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TECHNICAL EQUIPMENT AND COMMODITY PRODUCTION IN ECOLOGICAL ANIMAL PRODUCTION FARMS*

Urszula Malaga-Toboła, Maciej Kuboń, Dariusz Kwaśniewski
Institute of Agricultural Engineering and Informatics, University of Agriculture in Kraków

Summary. Improvement of the quality of the produced goods, which becomes more significant nowadays, as well as the increase of production is possible through modernisation of farms. It is especially significant in ecological farming which is one of the fastest developing branches of agriculture in the world. Therefore, the aim of the paper was to determine the level of technical equipment including a machinery park and farm buildings and the size of commodity production in farms. 83 ecological farms, where animal production was carried out were accepted for analyses – out of 100 farms included in the research project. Farms were located on the territory of the south Poland. The research was carried out in the form of a guided survey with farm owners. Data concerned 2011. In order to carry out comparable analyses, the facilities were divided into groups, assuming at least 60% of the population share of the particular utility group of animals, expressed in LSU in the total number of livestock, as a division criterion. The biggest number of technical means with reference to 1 ha of arable land was reported in poultry farms and the lowest number in farms specialising in horse breeding. Simultaneously, the highest commodity production amounting to 2.25 and 4.55 in $t \cdot ha^{-1}$ was reported in those two groups of farms. The statistical analysis, which was carried out, the aim of which was to find a relation between commodity production and technical equipment of farms in particular groups, proved to be insignificant.

Key words: technical equipment, commodity production, ecology, animal production

Introduction

Size, structure and quality of production are very often determined by farm equipment with technical production means. Therefore, constantly growing quality requirements force developing farms to invest in activity of the highest yield of marketable agricultural output. In order to be competitive they must increase the scale of their production both in the amount as well as quality [Malaga-Toboła 2009]. Farms, which desire to be competitive on the

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market, must modernize which means that they must introduce properly selected, modern technical means, which enable efficient acquisition of better quality products [Muzalewski 2004; Malaga-Toboła 2010; Kocira, Kuboń 2011]. Since, better technical equipment facilitates improvement of the quality of the produced goods, and their supply to the market in the most advantageous time limits as well as installation of devices, which serve for the protection of environment and animal welfare [Jóźwiak, Kagan 2008]. Specialists, inter alia Roszkowski [1998] and Wójcicki [2003], emphasise that such farms must be adjusted to new technologies resulting from sustainable agriculture requirement and multifunctional model of the Polish village.

Commodity production is the main source of money necessary for incurment of current expenses, whereas modernisation of farms requires financial support in order to increase their efficiency through better use of production factors [SPO 2004]. According to Wasąga [2009] such financing will influence the improvement of their profitableness and competitiveness, adjustment of a profile, scale and quality of production for the market needs, improvement of food safety, improvement of animal maintenance conditions, environmental production and work safety conditions.

The objective and the scope of the study

The objective of the study was to determine the relation between technical equipment of farms and the size of goods production in ecological farms, which maintain livestock.

The scope of the study covered the research in 83 certified ecological farms located in the south Poland in Małopolskie, Podkarpackie, Świętokrzyskie and Śląskie voivodeships. The study was carried out within the development subsidy No 12-0165-10 "Innovative impact of technology and IT support of management on efficiency of production in ecological farms". Out of 100 farms covered by the research within the realisation of the project, facilities which maintained livestock were selected for analysis.

Farms were divided according to livestock groups, assuming at least 60% of the population share of the particular utility group of animals, expressed in LSU in the total number of livestock, as a division criterion (tab. 3). From among the analysed groups the group specialising in cattle breeding was the most numerous – 51 farms while there were only 4 farms which bred pigs. Whereas, there were 10 poultry farms, 9 horse breeding farms and 9 farms with various kinds of animals called mixed farms.

Description of the researched farms

The area of arable land in the examined farms was within the range of 1.41 to 60.00 ha which resulted in the average on the level of 12.25 ha (tab. 1). Arable land constituted almost over a half (54%), agricultural land – 42% and orchards and perennial plantations – 4%. The area of arable land in cattle and horse breeding farms was approx. 2 times higher than in groups, where pigs, poultry and mixed animals were bred. Whereas acreage of agricultural land was comparable except for facilities, where horses occurred. In this case, it was three times higher than the remaining. While grasslands dominated considerably (68%) in facilities which specialised in cattle breeding.

