



## **TECHNICAL EQUIPMENT AND UTILIZATION OF HUMAN LABOUR RESOURCES IN SELECTED ORGANIC HOLDINGS**

*Urszula Malaga-Toboła, Sylwester Tabor, Anna Szeląg-Sikora*  
*University of Agriculture in Krakow*

### *Summary*

The human potential of an agricultural holding is increasingly treated as a capital allowing a competitive advantage. Its development takes place at the same time as the development of technical equipment and technical progress. The size of livestock herd, technical equipment, labour resources and actual workforce needs of organic holdings were determined. It allowed for calculation of the index of utilization of labour resources. The obtained results indicate a low level of human potential utilization, which amounted to average 40% and remained within the range from 29% for the holdings with the smallest area 58% for the facilities with the largest area. A statistical analysis confirms the significant relationship between the utilization of labour resources and the number of able-bodied persons, workload, machine stock replacement value and livestock size.

**Keywords:** ecological holdings, technical equipment, labour resources, workload

### **INTRODUCTION**

Labour resources and workload constitute very important factors in the process of management and organization of an agricultural holding. They have significant effect on its functioning and economy by the method of management, direction and organization of production (Kocira and Malaga 2012). According to Zięta (2001), in agriculture work efficiency is lower compared to work efficiency in non-agricultural sections. It is the effect of a high level of

employment in agriculture, with low share of this sector in the creation of gross domestic product. The excess of labour resources in agriculture and relatively low range of its use constitutes a serious problem, because it is one of the most important factors limiting the rate of economic transformations in agriculture (Karwat-Woźniak and Chmieliński 2006). Furthermore, the costs of employing redundant persons burden the finances of the family operating the holding from the point of view of the production as well as the actually unemployed people.

Workforce should be understood as the skills which are possessed by a person in production and non-production work. Modern production technologies are labour-saving by their nature, thus, the economic force of holdings is becoming dependent to a greater extent on capacity and ability to absorb new skills of holding employees (Terluin and Post 2000).

Staniewski (2007) points out to the fact that human resources are becoming increasingly commonly included in the group of the most valuable resources of a holding, because they constitute a capital, upon which the key competences are built and competitive advantage is gained. They may, but do not have to be entirely utilized. The form of workforce utilization is labour. Thus, labour resources constitute the upper limit of the possibility to complete a certain task and the upper limit of employment (Wysokiński 2013).

## **OBJECTIVE, SCOPE AND METHOD OF THE STUDY**

The objective of the study was the presentation of the level of workforce resources in organic holdings in the aspect of the direction and organization of agricultural production and technical equipment.

Fifty organic agricultural holdings with certificate confirming their organic character, were included in the analyses. The facilities included in the study were located in the south Poland and were characterized by diversified production.

In order to perform comparative analysis, the holdings were divided into four area groups

- group I (to 5.00 ha) – 12 holdings,
- group II (5.01 – 10.00 ha) – 17 holdings,
- group III (10.01 – 20.00 ha) – 11 holdings,
- group IV (over 20.01 ha) – 10 holdings.

The study was conducted in the form of interview carried out with owners of the holdings and analysis of the gathered documentation.

The plant production organization was evaluated on the basis of the structure of agricultural land use and sowings, whereas the animal production organization – on the basis of the structure of livestock density (Goraj and Mańko 2009).

Technical equipment of the holdings is presented by the machine stock replacement value, assuming prices of new and fully operational machines found

in studied holding without taking into account the level of their economic depreciation. For the calculations prices as of 2013 were assumed. (Gromadzki 2013).

For the evaluation of the utilization of human labour resources the number of able-bodied persons and full-time employees were determined.

Able-bodied person – is a person employed in a holding, calculated following the coefficients expressing his/her efficiency, according to his/her age and gender (Kowalak 1997).

**Table 1.** Coefficients for the calculation of holding employees to able-bodied workers

Holding employees		Coefficients for calculation of persons employed in production	
		of plants	of animals
Adults	man	1.0	1.0
	woman	0.8	1.0
Pensioners	man	0.3	0.4
	woman	0.2	0.3
Children to 18 years	boy	0.9	0.7
	girl	0.6	0.7

source: (Kowalak 1997)

Due to a wide variety of involvement of individual members of a farming family in works of a holding, workload are expressed in the equivalent of a full-time employment, i.e. full-time employees. It was calculated that it is equivalent to the situation of one full-time employee working in an agricultural holding for 2120 hours per year, i.e. 265 work days, 8 hours per day, which corresponds to 1 annual work unit (Szemberg 1998). Thus, the number of full-time employees is the number of persons employed for full time in an agricultural holding, who may obtain the income parity. A full-time employee is the category describing the needed labour resources after conversion to the standard working time of the year.

