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LABOUR CONSUMPTION OF FRUIT PRODUCTION ON THE EXAMPLE OF SELECTED FARMS*

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Abstract. The paper determines labour consumption of production in the selected fruit farms located on the territory of Łańcut commune. The research was carried out in the form of a guided survey in thirty fruit farms. For comparative purposes, the investigated farms were divided into area groups and the groups of a varied percentage share of orchards in the total area of AL. The net output balance showed that in the unit view, the highest value of this production category (8.88 thousand PLN·ha^{-1}AL) was obtained in farms, which had the lowest land resources i.e. to 5 ha of AL. In case of the economic index of workforce productivity, the most advantageous result was obtained in the biggest objects i.e. of the area above 10 ha, where one man-hour was compensated with the value of the net output at the level of 0.23 thousand PLN.

Key words: fruit production, work inputs, economic work performance

Introduction

Fruit production, next to vegetable and flower production, constitutes an important branch of horticulture, which deals with fruit production and storage. In the conditions of the moderate climate of Poland, a small number of fruit trees, bushes and perennial plants are included in fruit cultivation. Land planted with fruit trees and bushes of the area not smaller than 0.1 ha are included to orchards. Orchards smaller than 1 ha are not considered as good production orchards. Most frequently they are tended very weakly. As a rule, only those orchards are well tended, which have incomes sufficient to cover the costs of equipment with indispensable machines and devices and at the same time they ensure maintenance of the family (Pieniążek et al., 2000). As GUS [Main Statistical Office] states, according to to the National Agricultural Census of 2010, the area of orchards maintained

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in a good agricultural culture was 374.2 thousand ha and in comparison to 2002 was higher by 103.2 ha i.e. 38.1%. The number of agricultural farms which used orchards decreased from 316.8 thousand in 2002 to 284.6 thousand in 2010, that is by over 10%. Although, results of the National Agricultural Census of 2010 showed the increase of the fruit crops area at the simultaneous decrease of the number of farms, which managed such crops, the mentioned data show fragmentation of the Polish fruit production. Fruit processing is very dispersed, as the Main Statistical Office reports, approximately 1, 250 establishments are occupied with this activity. Approximately 90% of the total number of food processing plants are small establishments which employ from 1 to 50 persons. Big companies constitute 2% of the total number of food processing plants. Participation in the market of newly formed small establishments is estimated as 80-90%, they frequently are formed on municipal-rural areas, due to which they employ human resources, which come from the agricultural sector.

The fact that the capacity of storages, effectiveness of distribution of fruit and the commercial system is still improving, is optimistic. Poland produces 2.7 million tonnes of fruit annually, which gives us the fifth position among the countries of the European Union (after Italy, Spain, France and Greece) (Market reports, 2011). Poland has been on the lists of the global exporters of apples for years and it is at a high position. We are the leading producer of apple concentrate in Europe and we are at the third position in the world behind the USA and China; we produce it as much as the remaining EU countries in total. Poland is also a tycoon at the market of chokeberry, we have a 90% share in the global production (Kowalski et al., 2002). Perspectives and possibilities of the development of Polish fruit production are very high, we only have to invest in the organization of the market, improvement of quality, modern storage, packaging and specialistic transport. The objective of activity of each family farm is a systematic increase of the family income, indispensable for maintenance of family and enabling the increase and modernization of a farm, which will undoubtedly affect the improvement of the work conditions of family members in their own farm (Kowalski et al., 2002). In order to execute this objective, it is necessary to increase the farm production, at the simultaneous increase of efficiency of this production and the increase of inputs per a unit of a product and replacing the human work with mechanical work. Presence of machines, tools and agricultural devices in agriculture causes that work nuisance decreases and performance increases (Michałek et al., 1998). Mechanization in fruit production decreases the manual labour inputs, enables introduction and the use of modern technological treatments. In various farms, the level and the model of mechanization is varied, it is influenced by the production, organizational and economic changes. The objective of mechanization is not only to decrease labour consumption of production treatments as a result of workforce productivity increase and to simplify it, but also to ensure a timely execution of treatments and at the same time maintain the high quality of the obtained products. Research concerning the search for rational methods of machines selection for a single farm shows clearly the scale of the problem, which an owner will have to deal with in case of taking decisions concerning investment in agricultural technology. Informatics and artificial intelligence are more often used for control of complex technical and technological solutions, which support production processes in an agricultural farm (Mobli et al. 2012).