Table 1. Area and structure of the land use in the researched farms
Tabela 1. Powierzchnia i struktura użytkowania ziemi w badanych gospodarstwach

Specification	Unit	Production trend group					Average
		Cattle	Pigs	Poultry	Horses	Mixed	
Agricultural land	[ha]	14.27	7.03	6.27	15.94	6.12	12.25
Arable land	[ha]	4.32	4.37	4.40	12.09	4.31	5.17
	[%]	30	62	70	76	70	42
Grasslands	[ha]	9.75	1.98	0.7	2.97	1.27	6.63
	[%]	68	28	11	19	21	54
Orchards and plantations	[ha]	0.20	0.68	1.17	0.88	0.54	0.46
	[%]	1	10	19	6	9	4

Source: author's own study

On the average, in the structure of crops, grains prevailed, the share of which was 63% of the agricultural land (tab. 2). The remaining acreage was divided between the remaining plant groups, i.e. 5% root crops, 26% – forage plants, 4% – vegetables and 2% – industrial plants, pulse and herbs. While the area of the cultivated plants was similar in the distinguished groups, except for facilities that maintain horses, where grains, root crops and vegetables prevailed.

Table 2. Area and structure of the land use in the researched farms
Tabela 2. Powierzchnia i struktura zasiewów w badanych gospodarstwach

Specification	Unit	Production trend group					Average
		Cattle	Pigs	Poultry	Horses	Mixed	
Grain	[ha]	2.89	3.43	1.84	6.84	3.19	3.25
	[%]	67	78	42	57	74	63
Root crops	[ha]	0.31	0.37	0.13	0.24	0.23	0.28
	[%]	7	8	3	2	5	5
Forage crops	[ha]	0.99	0.44	1.90	3.73	0.80	1.35
	[%]	24	10	43	31	19	26
Vegetables	[ha]	0.06	0.14	0.21	1.28	0.00	0.21
	[%]	1	4	5	10	0	4
Remaining*	[ha]	0.06	0.00	0.32	0.00	0.08	0.09
	[%]	1	0	7	0	2	2

* industrial, pulse, herbs

Source: author's own study

Spread which occurred in the number of the headage (2-458 heads) resulted from maintaining different utility animals. While, calculating into LSU, this number was within the range of 0.48 to 17.12 LSU and at the average it was 13 LSU (table 3). Therefore, the livestock was at the average of 1.14 LSU·ha^{-1} AL and was lower almost of a half than normative restrictions for ecological farms amounting to 2 LSU·ha^{-1}.

Table 3. Number and structure of livestock
Tabela 3. Liczebność i struktura inwentarza żywego

Specification	Unit	Production trend group					Average
		Cattle	Pigs	Poultry	Horses	Mixed	
Cattle	[LSU]	16.37	1.28	0.00	0.24	2.91	10.44
	[%]	96	23	0	2	46	80
Pigs	[LSU]	0.00	3.72	0.00	0	1.61	0.49
	[%]	0	67	0	0	26	4
Poultry and others	[LSU]	0.24	0.32	0.48	0.2	0.43	0.28
	[%]	2.00	6	100	1	7	2
Horses	[LSU]	0.33	0.27	0.00	13.2	1.33	1.78
	[%]	2	5	0	97	21	14
Headage	[LSU]	17.12	5.59	0.48	13.64	6.28	13.00
Livestock	[LSU·ha^{-1}]	1.35	0.99	0.16	1.00	1.24	1.14

Source: author's own study

Cattle prevailed in the flock structure and constituted at the average 80% of headage. Whereas, the recent disadvantageous economic situation of pigs has resulted in the situation when the share of this animal group was only 4% of the total headage. The most numerous (17.12 LSU) and the biggest stock (1.35 LSU·ha^{-1}) occurred in facilities specialising in cattle breeding, while in poultry farms the size was only 0.48 LSU and the stock was 0.16 LSU·ha^{-1}.

Results of the research

Average number of tractors per a farm was 1.62 items. Facilities maintaining cattle and horses achieved high indexes, i.e. 1.67 items·farms^{-1} (table 4). It confirms the previous research results carried out by Kocira and Sawa [2008] which prove that equipment of farms with technical means of work was determined by a farm type, and the highest number of tractors was used in farms specialising in breeding animals fed in the grazing system.