Workload (man-hours able-bodied person<sup>-1</sup>) – is the amount of work for one able-bodied person, employed in the holding during the year.

Utilization of labour resources index – it is the value describing the use of workforce available in a holding, calculated as the ratio of full-time employees to able-bodied persons and expressed as a percentage.

## STUDY RESULTS

The average surface area of agricultural lands in the studied holdings was 12.88 ha and remained within the range from 3.27 to 32.12 ha. Thus, it was

significantly diversified in individual holdings, hence the advisability of division into area groups. On average, in the structure of agricultural lands, pastures constituted 53%, arable lands 43%, and orchards and perennial plantations the remaining 4%. Land use in the group areas is partially suggested by the direction of activity. It can be concluded, that holdings with the largest area of agricultural lands specialize in cattle rearing (group IV – 70%, Table 2). It is related to the large herd size of average 24.6 LSU (livestock units).

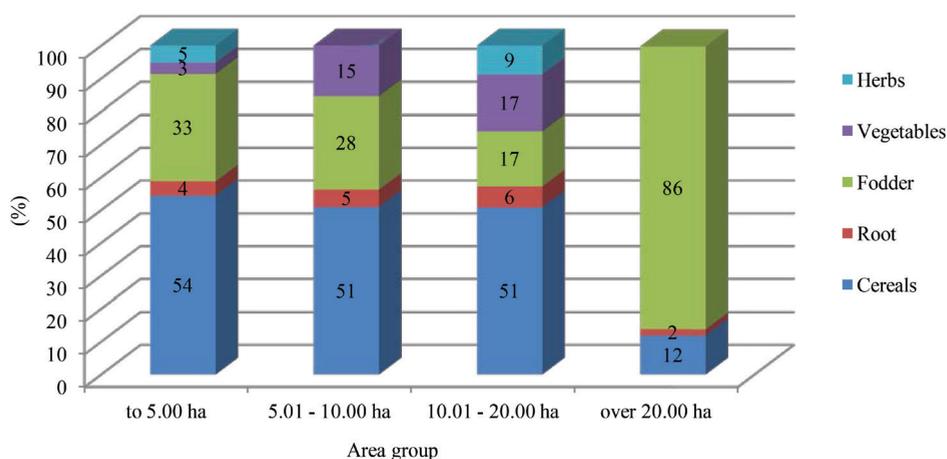
**Table 2.** Agricultural land use and animal stock in the studied holdings

Area group	Arable land (AL)		Permanent pastures		Orchards		Total agricultural lands	Number of livestock	Livestock density
	(ha)	(%)	(ha)	(%)	(ha)	(%)	(ha)	(LSU)	(LSU·ha <sup>-1</sup> AL)
to 5.00 ha	2.03	62	0.56	17	0.68	21	3.27	1.8	0.67
5.01 – 10.00 ha	4.24	61	1.97	29	0.68	10	6.89	5.0	0.81
10.01 – 20.00 ha	7.78	51	7.10	47	0.26	2	15.14	6.5	0.73
over 20.00 ha	9.69	30	22.43	70	–	–	32.12	24.6	0.80
Total	5.58	43	6.85	53	0.45	4	12.88	8.5	0.76

source: own study

Whereas plant production constituted the dominant activity in the smallest and the medium-sized holdings. In such facilities, the current Nitrates Directive, allowing for rearing of only LSU for one hectare of agricultural lands, limits the possibility to run profitable animal production. Thus, in the group I, the average herd size was only 1.8 LSU, and in groups II and III 5.0 LSU and 6.5 LSU respectively. The livestock density in all groups was comparable and remained in the range from 0.67 LSU·ha<sup>-1</sup> AL (group I) to 0.81 LSU·ha<sup>-1</sup> AL (group II), with the mean of 0.76 LSU·ha<sup>-1</sup> AL.

