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Procedural and economic studies of milking systems for larger dairy herds

Future-oriented milking systems have to suffice to diverse standards. They should help maintaining animal welfare, secure high quality of milk and reduce workload in an economic way. Based on data of a survey, which was joined by 28 farms in Brandenburg and Mecklenburg-Western-Pomerania, each of them with a herd from 160 to 2 700 cows. The used milking systems were rated, considering procedural and economic criteria. Nine of them use Side-by-Side parlour and two are milking in a Side-by-Side-Swing-over-system. Further on seven Rotary-parlours, six Heringbone-parlours, three Automatic Milking Systems and one Auto-Tandem were found.

Keywords
Milking systems, large dairy herds, replacement investments, annual workload, annual work costs

Abstract
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Problems with udder health are at present a main reason for culling along with fertility problems [1]. It is also known that the milking process demands more than 50% of the total work time in dairy farming. Investing in new milking systems has a strong influence on the farm's success, particularly in case of investments in new milking technologies for larger dairy herds. Depending on the form of business, production focus and philosophy, dairy farmers have to make an individual right decision, with regard to work and cost efficiency. However, existing systems also have to be reviewed with regard to these criteria and, if necessary, should be optimized. The aims of this bachelor thesis were to present the latest state of technology and to analyze costs as well as workload.

The presented results can be used for decisions regarding replacement investments or if new buildings for milking centers are needed. They could be a tool to support decision making in practice and an objective information base for consultants and farmers.

Material and methods

The data is based on interviews in 28 farms according to a developed questionnaire. Dairy farms with at least 150 cows were analyzed, preferring farms working with employees. In these interviews firstly information about dairy farming, process technology and the current milking system were recorded. Furthermore data of working economy and economy of milking sessions and workforce were gathered as well as data on investments and operating costs. The second part of the survey recorded expectations and improvement suggestions, respectively the basic choice of systems for possible planned milking installations. Within this bachelor thesis only a limited number of interviews was possible. The farms were selected regionally in Brandenburg and Mecklenburg-Western-Pomerania. Although only a few systems could be recorded, the results show clear trends.

Results

The large number of Rotary milking parlours and Side-by-Side parlours in this survey demonstrate clearly that at present larger dairy herds are mainly milked with these two systems. Apparently their users are satisfied with these milking systems. The comparison of the actually used milking systems to the notional planned milking systems shows an obvious trend. A clearly increasing demand for rotary-parlours (prospective 43 %) can be observed, but almost all owners of side-by-side parlours (approximately 30 % of all interviewed) would buy these again. This trend is at the expense of further use of herringbone parlours which are preferred by only 11 % of the interviewed farmers (**figure 1**).

It can furthermore be concluded that more External-Rotary parlours will be purchased in future. The ratio would be about 58 % for external- to 42 % for Internal-Rotary parlours.

Fig. 1

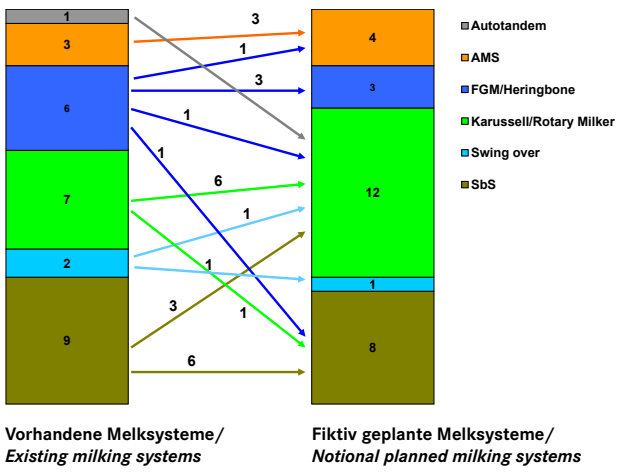

Fig. 1: Intensions for changing from present to the notional planned milking system (n=28)

With regard to the use of Automatic Milking Systems (n=3) it is shown, that they can probably only be an option for dairy herds with up to 250 cows. In spite of the fact that AMS are, in overall financial terms, inferior to the other systems, they are currently experiencing something of a boom. Among other it is because of the current high level of subsidies, but also the continually technical development and high quality of these systems, which have so far contributed to their establishment. By switching to the robot, the actual milking work is no longer necessary. The layout of stables as well as the daily working routine changes enormously. Much of the workload will be restructured in management tasks, which require a high degree of technical know-how [4; 5].

Annual workload for milking

In order to be able to compare the annual workload for milking per cow place (cleaning the parlour included), all information was standardized to milking "two times a day" (in total nine of 28 farms milk three times, another one even four times a day). Up- and downstream work, as pushing cows and taking care of the cubicles was not considered.

