

Profitability of Swiss dairy farms according to different milking systems

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Abstract – The choice of an investment in a milking system has a long-term influence on the labour organisation and cost structure of dairy farms. Based on farm-level survey data of the year 2020, the farm structure and economic performance between groups of farms with different milking systems are analysed for the Swiss plain region. Results show that farms with bucket or pipeline milking systems are smaller and achieve lower family farm income per family work unit than farms with milking parlours. Farmers' investments in automatic milking systems are more recent, occurring on farms with very large herds (58 dairy cows on average). High depreciation of investments in automatic milking equipment has a negative impact on their farm income.

INTRODUCTION

Despite an above-average decline in the number of dairy farms since the early 2000s, dairy farming in Switzerland still plays an essential role in grassland use and the production of agricultural commodity for food production, accounting for around 40 % of all farms (Zorn 2020; Agristat, 2021).

The income of dairy farms, however, remains below average compared to other farm types (Hoop et. al, 2021). A large proportion of the working time in the production process of dairy farming is spent on milking. Today, the majority of farms in Switzerland still uses either bucket or pipeline milking systems or milking parlours. Only a small proportion of farms have so far opted for automatic milking systems (Heitkämper et. al., 2021).

An investment in a milking system is made for a long-term time horizon. Usually, it has a significant impact on costs and income. Therefore, the decision needs to be well considered and well planned. On the one hand, farm specific calculations are necessary. On the other hand, research results, e.g. model calculations on profitability (Gazzarin et al., 2014) can support the decision-making process. In the Swiss context however, there is a lack of empirical studies on the profitability of different milking systems. The present analysis aims to close this gap. It examines how farms differ in terms of structures, profitability and non-agricultural activities depending on their milking system.

METHOD AND DATA

The data of the specialised dairy farms of the Farm Management Sample of the Swiss Farm Accountancy Data Network (Renner et al., 2019) are used as a basis, as well as their key figures on the existing milking system collected for the 2020 accounting year. 80% of these farms answered the supplementary survey on milking systems and, after a plausibility check and adjustment, data from 455 farms were available for the analysis. In the

questionnaire, we distinguished between bucket/pipeline milking system (BPMS), parlour (PMS) and automatic milking system (AMS). Differences in farm and farmers characteristics between these three groups were examined by non-parametrical group comparisons (Wilcoxon rank test, or χ^2). To minimise the influence of regional differences on the results, we limit the analysis to farms in the valley region.

RESULTS

Table 1 presents the characteristics of the different milking system groups in terms of farm structure and profitability. With regard to the absolute **labour input**, the **age of the farm managers**, the farm groups do not differ. Significant differences between groups exist in farm size, both in terms of agricultural area and livestock. Farms with BPMS are the smallest farms, followed by farms with PMS. Farms with AMS are the largest.

The **stocking rate** (animals per utilised agricultural area) and the proportion of silage maize per UUA is higher on AMS and PMS farms than on BPMS farms. AMS farms manage the largest herds per labour input with about 36 **livestock units (LU) per annual work unit (AWU)**, followed by PMS farms with about 23 LU per AWU and farms with BPMS with about 17 LU per AWU.

With about 0.14 CHF/kg milk the use of **concentrate** per kg produced milk is on the same level for BPMS, PMS and AMS. The **milk yield** is higher on AMS farms with 8'800 kg/milk cow and year, than on parlour farms with 7'900 kg/milk cow and year or 7'500 kg/milk cow and year on farms with BPMS.

The main results of the **monetary outputs and inputs** per farm size (dairy cows or UUA) show no differences between the farm groups. However, the resulting key figures for agricultural income and labour earnings differ between farms with BPMS and farms with the other two milking systems. The higher depreciation of investments is remarkable for the AMS farms, whereby the date of investment in the milking system is more recent than for the other two groups. If we try to standardise the (monetary) state of the investments by taking these higher depreciations for fixed installations of around CHF 20'000 into account, the farms with AMS achieve a significantly higher family farm income per family work unit. However, if we relate family farm income to the produced milk, the AMS farms have lower family farm income per kg produced milk than the farms with BPMS and PMS.