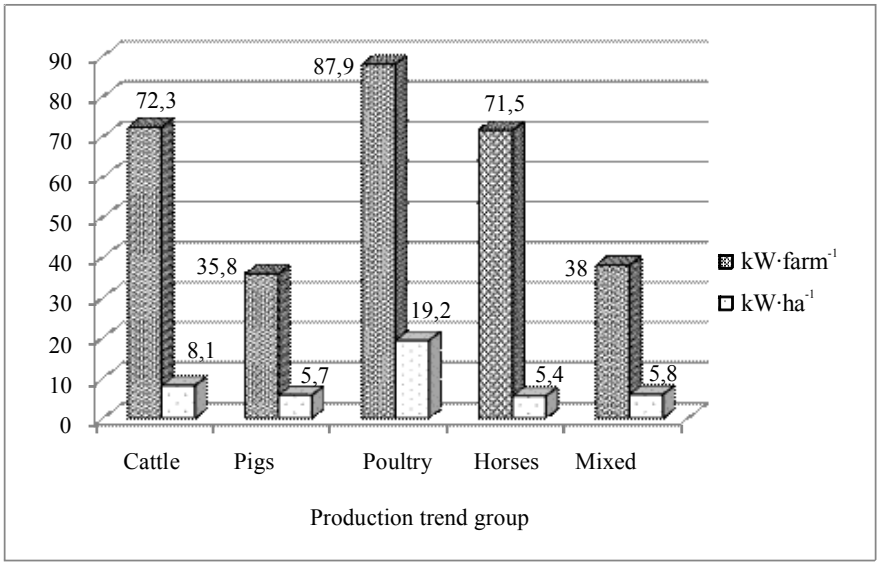
Whereas, the lowest number of tractors (1.13 items·farm^{-1}) was in the possession of farms which maintained various animal species, that is mixed farms. While, in reference to the unit of the field area, poultry facilities were distinctive. The number of tractors was there 2 times higher than the average, which was 0.23 item.

In regard to the number of machines and devices referred to 1 ha, poultry farms dominated, mainly on account of the smallest area of arable land, which occurred within this group. Whereas, the biggest horse farms were characterised by the lowest number of equipment with technical means of production per 1 ha of arable land. The weakest equipment in a machinery park per one farm was reported in pig and mixed farms.

Table 4. Farm equipment with tractors and agricultural machines
Tabela 4. Wyposażenie gospodarstw w ciągniki i maszyny rolnicze

Specification	Unit	Production trend group					Average
		Cattle	Pigs	Poultry	Horses	Mixed	
Tractors	[item·farm^{-1}]	1.67	1.25	1.89	1.67	1.13	1.62
	[item·ha^{-1}]	0.22	0.21	0.45	0.13	0.18	0.23
Cultivating machines	[item·farm^{-1}]	3.18	3.25	4.44	3.44	3.33	3.37
	[item·ha^{-1}]	0.51	0.59	1.20	0.30	0.66	0.58
Fertilization and plant protection machines	[item·farm^{-1}]	3.21	2.50	3.13	3.00	2.25	3.03
	[item·ha^{-1}]	0.49	0.36	0.70	0.29	0.53	0.50
Sowing and planting machines	[item·farm^{-1}]	1.67	1.33	1.57	1.80	1.57	1.64
	[item·ha^{-1}]	0.27	0.27	0.31	0.18	0.34	0.27
Green forage harvesting machines	[item·farm^{-1}]	2.92	2.75	3.44	3.00	1.86	2.88
	[item·ha^{-1}]	0.43	0.44	0.82	0.25	0.43	0.46
Grains and root crops harvesting machines	[item·farm^{-1}]	1.22	1.00	1.29	1.60	1.00	1.23
	[item·ha^{-1}]	0.21	0.20	0.34	0.15	0.19	0.22
Animal production machines	[item·farm^{-1}]	2.30	1.00	2.20	2.00	1.67	2.20
	[item·ha^{-1}]	0.29	0.07	0.42	0.15	0.43	0.30
Seeds cleaning and sorting machines	[item·farm^{-1}]	1.36	1.00	2.33	1.00	1.00	1.35
	[item·ha^{-1}]	0.31	0.33	0.62	0.09	0.27	0.30

