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Costs of Fruit Tree Production in the Region of Lublin

Koszty produkcji drzewek owocowych w rejonie lubelskim

Abstract. The level, structure and dynamics of the costs of fruit trees production in the years 1993-1996 in Specialist Nursery Farms in the region of Lublin were investigated. The analysis of costs was based on total self-costs. In order to compare two calculations of costs, two calculations of costs which were different in the method of self-rootstock evaluation, were made. It was stated that the production of self-rootstocks caused a reduction of production costs and a growth of profitability of fruit trees in the first years after budding production. Costs of pome trees in the first years after budding production were equivalent to the value of respectively 13.83, 10.92, 11.96 thousand of trees and 15.00, 11.49, 10.12 thousand of stone trees.

INTRODUCTION

In recent years the situation on the market for fruit and nursery production has influenced the economics of fruit tree production. Because of the permanently changing prices of means of production and labour, the knowledge of the costs of production in nursery farm management is a very important factor. In the intensification of fruit production high quality of

initial material is essential. The production of such nursery material calls for a change in recently used cultivation technology. The changes in technology increase expenditures and quality of fruit trees and bushes. These factors influence costs and profitability of nursery production.

The present research shows the level, dynamics and structure of tree production costs in the years 1993-1996 in specialist nursery farms in the region of Lublin.

MATERIAL AND METHODS

The source materials were records from the years 1993-1996 drawn up according to the method created by the author. The records were taken in the pome and stone tree nurseries in the first and second years of production.

The analysis of costs was based on total self-costs. In order to compare two calculations of costs, which differed in the method of own rootstock evaluation, were made. The self -rootstocks were evaluated either by the method of self- costs or according to the market price.

The total costs were divided in accordance to the connection with production criterion. Direct cost in fruit tree production contained material costs (such as costs of rootstocks, scions, fertilizer, fungicide, insecticide, herbicide, defoliant, foil bands, labels, bamboo pegs and string), labour and tractor costs, servicing and other direct costs such as evaluation fee and the rent of agriculfural holding. Indirect costs contained machinery, farmhouse and means of transports repair costs, as well as social insurance and amortization charges, electric energy and telephone bills, fees for membership in associations of producers, costs of advertising and others. Property costs included insurance, interests of credit and working capital taxes and other payments to the budget.

Material costs were counted by real consumption and purchase prices of these materials. The man-hour was evaluated by the level of an average salary in the national economy and the tractor-hour according to IERiGŻ for Ursus 35/12. In the years 1993-1996 these rates were as follows 1.5, 1.7, 3.3, 4.0 PZL for man-hour, and 9, 10, 13, 16 PZL for tractor-hour, without tractor driver's work. Servicing cost and other direct costs were given according to real costs.

The data were analysed by the use of common measures of dispersion. In vertical analysis of costs separate and chain indexes of dynamics were used. Selected relations between pairs of variables were analysed by the use of correlation method with linear regression model.

RESULTS

The level and the structure of costs in tree production in the first year after budding were different in the years of their production. The most capital consuming was the first year of nursery cultivation. The level of these costs was determined by the costs of initial materials. The costs of rootstocks and scions constituted from about 43.8 to 58.1% of total production costs for pome trees in the first years of cultivation and from 26.5 to 40.0% for stone trees. In the structure of initial material costs, the costs of rootstocks constituted about 70 to over 80%. In the tested farms apple trees were budded mainly on vegetative rootstocks M9 and M26, pear trees on *Pirus communis* var. *caucasica* Fed. seedlings, plum trees on *Prunus cerasifera* var. *divaricata* Borkh. and *Prunus domestica* subsp *oeconomica* Borkh. seedlings and cherry and sweet cherry trees on *Prunus avium* L. and *Prunus mahaleb* Borkh. seedlings. On average about 40 thousand vegetative rootstocks of apple tree per one hectare were grown and about 49 thousand generative rootstocks of stone tree.