It is distinctly shown that in case of the conventional milking systems with increasing size of the herds there is a tendency, that the annual workload per cow and place decreases. The investigated Side-by-Side parlours and Rotary milking parlours were almost congruent for herd sizes of approximately 350–1,200 cows. Within this range the respective workload drops from about 13.2 to about 8.0 hours (MPh) annually per cow and place. The Swing-over parlour fits in this trend with a minimum of effort respective to herd-size.

With regard to the Rotary parlours as a milking system for larger dairy herds, a linear trend allows the best approach. This group presents clearly the most efficient systems. Milking work on farms with 1,146 and 1,370 dairy cows for example in this case required 6.38 MPh per cow and year on average. In the largest herd of this investigation with 2,668 cows, 4.65 MPh per cow and year were needed (**figure 2**).

An absolute exception with regard to work efficiency is a farm with a herd of 730 cows, where only 2.83 MPh accrued per cow and year are needed. The used milking system was a Heringbone-Internal-Rotary parlour with 22 milking places.

Fig. 2

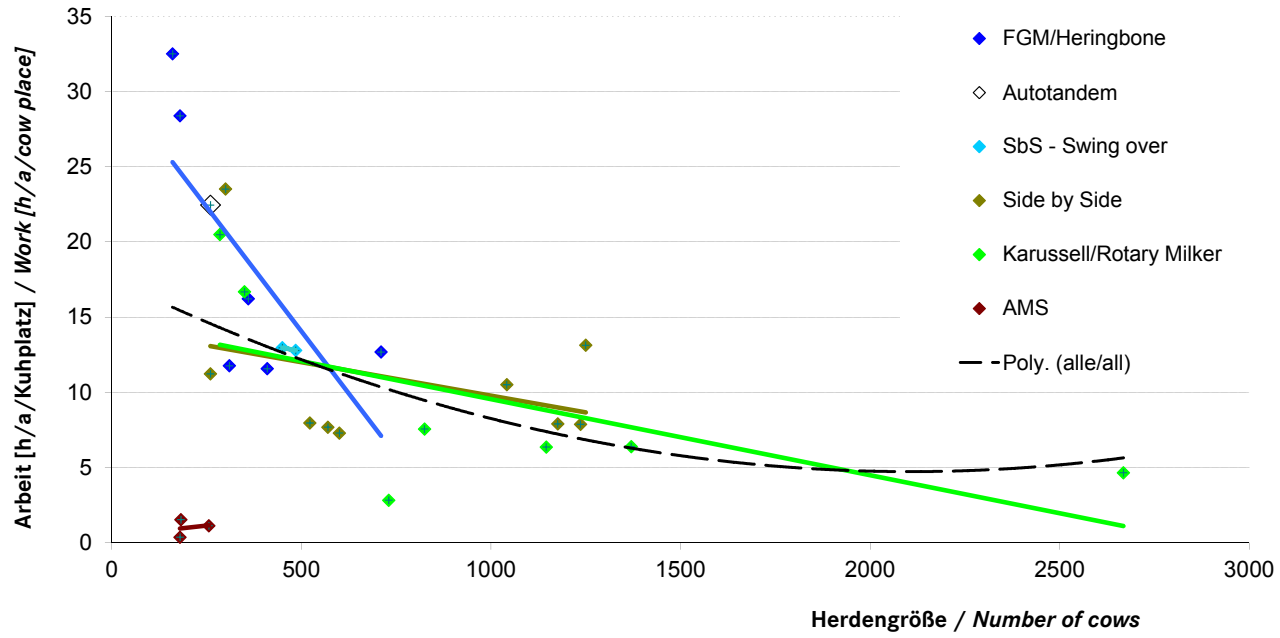

Fig. 2: Annual workload for milking and cleaning unified to two milking times per day

