



XVIIth World Congress of the International Commission of Agricultural and Biosystems Engineering (CIGR)

Hosted by the Canadian Society for Bioengineering (CSBE/SCGAB)
Québec City, Canada June 13-17, 2010



CALCULATION AND PLANNING FARM MANAGEMENT TASKS IN PIG AND DAIRY FARMING CHRISTOPH MORIZ¹

¹ Agroscope Reckenholz-Tänikon Research Station ART, Research Group Buildings, Animals and Work, 8356 Ettenhausen, Switzerland, christoph.moriz@art.admin.ch

CSBE100946 – Presented at Section V: Management, Ergonomics and Systems Engineering Conference

ABSTRACT Management tasks are assuming increasing importance in agriculture. Unlike the situation with production-related activities, there is a dearth of work-economics data on management tasks in pig and dairy farming, making it difficult to formulate reliable work-planning statements. Based on purposeful classification and a method of data collection and data modeling the present study serves to establish key work-economics figures for management in dairy farming, pig fattening and piglet production. Data on the corresponding work elements and influencing factors are recorded according to the systematic classification of farm management as a whole, using a new methodical approach. Separation is maintained between elements and influencing factors during the course of data collection. The work elements are collected in the form of work trials and stored in a database. The factors which affect the working-time requirement are collected empirically. Work elements and influencing factors can then be logically connected to one another in the mathematical model. The working-time requirement can thus be calculated for the individual working areas as well as for farm management as a whole. For dairy farming seventy-one dairy farms in the different regions of Switzerland as well as in southern Germany were chosen for the data recording. Depending on herd size, the working-time requirement for farm management is between 8.3 and 37.6 MPH per cow and year. The absolute values range between 263 and 1,281 MPH per herd and year. The percentage of the overall working-time requirement taken up by farm-management tasks fluctuates between 13 and 24%.

Keywords: farm management, working time requirements, calculation model

INTRODUCTION The time required for farm-management work in agricultural enterprises has substantially increased recently, particularly in relation to the total working-time requirement. The increase is essentially due to the increasing mechanisation of field and on-farm work along with considerable expansion of administrative activities. Farm-management work is therefore of central importance. It also seems reasonable to compile the appropriate fundamental farm-management data in order to obtain a complete picture of the agriculture enterprise as part of labour management planning. Unlike work which is directly related to production, such as milking and feeding, there is primarily a lack of fundamental and suitable systematisation

of the corresponding activities and a lack of actual labour-management characteristics. A systematic approach of this type forms the basis of differentiated data acquisition and calculation of the working-time requirement.

METHODOLOGY Based on the subdivision of farm-management work, the aim when recording data is to make a clear distinction between work elements and influencing factors. On the one hand, recording the data on the basis of work elements ensures that the level of transferability of individual elements between different production processes is high. On the other hand, by differentiated collection of the different influencing factors, the complexity of farm management can be considered with much greater accuracy. This also ensures that the working-time requirement for farm management is viewed in relation to individual production processes. These requirements, that is, being able to make a distinction between work elements and influencing factors and then integrate them into a model, form the outline of the basic claim to a new methodical approach. The special characteristics of farm management in agricultural enterprises must also be taken into account.

Since the overwhelming proportion of work elements to be recorded in agricultural practice is processed in the office, carrying out work trials is an appropriate approach to this part of data collection. Different influencing factors can be varied and combined at relatively low cost. It is also possible to repeat the process several times without a great deal of effort [cf. HAMMER 1976]. In order to make sure that the figures are representative, trials are carried out using different people and are carried out in different offices and on different days. The individual resulting average values from the work trials are then entered into the database in which all of the work elements are stored. Each work element is clearly labelled in the database with a code and a name. The database also produces the beginning, end, author and work content of the element. For each work element, a total value is calculated from the average values of the work trials and used as a plan-time value for the element concerned.

