

Production and technical potential of farms united in the selected producer group¹

Anna Szelaq-Sikora, Michał Cupiał

Institute of Agricultural Engineering and Informatics
University of Agriculture in Krakow

Summary. The purpose of this work was to carry out an analysis of the production size and direct outlays connected with it according to the gross margin balance index, the mean value of which amounted to 38.96 thousand PLN·ha-1AL. Moreover, equipment of the technical base of the producer group which aims at fruit production was described. The obtained data allow for the conclusion that in the case of the researched farms, there are no essential differences in the quantity equipment of the machinery park, which is selected according to the carried out agricultural production. The planned technical investments performed within the plan of the group, in order to be accepted assume purchase of machines and devices, which improve the quality of the production. In the case of the researched group, the most significant investment is construction of a cold storage of 1300 t of load capacity and purchase of an electronic line for fruit sorting of approx. 4 t·ha-1 productivity.

Key words: agricultural production, machinery park, agricultural farm, producer group

INTRODUCTION

Along with Poland's accession to the European Union, the membership on the European market created many development opportunities, e.g. access to the union funds or European consumers. On the other hand, it became a great challenge for Polish entrepreneurs, since it meant that Poland would have to adjust the legal requirements and deal with competition on the uniform inner market of the European Union [12]. Polish farms, in order to carry out the above mentioned tasks should be equipped with modern technical base, without which it is impossible to increase the plant and animal production [2,14, 16]. Proper organisation of transport has a significant meaning from the plant production point of view through an optimal selection of transport means [9]. An old machinery park and a low degree of its use limit mechanisation develop-

ment, while it should be developed rather than limited. It is due to extending the periods of machine use over the catalogue norms, which results in frequent failures of a machinery park and increasing changeable costs incurred on restorations and repairs [6]. Forming suitable agricultural organisations is an alternative for fragmented individual farms, which want to be significant on the European market [14]. A producer group is an agreement between people who operate together, in order to increase incomes and lower production costs and to convince that common marketing is the best way to increase a market position of farms [5]. Small and individual farms have more difficulties in remaining on the European market since incomes from the agricultural activity cannot cover the costs of purchase of modern equipment or modernisation of an old technical base [14, 7]. It is also more difficult for individual farms to strengthen their position on the European market, since they are not able to supply large uniform parts of products on time, which results from the lack of suitable machines and technologies. Except for large parts and continuity of supplies, this product should be of high quality in order to meet the recipients' demands [13]. Only implementation of modern technologies, machines and devices as well as suitable storage base may ensure the above mentioned demands [8]. Farms, which will potentially develop and which obtain incomes allowing an access to new technologies, due to which technical progress will occur in a farm, should carry out the modernisation process [11,13]. Newer sets of tools, machines and even technological lines enter the market every year. However, only skilful use may influence modernisation of Polish farms and adjusting to proper agro- and zoo-technical activities will bring expected results. Modernisation of a farm which will potentially develop should last few years so that it may balance its

¹ The article was prepared within a research and development grant no N313 759040

production and accept a new situation [4]. The majority of Polish farms have an old and exploited machinery park, due to which management effects are unsatisfactory. Thus, it is so important nowadays to modernize farms so that they may carry out balanced and low-energy consuming agricultural production [15]. Meeting the challenges of the European Union markets is possible through recommendation of agricultural farms and uniting farmers [5]. Upon Poland's accession to the European Union, aid funds which are granted to farmers within forming groups of agricultural producers have increased. Due to the amendments to the Act on Groups of Agricultural Producers of 18 June 2004, not only natural persons could enter the group as it has been so far, but also persons carrying out or not carrying out a legal personality. It was a stimulus which resulted in the increase of groups of agricultural producers, which was also influenced by a decreased number of members composing the group, a decrease from 10 to 5 members [10]. The review of literature concerning the issue of the equipment level of a technical base in Polish agriculture in the aspect of production efficiency, allows to precisely define the objective of the work that is an analysis of technical base modernisation in the group of producers which produce fruit. In order to fully carry out the objective of the work, analysis of the land resources and seize of production was carried out. The scope of the work covered the group of apple producers. This group associates 6 agricultural producers. An analysis of results was carried out for their farms as individual facilities and the group as a formalised form of cooperation of agricultural producers.

