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Quarter-Specific Milk Yield Measurement in Automatic Milking Systems under Practical Conditions

During automatic milking, the reliability and precision of milk yield measurement must meet high standards. To what extent the demands were fulfilled in daily practical use and over longer periods was examined. It has been shown that in the range between 7 and 13 kg, which comprised most milk yields, only slight differences between the total milk yield and the sum of the quarter milk yields occurred. The sum of the total milk yields must be compared with the tank content in order to detect hidden defects of the milk yield measuring instruments.

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Keywords

Automatic milking systems, milk yield, udder quarter

Literature

Literature references can be called up under LT 03412 via internet http://www.landwirtschaftsverlag.com/landtech/local/literatur.htm.

Automatic milking systems allow significantly more animals to be milked per milking unit than conventional technology. Therefore, more sophisticated technical equipment seems appropriate and is also provided by the manufacturers of automatic milking systems.

The measurement of the total milk yield and the quarter milk yields is an important component of automatic milking systems. The determination of the total milk yield is offered by all manufacturers as part of series equipment. The measurement of the quarter milk yield, however, is only offered as an option in some cases. In addition to the monitoring of the animals' current performance standard, milk yield measurement also serves to calculate access to milking and to check animal health.

For this reason, the reliability and the precision of the instruments used must meet great demands. This study was intended to examine to what extent these requirements are fulfilled in daily practical use and over longer periods.

Examined Systems

The studies were carried out with two automatic milking systems on experimental farms. Therefore, malfunctions and other events were able to be documented reliably.

In the system „Merlin" of the company Lemmer-Fullwood on the experimental farm Grub of the Bavarian State Institute of Agriculture, a milk yield measuring instrument for the determination of the total milk yield (type „MM95CE", volumetric measuring principle) and four milk yield measuring instruments (type „Dataflow", volumetric measuring principle), which work independently of the previously described instrument, were used to measure the quarter milk yields during the trial period (5/2001 until 8/2002). (According to the current series standard, the quarter milk yields were cacluated as fractions of the total milk yield using the milk flow.) In addition to the comparison of the total milk yields with the sum of the quarter yields, the summed-up milk yields (marketable milk) were compared with the bulk tank content every day.

For the system „VMS" from the company DeLaval on the experimental farm Hirschau of the Technical University of Munich, the trial period extended from 9/2001 until 12/2002. In this system, a milk yield measuring instrument (type „MM15 - FlowmasterPro", gravimetric measuring principle) was employed as part of series equipment for the measurement of the total milk yield along with four milk yield measuring instruments (type „MM25 - Freeflow", near infrared measuring principle), which work independently of the previously described instruments, for the determination of the quarter milk yields.

For the measurement of the total milk yield, all examined instruments meet international ICAR approval. Maintenance was carried out according to the instructions of the manufacturers.

Results

Figure 1 shows the relative deviation of the total milk yield from the sum of the quarter milk yields as the median and the inter-quartile distance (50% of the values). The consideration of the deviations shows that the different systems of milk yield measurement led to different deviations depending upon the total milk yield.

Thus, the sum of the quarter milkings in the „VMS" system was larger than the total milk yield if milk yields were low. With increasing milk yield, the ratio inverted. If milk yields were very high, which occurred only rarely in practice, absolute deviations were higher. For these milk yields, the median was ~ 3%.

In the system „Merlin", the inverse effect was observed. Here, the total milk yield was larger than the sum of the quarter yields if the milk yields were low. With growing milk yields, however, the two values approximated increasingly. At low milk yields, the highest absolute deviations occurred here, which caused very high relative deviations in this range.

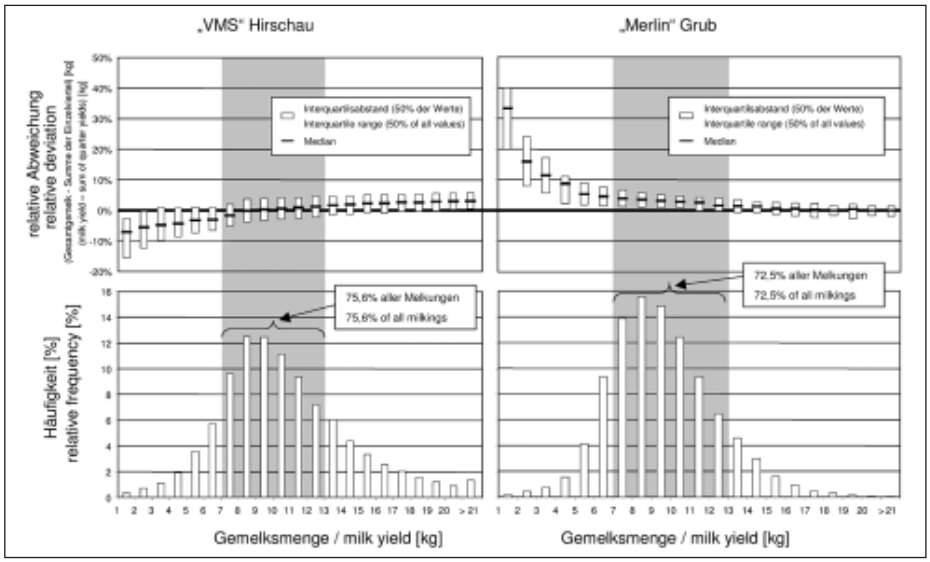

Fig. 1: Relative deviation of the total milk yield and the sum of quarter yields

On both farms, milk yields between 6 and 13 kg were striven for. In this range, both systems exhibited only slight deviations between the measurement of the total and the quarter milk yields. In the „VMS" system, differences were smaller than in the system „Merlin". However, the straggling of the values was smaller in the latter.