The median, standard deviation, variance and the coefficient of variation are also stated in the database. These work elements, which are collected essentially for office tasks, appear again when calculating the working-time requirement for almost all of the activities involved in farm management. Not only are the work elements used in numerous labour management planning models for farm management, but transferability between the farm management tasks of different processes is also guaranteed. The crucial advantage of using elemental steps in data acquisition is that once work elements have been recorded, they are not only useful for calculating different activities within farm management but can also be used for the numerous agricultural production processes and vice versa. Since the majority of the elements relevant to office work do not apply to agriculture alone, it is also conceivable that non-agricultural companies will generate models in order to optimize their office organisation. Recording the factors which affect the working-time requirement is just as important for calculating the working-time requirement as is collecting the work elements. Unlike the working procedures of farmyard and outdoor work, where a large proportion of the influencing factors (such as road distances, plot sizes and working widths) can be measured and therefore recorded directly, when collecting the influencing factors for farm management, other conditions must be assumed. Because a large proportion of the influencing factors has to be

discovered by questioning the farm managers, the influencing factors are collected in the form of an empirical study. The decision in favour of personal questioning, with the aid of a previously prepared questionnaire, takes due account of the complexity of the subject. The questionnaires are then evaluated and the influencing factors stored in a database. Based on the databases presented for work elements and influencing factors, the main task when calculating the working-time requirement lies in making the logical connection between elements and influencing factors [cf. AUERNHAMMER 1976]. This connection is made within mathematical models. The influencing factors which are stored in the database can be integrated into the corresponding calculation modules for each farm. The work elements required for the calculations in the module concerned are read in from the database described. The working-time requirement can therefore be calculated for different working areas (applications, finance, further training, etc.) in different modules and the results expressed in different units. The total working-time requirement is calculated by adding the results of all of the modules.

RESULTS The logical link between the non-operational work elements stored in data bases and farm-specific influencing factors is established in a modular calculation system. The structure of the system has its source in basic systematic classification, hence it was possible to adapt the calculation system to the circumstances of milk production as well as to pig fattening and piglet production. Transferability to different production processes also ensures that work elements already validated from the farm management sphere need not be gathered again. The appropriate calculation models had to be adapted and modified for the pig farming studies. The empirical survey of influencing factors was conducted on the basis of an existing questionnaire which was modified specifically to meet the requirements of pig fattening and piglet production.

Dairy farming The working time requirement calculation for farm management was carried out in a model. The model structure was geared to the systematic classification of farm management tasks. Initially the calculation was carried out individually for each activity involved (e.g. ration calculation), then for different groups of tasks (e.g. planning and organisation), and finally for farm management as a whole. In terms of the working time requirement for different tasks, three typical patterns emerged subject to farm size. Whereas very strong degressive effects were shown for some of the tasks (e.g. purchase of feed), only a slight reduction potential could be expected from other activities (e.g. breeding- and herd-planning), even for sizeable herds. An increase in the working time requirement per cow per year even needed to be factored in for large herds in the case of tasks like farm meetings or labour planning.

Depending on herd size, between 8.3 and 37.6 man-hours per cow per year have to be spent on farm management as a whole (Figure 1). The regression equation

$$y = 7.954 + 216.381 \cdot \frac{1}{x}$$

where x = herd size [cows n] and y = working time requirement [MPh per cow per year] explains the dependence of the working time requirement for farm management in dairy farming on herd size with a coefficient of determination of $R^2 = 84.8\%$. As is already known from directly production-related tasks (e.g. milking, feed distribution), economies of scale are particularly pronounced up to a herd size of 60 cows.

