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# Labour and economical evaluation of an automatic milking system

*In conventional milking systems the milking process requires over 30% of the total working time in a dairy cattle enterprise and represents, as a fixed-time chore, a comparatively high time and social stress factor. A work analysis and associated cost calculation were carried out with an automatic milking system to allow an improved labour management and farm management assessment*

A characteristic of the economic development of dairy farms is the increasing size of herds. The rising labour requirements through this development make the application of more technology or atomisation of the milking process necessary.

Developments within practical agriculture have progressed from hand milking through bucket and pipeline systems to today's universally accepted parlour systems with different modes of construction and equipment. Depending on the technical standards in such systems, many separate milking procedures, such as stimulation, stripping and cluster removal have been aided through technology. However, cluster attachment remains a central task for the milker. The milking process ties the worker as a fixed-time chore every day, representing at least 30% of the total work in dairying [1,4].

In automatic milking systems, technology also takes care of cluster attachment. The dairy person's working procedure, and the type of work done, is fundamentally altered by application of the new technologies. Part of the time for manual work saved through atomisation of milking has to be utilised for servicing and management tasks and increased livestock care.

This means that with the application of automatic milking systems the demand on the training of the milker is increased. In order to be able to make a quantitative statement regarding the altered working time requirements caused by changing over to

an automatic milking system, a work analysis was carried out.

## Trial equipment

The system analysed was a "Merlin" single box compact plant from Lemmer-Fullwood, Lohmar. The automatic milking system was built into the space usually taken-up by four cubicles in an existing two-row cubicle house. At the time of the trial, 47 cows were permanently kept in the stall. Their entry into the milker was voluntary. Normally, the stockperson only intervened when the time between milking for individual animals exceeded a predetermined period. Driving aids were available for such activities.

## Labour-management assessment

The working time was divided into main and auxiliary working periods. In the main period, the direct preparation work for milk production was carried out. To a great extent this is dependent of the number of cows. To auxiliary work, on the other hand, is counted the processes that do not mainly depend on the size of herd (table 1)

The average work required per cow and milking, based on two milkings per day, is

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## Keywords

Automatic milking system, labour requirements, economics

Literature details are available from the publishers under LT 00417 or via Internet at <http://www.landwirtschaftsverlag.com/landtech/local/fliteratur.htm>.

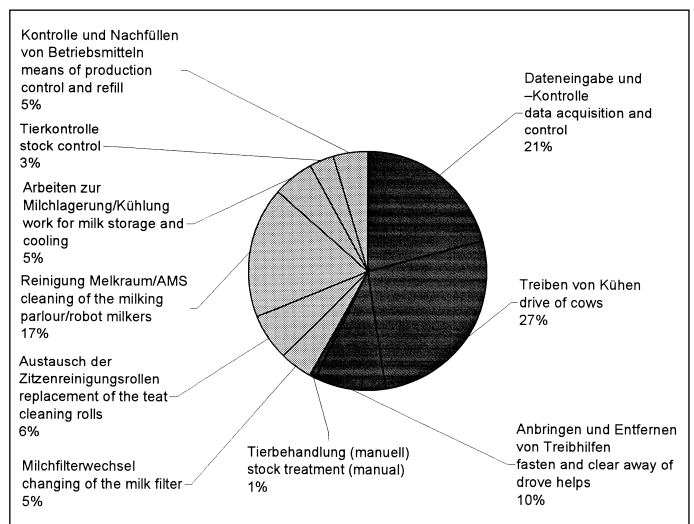
Table 1: Structure of working sections and temporally recorded work elements

	Work period	Main jobs
Main jobs	Data insertion and control	<ul style="list-style-type: none"> <li>• Accessing data of new cows</li> <li>• Data control</li> </ul>
	Driving of cows	<ul style="list-style-type: none"> <li>• Driving cow out of AMS</li> <li>• Driving cow in waiting area (WB)</li> <li>• Driving cow from WB to AMS</li> </ul>
	Attachment and release of driving aids	<ul style="list-style-type: none"> <li>• Attaching chain/rope</li> <li>• Releasing chain/rope</li> </ul>
	Handling of animal (manual)	<ul style="list-style-type: none"> <li>• Handling cow (medicine, hand milking)</li> </ul>
Auxiliary jobs	Changing milk filter	<ul style="list-style-type: none"> <li>• Changing milk filter</li> </ul>
	Replacement of teat cleaning-rolls	<ul style="list-style-type: none"> <li>• Changing cleaning rolls</li> <li>• Pulling cleaning sock from rolls</li> <li>• Putting on cleaning sock</li> </ul>
	Cleaning milking area and automatic milker	<ul style="list-style-type: none"> <li>• Cleaning AMS and milking area</li> </ul>
	Work involved in storing and cooling of milk	<ul style="list-style-type: none"> <li>• Preparing milk bulk tank for milking</li> <li>• Cleaning tank room</li> </ul>
	Tierkontrolle Checking and topping-up inputs (lubricant, etc) Breakdowns	<ul style="list-style-type: none"> <li>• Checking livestock, auffüllen</li> <li>• Breakdowns</li> </ul>

Work period		Work involved {APmin/cow/milking}
Main jobs	Keying-in data and controlling	0,24
	Driving cows	0,31
	Attaching and releasing of driving aids	0,12
	Livestock handling (manual)	0,01
Auxiliary jobs	Changing milk filter	0,05
	Replacing teat cleaning rolls	0,07
	Cleaning of milking area/AMS	0,20
	Work involved in milk storage/cooling	0,06
	Livestock control	0,04
	Control and topping-up of lubricant, etc.	0,06

Table 2: Specific average working time for the working sections

Fig. 1: Time share for partial work processes



presented for each individual working period in table 2.

