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THE FINANCIAL INDICATORS OF TMR MONITORING ON DAIRY FARMS IN HUNGARY, AS PART OF QUALITY ASSURANCE TOOLS

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Abstract: The TMR (total mixed ration) technology is one of the most sufficient feeding methods on the dairy farms. From a quality assurance and technological point of view, regular TMR testing is of paramount importance to reduce the risk and extent of milk production losses and animal health problems. The goal was to find out how popular the TMR monitoring in Hungary is, and find out, how much it may cost for a dairy farm in a year. In the course of our investigations, we assessed the economic indicators of TMR samples received by the NIR Forage Laboratory of Livestock Performance Testing Ltd. between 2013 and 2021, especially the distribution and size of costs per farm and per cow. Our aim was to be able to draw conclusions about the application rates, the total and relative costs of TMR analyses according to the farm size. The proportion of farms requesting TMR examinations was higher for farms with a larger number of animals (501-1000 cows inspected). Within the category, the highest TMR sample submission rate was found for the farms with 501-600 and 801-1000 cows inspected. The average monthly total TMR laboratory cost per site was extremely low in the period of 2013-2021 (HUF 3,000-10,000 /month/farm) compared to the risk and potential loss. The relative TMR cost of farms with more than 701 cows inspected was rather low (HUF 6-9 / inspected cow / month) in terms of screening for technological errors, risk of loss and quality assurance. This indicates that there is great potential for quality assurance in TMR studies at sites and that this potential is not currently being exploited.

Keywords: TMR testing, forage analytics, self control, financial indicator, quality assurance

1. Introduction

Many studies consider the total mixed ration (TMR) was the most significant advance in the worldwide dairy business in the previous 50 years [1]. It is a full diet that is prepared on a regular basis by dairy producers and originated in California in the early 1970s [2]. TMR is fed to a dairy cow to help it perform at its best [3][4][6]. The role of ruminal fermentation in dairy cow milk production has been discovered via research in dairy science. The goal is to provide the optimum possible ruminal environment for bacteria growth by combining particular nutritional amounts in the diet. The totally mixed rations (TMR) strategy addresses this demand by mixing all of the feed together and making it available for 20-22 hours a day, but several issues remain. There have been several reports of differences between theoretical and prepared TMR and successfully absorbed TMR by cows. This is accomplished by always delivering a nutritionally balanced diet, allowing cows to ingest as close to their real energy and nutrient requirements as possible while preserving the physical characteristics essential for optimum rumen function, which we now refer to as feed particle size. In order to achieve the best performance from cows good feeding management practices should be followed [7][8][9]. Examination of TMR samples would be useful in making a number of seemingly incomprehensible and 'unseen' anomalies

'visible'. Monitoring of TMR is extremely important to get a realistic picture of the composition of the mixture actually consumed by the cow, to shed light on measurement, mixing and technical problems (inaccurate measurement, inhomogeneity), to compare the measured values directly with the concentrations for a specific batch in the feed ration program (which will not be the same if the basic data are not based on specific measurement results) that may indicate intentional or negligent damage, and last, but not least, to shed light on the degree of variability / variance in the feed base and feeding system of the farm [7]. It is clear, that self-control in the aspect of TMR monitoring is cardinal. From a quality assurance and technological point of view, regular TMR testing is of paramount importance to reduce the risk and extent of milk production losses and animal health problems. This can be done by using NIR technology [8][9][10]. In this study, the goal was to find out how popular the TMR monitoring in Hungary is, and find out, how much it may cost a dairy farm. In the course of our investigations, we assessed the economic indicators of TMR samples received by the NIR Forage Laboratory of Livestock Performance Testing Ltd. between 1st April 2013 and 31st December 2021, especially the distribution and size of costs per farm and per cow. Our aim was to be able to draw conclusions about the application rates, the total and relative costs of TMR analyses according to the farm size based on the data of the samples received in the laboratory during the study period. Description of the TMR sampling frequency is important for both the farms and the laboratories, especially in the face of rising feed, raw material and fuel prices.

2. Materials and Methods

In the course of our research we used the database of the NIR Forage Laboratory of the Livestock Performance Testing Ltd., using a quantitative research model. With the help of this, we obtained data on TMR samples submitted by dairy farms between 1 April 2013 and 31 December 2021, which were inspected by Livestock Performance Testing Ltd. As the information used in the research were obtained and found by us and there were no direct connection between us and a person/ farm., the primer research model was used [11]. The basis of the quantitative approach is the quantification; we were able to retrieve data from the system using various filtering methods. With the help of these quantitative indicators, it was possible to group the answers clearly and follow regularities and draw conclusions [12][13].