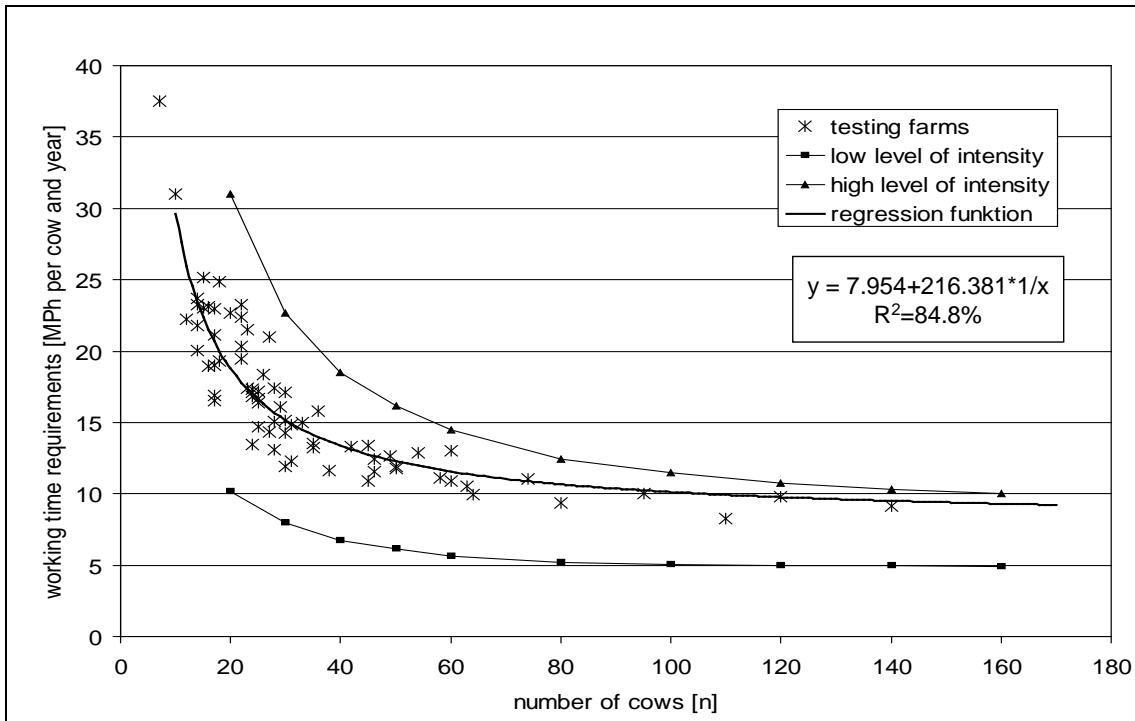


Figure 1. Working time requirements for farm management in dairy farming in dependence on the herd size.

Due to the fact that the degressive effects for farm management tasks follow the patterns already known in other jobs, no dependence of the relative share of farm management in overall working time requirement was anticipated in dairy farming. For the farms studied, the relative share of farm management tasks in overall working time amounted to an average of 18 %. This is within a range between 13 % and 24 % (Figure 2).

