *204.5	30.1	25 055 712.0	4 294 802.7	10 452 606.0	300	61 350.0	490 800.0

*****Average number of workers and total number of workers at the examined farms.

The most accurate data determining labour productivity were realised income and profit per annual work unit (AWU) and one man-hour **(Table 2).**

Table 2. *Labour productivity in BGN*

Farms	**Income**		**Remuneration fund**		**Profits**		**Annual milk production per worker in kg.**
	per 1 AWU	**per man-hour**	**per 1 AWU**	**per man-hour**	**per 1 AWU**	**per man-hour**	
Small	106.0	13.2	-	-	28.4	3.5	55281
Medium	190.7	23.8	25.2	3.15	72.2	9.0	85795
Large	352.8	44.1	70.6	8.82	144.1	18.0	152173
Huge	576.8	72.1	100.8	12.60	245.3	30.7	231548
Average for all	408.4	51.1	70.0	8.75	170.4	21.3	175081

Our results definitively proved higher labour productivity in huge farms with capacities over 100 cows. Income per 1 AWU, and respectively 1 man-hour, were 3 times higher than for medium, and 1.6 for large farms. With regard to profit, the difference between huge farms and the rest was even more notable. Huge farms exhibited 8.6 times higher profit per one AWU and per man-hour than small, 2.4 times more than medium and 1.7 times more than large farms. Labour expenditure is higher, but the effect on production was also considerably higher.

The expenses for the realised income per 1 AWU are presented in a more apparent way in **Figure 1.**

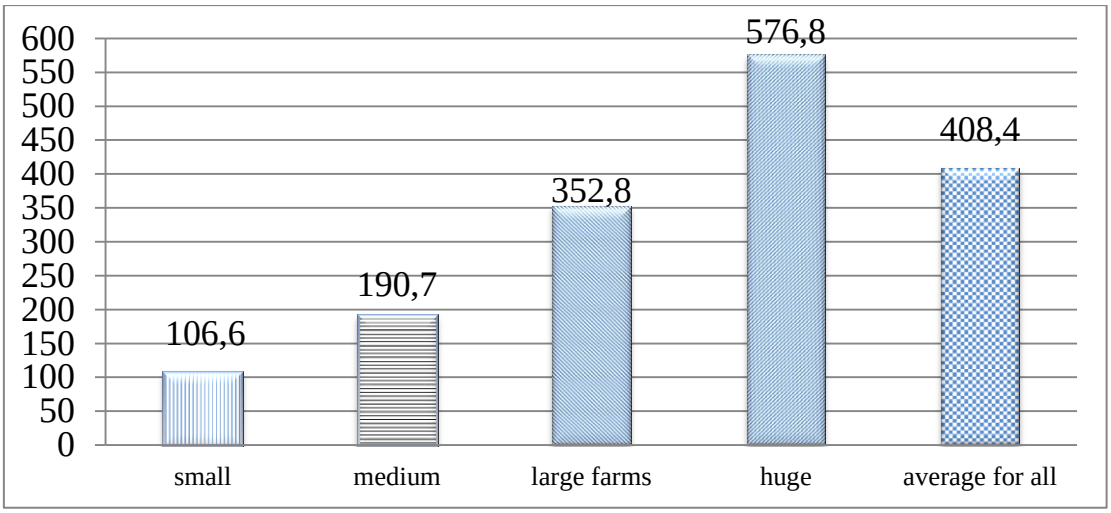

Figure 1. Income per 1 AWU

The most accurate measurements of labour productivity were the actual products of the production activities, and the values of a day and an hour. For the examined dairy cattle farms, we calculated them per 1 AWU and per man-hour.