2.1 Research design

All farms (152) requesting TMR examination were divided into 9 categories according to the number of cows inspected (101-200, 201-300, 301-400, 401-500, 501-600, 601-700, 701-800, 801-1000, 1001- Subsequently, the proportion of farms requesting TMR testing to the total number of farms (%), the proportion of farms requesting TMR testing to scale was calculated according to the number of cows inspected(%), the average annual total TMR laboratory testing cost (HUF thousand, 2013-2021), the average total annual TMR laboratory testing cost per farm (HUF thousand, 2013-2021), the average monthly total laboratory test cost per site (HUF thousand, 2013-2021) and the number of submitted TMR samples (pcs, 2013-2021). With the help of these calculations we were able to obtain additional information: the specific cost of TMR tests per 1 inspected cow (2013-2021, HUF / insp.cow), the specific annual cost of TMR tests per 1 inspected cow tested (2013-2021, HUF / insp.cow) and Specific monthly cost of TMR examinations per 1 inspected cow (2013-2021, HUF / insp.cow).

3. Results

In the examined period (2013-2021) a total of 6987 TMR samples were sent from 382 inspected farms (holding more than 100 inspected cows) to the Feed Analysis Laboratory of the Livestock Performance Ltd. to be tested. This means that the proportion of farms requesting a TMR test is 40%. The cost of all TMR examinations between 2013 and 2021 was HUF 111,785,000. This is an average of HUF 12,421,000 per year, while the annual average for farms is only HUF 42,000, which means a monthly TMR test cost of HUF 3,500.

The distribution of the frequency and total cost of TMR examinations by farm size is shown in Table 1.

Table 1. Distribution of frequency and total cost of TMR analyses by farm size

	101-200	201-300	301-400	401-500	501-600	601-700	701-800	801-1000	1001-
Number of farms	81	58	58	64	29	30	19	22	51
Total amount of requested TMR examinations 2013-2021, pcs	411	532	1225	1180	661	952	371	603	1052
Farms requesting TMR testing in proportion of total number of farms, %	13	14	15	16	10	9	5	7	11
Average annual TMR laboratory total cost per category (HUF thousand, 2013-2021)	731	946	2178	2098	1175	1692	660	1072	1870
Average annual TMR laboratory total cost per farm (HUF thousand, 2013-2021)	37	45	95	87	78	121	82	97	117
Average monthly TMR laboratory total cost per farm (HUF thousand, 2013-2021)	3	4	8	7	7	10	7	8	10

The cost distribution of TMR testing by farm size is shown in Table 2.

Table 2. Cost distribution of TMR analyses by farm size

	101-200	201-300	301-400	401-500	501-600	601-700	701-800	801-1000	1001-
Unit cost of TMR examinations per 1 inspected cow (2013-2021, HUF / insp.cow)	2480	1660	2332	1756	1314	1655	983	1000	612
Annual unit cost of TMR examinations per 1 inspected cow (2013-2021, HUF / insp.cow)	276	184	259	195	146	184	109	111	68

4. Discussion

Based on the data in Table 1, we found that approximately 60% of the farms requesting TMR testing were from farm with 500 or less cow populations. Farms with over 500 inspected cow farms achieved a share of 9-11% per category, of which farms with 701-800 and 801-1000 animals had the lowest rate (5 and 7%) of all farms keeping dairy cattle under control can be stated that the proportion was also weak in the case of farms counting 100-200 cows. Furthermore, we established that based on the database of ÁT Ltd. in the case of farm sizes close to the average number of cows on farms in Hungary (approx. 400 animals / farm), a higher

TMR testing requirement can be measured. This can be explained by the fact that the number of large farms is smaller than the number of dairy farms close to the average. In the category of large number of farms (81 pcs), but small sized (101-200 inspected cows), the TMR testing has a lower frequency.

The proportion of farms requesting TMR examinations per scale-based number of farms (Table 1) was higher for farms with a larger number of animals (501-1000 cows inspected), so in this case the frequency of sampling was higher. Within the category, the highest TMR sample submission rates were found for the 501-600 and 801-1000 cow counts inspected. An exception is the category of farms with more than 1000 cows, where the proportion has decreased. In the case of farms with 501-1000 inspected cows, the experts would presumably give more importance to self-control (higher risk of error, higher loss) and a larger budget is available, but the proportions are not indicated (the unit cost per cow is 2 shown in Table). In the category of farms with more than 1000 cows, international consultancy (US) is more common, in which case a different laboratory is used for the measurements due to the foreign consultant [14][15].