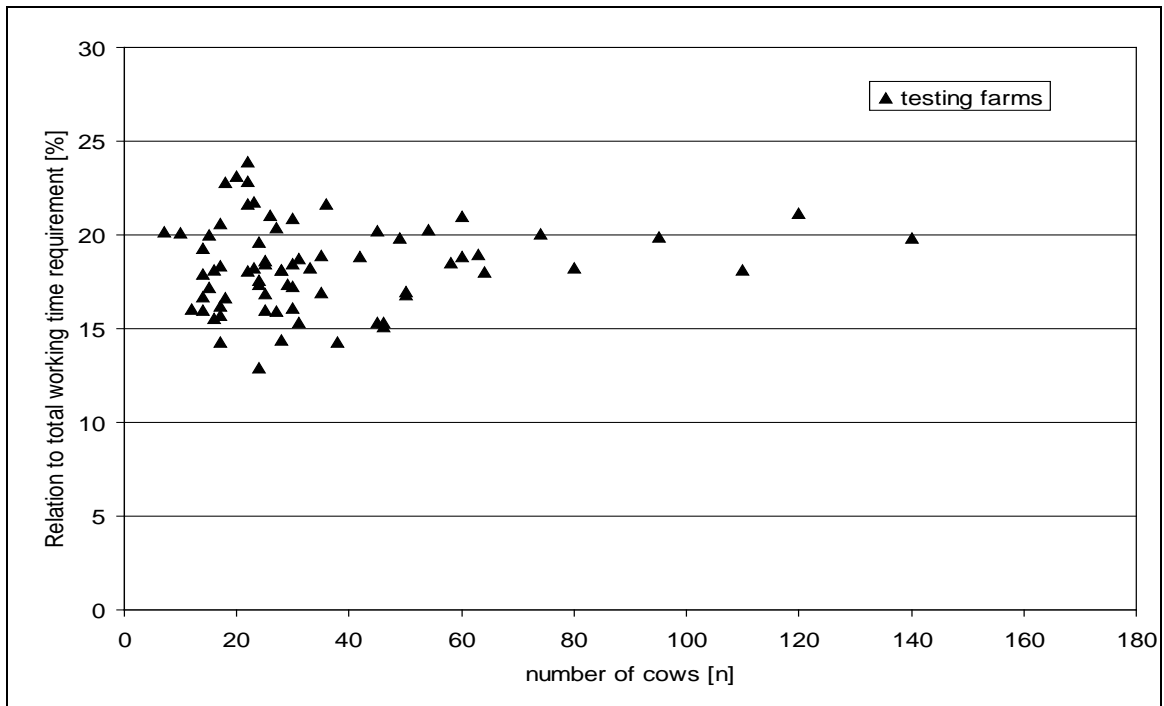


Figure 2. Working time requirements for farm management in dairy farming in relation to the overall working time requirement.

Pig fattening The calculations relating to the working time requirement in pig fattening show that different amounts of time are spent on individual farm management categories. Hence a lot of time is taken up by planning and organisation, control tasks and sales in particular (Table 1).

Table 1. Working time requirements for farm management in pig fattening.

Number of places	MPH / 100 places and year					
	400	800	1200	2000	3000	4000
Planning	23.6	21.5	21.4	23.4	24.7	26.5
Control	22.9	21.1	20.5	20.9	21.1	21.3
Records	7.8	6.0	5.4	4.9	4.6	4.5
Applications	3.7	2.0	1.5	0.9	0.6	0.5
Purchasing	3.9	2.0	1.4	0.9	0.7	0.5
Sales	10.5	10.3	10.2	10.1	10.1	10.1
Finance	3.8	2.5	2.0	1.8	1.8	1.7
Accounts	2.7	1.4	1.0	0.7	0.5	0.4
Further training	14.5	8.4	7.7	5.5	3.7	2.7
Consultation	5.3	3.3	2.6	1.8	1.2	0.9
Farm management	98.7	78.5	73.7	70.9	69.0	69.1

Altogether in pig fattening between approximately 100 and 70 man-hours per 100 fattening places per year are spent on farm management (Figure 3). On each farm this is equivalent to an annual working time requirement of around 400 MPh (400 fattening places) to approximately 2760 MPh (4000 fattening places). The reduction in time requirement per place per year is particularly pronounced up to a herd size of 1500 fattening places. From around 3500 fattening places onwards the working time requirement again increases slightly. This is linked to the differing time requirement patterns in individual farm management categories. Whereas the time requirement for information and further training follows a strongly degressive pattern, the time spent on control jobs decreases only slightly as herd size increases. In the sphere of planning and organisational tasks, a decrease in time requirement is shown up to around 1000 fattening places, after that there is a significant increase again.

