## Bavarian animal welfare pilot farms – Labor input by comparison

## Bernhard Haidn<sup>\*</sup>, Thomas Schleicher and Juliana Mačuhová

Bavarian State Research Center for Agriculture, Institute for Agricultural Engineering and Animal Husbandry, Prof.-Dürrwächter-Platz 2, 85586 Poing, Germany

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### Abstract - Kurzfassung

The aim of this working time study was to obtain basic data from all 34 monitored farms with different farm activities. Moreover, an overview of the labor management and working conditions in Bavarian livestock husbandries was to be given to assess their national and international level. To collect labor input data, the farmers kept working diaries for 16 weeks over one or more periods (e.g. at least during one whole fattening period, or distributed equally over the whole year), depending on their specialization. They were to enter all working procedures performed during this period. For seven farms the recording quality was evaluated as "unsatisfactory" or "insufficient". Reliable data on labor input were obtained from the others. For the 12 dairy farms (18-99 cows) a labor input of 42 - 114 working hours (WH) per cow and year was ascertained. Milking, feeding, young cattle care and management required the greatest shares of working time in descending order. Only five farms do not exceed the available labor capacity. Three organic farms keeping 20-52 suckler cows had a labor input of 16-27 WH per cow and year. These are typical results for the herd sizes observed. In the piggeries the organic production method had a bearing on the labor input. Three organic farms keeping breeding sows needed 22-35 WH per sow and year, while four conventional farms had results between 10 and 14 WH per sow und year. Also in the pig fattening activity the one organic farm tested differs substantially (3.7 WH per pig place and year) from the three conventional farms with 0.6-1.1 WH per pig place and year. In pig fattening production, the labor input is between 4 and 98 % of the available work capacity. This was mostly influenced by the volume of production and the better utilization of the housing capacity after moving into a new building. Three farms with laying hens (500-3,000 hen places) had a decreasing labor input per place und year with increasing herd size. Only 15-30 % of their available work capacity was used.

**Keywords:** Working time requirement, livestock husbandry, Bavarian family farms

# Arbeitszeitaufwand in Bayerischen Pilotbetrieben für artgerechte Tierhaltung

Mit einer Arbeitszeitstudie in 34 Pilotbetrieben werden Basisdaten für verschiedene Betriebszweige ermittelt und ein Überblick über die Situation der Arbeitswirtschaft in den bayerischen Tierhaltungsbetrieben gegeben, um das Niveau auf nationaler und internationaler Ebene einordnen zu können. Zur Erfassung des Arbeitszeitaufwands in allen Betrieben wurde die Methode der Zeitermittlung über ein Arbeitstagebuch, das jeder Landwirt über 16 Wochen zu führen hatte, gewählt. Die Arbeitszeit sollte nach Arbeitsvorgängen und -teilvorgängen aufgezeichnet werden. Die in fünf Stufen bewertete Qualität der Aufzeichnungen ergab für 7 Betriebe "mangelhaft" oder "unbrauchbar". Von den restlichen Betrieben liegen zuverlässige Arbeitszeitdaten vor. Für die 12 Milchviehbetriebe mit Bestandsgrößen von 18-99 Kühen wurde ein Arbeitszeitaufwand von 42 bis 114 APh pro Kuh und Jahr ermittelt. Melken, Füttern, Jungviehversorgung und Management besitzen in dieser Reihenfolge die höchsten Anteile. Nur 5 Betriebe liegen nicht an der Grenze zur vollständigen Auslastung der vorhandenen Arbeitskapazitäten. Für die drei nach den Richtlinien des ökologischen Landbaus wirtschaftenden Mutterkuhbetriebe wurde mit 16-27 APh pro Kuh und Jahr ein für die vorhandenen Bestandsgrößen (20-52 Kühe) typisches Ergebnis erzielt. Im Bereich der Schweinehaltung wirkte sich die ökologische Wirtschaftsweise ganz erheblich auf den Arbeitszeitaufwand der Betriebe aus. Drei Bio-Betriebe mit Zuchtsauenhaltung benötigten zwischen 22 und 35 APh pro Sau und Jahr, während die vier konventionellen Betriebe zwischen 10 und 14 APh pro Sau und Jahr lagen. Auch in der Mastschweinehaltung weicht ein Bio-Betrieb mit 3,7 APh pro Mastplatz und Jahr erheblich von den drei konventionellen Betrieben (0,6-1,1 APh/Mastplatz und Jahr) ab. Für die Schweinehaltung lag der Anteil des Arbeitszeitaufwands an der vorhandenen Arbeitskapazität innerhalb einer sehr breiten Spanne von 4 und 98 %. Maßgeblichen Einfluss übt der Produktionsumfang des Betriebszweigs und die Auslastung der Stallplätze nach dem Neubau aus. Drei Legehennenhalter wiesen mit zunehmender Bestandsgröße von 500 bis 3.000 Stallplätzen einen abnehmenden Arbeitszeitaufwand pro Huhn und Jahr auf. Dabei betrug die Auslastung der vorhandenen Arbeitskapazität nur etwa 15 bis 30 %.