MATERIALS AND METHODS

In order to determine efficiency of activity in the researched facilities, the gross margin was calculated and economic size of farms was estimated.

Gross margin (NB) was calculated according to the following formula:

$$NB = PK_{brutto} - KB_{m-s} + SU \quad [tys.zł \cdot ha^{-1}UR]$$

where: PK_{gross} - annual value of the gross final production obtained from animal and plant production,
 KB_{m-s} - direct costs incurred on production,
 SU - union subvention in direct subsidies [1].

A tractor- machinery park of the researched farms was presented by calculating the following: quantity equipment of a technical base, replacement value of a machinery park, energy saturation index and by describing farm tractors (giving their number and age). The accepted research methodology according to the accepted assumptions was composed of two independent stages, that is: - the first stage assumed direct interviews in the group of producers with a managing team of the producer group, the second stage consisted in carrying a guided interview with farmers united in the researched group. As a result of

the interviews carried out directly in the producer group, suitable lists including realisation of an investment were presented, which according to the principles of the Union subventions have to be included in the acceptance plan.

RESEARCH RESULTS, DISCUSSION

The level of equipment of the machinery park in the researched group has been presented in Table 1. Each farm has at least one basic machine. There are few machines, with which half of farms is equipped, that is: a planting auger, a pile driver, a mower-shredder. Moreover, there are few farms, which have a particular machine as the only one, e.g. a cultivator or a mower. When looking at the column, which includes a mean amount of particular machines, one may notice that a farm is equipped mostly with such machines as: fruit tappers, a fruit stand, a sprayer, a fork lift truck and a tractor.

Table 1. Park machinery equipment of the researched group

Machines, tools	Farm [item-farm. ⁻¹]						Average
	1	2	3	4	5	6	
Tractor	2	1	2	2	2	2	1.83
Vehicle	1	1	1	1	1	2	1.17
Plough	1	-	1	1	1	1	0.83
Harrow	1	-	1	1	1	1	0.83
Fertilizer distributor	1	1	1	1	1	1	1.00
Tree planting auger	1	-	-	-	1	1	0.50
Herbicide bar	1	-	1	1	1	1	0.83
Pile driver	1	-	1	1	-	-	0.50
Cultivator	-	-	1	-	-	-	0.17
Soil miller	-	-	1	-	-	1	0.33
Sprayer	3	2	3	3	3	3	2.83
Branch shredder	1	1	-	-	-	-	0.33
Planting rack	6	6	6	6	6	8	6.33
Mower-shredder	-	-	1	1	1	-	0.50
Mower	-	-	-	-	-	1	0.17
Fork lift	2	2	2	3	2	2	2.17
Fruit tappers	10	10	10	8	8	8	9.00
Jumbo boxes trailer	1	-	1	-	-	-	0.33
Electric fork lift truck	-	1	1	1	1	2	1.00
Diesel fork lift truck	1	1	-	-	-	-	0.33
Jumbo boxes leaning machine	1	1	1	1	1	1	1.00
Electronic scale	2	2	-	2	2	2	1.67

Source: author's own study

Particular farms have a similar number of machines and tools. Differences occurring between farms in a quantity of machines they possess are slight and result from low diversity in work technologies. Farm no. 6 has the most numerous machinery park with a total number of machines and tool – 37, the second comes farm no. 1 with 36 units.

The farms united in a group are frequently equipped in an old and worn out machinery park (Table 2). It is not a favourable index, since it leads to the increase of the costs incurred on repairs and renovations.