The average annual TMR laboratory total cost (Table 2) was the highest in the 301-400 and 401-500 cow farm categories due to the larger number of farms. This category therefore represents the potentially highest income for laboratories. However, the average monthly TMR laboratory total cost per farm proved to be extremely low (HUF 3,000-10,000 / month) compared to the risk and potential loss, indicating that there is great potential for quality assurance in TMR testing for farms and this potential is currently lacking of utilization.

For smaller farms (101-700 cows, especially 101-200 and 301-400 cows), the unit cost of TMR testing is higher. This is partly due to the lower number of cows. The unit TMR cost of farms holding more than 701 inspected cows was rather low (HUF 6-9 / inspected cow / month).

The proportion of farms requesting TMR examinations was higher for farms with a larger number of animals (501-1000 cows inspected), so in this case the frequency of sample submission was higher (Figure 1). Within the category, the highest TMR sample submission rate was found for the 501-600 and 801-1000 cows inspected. The average monthly total TMR laboratory cost per site was extremely low in the period of 2013-2021 (HUF 3,000-10,000 / month) compared to the risk and potential loss. Overall, the specific TMR cost of farms with more than 701 cows inspected was rather low (HUF 6-9 / inspected cow / month) in terms of screening for technological errors, risk of loss and quality assurance (Figure 2). This indicates that there is great potential for quality assurance in TMR studies at sites and that this potential is not currently being exploited. The reasons of such lack of monitoring can be many reasons. As checking the quality of TMR (or any other forage) is not under any kind of legal obligations in Hungary, farms tend to believe that by not sending their TMR in for quality reassuring, they are saving money.

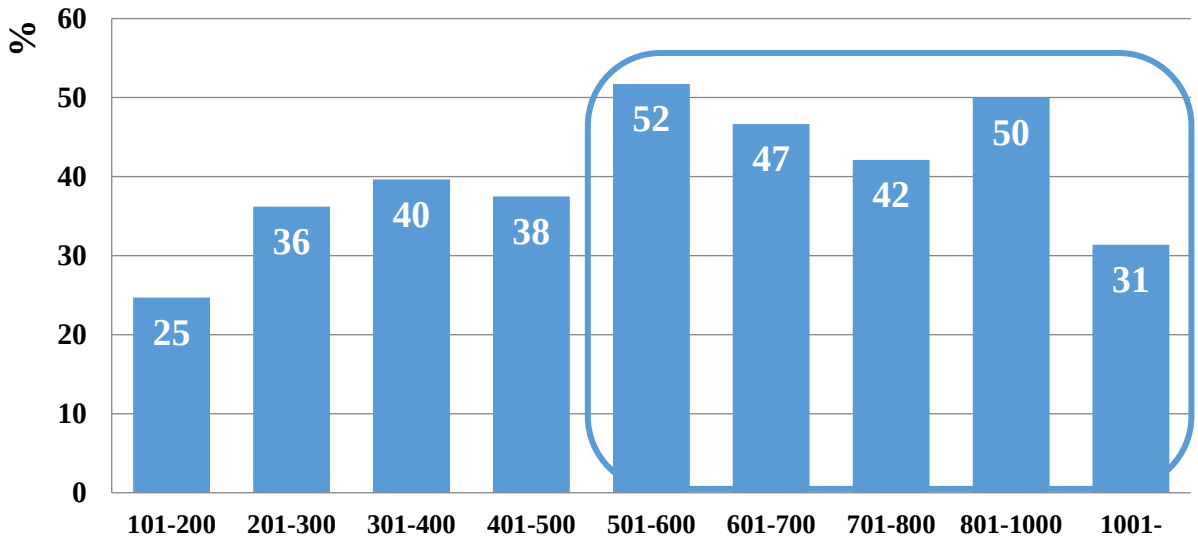

Figure 1. Farms requesting TMR testing in proportion of farm sizes, % (2013-2021, ÁT Kft. Database, %)