Schlüsselwörter: Arbeitszeitaufwand, Tierhaltung, bayerische Familienbetriebe

<sup>\*</sup> Corresponding author. Tel: ++49 (0) 8161 713899; Fax: ++49 (0) 8161 714048; E-mail: bernhard.haidn@lfl.bayern.de

## 1 Introduction

Bavarian livestock husbandry faces national and international competition. To promote animal welfare housing systems, a pilot study was carried out in 2003 – 2005 in a combined project accompanied by a scientific group. Among constructional-technical aspects and animal welfare, environmental protection as well as economics and work management were also researched. In total 34 farms participated in the project.

The time studies on these pilot farms in Bavaria were geared to ascertaining the time-based work load of the farms. The project gathered data on important work procedures (sub-procedures) for conventional and organic farms, carrying out weak point analyses and comparing the results with known data from literature. Furthermore, basic data for planning and optimizing animal housing systems were to be obtained.

In order to achieve these goals, suitable methods for working time collection had to be selected and applied in time studies.

## 2 Material and methods

In view of the high effort involved in time measurements for the collection of labor input data by the farmer, a work diary was selected as this offers sufficient and differentiated data accuracy for each farm, if kept carefully. However, general use of the data to develop calculation models (e.g. on the level of time standards) was not possible.

For the individual production processes, standardized work diaries were provided as DIN A4 data entry forms differentiating work inputs down to subprocedures. Time measurements accomplished in the past served as guidelines (Haidn 1992, Haidn & Kraus 1994, Haidn et al. 1997, Haidn et al. 1998, Haidn & Freiberger 1999, Haidn & Freiberger 2001). The procedure for recording work times was agreed upon exactly with the farmers. The work done was to be registered daily in each case and/or for each feeding time in the data entry form. The work performed on at least five days per week was marked as routine work, other as a special work. The recording period for each farm and year covered at least 16 weeks (over one or more periods (e.g. at least during one whole fattening period or distributed equally over whole year), depending on specialization. In the case of newly built housing the recordings began only several months after the first use, so that a work routine had developed. In order to identify and rectify recording errors or problems arising in the course of time, the farmers were asked to deliver the weekly papers at regular intervals during the recording phase. After completion of the diary recordings requested, the raw data in the forms were available. The various farming activities were treated

differently in the computation of the total labor input.

Dairy cattle husbandry, beef fattening and raising young cattle are continuous production processes with hardly any seasonally caused work peaks in barn and yard operations. Therefore the resulting working time was calculated in each case in the four recording periods of the diaries, projected for the respective season, and the yearly total labor input of the farm activity was ascertained.

For suckler cow and laying hen husbandry the recording scheme for dairy cattle husbandry was used. However (seasonal) work peaks (e.g. laying hens in/out or grazing/calving season with the suckler cows) had to be considered. The consequence was that additional interviewing of the farmers was necessary in order to be able to consider all work peaks or seasonal work and to include them as exactly as possible in the calculations.

Breeding sow husbandry exhibits specified work in the weekly rhythm. Therefore the diary recordings allowed projections for one year from a multiple of the weekly rhythms, since all work in this rotation is repeated.

With fattening pig husbandry, piglet rearing and turkey fattening the labor input for one or two batches was ascertained and the results were projected for one year.