Table 2. Age of a machinery park (of the selected machines)

Machines	Farm [years]						Average
	1	2	3	4	5	6	
Tractors- average	16	8	27,5	20	28	18	19.60
Vehicles	4	4	7	11	12	11	7.00
Sprayers	4	8	4	31	31	7	14.17
Fertilizer distributors	6	4	4	7	12	4	6.17
Mowers	-	-	4	30	29	7	11.67

[Source: author's own study]

Tractors are the most worn out machines - their average age is 19.5 years. Farm no. 2 is an exception as it has an 8-years old tractor. Fertilizer sprayers with an average age of 6 years were among “the youngest” machines. For farm no. 5, the age is two times higher for the whole population of the researched facilities.

An average installed capacity of tractors amounts to 77.90 kW, whereas in the case of vehicles it is on the level of 87.50 kW. An average installed capacity on 1 ha of AL is 17.47 kW (Table 3). However, it should be noticed that capacity installation is considerably varied - it is between 12.51 kW·ha⁻¹AL in the farm no. 5 up to 32.63 in the facility no.6.

Table 3. Installed capacity in the machinery park

Ma-chines	Farm [years]						Average
	1	2	3	4	5	6	
Tractors [kW]	88.4	81.0	60.6	88.4	60,6	88.4	77.90
Vehicles [kW]	77.0	77.0	77.0	77.0	77.0	140.0	87.50
Total [kW]	165.4	158.0	137.6	165.4	137.6	228.4	168.90
Average [kW·ha⁻¹AL]	23.30	13.74	13.10	16.54	12.51	32.63	17.47

[Source: author's own study]

Table 4 presents a cold storage and storage equipment in the researched farms. All farms, except for the first

one, have both first and the second storage facility. Farms no. 3 and 5 (of 100 t load capacity) have the smallest cold storages, whereas the farm no. 2 of 210 t load capacity has the biggest cold storage. A cold storage in farm no. 1 has a slightly lower load capacity (200 t). In the case of storages, the smallest is located in farm no. 6 (60 t), whereas the biggest in farm no. 4 (100 t).

Table 4. Cold storage and storage equipment in the researched farms

Farm	Cold storage (load capacity [t])	Storage (load capacity [t])
1	200	-
2	210	70
3	100	80
4	150	100
5	100	90
6	140	60

[Source: author's own study]

When comparing a storage volume in the researched farms with the production size (Table 1), one may notice that not all of them have a sufficient storage base, shortages occur in the facilities no. 3 and 5.

Presently, the group of producers does not have a full possibility of storing, sorting and packing fruit according to the market expectations. A product is stored in storages and “regular” cold storages and fruit are sorted manually in farms by their members. Such a situation results in non-homogeneous products of low quality, which the group offers. Upon finalization of the 5-year acceptance plan (2010-2014) this situation will be changed due to realisation of the planned technical investments.

Construction of an outbuilding – a storage of agricultural products “fruit” with a socio-technical base and a purchase of a sorting machine and the remaining facilities will allow preparation of fruit for trade in a way expected by recipients. Fruit collected from all members stored in ULO conditions (cold storage with a controlled atmosphere - storing in low-oxygen conditions) and then prepared with large homogeneous parts concerning quality, size and colour, will improve their trading quality and will allow a group to present a better offer. A cold storage constructed by a group will have a total volume of approx. 1300 tons.

A vehicle scale located on a vehicle manoeuvre area will be used to weigh jumbo-boxes and pallets with fruit, trucks and tractors with trailers which supply fruit from the members and at the sale of fruit in large quantities. Lifting capacity of the scale is approx. 60 tons.

The group will purchase two vehicles of varied load capacity. The first vehicle will be of a total mass of approx. 12-15 tons with isotherm and a loading lift of a loading capacity of approx. 5-8 tons. Whereas, the second vehicle will be of a total mass of approx. 5 tons with isotherm and a loading lift of a loading capacity of approx. 2 tons.

TRAFO station construction will be used to supply the building, cold storages and sorting rooms, with a transformer with power indispensable for correct operation of the installed devices.