Table 3. *Quantity and cost of milk per 1 AWU and per 1 man-hour*

Farms	Milk amount per 1 AWU in kg.	Average selling price - BGN	Value of 1 AWU in BGN	Milk amount per 1 man-hour in kg.	Value of milk per 1 man-hour in BGN
Small	151.5	0.60	90.90	18.90	11.34
Medium	273.2	0.60	163.92	34.15	20.49
Large	503.9	0.60	302.34	62.98	37.78
Huge	824.0	0.60	494.40	103.00	61.80
Average for all	583.6	0.60	350.16	72.95	43.77

The data from **Table 3**, and **Figures 2 and 3** convincingly indicated that a larger farm size meant an increase in the amount of the milk yield and its value per AWU and per man-hour. Huge farms with more than 100 cows were superior to all others as follows: small by 5.4 times, medium by 3 times, and large by 1.6 times. The total average for all studied farms indicated relatively good values per one AWU and per man-hour, which were higher than the established average values for these parameters in Bulgaria. This was due to the better technological equipment of the farms, the more wholesome and balanced feeding of the cows, high level of selection and smoother organization of the work process. All large and huge farms are first category and compliant with the requirements of the EU. Modernisation of production in them was conducted with funds from the SAPARD programme.

The organisation of labour at the studied farms of Central and Southeast Bulgaria was different and directly dependent on the farm size.

Small farms raise their animals individually or in mixed herds together with other owners. Most of the main activities are conducted manually. All farms included into the study were of the third category, as they did not meet the requirements for buildings, healthcare measures, and raw milk quality. They produced milk for their own needs and for direct sales, but not for delivery to milk processing plants. Considering the high share of farms with 1 to 9 dairy cows, the Ministry of Agriculture and Food's policy throughout

the new programme period of 2014 – 2020 would be oriented towards farm consolidation, increasing average milk yield through artificial insemination by high-yield bulls, improving the milk's quality, and increasing the relative share of direct sales, especially for milk produced in mountainous and underprivileged regions. One of the forms of consolidating farms that we could recommend is forming cooperatives of smaller farms, though the organisational form for building up associations and groups of producers accepted in Bulgaria. The cows of these farms are primarily raised under pasture conditions.