## 3 Results and discussion

The results of the computation of the labor input are summarized in the following section for the production processes and/or for the activities dairy cattle and suckler cow husbandry, breeding sow and fattening pig husbandry, as well as for laying hen husbandry in tables broken down by farms and working procedures. Results for calf husbandry, piglet rearing and turkey fattening can be read in Haidn & Schleicher (2006). The quality of the recordings was assessed by the person responsible. Altogether of the 34 farms, 8 were assessed as "very good", 8 as "good", 11 as "satisfactory" and 5 as "unsatisfactory". Two farms did not record any labor input.

## 3.1 Dairy cattle husbandry

Five (MV4, MV7, MV8, MV10 and MV11) of the 12 pilot farms with dairy cattle husbandry also practice mixed farming (i.e. besides dairy cows also crop production). In the investigation period the average herd size was between 18 and 99 cows. With one exception the animals were kept in cubicle loose housing stables. The quality of the recordings varied very strongly. The assessment was "very good" for two farms, "good" for three farms and "satisfactory" for four farms. One

farm supplied incomplete recordings and no results were available from two farms.

The average labor input of the farms varied between 42 and 114 working hours (WH) per cow and year (Table 1). While 7 farms exhibited a labor input between 40 and 60 WH, independently of the herd size, three farms (MV3, MV10, MV12) deviate substantially. The causes of this are to be seen in the high labor input for individual work procedures. With on average almost 30 WH per cow and year, milking accounted for the highest portion. The large variations can be explained both by the herd size and by the technical equipment. Highly mechanized capacities in small herds (e.g. MV1, MV7) led to a labor input of less than 20 WH per cow and year. On the other hand poor labor management in combination with an unfavorably arranged milking area caused a very high labor input (MV3, MV12). Likewise with 6 to 27 WH, the feeding work took up a very high portion of the total work. A direct relationship to the feeding technology can be identified for this working procedure. Farms with a fodder mixing wagon (farms MV1, MV2, MV4, MV6, MV9, MV10 und MV11) had a recognizably lower labor input (expect MV10) than those (remaining farms) which provided the fodder via a "silo cutter" with manual distribution in the stable.

Table 1: Labor input of the dairy farms (MV1 to MV12)

Management and the work for young cattle require a comparable input of approximately 9 WH per cow and year. The large variation between the farms is to be considered here, too. The portion of routine work preponderated on all farms. Only five farms did not surpass the available work capacity (the annual work units) with the labor input ascertained. In particular the farms with 50 to 70 cows as well as the two poorly organized small farms exceeded the available work capacity. Also farm MV2 is to be mentioned here, as one old person will retire from work on a long-term basis and so the annual work units will decrease. However, the workload of the remaining work capacity will increase.

An evaluation of the results on the basis of the model calculations by Schick (2004) shows altogether good concordance (Fig. 1). The stronger deviations of the farms MV1, MV3 and MV12 are not explicable, however typical for this herd size. An improvement of the work organization can already show a substantial effect for the farms.

Farm	MV1*)	MV2	MV3	MV4	MV5*)	MV6
Labor input per cow and year (WH)						
Management	9.3	7.0	21.4	-	4.4	4.9
Feeding	8.4	5.9	27.5	-	11.1	6.9
Littering	1.5	2.9	2.8	-	1.2	1.3
Mucking out	1.5	2.2	3.2	-	3.7	4.5
Milking	16.3	21.0	37.9	-	34.6	18.8
Young cattle	2.9	12.8	15.5	-	5.9	9.7
Grazing	0.4	0.0	3.9	-	0.7	0.0
Maintenance and repair	1.2	0.1	1.8	-	0.6	0.5
Total	42	52	114	-	62	47
Average herd size	40.3	99.0	18.6		38.0	73.0
Labor input of the farming activity (WH)	1,676	5,160	2,121	-	2,359	3,397
Annual work units (AWU)	1.2	3.0	1.0	3.0	1.9	1.6
Available work capacity ( $1 \text{ AWU} = 2,300 \text{ WH}$ )	2,760	6,900	2,300	6,900	4,370	3,680
Needed work capacity (%)	61	75	92	_	54	92
Farm	MV7	MV8*)	MV9	MV10	MV11	MV12*)
Labor input per cow and year (WH)						
Management	2.4	1.2	_	11.6	7.7	15.7
Feeding	10.5	13.9	_	20.0	7.0	26.9
Littering	1.1	1.4	_	4.9	1.9	2.4
Mucking out	3.3	3.4	_	7.4	2.5	6.6
Milking	19.3	28.6	_	30.6	31.6	53.5
Young cattle	10.8	10.7	_	11.0	5.6	5.4
Grazing	0.0	0.0	-	0.0	0.0	0.5
Maintenance and repair	0.0	0.4	_	0.8	0.9	0.0
Total	48	60	-	86	57	111
Average herd size	37.4	18.0		50.6	61.0	35.0
Labor input of the farming activity (WH)	1,778	1,073	-	4,368	3,487	3,886
Annual work units (AWU)	1.2	3.0	2.2	1.8	1.5	1.2
Available work capacity (1 AWU = 2300 WH)	2,760	6,900	5,060	4,140	3,450	2,760
Needed work capacity (%)	64	16	_	105	101	141