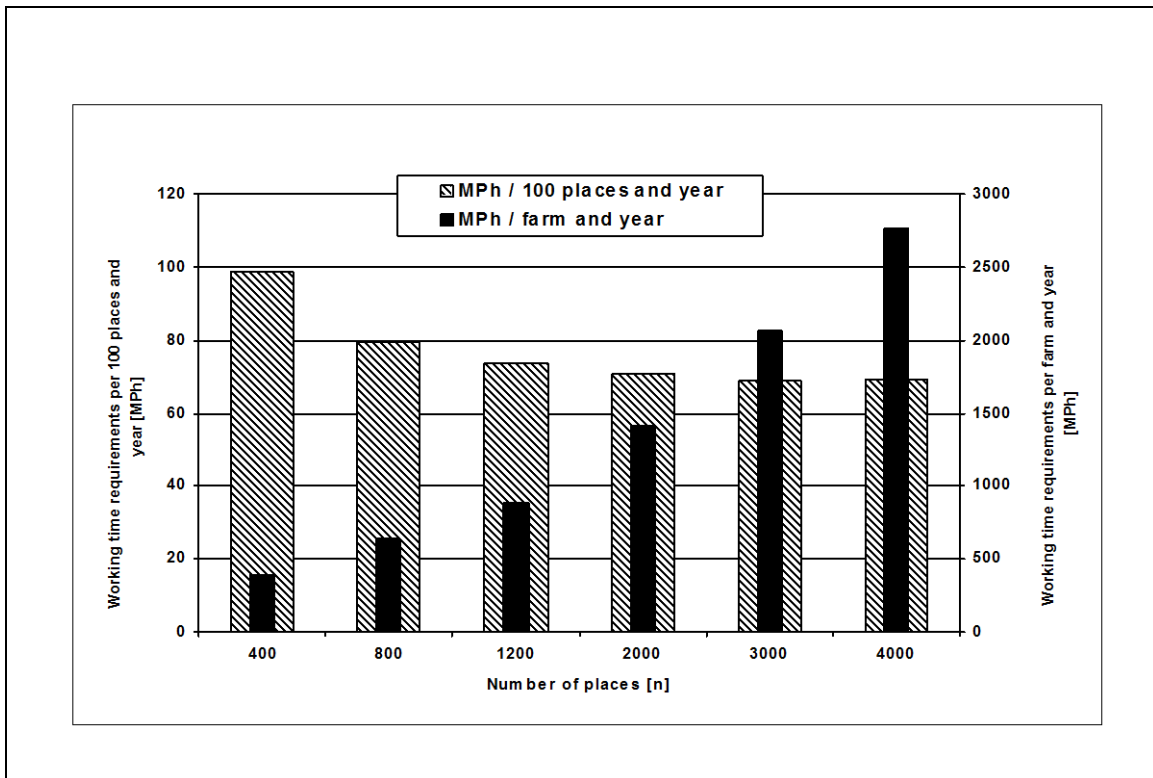


Figure 3. Working time requirement for farm management in pig fattening subject to fattening places.

Piglet production In piglet production as well, different categories of farm management assume significantly differing levels in relation to time requirement. Planning and organisation in particular, together with control tasks, make high demands on the farmer's working time. Depending on herd sizes, up to more than 80 percent of working time spent on farm management as a whole is for these two categories. The importance of these activities is therefore very much more pronounced in piglet production than in pig fattening. Here the share of planning, organisation and control work accounts for up to around 60 percent of farm management.