The deviations described above can be caused by both the measurement of the total milk yield and the determination of the quarter milk yields. Therefore, a comparison with the milk yield established by the tanker, which may deviate by 0.5% after standardization, was carried out in the „Merlin" system over the entire trial period. This yield was used as a reference value and compared with the results of the milk yield measuring instruments. In *Figure 2*, the course of the determined deviations is shown for a period of three months in an examplary manner.

The deviations of the total milk yield and the sum of the quarter yields from the bulk tank content were clearly noticeable in this period. It must be taken into account, however, that short-term deviations may not only be caused by measuring inaccuracies of the milk yield measuring instruments, but also by inaccuracies
during milk extraction by the tanker, for example. Another possible reason is that single milkings were added to the bulk tank content even though the milk was discarded.

The significant deviations on individual days were caused by total failures of the milk yield measuring instrument, which often had to be attributed to contamination by dirt, e.g. litter. Due to the lacking alarm system, dirt contamination was only noticed during the next routine check (at least three checks/day). If, however, such a failure only affected a few milkings, the defect could only be found if the individual milkings were checked.

Only a comparison with the bulk tank content allowed the regular increase in deviations over the course of time to be detected. In most cases, this increase was caused by calcification of the electrodes, which could be eliminated through manual cleaning of the milk yield measuring instrument. Recalibration of the milk yield measuring instruments enabled the difference between the measurements of the total milk yield, the quarter milk yield, and the bulk tank content, which could only be determined by means of a comparison with the bulk tank content, to be reduced to a very low level even though it kept occurring.

Conclusions

The study shows that under practical conditions the independent measurement of the quarter milk yields and the total milk yield led to large relative deviations between the total milk yield and the sum of the quarter milk yields, especially if the milk yields were small. In practical use, however, these deviations should play a subordinate role because both the number of the milkings concerned and the absolute deviations were small.

For the farmer, the comparison of the milk yields with the measured bulk tank content is often the only indicator of a potential general deviation or medium-term trends, which must be attributed to hidden alterations of the instruments or dirt contamination. Short failures of the milk yield measuring instrument cannot be detected during such a comparison because such failures only lead to small deviations in relation to the entire bulk tank content. Therefore, short-term failures must be compensated for by other control mechanisms, which include the comparison of milk yield measuring instruments, milk flow control, or the comparison of current parameters with values of the individual animals. Thus, deviations could be detected earlier. This would allow accuracy and reliability, which are decisive for the system, to be improved.

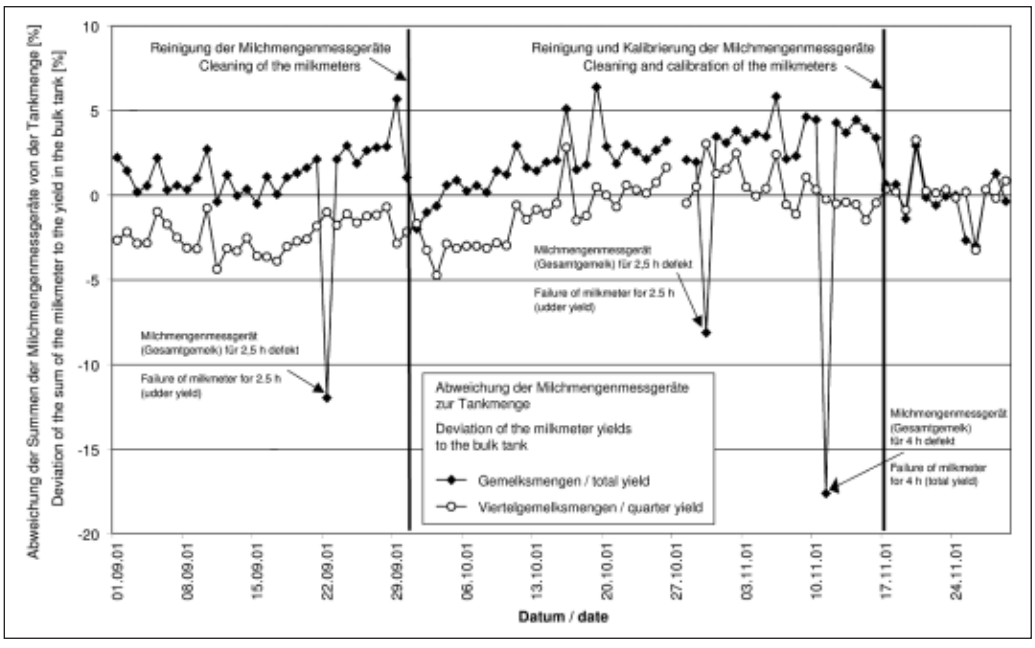

Fig. 2: Development of relative devilation of the milk meters results to milk in the bulk tank