Fig. 3

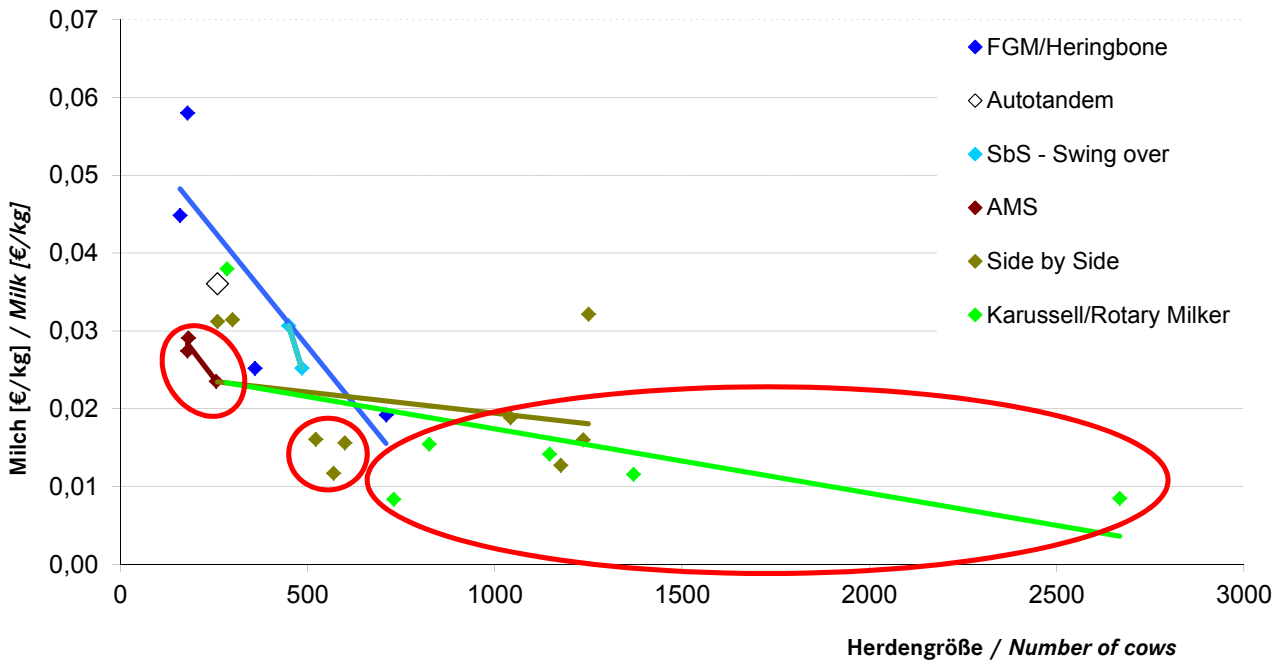

Fig. 3: Total annual costs of the milking system per kg produced milk

The milking capacity is 95 cows per hour. The exact workflows during the milking were not part of this study. Therefore quality features as for example udder hygiene and udder health could not be judged.

In this study the Heringbone-parlour was the system where milking work comparatively takes more time, one reason being the larger distance from udder to udder. But it has to be pointed out here, that the Heringbone-parlour as well as the Tandem-parlour, is still the system in which the milking staff has the better control over every single cow [6].

In contrast to conventional systems the Automatic Milking Systems, as expected, perform best particularly with regard to annual workload, because only the cleaning of the robot and the management tasks are included in this evaluation.

Annual total costs

Basis of the annual total cost calculation referred to the produced raw milk (basis: Ø-LKV-results) is the determination of the sum of the annual costs for the used milking equipment. The total annual costs consist of the annual costs (repair and maintenance + depreciation + interests) and the costs of labour (milking, cleaning the parlour included).

It is evident that, with the dairy herds getting larger, the annual costs for the used milking system decrease per kg of produced milk. Furthermore it is clearly visible that nearly all of the Rotary milking parlours and most of the Side-by-Side parlours, especially for herds with more than 500 cows, are on a significant lower cost level than Heringbone-parlours or Swing-over parlours as well as the Automatic Milking Systems (**figure 3**).

It can be concluded on base of these facts, that milking robots could be relatively favorable (about 2.3–2.9 €-Cent costs per kg milk) for herd-sizes of about 150–250 dairy cows. In the following section with herd-sizes of about 250-650 cows, Side-by-Side parlours are more likely to be recommended. This is where the costs are at just under 1.2 to about 1.6 €-Cent per kg milk.

With 0.85 €-Cent proportional production costs, the rotary parlours represent the most favorable system with a supposed downward trend, for herd-sizes starting at 650 cows.

A further argument for the usage of Automatic Milking Systems for smaller herds and the employment of Side-by-Side parlours in medium-sized herds is the extensibility of the modules. Especially the AMS as single-box-systems can be easily adapted to the stock in case of an enlargement of the herd [7]. This is not possible with Rotary milking parlours, due to their construction. In this case, an enlargement of the herd should be included in the plan from the beginning, or a new building be considered.

Conclusions

The examples of this study show that dairy herds of up to approx. 250 cows can be milked efficiently with Automatic Milking Systems. For the medium-sized herds in this investigation, Side-by-Side parlours also proved to be suitable up to about 650 cows. Furthermore the evaluation shows that large herds (starting at about 650 cows) can be milked by a Rotary milking parlour in an effective way. The incurred fixed costs are extremely low in comparison to other systems with increasing size of the herds. The trend towards Rotary milking parlours that

was observed in the beginning of the study turned out to be justified.

Although Rotary parlours require the highest skills for milking staff, they present the milking system that can be used successfully for a wide range of herd sizes (already starting at about 300 cows) from both the procedural and economic point of view.

The next development step, automatic milking on Rotary parlours, has already been presented to the professional community. Whether this method will establish itself in the long run or not will be seen. It could be conceivable that modular retrofit kits can be integrated in existing systems.

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