After a performance estimation and a few trails [3] the main working time required was 0.46 man minutes/cow/milking, and 0.41 man minutes/cow/milking for the auxiliary work.

In comparison to the working times determined in other automatic milking systems [2,8], the times required for the main working periods were minimally higher, and in the auxiliary work area, lower. Of special im-

Fig. 2: Labour requirements of conventional and of automatic milking systems

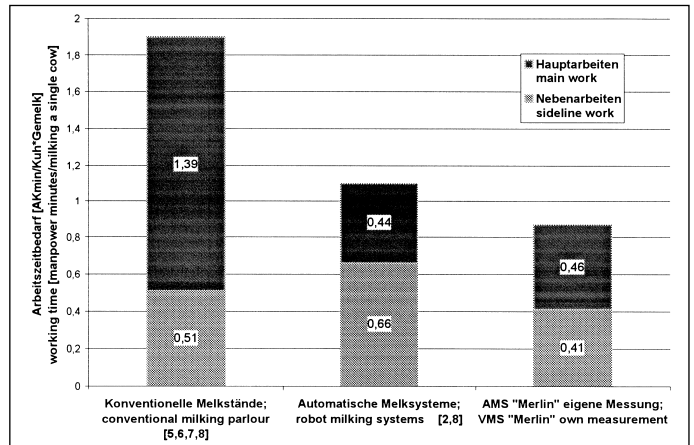


Table 3: Difference in costs between conventional (FGM) and automatic milking systems (AMS)

Parameter	System	Szenario Nr.			
		1	2	3	4
Labour costs (DM/man-hour)		25	40	0	25
Interest (%)		6	6	6	4
Working costs (% of MS purchase costs)	AMS	6	6	6	4
Working lifetime (years)	FGM	3	3	3	3
	AMS	8	8	8	10
Labour requirement} man-hour/cow/year)	FGM	15	15	15	15
	AMS	10	10	10	10
Investment total for milking system (DM)	FGM	19	19	19	19
	AMS	290 000	290 000	290 000	290 000
Residual value of milking system (DM)	FGM	100 000	100 000	100 000	100 000
	AMS	29000	29000	29000	29000
Result	FGM	5000	5000	5000	5000
	AMS	61170	61170	61170	44939
Milk system costs (DM/year)	FGM	13081	13081	13081	11744
Costs for livestock building, milking area (DM/year)	AMS	27619	27619	27619	23786
	FGM	33155	33155	33155	28554
Labour costs (DM/year)	AMS	17500	28000	0	17500
	FGM	36575	58520	0	36575
Milk sales penalty	AMS	7219	7219	7219	7219
<b>Difference in costs AMS-FGM {DM}</b>		30697	19252	49772	16571
<b>Difference / kg quota {pF/kg}</b>		5,85	3,67	9,48	3,16
<b>Financially advantageous system</b>		FGM	FGM	FGM	FGM

portance, however, was the comparison of the necessary working time with conventional milking systems [5,6,7,8]. Here it was

shown that economically effective working time savings are to be expected, especially

in the main working periods. In a changed form, the auxiliary tasks are also present in conventional milking systems.

### Economical assessment

Because of the labour-economical advantages, there's considerable interest in automatic milking systems from dairy farmers. However, the economic situation on many dairy farms at the moment is unsatisfactory, leaving limited opportunity for business investments.

From the economical point of view, the working time released or saved has to be evaluated financially and balanced with the altered machinery and housing costs. The costs involved in carry out the work in farms with paid staff are calculated from the product of saved working time and wages, in-

cluding additional labour costs, only when the time saved is unpaid free time. In family dairy farms the economic advantages are measured according to the time cost allotted to the manager involved. In family farms, the advantages in time are only able to be taken advantage of when either in-farm tasks or ex-farm income sources are considered. In each case the work that takes the place of the saved time should represent as full a utilisation of the working personnel as possible.

Alongside the different working costs, the following working blocks have to be considered:

- Capital costs
- Depreciation
- Working, servicing and repair costs
- Residual value of the milking system concerned
- Building costs
- Milk revenue

The result from model calculations [3] as scenarios for different wage calculations is compiled in table 3. In the current costs structure, milking with automatic milking systems performed less well on economical basis. This fact should not, however, lead to the stopping of further development of this new technology because, alongside the saving of working time, one of the main grounds for the application of the technology is also the fact that the working day can be made more flexible.