In groups I-III, i.e. in holdings with area of agricultural lands up to 20 ha, cereals dominated in the structure of sowings and constituted over half of arable land area (Fig. 1). The share of fodder plants, which amounted from 17 to 33%, can be also considered to be high. Furthermore, these facilities also cultivated vegetables, but also herbs, with the joint share of 8 to 26%. High diversity of the groups of cultivated plants and low herd size reflect the requirements of biodiversity, which is characteristic of organic holdings. At the same time they indicate the lack of production specialization, which usually results in high workload and their low efficiency. Such specialization is observed in the holdings with the largest area, where fodder plants constituted 86% of sowings, which supplemented the juicy roughage obtained from pastures. Low percentage of cereals constitutes the nutritive fodder, necessary for the balance of complete food ration for cattle.



source: own study

**Figure 1.** Structure of sowings in studied holdings

The average replacement value of the machine stock in the studied holdings was 36.11 thousand PLN·ha<sup>-1</sup> AL. The value in the individual area groups seems to confirm the type of their activity. As the high diversity of plants cultivated in holdings with area up to 20 ha to a certain extent forces the farmers to own diverse technical measures. It is reflected by the high machine stock replacement value in these groups, remaining in the range from 31.42 to 48.68 thousand PLN·ha<sup>-1</sup> AL (Table 3).

**Table 3.** Machine stock replacement value (PLN thousand·ha<sup>-1</sup> AL)

Area group	Tractor	Means of transport	Machines and tools for technologies of					Total
			Cultivation	Sowing, planting and maintenance	Fertilization and protection	Harvest	Animal production	
to 5 ha	18.61	2.28	1.38	1.25	3.13	4.18	0.60	31.42
5.01 – 10.00 ha	16.77	3.43	1.03	2.44	3.56	20.52	0.92	48.68
10.01 – 20.00 ha	11.47	2.78	0.66	0.89	2.20	20.77	0.43	39.20
over 20.00 ha	7.66	2.08	0.44	0.49	1.79	3.56	0.96	16.98
Total	14.22	2.74	0.92	1.42	2.80	13.26	0.74	36.11

source: own study

In holdings with the largest area the machine stock value was only 16.98 thousand PLN·ha<sup>-1</sup> AL, and therefore was significantly lower than in the remain-

ing groups. It should be supposed that it resulted to a large extent from the specialization of these facilities in cattle rearing. As a result, the machine stock was limited only to machines used for harvesting and preservation of green fodders. Thus, the structure of the values of production technical measures was dominated by harvesting machines, including both combine harvesters, as well as machines specialized in harvesting and preservation of green fodder. The value of the remaining machine groups amounted from 0.74 thousand PLN·ha<sup>-1</sup> AL in the case of devices for animal production to 2.80 thousand PLN·ha<sup>-1</sup> AL for fertilization and plant protection machines.

In total, for the analysed holdings 2.4 able-bodied persons accounted for one field unit, including 1.8 adult persons, 0.2 pensioners and 0.4 children up to the age of 18 (Table 4).

**Table 4.** Labour resources (persons per ha<sup>-1</sup> AL)

Area group	Parameter	Number of able-bodied persons employed in holding			
		Total	including:		
			Adults	Pensioners	Children to 18 years
to 5 ha	mean	2.5	1.9	0.2	0.4
	stand. dev.	0.8	0.6	0.3	0.5
5.01 – 10.00	mean	2.2	1.6	0.2	0.4
	stand. dev.	0.9	0.8	0.3	0.6
10.01 – 20.00	mean	2.7	2.1	0.1	0.5
	stand. dev.	1.0	0.7	0.2	0.6
over 20.00 ha	mean	2.1	1.6	0.2	0.4
	stand. dev.	1.0	0.5	0.3	0.8
Total	mean	2.4	1.8	0.2	0.4
	stand. dev.	0.9	0.7	0.3	0.6

source: own study

The lowest labour resources were reported for the facilities, which had 5 to 10 ha, and over 20 ha AL. In these groups, respectively 2.2 and 2.1 person accounted for ha<sup>-1</sup>. Whereas in the remaining groups they were considerably higher and amounted to 2.5 person per ha<sup>-1</sup> in the smallest holdings and 2.7 in holdings, which had 10 to 20 ha. These differences of human potential applied to adult persons, because in the case of pensioners and children the number in the distinguished groups was very similar and amounted to: for pensioners 0.1-0.2 person·ha<sup>-1</sup> and for children 0.4-0.5 person·ha<sup>-1</sup> AL.