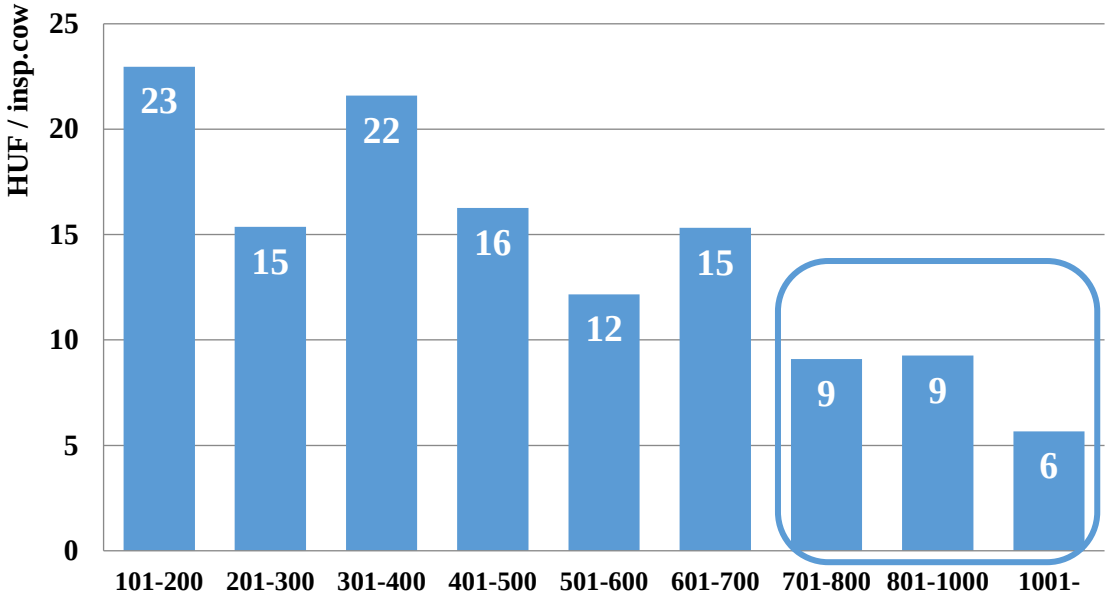

Figure 2. Monthly unit cost of TMR examinations per 1 inspected cow (2013-2021, HUF / insp.cow)

However, in case of quality assurance, these numbers are not promising. In order to understand and improve TMR quality, a lot more frequent testing is necessary. There is no method for determining the TMR's nutritional content based only on feel, texture, smell, or look. In truth, farmers have regularly bought or used TMR that has inferior nutritional content and is frequently uneconomical or counterproductive as a result of only sensory examination. Only after getting a representative sample of the forage and having that sample examined in an accredited laboratory can the forage's nutritional value be determined. It is possible to overestimate or underestimate the nutritional content of a forage lot by using tabular data from a nutritional guide. Long-term averages offer a standard by which farmers can evaluate a particular forage lot. The actual outcomes, however, will vary, sometimes greatly. This is the reason, why monthly testing is essential. Conducting a forage test is the only technique to determine the nutritional value and quality of the given TMR lot. Producers can reduce the cost of animal production and boost profitability by measuring, maintaining, and controlling the quality of the TMR and altering the diet as necessary [8].

5. Conclusions

To obtain the most performance out of cows given TMR, rations must be measured, mixed, tested, and monitored on a regular basis. Closing the loop on feed delivery to assess actual output and make modifications takes longer, but it's the only way to ensure that everything is done right. Regular, comprehensive laboratory testing of TMR samples can be costly; as a result, many farmers and consultants test only the components – but not the final TMR – to save money. With feed prices accounting for 40 to 50 percent of production expenses, this might not be the greatest place to save money [8]. The research clearly shows, that farms with a higher number of cows (501-1001-) tend to pay more attention to risk management and self controlling in terms of TMR testing. For ÁT Ltd. it is important to reach out to smaller farms and explain to them that even if TMR testing costs money, in the long run it helps with decision making and avoiding risks. Final conclusion is, in research conducted with young herds, TMR feeding minimizes feed selection, which can improve the accuracy and reliability of the test. TMR feeding of dairy cows has developed in the last half of the last 100 years. It allows for a more precise feeding of a nutritionally balanced diet, as the sorting and separation of ingredients is minimal. TMR feeding allows the incorporation of commodity by-products and special – sometimes unpleasant – ingredients into the diet. Cows suffer from less indigestion and milk fat depression and other health problems because they eat a consistently balanced

nutritional diet. Feeding TMR allows feeding larger groups of cows faster and more economically than feeding forages and concentrates separately, but it comes with certain costs. In the case of larger herds, it may become economically feasible to further refine the grouping and feed ration. The increased use of robotic milking systems means new challenges and opportunities in herd feeding.

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