\*) organic farm



Fig. 1: Grading of the labor input in the dairy farms

#### 3.2 Suckler cow husbandry

The three suckler cow farms vary in the different fattening duration and the different housing systems. Two smaller farms (MK1, MK2) keep the animals in a sloped floor system and/or deep litter stable with solid concrete surfaces. In the larger farm MK3, cubicles are present for the suckler cows and sloped floor areas for the fattening cattle. The duration of fattening on farm MK1 was 10-14 months, on farm MK2 approx. 12 months and on farm MK3 approx. 22 months. The quality of the recordings and thus the data could be evaluated for one farm as "good" and for the two others as "satisfactory".

The total labor input varied between 16 and 27 WH per cow and year (Table 2). Clear deviations in the working procedures are present with the routine tasks feeding (6.5 to 13 WH), littering (2.5 to 6 WH) and mucking out (1 to 4.8 WH). Only 17-30 % of the available work capacity was needed.

The ascertained labor input of all three farms is lower than the comparative figures by Schied 2002 (Fig. 2) or data published by Schrade et al. (2006). The farm MK1 deviates very strongly downward. Its cleverly

Table 2: Labor input of the suckler cow farms

devised littering procedure and the very simple mucking out system make a certain labor saving quite plausible according to working diary. About one third of the working time was for special work.

#### 3.3 Breeding sow husbandry

All seven breeding sow farms practice arable farming as a further farming activity, farm ZS5 additionally piglet rearing and farm ZS6 pig fattening. The average herd size is 120-210 for the conventional farms and about 20-50 breeding sows for the organic farms (Table 3). Due to the different requirements and number of animals, both ways of farming must be regarded separately. The quality of the recordings of the pilot farms can only be assessed as "very good" in one case and also as "good" in one case. Three farms kept the diary "satisfactorily", and with two others there were obvious deficiencies.



Fig. 2: Grading of the labor input in the suckler cow farms

The labor input ascertained on the four conventional farms was between 5 and 14 WH per breeding sow and year, where the very low value of farm ZS3 cannot be explained. It might be assumed that particular

Farm	MK1*)	MK2*)	MK3*)	
Labor input per cow and year (WH)				
Management	4.0	2.6	3.4	
Feeding	6.5	13.0	7.1	
Littering	3.2	6.0	2.5	
Mucking out	1.0	1.4	4.8	
Young cattle	0.0	0.2	0.7	
Grazing	0.6	3.1	3.1	
Maintenance and repair	0.9	0.5	0.3	
Total	16.2	26.8	21.8	
Average herd size	27.0	14.4	50.5	
Labor input of the farming activity (WH)	436	384	1,102	
Annual work units (AWU)	1.0	1.0	1.6	
Available work capacity (1 AWU = 2,300 WH)	2,300	2,300	3,680	
Needed work capacity (%)	19	17	30	