Purchase of a diesel forklift truck of a lifting capacity of approx. 2500 kg and the height of lifting of approx. 4.5-5.5 m.

Purchase of an electric front three-wheels forklift truck of a lifting capacity of approx. 1600-2000 kg and the height of lifting of approx. 4.5-5.5 m.

Purchase of a forklift truck with a platform for an operator

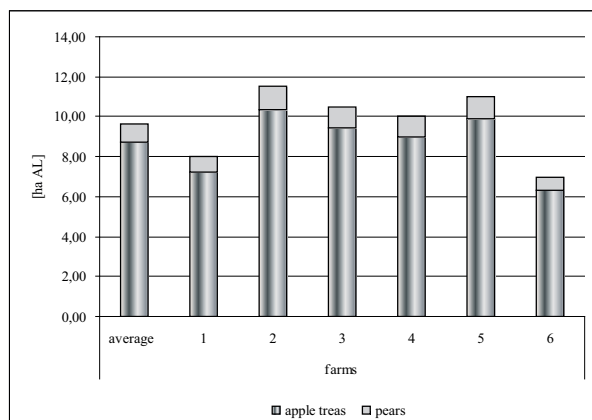
Purchase of hand pallet trucks in the amount of 6 units of a lifting capacity of approx. 2-2.5 tons each.

Purchase of jumbo boxes, which will be used to store fruit.

Purchase of an orchard platform used to collect fruit in the amount of 6 units. Each orchard platform connected to a farm tractor will carry the maximum of four jumbo boxes.

Purchase of an electronic line for fruit sorting- capacity of a sorting facility is approx. $t \cdot h^{-1}$. The line for sorting apples, including parameters of sorting, inter alia, colour, weight, optic seize. The line for plastic and wooden jumbo boxes, equipped with packing tables. The sorting machine will be equipped with the system of video cameras and software which will enable detection of damages and surface failures on fruit.

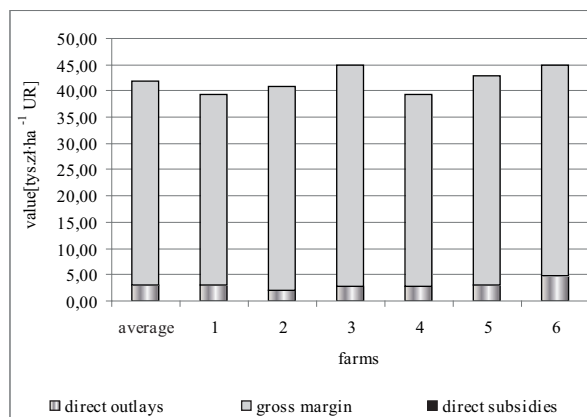
Average surface area of the researched farm belonging to the group of producers is 9.67 ha. The whole surface of arable land in all farms was designed for orchards and multi-year plantations. The researched farms are designed for two fruit species: apples and pears. Average surface area of an apple tree plantation is 8.70 ha whereas a pear plantation is 0.97 ha (Figure 1).



[Source: authors' own study]

Fig. 1. Surface area of arable lands in the researched farms

An average value of the gross margin obtained from 1 ha of a cultivation, is on the level of 38.96 thousand. PLN·ha⁻¹. Whereas an average value of a direct subsidy is 0.28 thousand PLN·ha⁻¹. It results from the obtained data that direct subsidies constitute a small part of the obtained production in relation to the gross margin.



[Source: authors' own study]