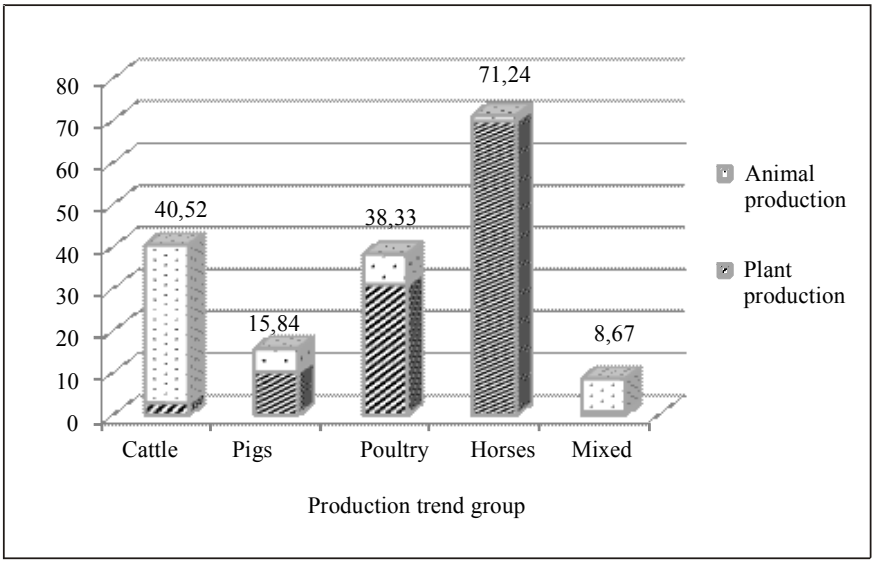
Source: author's own study



Source: author's own study

Fig. 1. Power installed in tractors
Rys. 1. Moc zainstalowana w ciągnikach rolniczych

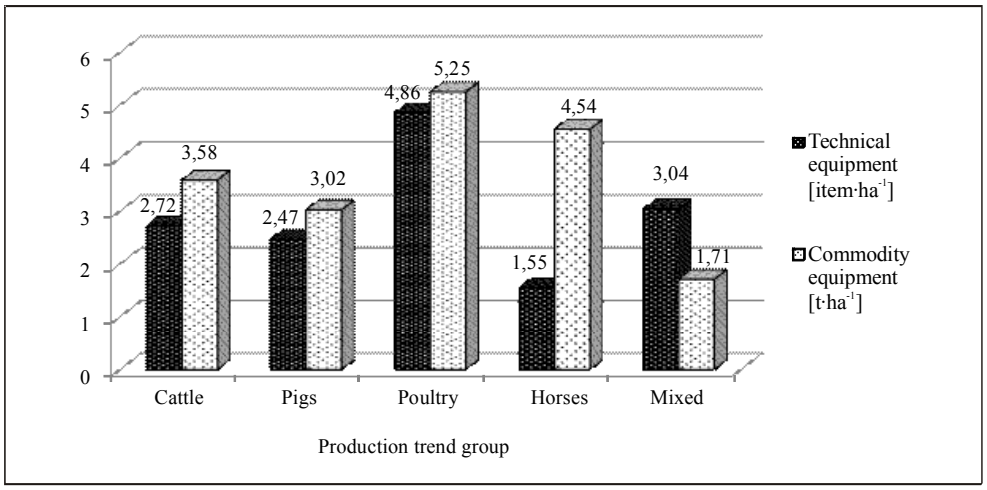
Saturation with power of tractors expressed with kW·farm^{-1} in the facilities, where cattle, poultry and horses were bred was comparably high and at the average approx. 2 times higher than in the facilities maintaining pigs and in the mixed farms (fig.1). Whereas, in reference to the unit of the field area, the installed power in tractors was similar in the facilities with horse breeding, pigs breeding and mixed animals breeding and it was 5.5 to 5.8 kW. It was a little bit higher in the facilities maintaining cattle (8.1 kW·ha^{-1}) and the highest in poultry farms, where it was on the level of 19.3 kW·ha^{-1}.



Source: author's own study

Fig. 2. The size of goods production [t·farm.$^{-1}$]
Rys. 2. Wielkość produkcji towarowej [t·gosp.$^{-1}$]

The size of commodity production in the distinguished groups was significantly diverse, starting with 8.67 t, which was obtained in mixed farms, ending with 71.24 t - in the facilities, which dealt with horse breeding (fig.2). Whereas the size of the sold products in objects specialising in cattle and poultry breeding was comparable, i.e. 40.52 and 38.33 t·farm^{-1}. It must be emphasised that respectively 93 and 91% of animal products were sold only in cattle and mixed animals farms. In the remaining groups, plant products clearly dominated in the sales structure. At the average, animal production constituted only 1/3 of the sold products. Therefore, it may be said that the situation has changed over the years since according to Ziętara's research results [2006] in 2001-2004 in the structure of commodity production, animal production was a prevailing branch and its share in the total goods production exceeded 60%.