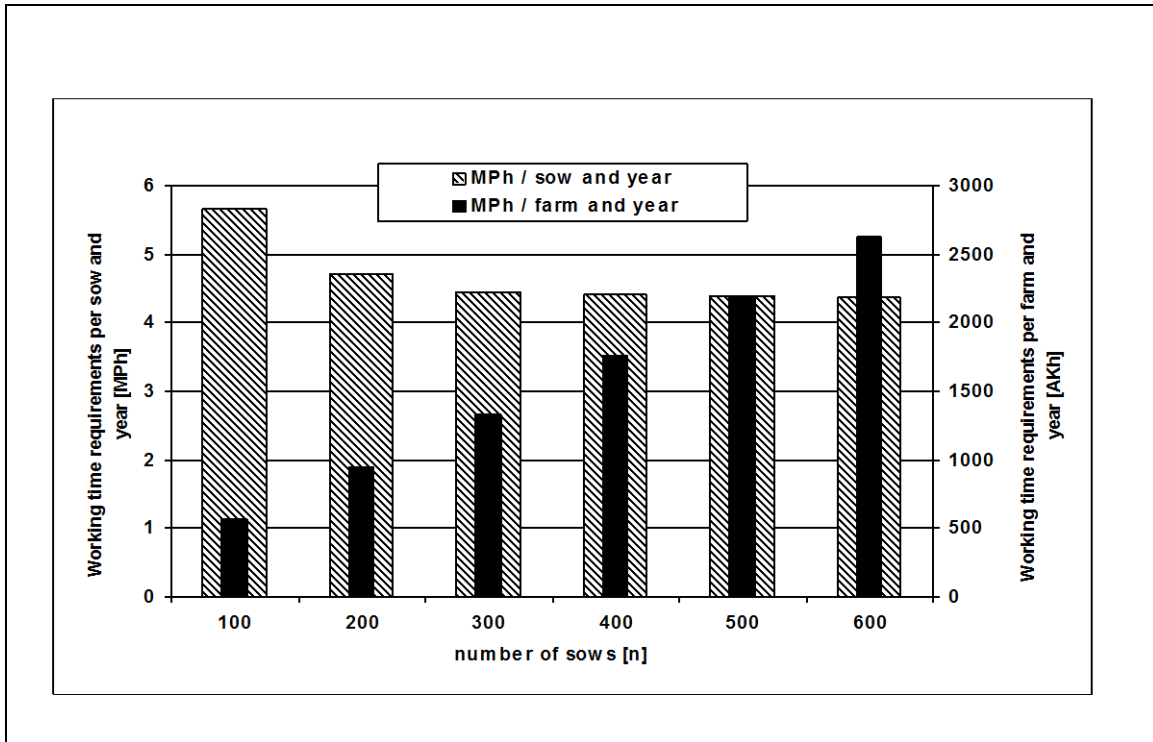


Figure 4. Working time requirement for farm management in pig production subject to number of sows kept.

In piglet production altogether between approximately 5.7 and 4.4 MPh per sow per year are spent on farm management, subject to herd size (Figure 4). On each farm this is equivalent to an annual working time requirement of between around 565 MPh (100 breeding sows) and around 2622 MPh (600 breeding sows). Up to a herd size of approximately 300 sows the decrease in time requirement is per sow per year particularly clear. This decrease in time requirement remains static for a herd size of around 500 sows and over. Again, these effects are caused by the differing time requirement patterns in individual farm management categories. The time requirement for planning and organisation again increases significantly for a herd of 400 sows or more. For a herd of 600 sows the time requirement per sow per year reaches even higher values than for a herd of 100 sows. The values for control tasks show a similar pattern. Here, however, only a slight increase in the time requirement per sow per year was noted for a herd of 300 sows and over. Viewed as a whole, these two patterns definitely underline the importance of planning, organisation and control tasks in piglet production.

CONCLUSION Farm management work is becoming increasingly important in agriculture. In contrast to production-related activities, only a limited amount of data material is available on labour management, which makes it difficult to formulate appropriate statements for planning purposes. Data on the corresponding work elements and influencing factors are recorded according to the systematic classification of farm management as a whole, using a new methodical approach. Separation is maintained between elements and influencing factors during the course of data collection. The work elements are collected in the form of work trials and stored in a database. This method of recording based on elements allows data which have been collected once to be used in

different calculation modules and for different production processes. The factors which affect the working-time requirement are collected empirically. The complexity of the subject is reflected by carrying out a personal survey with the aid of a previously prepared questionnaire. Work elements and influencing factors can then be logically connected to one another in the mathematical model. The working-time requirement can thus be calculated for the individual working areas as well as for farm management as a whole.

REFERENCES

- Auernhammer, H. (1976): Eine integrierte Methode zur Arbeitszeitanalyse. [*An integrated method for working time analysis.*] KTBL-Schrift Nr. 203, Landwirtschaftsverlag Münster-Hiltrup.
- Hammer, W. (1976): Arbeitszeit- und Beanspruchungsfunktionen. [*Working time and stress functions.*] KTBL-Schrift Nr. 202, Landwirtschaftsverlag Münster-Hiltrup.
- Moriz, C. (2004): Arbeitszeitermittlung für das Betriebsmanagement – ein kausal-empirischer Ansatz. [*Determination of working time for farm management – a causal-empirical approach.*] FAT-Schriftenreihe Nr. 62, Pg. 51-57.
- Moriz, C. (2005): Betriebsmanagement in der Landwirtschaft – Systematisierung und Ansatz für die Arbeitszeitermittlung. [*Farm management in agriculture – systematisation and approach for the determination of working time.*] 7. Tagung: Bau, Technik und Umwelt in der landwirtschaftlichen Nutztierhaltung, Pg. 223-228.