Fig. 2. The gross margin balance

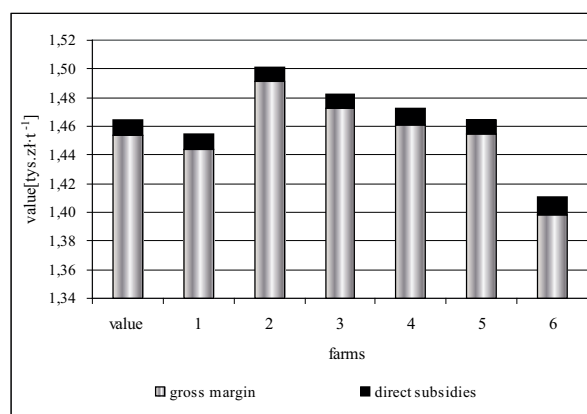
As much as 99.3% of the value of the obtained production is value of the gross margin, and only 0.7% is direct subsidies (Figure 2). Therefore, it may be concluded that it is a marginal value which almost does not influence efficiency of farms in fruit-growing. While examining the researched facilities regarding the amount of the evaluated index, it is noticed that facility no. 3 manages in the most efficient way (42 thousand PLN·ha⁻¹), while facilities no. 1 and 4 are the least efficient (over 36 thousand PLN·ha⁻¹).

Farms which belong to the producer group have 10 varieties of apples and 2 varieties of pears in their orchards. Total production potential of all farms is 1550 t of fruit, and apples constitute a considerable majority - 90% of the total fruit production. 232.50 t of apples and 25.83 t of pears are on average in a farm (Table 5).

Table 5. The size of crops in particular farm [t]

Specification	Farm [t]						Average
	1	2	3	4	5	6	
Apples	180	270	270	225	270	180	232.50
Pears	20	30	30	25	30	20	25.83
Total	200	300	300	250	300	200	258.33

[Source: author's own study]



[Source: authors' own study]

Fig. 3. Gross margin and direct subsidies [thousand PLN·t⁻¹]

Average value of the gross margin for 1 tone of collected fruit is 1.45 thousand PLN·t⁻¹ whereas average value of direct subsidies is only 0.01 thousand PLN·t⁻¹ (figure 3).

SUMMARY

The work presents the analysis of farm equipment united in the producer group in the machinery park and its planned modernisation. Quantity equipment of the machinery park and selection of particular machines was pursuant to the production aim. At the same time it allows performance of indispensable agro-technical operations and ensures their realisation on time. Regarding a small scale of production of particular farms, their unification in the group of farm producers increased their chances of access to modern, high-efficient machinery park and a chance for development of their farms. The most important intended investments, that is construction of a cold storage and purchase of electronic line for fruit sorting will ensure new contractors for a group and will strengthen a position of a group on the national and world market due to the supply of considerable uniform production batches. Specificity of the producer group, consisting in the fact that particular members act as individual farmers whereas in other, as an organised group causes that technical production means must be discussed in two aspects. On one hand, it will be a property of particular farmers, on the other a property of a producer group - designed for common use. Additionally, such organisation of the production system does not exclude delivering a service with own machines, both inside the group as well as for non-united farmers. A farmer who is a group member may modernize his own machinery park and at the same time may use expensive and complicated machines and devices purchased commonly, since the purchase of machines and devices is beyond financial abilities of single farmers. Moreover, common use of expensive equipment, highly efficient equipment gives an opportunity to considerably lower unit production costs.

Mean value of the gross margin index, which was obtained for the whole group on the level of 38.96 thousand PLN·ha⁻¹AL, allows for the conclusion that orchard production in the researched farms is highly economically effective. Therefore, despite unfavourable agricultural structure (average surface area 9.67 AL) it allows to obtain incomes on the level decisively exceeding income parity.

REFERENCES

1. **Augustyńska-Grzybek I. i in. 1999.** *Metodyka liczenia nadwyżki bezpośredniej dla działalności produkcji rolniczej.* IERiGR. Warszawa. ISBN83 -88010-36-0
2. **Cupiał M. 2005.** *Informacja techniczna w rolnictwie Małopolski.* Inżynieria Rolnicza. Nr 3 (63). s. 119-124.