There are many problems to deal with for the Polish agriculture. Unfavourable agrarian structure is a basic weakness, which influences, inter alia, the high level of employment, low level of mechanization and low marketability of individual farms. In Poland small farms prevail in number; they are up to 5 ha area and they constitute 69.3% of the total number of farms. Moreover, farms from 5 to 10 ha, which constitute 15.4% have a considerable share and it has decreased in the recent years. Farms, which have the biggest area, i.e. above 20 ha of agricultural land, which have the biggest perspectives of development constitute only 5.4%. Average area of an individual farm has decreased slightly in recent years and in 2010 it was 10.23 ha (tab. 1). However, it seems that still this area is too small for effective use of the machinery park, for increase of the work performance and for obtaining higher incomes.

Table 1
Structure of Polish individual farms

Area groups (ha)	Years			
	2000	2005	2008	2010
0 – 1	34.1	34.7	29.5	31.4
1 – 2	15.7	16.4	16.7	15.1
2 – 5	21.5	21.5	23.5	22.8
5 – 10	15.7	14.2	16.1	15.4
10 – 15	6.5	6.1	6.4	6.7
15 – 20	2.9	2.8	3.0	3.2
20 – 30	2.2	2.4	2.4	2.7
30 – 50	1.0	1.2	1.4	1.6
above 50	0.4	0.7	1.0	1.1
Average total area of a farm	8.0	9.34	10.02	10.23

Source: Rocznik Statystyczny Rolnictwa 2011 r.

According to the mentioned data in table 1, small farms will prevail in Poland for a long time; from 2000 to 2010, average surface area of a farm increased by 27.87% i.e. below 3% annually. It is necessary to adjust to the existing market situation as quick as possible so a small area of a farm does not constitute a barrier for development and a will for constant increase of income. Smaller farms in order to ensure profitability should strive to improve production intensity, speciality e.g. in fruit production. Combining small individual farms in groups i.e. producer groups seems to be an alternative, which allows, inter alia, common acquisition and use of machines and thus affect the improvement of work performance. In Polish agriculture conditions, reaching the model of multi-area farm is a very long process but it is not impossible. Only profitable farms, of a specialistic agricultural production can meet that challenge.

According to Michałek (1998) self-reconstruction of agrarian structure may be a long-lasting process, limited mainly with psychological aspects of farmers, which next to attachment to land in the present economic situation of the country were multiplied with

a considerable unemployment and the lack of employment possibility in industry or in the service zone. Increase of the farm area is desirable, because along with its increase, unit labour and energy inputs drop and the use of tractors and machines raises and as a result the mechanization costs decrease and farm effects improve (Sikora, 2009). A traditional manner of multi-trend production will not ensure maintenance for the farming family. Research of many authors (Borcz and Kowalczyk, 1997; Sawa and Parafiniuk, 1999) show that high intensity of production organization, which results from adjusting farmers to conditions of the market economy, is of great significance in shaping the family income. Thus, introduction of specialistic crops such as vegetables or fruit production, which bring considerably higher incomes than a systemic farming production, is a good solution for small farms (Borcz and Kowalczyk, 1997). Presently, a possibility of obtaining European funds at assumption that appropriate management of the possessed land resources is carried out is a significant factor which increases efficiency of farming (Sikora, 2012).

Great overpopulation and difficulties with managing the surplus of labour force constitute the next important problem. According to Wójcicki (1998) in 1996 almost 17 million people in Poland, that is 44%, lived in the country and only 22% of society maintained themselves from agricultural production. Presently as the Main Statistical Office [GUS] presents (2010) 39% of society lives in the country and people who work only or mainly in farming is approx. 16%. It proves that over half of rural population is a non-agricultural population and only every second household in the country is related to agricultural farming above 1 ha. In Poland, only approx. 5 ha is for one person working in agriculture. For comparison in France, there is 19 ha per one person employed in agriculture, in Great Britian – 30 and in the USA – over 100 ha (Kowalski et al., 2002).

Great reserves of labour force cause that costs of labour force in Poland are very low. Therefore, a belief prevails that our country may be competitive in production of labour consuming plants and plants difficult for mechanization. This condition is met by fruit production. Specialistic crops require great labour inputs, but small farms usually have surpluses of labour force, which creates a chance for development. Low efficiency of work in Polish agriculture constitutes next problem. In the "old" European Union, level of producitvity is 6-7 times higher than in Poland. It results from, inter alia, overpopulation of the country and fragmentation of farms. Difficulties with selling produce can be added. Lack of consumers forces producers to search for other markets e.g. local markets, which, however, is very time consuming (Grotkiewicz and Michałek, 2009).