It was stated that the initial material costs would be higher (respectively by 49, 22, 52, 28% in the pome tree nursery and in stone tree nursery by 15, 43, 25% but in 1994 it was lower by about 7%) if the farms had to buy all the initial material. In different years the share of own rootstocks was from 53 to 66% in pome tree nursery and from 73 to 86% in stone one.

The labour cost influenced the level of costs in the first year of fruit tree production because of high labour consumption of rootstock planting, budding or weed control.

In the second year of cultivation the level of costs was determined by labour and tractor costs. The share of labour cost in total costs was growing in the years of the studies and in 1996 it reached the highest level of 42% in pome tree nursery and over 37% in stone one. In the years 1993-1996 these costs increased, on average by 277% in pome tree nursery and by 255% in stone one. The growth in the share of labour costs in 1996 was caused by the increased input of work because of the necessity to label every tree. The material cost constituted 11 to 17% of total costs in the second year of pome tree production and over 11 to about 13% for stone trees. In the material costs the highest share belonged to pesticide (Tab. 1).

In the years 1993-1996 the index of direct cost dynamics in the first year of nursery cultivation was above 200% and was higher in pome tree production. Especially high dynamics in growth was characteristic of the pesticide,

Tab. 1. Average costs of fruit trees production in the first and second years growing a nursery in the years 1993-1996 and their dynamics

Specification	1993				1996				Dynamics of costs in the years 1993/1996 1993=100			
	pome trees		stone trees		pome trees		stone trees		pome trees		stone trees	
	I	II	I	II	I	II	I	II	I	II	I	II
	cost thousand PZL per ha											
Labour cost	3.24	3.62	3.58	2.99	5.80	10.03	6.70	7.62	1.79	2.77	1.87	2.55
Tractor work cost	1.22	1.65	1.15	2.16	1.05	2.00	0.92	2.34	0.86	1.21	0.80	1.08
Material costs	9.15	1.33	5.06	1.43	22.11	4.09	12.52	2.61	2.42	3.07	2.48	1.82
including rootstocks	7.19	x	3.00	x	15.25	x	8.18	x	2.12	x	2.73	x
scions	1.02	x	1.07	x	5.38	x	3.15	x	5.27	x	2.94	x
Other costs	0.13	0.10	0.13	0.11	0.25	0.56	0.22	0.21	1.96	5.48	1.65	1.90
Direct costs	13.73	6.70	9.92	6.69	29.21	16.68	20.36	12.77	2.13	2.49	2.65	1.91
Indirect costs	4.33	4.51	4.68	5.03	6.06	5.82	6.57	6.37	1.40	1.29	1.40	1.27
Property costs	0.69	0.70	0.74	0.81	1.50	1.57	1.37	1.30	2.17	2.23	1.85	1.61
Total costs	18.76	11.92	15.34	12.53	36.77	24.07	28.30	20.44	1.96	2.02	1.84	1.63
Standard deviation	3.254	3.668	3.402	1.846	11.754	5.093	2.733	3.748				
Variation coefficient	16.67	28.7	21.18	14.4	31.44	21.0	9.59	18.9				

I — first year of fruit trees production
II — second year of fruit trees production
Source: The author's own research

scions and property costs. What influenced the pesticide costs was not so much the frequency of spraying (since it was getting lower) but rather the choice of doses, kinds of pesticide and their prices. In the years 1993-1996 the prices of commonly used fungicides such as Syllit, Punch, Rubigan and Nimrod went up to over 200%. The prices of insecticides such as Bi-58, Fastac and Decis showed a lower rate of growth. As a result of the high dynamics in the growth of pesticide prices and the change in the use of pesticide the overall level of these costs and their share in the total cost structure increased. The cost of buds went up more quickly then the cost of rootstocks. In the years 1993-1996 the dynamics index was 5.27 for apple buds and 2.94 for stone tree buds.