\*) organic farm

Farm	ZS 1*)	ZS 2	ZS 3	ZS 4*)	ZS 5	ZS 6*)	ZS 7
Labor input per sow and year (WH)							
Management	0.0	1.5	0.2	1.0	0.2	1.0	0.4
Feed supply	1.2	0.0	0.3	3.5	0.7	5.0	0.0
Animal movement	2.7	0.3	0.4	0.2	0.9	3.4	0.5
Feeding	5.6	4.5	1.1	9.7	1.6	11.0	3.7
Mucking out	2.8	0.0	0.6	0.9	1.5	3.5	0.9
Littering	1.1	0.0	0.0	3.1	0.4	5.6	0.2
Animal control	5.9	2.4	1.3	7.2	1.7	2.0	1.7
Animal medicating	1.9	1.0	0.5	2.1	0.7	0.7	0.5
Cleaning	1.1	1.5	0.4	0.1	1.3	2.2	0.8
Maintenance and repair	0.0	0.2	0.1	0.0	0.1	0.3	0.1
Other work	0.0	2.7	0.0	0.0	1.2	0.5	1.2
Total	22.3	14.1	5.0	27.9	10.1	35.0	10.0
Average herd size	38	120	172	22	210	50	141
Labor input of the farming activity (WH)	847	1,691	854	614	2,130	1,752	1,415
Annual work units (AWU)	1.3	1.3	2.0	2.3	1.7	1.2	1.0
Available work capacity $(1 \text{ AWU} = 2,300 \text{ WH})$	2,990	2,990	4,600	5,290	3,910	2,760	2,300
Needed work capacity (%)	28	57	19	12	54	63	62

Table 3: Labor input of breeding sow farms

\*) organic farm

working procedures were not included, or only taken into account incompletely. The three organic farms had a labor input of 22, 28 and 35 WH per breeding sow and year. In each of the two farming methods feed supply and feeding needed the highest time input. Similarly, as with the total work, the level of these working procedures with 7 to 16 WH per breeding sow and year was clearly higher on the organic farms than on the conventional farms (2 to 4 WH). Deficits in feeding mechanization and in standardization of the feeding stuff are obvious. This indicates that organic farms have a large potential for working time savings. Due to stock size and type of husbandry, animal controls are more time-consuming on the organic farms. The same applies for littering and mucking out, too. The remaining work procedures do not show major differences in the labor input. In particular it is surprising that the cleaning took hardly more time, despite the larger surfaces in the organic farms. Based on the available work capacity in the breeding sow farms, 12 to 63 % of the capacity is needed. Thus sufficient capacities are available for the other farming activities. It must be considered that the organic farms (ZS1, ZS4) are still building up their stock. In future they will have to spend more working time on the breeding sow husbandry activity.

A comparison of the results with data from literature, which are based on measurements and model calculations, shows generally good concordance (Fig. 3). For the organic farms, calculations by Riegel & Schick (2006) who examined comparable littered husbandries in Switzerland were consulted. Due to good operational conditions and also because of deficits in the recordings, the calculated optimum values are not reached on some farms. Similarly this applies for the comparison with the calculations of Haidn (1992) for strawless husbandries. The farm ZS2 rears gilts, too, where an increased labor input for management, feeding and animal control of 3-5 WH per sow and year is to be expected.

#### 3.4 Fattening pig husbandry

In the four pilot farms keeping fattening pigs, this farming activity is always combined with arable farming, and once each with dairy husbandry or piglet rearing. The farms have 350 to 1,400 fattening pig places. In the conventional farms strawless variants with different functional areas such as PigPort I (MS1) and/or PigPort II (MS3) and a one-room piggery were predominant. The farm MS4 manages 600 fattening places in a deep litter piggery, connected with a run, according to the criteria of organic farming. The quality of the recordings made by the farmers was judged predominantly as "good" to "very good", so a reliable data source is to be assumed.

With 3.7 WH per feeding place and year, the labor input ascertained on the organic farm differs significantly from the labor input on the conventional farms



Fig. 3: Grading of the labor input in breeding sow farms

1 818				
Farm	MS1	MS2	MS3	MS4*)
Labour input per pig and year (WH)				
Management	0.08	0.02	0.03	0.42
Animal movement	0.12	0.10	0.12	1.17
Feed supply	0.02	0.13	0.14	0.12
Feeding	0.25	0.03	0.11	0.35
Animal control	0.38	0.39	0.04	0.29
Animal medication	0.00	0.03	0.00	0.15
Littering	0.00	0.00	0.07	0.13
Mucking out	0.00	0.00	0.00	0.57
Cleaning	0.23	0.23	0.05	0.38
Maintenance and repair	0.05	0.09	0.00	0.17
Total	1.1	1.0	0.6	3.7
Average herd size	1,200	1,400	350	600
Labour input of the farming activity (WH)	1,350	1,400	196	2,239
Annual work units (AWU)	0.6	1.2	1.9	2.1
Available work capacity (1 AWU = $2,300$ WH)	1,380	2,760	4,370	4,830
Needed work capacity (%)	98	61	4	46