Fruit production may be a chance for increasing workforce productivity in farms. It, indeed requires considerably higher labour inputs, because a great part of works is carried out manually but the obtained crops and higehr prices of fruit cause that incomes are high. It causes that fruit farms seem to be more competitive in comparison to farms, which are oriented at traditional plant production (grains, root crops, etc.). Even, at assumption that many times a weak bargaining force of agricultural producers is mainly their low share in the final price of products (Whitley, 2003).

Objective, scope and methodology of work

The objective of the paper was to analyse labour consumption of production in fruit farms relative to their area of agricultural land and the size of orchards in the total area of agricultural land in a farm. The scope of paper covered 30 farms specializing in fruit production located in Łańcut commune on the territory of Podkarpackie Voivodeship. Research was carried out in the form of the guided survey, which consists in filling out previously prepared questionnaire. Selection of farms was purposeful. The following principles were applicable at the selection of a farm: owner's consent, income from a farm constituted a main source of the owner's and its family's maintenance, farms owned a mechanical tractive force and a basic machinery park, area diversity occurred and diversity of the land use structure (varied participation of orchards in the area of AL).

According to the methodology of calculations accepted in the Institute of Agricultural Engineering, efficiency of production labour consumption in orchard farms was determined with calculation methodology. In order to fully accept the objective of the paper, the level of incurred labour inputs with reference to the calculation unit of one hectare of agricultural land (ha AL) was determined and the value of net output was calculated as a difference between global production and total costs incurred in a farm (Kowalski et al., 2002):

$$P_c = P_g - K_c \quad \text{(thousand PLN·ha}^{-1}\text{AL)} \tag{1}$$

where:

P_c – net output (thousand PLN·ha^{-1}AL),
P_g – global production (thousand PLN·ha^{-1}AL),
K_c – total costs (thousand PLN·ha^{-1}AL).

Further, economic work performance, informing on the value of production per one unit of labour consumption was calculated as an index, which characterizes efficiency of the incurred labour inputs (Gębska and Filipiak, 2006):

$$E_{wp} = \frac{P_c}{t} \quad \text{(thousand PLN· man-hour}^{-1}\text{)} \tag{2}$$

where:

P_c – net output (thousand PLN·ha^{-1}AL),
t – of labour consumption (man-hour ·ha^{-1}AL).

Research results

For comparative purposes at the analysis of data, the investigated farms were divided into area groups relative to the surface area of a farm and into groups of a varied percentage share of orchards in AL (tab. 2).

Analysing the accepted division into area groups one may notice that the listed three groups were compared on account of the number of object in each of them. In case of divi-

sion, which includes share of orchards in AL, farms prevailed, where orchards were the main or the only production trend and their participation in the total area of AL was above 80%.

Table 2
Division of the researched farms

According to area groups		
Area groups (ha AL)	Average area (ha AL)	Number of farms in the group
up to 5	2.9	10
from 5 to 10	5.9	9
above 10	25.7	11
According to the percentage share of orchards in AL		
Share of orchards in AL (%)	Average area (ha AL)	Number of farms in the group
Number of farms in the group	26.9	6
from 50 to 80	9.2	8
above 80	6.2	16

Both plant and animal production were included in the production labour consumption. Plant production included mainly orchard production, which occurred in all farms and the remaining plant production occurring in 17 farms (i.e. in 56.6% of the investigated farms). Animal production occurred only in 7 farms (i.e. in 23.3% of the investigated farms) (tab. 3).

Table 3
Labour inputs of plant and animal production (man-hour·ha^{-1}AL)

According to area groups			
Area groups (ha AL)	Plant production	Animal production	Total
up to 5	740	40	780
from 5 to 10	305	33	337
above 10	220	30	250
According to the percentage share of orchards in AL			
Share of orchards in AL (%)	Plant production	Animal production	Total
Number of farms in the group	284	49	333
from 50 to 80	366	92	458
above 80	495	–	495

In the investigated objects, both in case of plant production and animal production, labour inputs decrease along with the increase of the surface area. Having resources of land above 5 ha of AL allows farm production, which generates smaller labour inputs as a result of more effective organization of particular production processes. Time of crossings between fields, time for return, etc, decreases inter alia. In case of the analysed fruit production in smaller farms, more intensive production on account of multiplicity of manual

treatments is carried out (inter alia, cutting young shoots, during full vegetation period, number of fruit is controlled in comparison to the area of leaves transpiration - manual picking of the surplus of fruit, preferred relation of fruit to leaves 1:24).