Source: author's own study

Fig. 3. Technical equipment and goods production
Rys. 3. Wyposażenie techniczne a produkcja towarowa

When comparing equipment of farms with technical production means expressed by the number of machines per 1 ha of arable land and a unit size of commodity production, it may be found that the situation was similar in cattle, pigs and poultry breeding farms, i.e. the size of commodity production in $t \cdot ha^{-1}$ slightly exceeded technical equipment in $item \cdot ha^{-1}$ (fig. 3). While, attention should be paid to advantageous situation in facilities maintaining horses and disadvantageous in mixed farms. In case of the first example, the size of commodity production was 4.55 $t \cdot ha^{-1}$ and was only slightly different from the highest (5.25 $t \cdot ha^{-1}$) at the lowest technical equipment of these farms, which was on the level of 1.55 $item \cdot ha^{-1}$. While, in case of the mixed objects, the lowest size of commodity production and a considerably high equipment in a machinery park, i.e. 3.04 $item \cdot ha^{-1}$ was reported.

Farms of considerable commodity production usually have a vast area of land, more modern equipment in technical means of production and prove higher investing activity.

Statements and conclusions

1. 13.95 items of technical means, including 1.62 items of tractors was in total per 1 farm. In this regard, cultivation machines and devices, fertilization and protection devices and forage harvesting machines and devices dominated (respectively: 17.65, 14.08 and 13.97 $items \cdot farm^{-1}$). While, in reference to 1 hectare of arable land at the average 1.43 items of machines, including 0.23 item of tractors was reported in the researched farms.
2. The power installed in farm tractors expressed in $kW \cdot ha^{-1}$ was the highest in poultry farms, where it was 19.3 $kW \cdot ha^{-1}$ and was almost 4 times higher than in the remaining groups.

3. The highest commodity production (71.24 t) was reported in facilities maintaining horses. However, plant production constituted 98% of its size. Also in cattle and poultry farms, production was relatively high, but 90% of the products sold there were animal products.
4. Analysing the relation between equipment of farms with a machinery park and the size of commodity production, referred to arable land areas, the most advantageous situation was reported in facilities maintaining horses, since they obtained a relatively high commodity production (from plant production) at the lowest technical equipment of those farms. Whereas, the mixed farm obtained the lowest commodity production despite the fact that they had high technical equipment. It may prove that those farms were overinvested technically and a machinery park was irrationally used.
5. Statistical analysis did not prove any significant relations between the tested variables, i.e. technical equipment and the size of commodity production.

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WYPOSAŻENIE TECHNICZNE A PRODUKCJA TOWAROWA W GOSPODARSTWACH EKOLOGICZNYCH UKIERUNKOWANYCH NA PRODUKCJĘ ZWIERZĘCĄ

Streszczenie. Poprawa jakości wytwarzanych produktów, która nabiera obecnie coraz większego znaczenia, jak i zwiększenie wielkości produkcji jest możliwe poprzez modernizację gospodarstw. Jest to istotne szczególnie w systemie rolnictwa ekologicznego, które stanowi jedną z najszybciej rozwijających się gałęzi rolnictwa na świecie. Dlatego celem pracy było określenie poziomu wyposażenia technicznego, w tym parku maszynowego i budynków gospodarskich, oraz wielkości produkcji towarowej w gospodarstwach rolnych. Do analizy przyjęto 83 gospodarstwa ekologiczne, w których prowadzono produkcję zwierzęcą – spośród 100 objętych realizacją projektu badawczego. Gospodarstwa położone były na terenie Polski Południowej. Badania przeprowadzono w formie wywiadu kierowanego z właścicielami gospodarstw. Dane dotyczyły roku 2011. W celu analizy porównawczej obiekty podzielono na grupy, przyjmując za kryterium podziału przynajmniej 60% udział liczebności poszczególnej grupy użytkowej zwierząt, wyrażonej w DJP (dużych jednostkach przeliczeniowych) w łącznej liczbie inwentarza żywego. Najwięcej środków technicznych w odniesieniu do 1 ha użytków rolnych odnotowano na fermach drobiu, a najmniej w gospodarstwach specjalizujących się w chowie koni. Jednocześnie to w tych dwóch grupach gospodarstw odnotowano największą produkcję towarową, wynoszącą odpowiednio 5,25 i 4,55 w $t \cdot ha^{-1}$. Przeprowadzona analiza statystyczna, mająca określić związek między wielkością produkcji towarowej a wyposażeniem technicznym gospodarstw w poszczególnych grupach kierunkowych, okazała się nieistotna.

Słowa kluczowe: wyposażenie techniczne, produkcja towarowa, ekologia, produkcja zwierzęca

Contact address:
Urszula Malaga-Toboła; e-mail: Urszula.Malaga-Tobola@ur.krakow.pl
Instytut Inżynierii Rolniczej
Uniwersytet Rolniczy w Krakowie
ul. Balicka 116B
30-149 Kraków