Table 4: Labor input of fattening pig farms

\*) organic farm

(Table 4). In the labor input only few working procedures are comparable with those of the conventional farms. In particular the high values for animal movement (1.17 WH per feeding place and year), management, as well as littering and mucking out are noticeable. In the case of conventional husbandries, pig farming in the PigPort II housing of farm MS3 with 0.6 WH per pig place and year seems to cause particularly little working time. One reason for this may be that after stalling the pigs out, the fattening boxes were only broom-cleaned and flamed instead of wet cleaning with following disinfection. Nevertheless, the highest daily weight gain is found on this farm.

The three conventional farms feature values in line with the literature data (Fig. 4). Deviations through special procedures and techniques are to be observed on some farms. The labor input of the organic farms exceeds the data known from literature (KTBL 2004) substantially.

#### 3.5 Laying hen husbandry

The flock sizes of the three pilot farms with laying hen husbandry were about 500 to 3,000 hens during the working time recordings, whereby on farm GH2 a further 5,000 hens were kept in cage batteries. However the labor time was not recorded. The quality of the recordings on farms GH1 and GH3 is "good" and/or "very good", and lacking on farm GH2.

The labor input ascertained amounted to 0.28 to 1.28 WH per hen place and year (Table 5). The low value of 0.28 WH in GH2 is not meaningful, as work procedures such as management and egg handling, which accrue likewise in the battery system, were not differentiated, and therefore were not or only partially entered in the whole labor input. On all farms the working procedures "egg handling" as well as "management" were the most time-consuming, with a portion

of altogether clearly over 50 %. The work capacity required on the farms accounted for 12 to 29 % of the available work capacity. Even if further farming activities are pursued, the resulting work can be mastered well by the available work capacity on all three pilot farms.



Fig. 4: Grading of the labor input in the farms with fattening pigs

The comparison of the results with literature data shows that labor input ascertained on the pilot farms comes very close to the expected values (Fig. 5). Thus farm GH3 almost coincides with the values ascertained by Hörning et al. 2004, while the two other farms are a little below. The concept of the mobile hen house with free-range on farm GH3 was connected with a clearly higher labor input in relation to housing systems with fixed buildings and a winter run only. In addition the small flock size must be considered, so that preparation times (long distances to the housing) had a stronger effect. Compared with the result of 0.51 WH per hen and year found by Klemm et al. (2004)

Farm	GH1	GH2	GH3
Labor input per hen and year (WH)			
Management	0.07	0.00	0.22
Animal movement	0.01	0.01	0.05
Feed supply	0.01	0.01	0.07
Feeding	0.01	0.00	0.05
Animal control	0.00	0.00	0.01
Animal medication	0.00	0.00	0.00
Littering	0.01	0.00	0.01
Egg handling	0.33	0.20	0.52
Mucking out	0.03	0.03	0.01
Cleaning, preparing	0.01	0.00	0.27
Maintenance and repair	0.01	0.01	0.06
Total	0.49	0.26	1.28
Average herd size	2,075	3,000	500
Labor input of the farming activity (WH)	1,014	782	638
Annual work units (AWU)	1.5	2	2.4
Available work capacity $(1 \text{ AWU} = 2,300 \text{ h})$	3,450	4,600	5,520
Required work capacity (%)	29	17	12

Table 5: Labor input of laying hen farms

on five farms with an average flock size of approx. 1,400 hens (1,000-2,000 hen places), almost the same value is reached on farm GH1.



Fig. 5: Grading of the labor input in the farms with laying hens

#### 4 Conclusions

Data about labor input on most of the Bavarian family farms tested are comparable with known results from other work studies. Only in dairy farming where the labor input requirement is generally very high do some farms lie well above the working time observed in other studies. Moreover, some farms exceed their working capacities by far. In addition, in the piggeries organic farming increases the labor input requirement considerably.

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