The workload borne for the production amounted to the average of 2009 man-hours, including 58% of workload for animal production (Table 5). The studied holdings, due to the relatively small size as well as the organic character, the animal production still remains poorly mechanized. This state of affairs results in high amounts of human labour. In the plant production sector the workload amounted from 601 to 894 man-hours. The only exception were the holdings of the group III, in which plant production required 1316 man-hours. Therefore, in this group the workload of animal production constituted only 39% of total workload, whereas in the remaining groups it constituted from 53 to 68%. After the conversion of workload to one hectare of agricultural lands, their clear decreasing tendency is visible along with the increase of the agricultural land surface area, both jointly as well as in individual production sectors.

**Table 5.** Workload and number of full-time paid employees

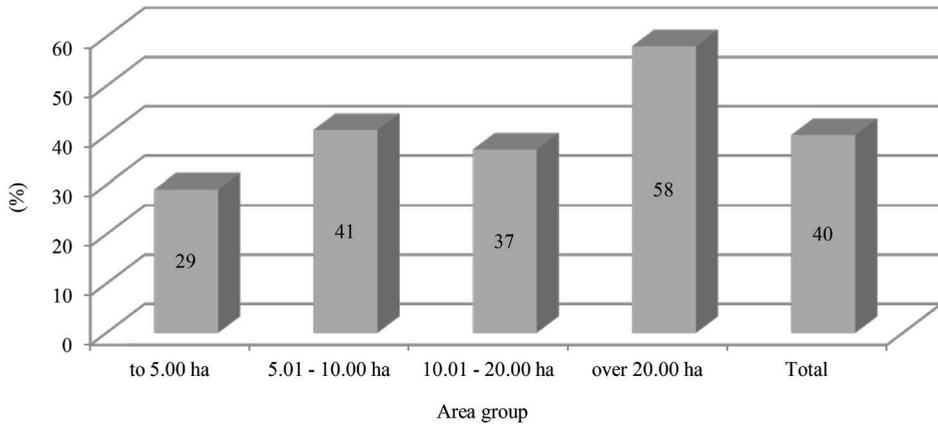
Area group	Parameter	Plant production		Animal production		Total	
		(man-hours)	(full-time paid employees)	(man-hours)	(full-time paid employees)	(man-hours)	(full-time paid employees)
to 5 ha	mean	714	0.3	821	0.4	1535	0.7
	stand. dev.	822	0.4	641	0.3	1306	0.6
5.01 – 10.00 ha	mean	601	0.3	1286	0.6	1887	0.9
	stand. dev.	492	0.2	897	0.4	962	0.5
10.01 – 20.00 ha	mean	1316	0.6	844	0.4	2159	1.0
	stand. dev.	1984	0.9	992	0.5	1798	0.8
over 20.00 ha	mean	894	0.4	1728	0.8	2622	1.2
	stand. dev.	1103	0.5	864	0.4	828	0.4
Total	mean	844	0.4	1165	0.5	2009	0.9
	stand. dev.	1195	0.6	926	0.4	1308	0.6

source: own study

Taking into consideration the workload, the number of full-time paid employees in the studied holdings was 0.9. This demand increases with the area of agricultural lands and amounts from 0.7 in the smallest holdings to 1.2 in the largest facilities (Table 5).

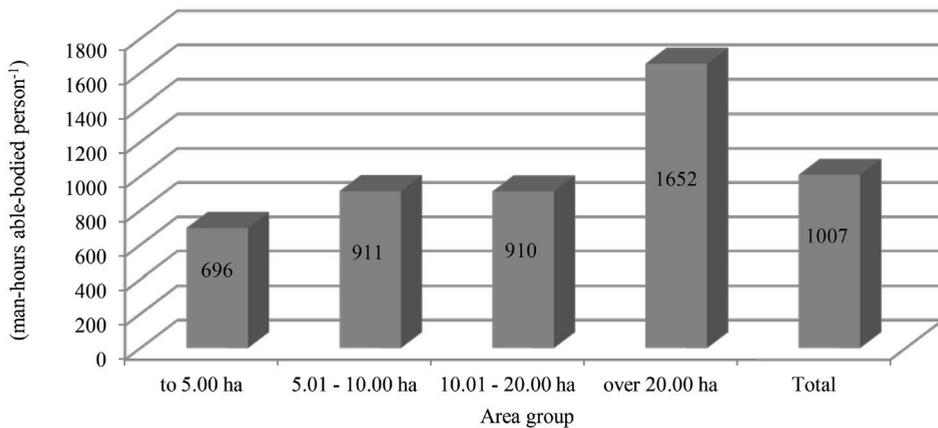
The analyses demonstrate, that labour resources in the studied holdings considerably exceed the demand for workforce. It is corroborated by the utilization of labour resources index, which on average amounted to only 40% (Fig. 2). The human potential was best utilized by the holdings with the largest area, and it amounted there to 58%. Whereas it was utilized to the lowest extent, i.e.