3. **Ejsmond J., Milewski R. 2005.** *Podstawy prawne tworzenia i działalności grup producentów.* Warszawa.
4. **Golka W., Wójcicki Z. 2006.** *Ekologiczna modernizacja gospodarstwa rolniczego.* Warszawa.
5. **Jablonka K., Kaluża H., Marcysiak A., Nawrocki T., Szarek S. 2006.** *Ekonomika w rolnictwie.* Warszawa.
6. **Kowalczyk Z. 2008.** *Intensywność produkcji a wyposażenie i wykorzystanie wybranych technicznych środków produkcji w gospodarstwach sadowniczych.* Inżynieria Rolnicza. Nr 10 (108).
7. **Kowalski J. i in. 2002.** *ostęp naukowo-techniczny a racjonalna gospodarka energią w produkcji rolniczej.* PTIR, Kraków, ISBN 83-905219-9-7
8. **Malaga-Toboła U. 2011.** *Operating Costs of Farm Buildings in Selected Ecological Holdings.* TEKA. Commission of Motorization and Power Industry in Agriculture and the Volodymir Dehl East-Ukrainian National University of Lugansk. Volume XIC. Lublin, 181-190
9. **Marczuk A., Misztal W. 2011.** *Optimization of a transport applying Graph- Matrix method.* TEKA. Commission of Motorization and Power Industry in Agriculture and the Volodymir Dehl East-Ukrainian National University of Lugansk. Volume XIC. Lublin.
10. **Martynowski M. 2010.** *Organizowanie się gospodarce polskich rolników po 1990 roku.* KRS. Warszawa.
11. **Muzalewski A. 2000.** *Aktywność inwestycyjna i wyposażenie gospodarstw w środki mechanizacji.* Problemy Inżynierii Rolniczej. IBMER. Nr 3. Warszawa.
12. **Sasińska-Klas T., Szymańska A. 2007.** *Małopolski przedsiębiorca na rynku Unii Europejskiej.* Kraków.
13. **Szeląg-Sikora A., Kowalski J. 2008.** *Źródła dochodów a poziom wyposażenia w park maszynowy gospodarstw rolnych.* Inżynieria Rolnicza. Nr 2 (100).
14. **Szeląg-Sikora A., Kowalski J. 2010.** *Wyposażenie sadowniczej grupy producenckiej w środki techniczne.* Inżynieria Rolnicza. Nr 4 (122).
15. **Wójcicki Z., Kurek J. 2011.** *Technologiczna i ekologiczna modernizacja wybranych gospodarstw rodzinnych.* Warszawa.
16. **Zając S., Izdebski W., Skudlarski J. 2012.** *Analysis of the significance of technological and organizational factors affecting the efficiency of agricultural tractors operation.* TEKA. Commission of Motorization and Energetics in Agriculture. An International Journal on Motorization, Vehicle Operation, Energy Efficiency and Mechanical Engineering. Vol. 12. No 1. Lublin-Lugansk, 323-329.

POTENCJAŁ PRODUKCYJNY I TECHNICZNY GOSPODARSTW ZJEDNOCZONYCH W WYBRANEJ GRUPIE PRODUCENTÓW

Streszczenie. Celem niniejszej pracy było przeprowadzenie analizy wielkości produkcji i bezpośrednich nakładów związanych z nią, zgodnie z indeksem bilansowym brutto marży, której średnia wartość wyniosła 38,96 tysięcy zł · ha⁻¹AL. Ponadto, opisano urządzenia z bazy technicznej producenta grupy, które ma na celu produkcję owoców. Uzyskane wyniki pozwalają na wniosek, że w przypadku badanych gospodarstw, brak istotnych różnic w ilości urządzeń parku maszynowego, która jest dobrana w zależności od prowadzonej produkcji rolnej. Planowane inwestycje techniczne wykonywane w ramach planu grupy zakładają

zakup maszyn i urządzeń, które poprawiają jakość produkcji. W przypadku badanej grupy, najbardziej znaczącą inwestycją jest budowa chłodni z 1300 ton nośności i zakup elektronicznej linii do sortowania owoców o wydajności $4 \text{ t} \cdot \text{ha}^{-1}$.

Słowa kluczowe: produkcja rolnicza, park maszynowy, gospodarstwo rolne, grupy producentów.