Analysing incurred labour inputs in farms divided according to the participation of orchards in the total area of AL, one may notice that the highest level of labour consumption characterizes single-trend objects i.e. fruit (above 80% of orchards). For comparison, difference between the mentioned group and the first group (up to 50% of orchards in AL) in case of plant production was as much as 211 man-hour·ha^{-1}AL.

When analysing all objects, one have to notice that, inter alia, mechanical and chemical treatment of directly production area of orchards (tree crowns) as well as inter rows treatment (e.g. cutting roots shoots which weaken cropping potential influenced such a great level of labour inputs. In the fruit production, activities related to fruit collection, transport, preparation for sale and sale of fruit are a significant element of the production process. Methods of production of cultivated orchard plants in the investigated farms differ from each other both with the manner of performed treatments, type of activity and degree of their mechanization. For example, spraying is the most frequent treatments performed at production of apples, plums, pears whereas raspberries, strawberries require more manual treatment works.

The obtained results are comparable with vegetable production, which is also very labour consuming. It is confirmed by the research of Boracz and Kowalczyk (1997) carried out in vegetable farms, which proved that e.g. cabbage plants are characterized with labour inputs at the level of approx. 800 man-hour ·ha^{-1}AL, whereas cultivation of potatoes generated inputs amounting to 287 man-hour·ha^{-1}AL. Low degree of mechanization of majority of works and in consequence their considerable labour consumption affect decisively the level of total labour inputs related to production of vegetables, which are within from 680 man-hour·ha^{-1}AL in case of ground cultivation of cellery, up to 2698 man-hour·ha^{-1}AL: in a tunnel cultivation of pepper (Kowalczyk and Wnęk 2007). In the research carried out in 2006-2009, Molendowski et al. (2010) draws attention to a very high labour consumption in small-area farms which cultivate lettuce, where total labour inputs of manual work were 1965 man-hour·ha^{-1}AL. Even, after carrying out optimization activities, which aimed at decrease of manual work inputs, labour consumption at the cultivation of lettuce was 1050 man-hour·ha^{-1}AL. For comparison in the cultivation of the so-called traditional plants i.e. grains labour inputs were incurred in the amount 70 man-hour·ha^{-1}AL that is few times lower than the analysed fruit production.

The net output balance showed that in a unit view, the highest value of net output (8.88 thousand PLN·ha^{-1}AL) was obtained in farms, which had the lowest land resources i.e. to 5 ha of AL. Here, one has to emphasize that in these objects, simultaneously the highest total inputs were incurred. They were over two times higher in comparison to farms above 10 ha AL. (table 4).

Analysing balance of net output with reference to the assumed division acc. to participation of orchards in the total AL area, one may notice that objects up to 50% orchards were characterised by the lowest total inputs (3.98 thousand PLN·ha^{-1}AL); however, it did not translate into achieving the highest value of the net output index, which was obtained in objects above 80% of orchards i.e. 8.98 thousand PLN·ha^{-1}AL (tab. 4).

Balance of the net output was the starting point for calculation of the index of economic workforce productivity (fig. 1) because achieving workforce productivity as high as possible is a measurable effect of agricultural production.

Table 4
Balance of net output (thousand PLN·ha^{-1}AL)

According to area groups			
Area groups (ha AL)	Global production	Total inputs	Net output
up to 5	17.80	8.97	8.88
from 5 to 10	13.36	7.10	6.26
area 10	9.57	3.80	5.77
According to the percentage share of orchards in AL			
Share of orchards in AL (%)	Global production	Total inputs	Net output
Number of farms in the group	11.13	3.98	7.15
from 50 to 80	11.90	5.90	6.00
above 80	14.78	6.80	7.98