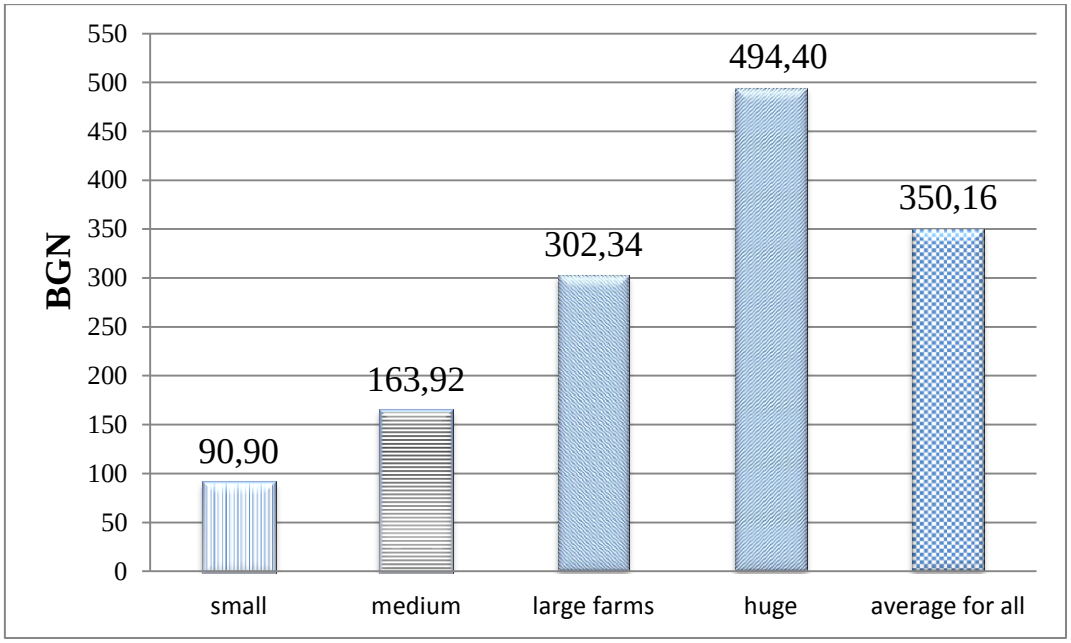

Figure 2. Cost of milk per 1 AWU

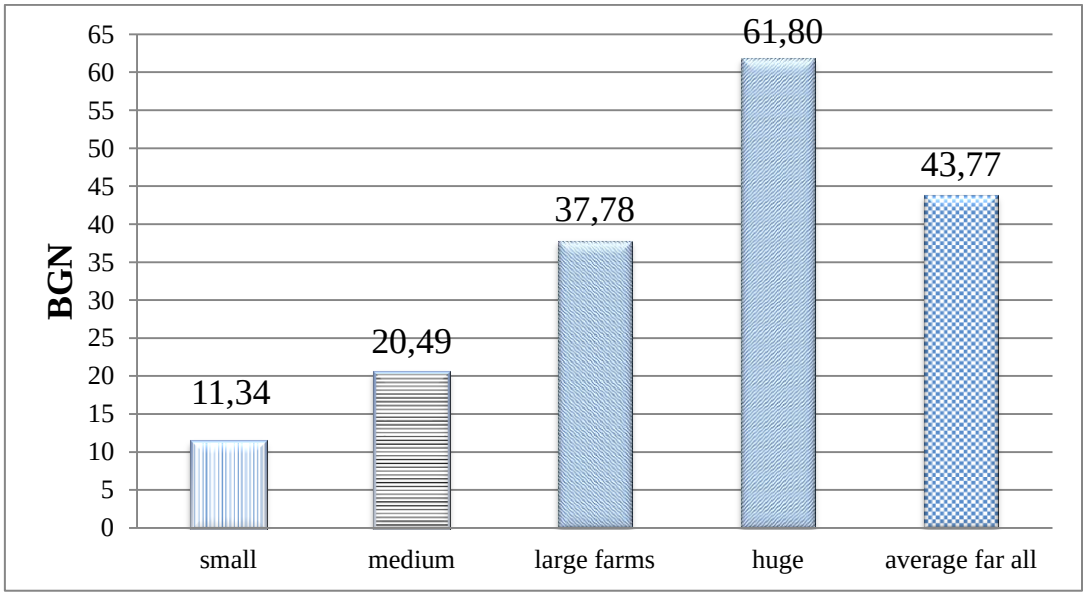

Figure 3. Cost of milk per 1 man-hour

At the medium farms, production processes were conducted by the farmers and their families. In a small part of the farms with more than 30 cows, they would hire an additional worker for the milking, as a shepherd or a fodder distributor. Veterinary services are based on contracts with private veterinarians. The farms were of second and first category, meaning that the milk could be delivered to milk processing plants, alongside direct sales. The second category farms met the general zoo hygienic requirements, but have not yet fully covered the requirements for the quality of raw milk. This group of farms uses both forms of raising – in a barn and on a pasture. The cows at farms that also raise crops are kept in barns.

In the large, and especially in the huge farms, the owners predominantly served in a managerial capacity. Most of the farms had mixed produce – horticulture and animal husbandry. The biggest farms were managed by zoo engineer specialists, and veterinary services were provided by hired full-time veterinarians, or by private practitioners on contract for the farms with fewer than 150 cows. The main production activities were carried out by hired employees – milking workers, fodder distributors, young animal caretakers, and guards. All large and huge farms included into this study were of the first category, which means they met all zoohygienic requirements for healthcare measures, humane treatment of the animals, and raw milk quality. The produced milk was primarily intended for delivery to milk processing plants, and the ready produce was exported to countries of the EU and other parts of the world. All production processes were mechanised, the cows were kept in barns, and selection was very strict.

CONCLUSION

The results of our study indicated that large and huge farms were distinguished by higher labour productivity. The income from production, profit, milk quantity, and the value of one AWU and a man-hour were several times higher than what was observed at small and medium farms. Production was organised on a very good technological level, which was a real prerequisite for high-quality and competitive milk production. Consolidation would be recommendable to small and medium farms, as well as improving selection, and technological development.

The volumes of natural and value parameters, and therefore of labour productivity, could be increased by including farmers into groups of producers and unifying their material resources.

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