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Investment requirements and costs of conventional milking systems

In dairy farming the costs of milk extraction have a main share of the process costs. These costs mainly depend on the chosen milking system, it's dimension and the technical equipment. Apart from fixed costs for technics and construction the other process costs like variable costs and labour costs play an important role. The biggest portions of the total expenses for milk extraction claim the labour costs (30-50 %) and the fixed costs (about 25-45 %). With increasing utilisation of the milking systems the costs per kg of produced milk decrease. However in many cases working-economic factors restrict the maximum extent of utilisation.

Keywords
Milking technology, investment requirements, annual costs

Abstract
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With new investments or spare investments in dairy production, the related question that has to be answered is: what is the optimum milking system for the respective situation? Important criteria for the selection are: milking capacity (in association with available employees and intended time for milking), characteristic of the milking system, investment requirements and annual costs of the system.

KTBL-projekt calculation data

Within the scope of the KTBL-project „calculation data" the investment requirements as well as the running costs of conventional milking systems, including milk cooling systems, have been determined. Different conventional milking systems (herringbone-, abreast-, swingover-, tandem- and rotary milking parlours) have been considered in various sizes. In consistence with the milking system and herd sizes from 60 to 1,200 cows two different cooling systems (direct– and ice water cooling) were compiled.

The area requirements for the milking systems including the area for the milk room and the necessary side rooms was compiled. The capital investment requirements (separate for technics and buildings) were determined based on manufacturer´s data, evaluated offers or concluded projects.

For the calculation of the annual costs the depreciation period for buildings was set on 25 years and for the milking technology 12 years (10 years in case of the rotary milking parlour). The interest rate was assumed to be 6 %. Maintenance and repair costs, as well as water-, engine- and cleaning-costs have been considered for the calculation of the variable costs. For the calculation of consumption, values were taken from the data basis of the manufacturer's as far as possible, if necessary standard values have been used.

Investment requirements for milking technics and buildings

In **table 1** the investment requirements for conventional milking systems in different sizes and with different technical equipment are shown.

It is obvious, that the investment requirements is largely determined by the degree of mechanisation of the milking system, and the considered additional technology (e.g. automatic cattle driver) respectively. For example the herringbone milking parlours with the high grade equipment cost about 130 % more, if compared with the basic equipment. Hence, the technical equipment has to be considered when comparing different milking systems.

The average capital expenditure requirements for milking technology with higher valued equipment is at about 5,700 Euro per milking place with the herringbone milking parlours, 7,700 Euro with the tandem milking parlour and 6,600 Euro with the rotary milking parlour. The bigger the milking parlours are, the more cost degression per milking place can be observed in all milking systems.

For the calculation of the investment requirements for the buildings, the room for the milking parlour, the waiting area, the engine room and other side rooms (office, WC/shower, social rooms) have been considered. **Table 2** shows an overview of the area requirements and the resulting investment needs for the different areas. For the milking parlour room on average 460 Euro per m^2 were used for the calculation (360 up to 550 Euro per m^2 depending on the size of the room). Investment requirements for the construction of

Tab. 1

Investment requirements of conventional milking systems

Design of milking parlour	Number of milking places	Capital investment requirements			
		Basic equipment* Mean		High grade equipment** Mean	
		€	€/milking place***	€	€/milking place***
Herringbone / Abreast	2 x 6	36,000	2,960	74,000	6,200
	2 x 8	45,000	2,820	90,000	5,600
	2 x 10	54,000	2,680	126,000	6,300
	2 x 14	68,000	2,420	162,000	5,800
	2 x 20	82,000	2,060	208,000	5,200
	2 x 24	89,000	1,850	235,000	4,900
Swingover	(2 x) 12	43,000	3,550	82,000	6,800
	(2 x) 14	48,000	3,460	91,000	6,500
	(2 x) 20	64,000	3,210	138,000	6,900
	(2 x) 28	81,000	2,900	174,000	6,200
	(2 x) 32	88,000	2,750	192,000	6,000
Tandem	2 x 4	32,000	4,040	64,000	8,000
	2 x 5	39,000	3,940	74,000	7,400
Rotary	24	124,000	5,160	178,000	7,400
	36	171,000	4,740	241,000	6,700
	48	213,000	4,430	302,000	6,300
	60	253,000	4,220	360,000	6,000