only in 29%, in the facilities with the smallest area of agricultural lands. Similar results were obtained by Tabor and Peszek (2008) in holdings from the Małopolskie voivodship, which had conventional production system. Low level of labour resource utilization is reflected by its low efficiency. As a consequence, it leads to high work costs and low unit profitability for one person.



source: own study

**Figure 2.** Utilization of labour resources index



source: own study

**Figure 3.** Workload

On average, 1007 man-hours accounted for one able-bodied person (Fig. 3). Workload in the holdings from 5 to 20 ha, i.e. including II and III area group, was comparable and amounted to 911 man-hours and 910 man-hours, respectively. It was significantly lower in the smallest facilities, where it amounted to only 696 man-hours. On the other hand, the highest workload was reported from the holdings of over 20 ha, where it amounted to 1652 man-hours able-bodied person<sup>-1</sup>.

## **SUMMARY AND CONCLUSIONS**

The number of able-bodied persons employed in the studied organic holdings was average 2.4. Depending on the size of holdings it was variable and remained in the range from 2.1 to 2.7 persons. Whereas the number of full-time employees was average 0.9 and remained in the range from 0.7 to 1.2. Therefore, the labour resources possessed by the holdings, significantly exceeded the actual demand for workforce. Thus, average utilization of human potential in the studied facilities was only 40%. The highest was reported from the holdings with the largest area, where it amounted to 58%. These holdings were specialized in the animal production, primarily dairy cattle rearing, which under the conditions of organic production generates high workload. The lowest workload was observed in the smallest holdings, i.e. to 5 ha, which resulted from the structure of field plant cultivation, primarily dominated by cereals and fodder plants, and only to a slight extent by vegetables.

## **REFERENCES**

- Goraj L., Mańko S. (2009). Rachunkowość i analiza ekonomiczna w indywidualnym gospodarstwie rolnym. Difin.
- Gromadzki J. (2013). Katalog-cennik ciągników i maszyn rolniczych. PIMR, Poznań
- Karwat-Woźniak B., Chmieliński P. (2006). Praca w indywidualnych gospodarstwach rolnych. Warszawa, IERiGŻ, ISBN 83-89666-50-2
- Kocira S., Malaga-Toboła U. (2012). Zasoby i nakłady pracy ludzkiej w gospodarstwach o różnym kierunku produkcji. *Problemy Inżynierii Rolniczej*, (IV–VI): z. 2 (76)
- Kowalak Z. (1997). *Ekonomika i organizacja rolnictwa*, eMPI<sup>2</sup>, Poznań, 45
- Staniewski M. W. (2007). Architektura zasobów ludzkich nie tylko na trudne czasy. *Zarządzanie Zasobami Ludzkimi* 5, 19-33.
- Szemberg A. (1998). Przemiany agrarne i ludność w indywidualnym rolnictwie, [w:] *Analiza produkcyjno-ekonomicznej sytuacji w rolnictwie i gospodarce żywnościowej w 1997 roku*, IERiGŻ, Warszawa, 192.
- Tabor S., Prusak A. (2008). Wykorzystanie zasobów pracy ludzkiej w wybranych gospodarstwach rolnych Małopolski. *Inżynieria Rolnicza*, 10(108), 253-259

- Terluin I.J, Post J.H.(red). (2000). *Employment Dynamics in Rural Europe*, CABI Publishing, 20.
- Wysokiński M. (2013). Nakłady robocizny i substytucyjność pracy żywej pracą uprzedmiotowioną w gospodarstwach mlecznych o różnej skali produkcji. *Roczniki ekonomii rolnictwa i rozwoju obszarów wiejskich*, T. 100, Z. 1, 102-111
- Ziętara W. (2003). Wydajność pracy w rolnictwie i w różnych typach gospodarstw rolniczych, „*Roczniki Naukowe SERiA*”, Tom V, Zeszyt 1, Warszawa, 316.

Urszula Malaga-Toboła, Sylwester Tabor, Anna Szelaǳ-Sikora  
Institute of Agricultural Engineering and Informatics  
University of Agriculture in Krakow /Poland  
Balicka Str. 116 B. 30-149 Kraków  
umalagatobola@gmail.com

Received : 29.10.2015

Accepted : 11.12.2015