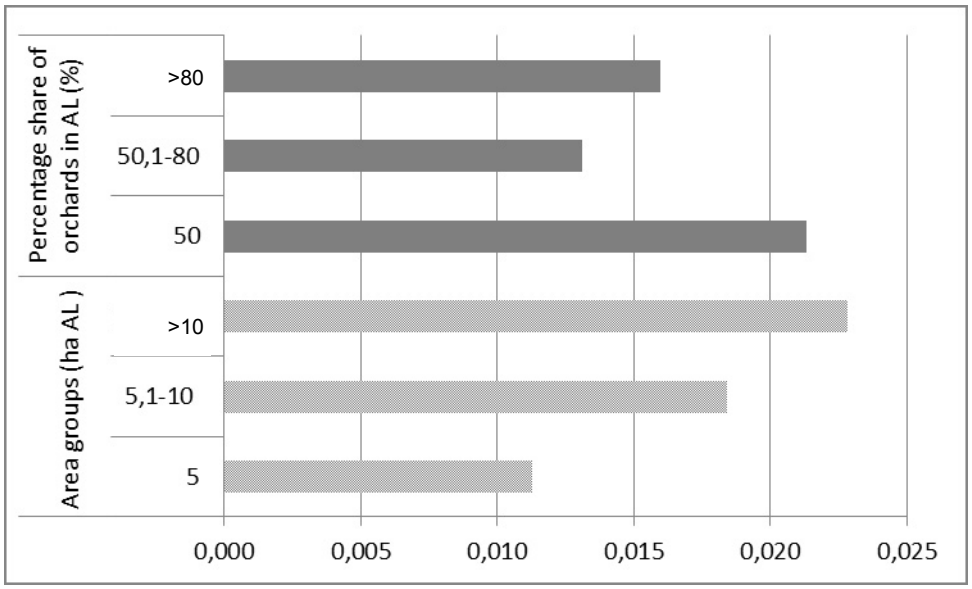

Figure 1. Economic workforce productivity (thousand PLN· man-hour^{-1})

When comparing the investigated farms within the area groups in the biggest objects i.e. above 10 ha, one man hour was compensated with the net output production at the level

of 0.023 thousand PLN. It mainly resulted from obtaining the most advantageous performance between the level of incurred work inputs (the lowest within the comparable area groups) and the value of the obtained net output.

In case of analysis of the discussed index in relation to participation of orchards in the total area of AL, high-commodity production carried out in the group up to 50% of orchards was accompanied by low labour inputs, which allowed obtaining the index of economic workforce productivity at the level of 0.021 thousand PLN·man-hour^{-1}.

Conclusion

Effective agricultural production is inseparably related to the level of incurred labour inputs. Orchard production in the investigated farms is characterised by relatively high labour inputs, at the average 458 man-hour·ha^{-1}AL. Increase of orchard cultivations in the total surface area of farms causes that labour inputs are even three times higher in farms, which carry out a typical agricultural production. Small-area farms usually have considerable surpluses of labour force which gives them a chance for development and may make them competitive in production of labour consuming plants and plants, which are difficult for mechanization. An attempt to mechanize some works in fruit production is related to the purchase of expensive machines, the unit fixed costs of which at a low degree of use were very high. On the other hand, there are many works, which cannot be mechanized, e.g. cropping strawberries, raspberries. These are soft fruit, mechanical cropping of which would mean extensive damage to fruit and therefore losses. Orchard production may be a chance for increasing workforce productivity in individual farms. When comparing, on one hand, considerably increased work inputs than in the traditional agricultural production, on the other hand, the obtained crops and fruit prices, one may conclude that the obtained incomes will be high. Forming joint organizations the so-called producer groups, which could face competition of dedicated farms, can also be an alternative (Szeląg-Sikora, 2010).

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PRACOCHŁONNOŚĆ PRODUKCJI SADOWNICZEJ NA PRZYKŁADZIE WYBRANYCH GOSPODARSTW

Streszczenie. W pracy określono pracochłonności produkcji w wybranych gospodarstwach sadowniczych zlokalizowanych na terenie gminy Łańcut. Badania zostały przeprowadzone w formie wywiadu kierowanego w trzydziestu gospodarstwach sadowniczych. Dla celów porównawczych, badane gospodarstwa podzielono na grupy obszarowe oraz na grupy o różnym udziale procentowym sadów w łącznej powierzchni UR. Przeprowadzony bilans produkcji czystej wykazał, że w ujęciu jednostkowym najwyższą wartość tej kategorii produkcji (8,88 tys. PLN·ha^{-1}UR) uzyskano w gospodarstwach posiadających najmniejsze zasoby ziemi tj. do 5 ha UR. W przypadku wskaźnika ekonomicznej wydajności pracy najkorzystniejszy wynik uzyskano w obiektach największych tj. pow. 10 ha gdzie jedna roboczogodzina była rekompensowana wartością produkcji czystej na poziomie 0,023 tys. PLN.

Słowa kluczowe: produkcja sadownicza, nakłady pracy, ekonomiczna wydajność pracy

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