* Basic equipment: functional milking installation incl. prestimulation

** High grade equipment: Basic equipment plus automatic cluster removal, milk meter, fast exit exceeding 20 milking units, cattle driver, animal identification, PC, herdmanagement software

*** With the swingover milking parlours the prices refer to the milking units

the side rooms were prized with 760 Euro per m^2 and for the required waiting area with 290 Euro per m^2.

In **figure 1** the summarized total investment requirements (technics and construction) for different milking systems are shown. On average the costs for buildings amount to 50 % of the total investment needs. For the herringbone and the rotary milking parlour the costs for buildings take about 50 % of the total expenditures, in the swingover milking parlour and the tandem milking parlour the percentage is nearly 55 %, and 60 % respectively.

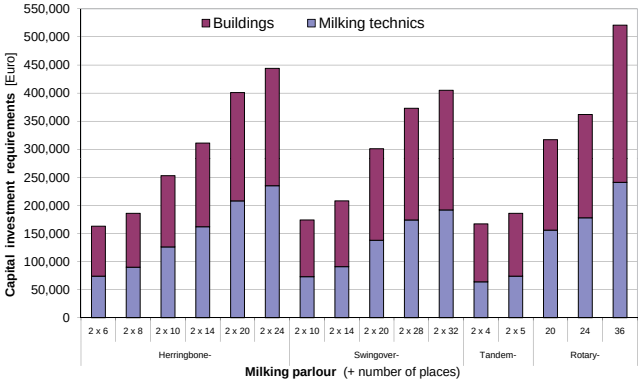
Annual costs of milk extraction and storage

The annual costs for milk extraction and storage are important factors, determining the economic efficiency of a certain milking system. For the calculation fixed costs for technics and construction as well as variable costs of the milk extraction (including labour costs) have to be considered.

In **figure 2** the total annual costs per kg of produced milk (including costs for milk cooling and storage) are shown exemplarily for certain systems.

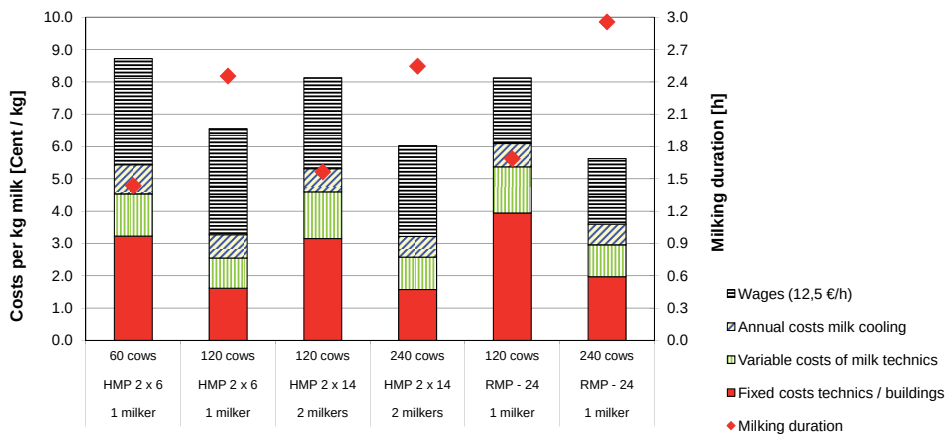
With increasing degree of utilization of the milking systems, the costs per kg of produced milk decrease. This effect mainly occurs due to a decreasing portion of the fixed costs for technics and construction. But also regarding the variable costs for milk extraction, milk cooling and storage, cost benefits can be realised to a certain extent. Thus, for example, the cleaning of the milking system runs regardless of the number of milked cows only once after each milking.