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Table 1. Characteristics of the three milking system groups in terms of farm structure and profitability (average) in 2020 in the plain Region.

Milking system	BPMS	PMS	AMS
Farms [n]	44	86	15
Farm structure			
Farming system Bio [%]	14	7	0
Year of investment in the milking system	1999 ^{2,3}	2004 ^{1,3}	2016 ^{1,2}
Unpaid (family) labour input [FWU]	1.6	1.53	1.66
Paid labour input [AWU]	0.46	0.75	0.42
Age farm manager	50	47	48
Utilized agricultural area (UAA) [ha]	26.54 ^{2,3}	30.23 ^{1*}	40.19 ¹
Silage maize [ha]	2.16 ³	3.1 ³	6.46 ^{1,2}
Total livestock units [LU]	34.74 ^{2,3}	51.69 ^{1,3}	74.19 ^{1,2}
Dairy cows [LU]	26.81 ^{2,3}	43.00 ^{1,3}	61.59 ^{1,2}
Animal stocking (LU/ ha)	1.31 ^{2,3}	1.71 ¹	1.85 ¹
Livestock per labour input (LU/AWU)	16.86 ^{2,3}	22.73 ^{1,3}	35.55 ^{1,2}
Milkyield [kg per cow & year]	7455 ³	7899 ^{3*}	8845 ^{1,2*}
Output/Input/Income			
Output total per Dairy cow [CHF/GVE]	11'572	10'774	10'360
Output Livestock per Dairy cow [CHF/GVE]	6746	6909	6944
Output milk [CHF/GVE]	4674	5154	5293
Output direct payments per UAA [CHF/Ha]	2322	2404	2211
Input total [CHF] per Dairy cow	8727	8335	8321
Input concentrate per milkyield [CHF/kg]	0.14	0.13	0.15
Depreciation Fixed installations [CHF]	3'576 ^{2,3}	8'404 ^{1,3}	33'509 ^{1,2}
Variable input on total input [%]	39	41	45
Agricultural income [CHF]	76'270 ^{2,3*}	104'894 ¹	125'611 ^{1*}
Family farm income per family work unit [CHF/FWU]	47'758 ^{2,3}	68'740 ¹	75'572 ¹
Farms ⁴ [n]	204	203	19
Off farm income ⁴ [CHF]	19'461	21'210	11'323
Share of working days off farm in total working days ⁴ [%]	8	10	4

¹Sign. different to BPMS, ²Sign. different to PMS, ³Sign. different to AMS. *Level of significance < 0.05. ⁴ only available for individual farms, since key figures on non-agricultural activities are not collected for farm associations 31.12.2020: 1 Euro = 1.078 CHF

For the analysis of non-agricultural activities, we only use individual farms (i.e. did not consider farm associations), since key figures on non-agricultural activities are not collected for farm associations. In the case of individual farms, we do not observe that the proportion of working days for non-agricultural activities or the absolute figures for non-agricultural income are significantly different between the groups.

DISCUSSION

The present study was the first to analyse descriptively the differences between farms in terms of structure and profitability according to their milking system in Switzerland. BPMS and PMS are still the most common milking systems, with more farms in hill and mountain regions using BPMS. The clear differences in livestock per labour input highlight the

great gaps in physical labour productivity between these milking systems. The investment in a more modern milking system is often associated with an increase in farm size. Bigger farms have mostly higher family farm income per family work unit at higher intensities.

AMS tend not to be used on smaller farms in Switzerland. This is likely because these milking systems require a certain size in order to ensure economic profitability. The profitability gap between AMS versus non-AMS farms would be even bigger if we would account for the huge differences in terms of age of the milking system.

From the point of view of the farm manager's family, flexibility through AMS can economically only be achieved on larger farms and despite easing physical labour, these farms still have to cope with a heavy workload. The fact, that the labour efficiency gained with an AMS does not lead to a substitution of agricultural work with non-agricultural work or leisure time, is also related to this.

As the results presented are initial descriptive analyses, we intend our future research to investigate causal effects of the milking system on farm economic performance.

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