Fig. 1



Total investment requirements for milking technology and milking buildings of different milking systems

Fig. 2



Annual costs of milk extraction and storage (cent/kg of produced milk) and milking duration in chosen milking systems with different herd size, milk yield: 8000 kg

In case of the 2x6 herringbone milking parlour (HMP) the fixed costs load declines from 35 % of the total expenses to 23 % by doubling the number of milked cows, and from 3.23 Cent to 1.62 Cent per kg milk respectively. With a higher utilization the fixed costs load in the rotary milking parlour (RMP) declines from 48 % to around 23 % of the total expenses. The costs for milk cooling are in each case about 10 %.

The assumed labour costs have an essential share of the

Tab. 2

Area and investment requirements for milking buildings

Design of milking parlour	Number of milking places	Demand of area			Investment requirements for buildings			
		Milking room[1] [m²]	Waiting area [m²]	Side rooms[2] [m²]	Milking room €	Waiting area €	Side rooms €	Total €
Herringbone/ Abreast	2 x 6	67	90	34	35,000	28,000	26,000	**89,000**
	2 x 8	84	90	35	42,000	28,000	26,000	**96,000**
	2 x 10	130	150	38	54,000	44,000	29,000	**127,000**
	2 x 14	172	170	39	69,000	50,000	30,000	**149,000**
	2 x 20	235	250	43	90,000	70,000	33,000	**193,000**
	2 x 24	282	250	44	105,000	70,000	34,000	**209,000**
Swingover	2 x 12	120	90	34	57,000	28,000	26,000	**111,000**
	2 x 14	137	90	34	63,000	28,000	26,000	**117,000**
	2 x 20	235	150	38	90,000	44,000	29,000	**163,000**
	2 x 28	324	170	39	119,000	50,000	30,000	**199,000**
	2 x 32	367	170	39	133,000	50,000	30,000	**213,000**
Tandem	2 x 4	97	90	34	50,000	28,000	25,000	**103,000**
	2 x 5	117	90	34	58,000	28,000	26,000	**112,000**
Rotary	24	216	130	35	119,000	39,000	26,000	**184,000**
	36	324	260	40	178,000	72,000	30,000	**280,000**
	48	432	330	41	238,000	88,000	31,000	**357,000**
	60	540	390	45	297,000	100,000	35,000	**432,000**

[1] incl, way back and post waiting area or demand for fast exit

[2] engine room, office, WC/shower, social room

total costs. According to the utilisation of the milking system the share is between 30 and 50 % of the total expenses. For the calculation the labour input was estimated with 21 Mph per cow and year with the 2x6 HMP, 18 Mph per cow and year with the 2x14 HMP and 13 Mph per cow and year with the RMP.

Therefore a higher utilization of the technics leads to significant cost advantages. However, the decision for a certain milking system is strongly influenced by the working-economic situation of the farm.

For example, with a 2x6 HMP and a herd of 120 cows in most cases the acceptable milking time for family farms is exceeded. With a herd of 60 animals the milking time (including set-up times) is about 1.5 hours. With 120 animals the milking time already lasts about 2.5 hours, thus the often accepted border for family farms is extravagated.

The RMP shows the highest fixed costs compared to the other systems, but in bigger herds (e.g. 240 cows) the annual costs of milk extraction are lower than in other systems due to minor labour costs.

Conclusions

The investment requirements of conventional milking systems mainly depend on the chosen milking system and the extent of the technical equipment.

With an increasing extent of utilization of the milking systems the annual costs per kg of produced milk decline. Minimizing the annual costs of milk extraction is an important argument with the choice of a milking system, however the other farm-individual factors (working-economics, etc.) have to be considered for the planning.

With the revision of the KTBL-"calculation data" updated planning criteria for different milking parlours (including milk cooling) with different technical equipment and for herd sizes of from 60 to 1,200 animals are available. Apart from the capital investment requirements, the running costs as well as the area requirements and the milking capacity are included.

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