The growth of the costs in the years 1993-1994 was determined by growing prices of varieties of plum buds (from 0.03 up to 0.045 PZL per bud) and pear bud (from 0.025 up to 0.04 PZL per bud) and by the higher than previously share of licenced varieties of apple trees such as Jonagold Decosta, Jonica, Ligol and some others in the structure of production. The buds of these varieties were difficult to purchase (they were often imported) and very expensive, eg. Jonica and Jonagold Decosta buds cost about 0.6 PZL, and Ligol bud 0.13 PZL. The high dynamics in the growth of property costs and their high variability were connected with the growth in the share of agricultural holding costs (the increase in the area and the soil rent) and credit service. While in 1993 all the fields for present and future nursery planting were rented by 6 out of 8 farms, in 1994 by all the farms (at the same time the cost and the size of rented fields were higher). In both years two or three farms took out a bank credit for nursery production but these credits were higher in 1994 than in 1993.

During the years of studies (1993-1996) the material costs as well as the costs of defoliants and some other material turned out to be most dynamic in the second year of fruit tree in the first year after budding production. The dynamics index in these years was higher for pome tree nurseries (4.84) than for stone ones (2.31). Other material costs in pome tree nursery in the second year of production (particularly in 1995-1996) were especially high because of the necessity to buy labels for all the apple trees. Moreover, in 1993 none of the tested nurseries was grown with the use of bamboo pegs while in 1996 every second nursery used the pegs (especially if it produced apple trees on M9 rootstock).

A statistically essential linear correlation between the direct costs in the first and second years of nursery production and the value of trees was

Tab. 2. Average total costs of pome trees and stone trees in the first year after budding production with different calculation of the cost of own rootstocks and selling price in the years 1993-1996

Specification		1993/1994		1994/1995		1995/1996	
		a	b	a	b	a	b
Pome trees in the first year after budding	cost of production thousand PZL per ha	35.27	38.62	46.07	50.11	57.63	61.38
	PZL per tree	1.34	1.47	1.64	1.78	1.93	2.06
	average selling price PZL per tree	2.55		4.22		4.82	
Stone trees in the first year after budding	cost of production thousand PZL per ha	28.80	29.53	32.16	31.70	44.41	48.82
	PZL per tree	1.02	1.05	1.22	1.20	1.73	1.90
	average selling price PZL per tree	1.92		2.80		4.39	

a — the cost of own rootstocks estimated according to the total self-cost
b — the cost of own rootstocks estimated according to the market price

shown. The correlation coefficients between these variables in pome tree production were 0.319, 0.769 and in stone tree production 0.424, 0.752. In the tested conditions of production the growth in value of pome or stone tree production by 1000 PZL per hectare entailed the increase in direct costs in the first year of nursery production by 64 PZL per hectare or 90 PZL and in the second year by 77 PZL per hectare or 70 PZL.

In the years 1993-1996 the calculated total costs of pome tree production in the first year were equivalent to the following values 4.17, 5.87, 6.67, 8.17 thousand trees and in the second year of production 2.65, 2.84, 3.57, 5.35 thousand. In a stone tree nursery in the first year of production the total costs were equivalent to the values of 5.11, 5.37, 7.33, 9.43 thousand trees and in the second year of production respectively 4.18, 4.10, 4.84, 6.81 thousand. The total costs of pome tree production in the three tested cycles were equivalent to respectively 13.83, 10.92, 11.96 thousand apple trees and 15.0, 11.49, 10.12 thousand stone trees. The total costs per hectare and per tree and the average selling prices in the years 1993-1996 are shown in Tab. 2.

DISCUSSION

Costs are the basic element of the profitability calculation. In the orchard nursery the knowledge of costs, their structure and tendency is especially important because the production is property consuming, the cycle is long and the costs of tree and rootstock production increase quickly.

The unit costs in pome tree in the first year after budding production in nurseries in the region of Lublin during the tested period were in average 1.34, 1.64, 1.93 PZL per tree and in stone tree production respectively 1.02, 1.22, 1.73 PZL per tree. What influenced the reduction in unit costs in production of trees in the first year after budding was the high share of self-rootstocks since the costs of rootstock production were much lower than the market prices. The research showed that the nurseries which in 1995 and 1996 used their own *Prunus avium* L. and *Prunus mahaleb* Borkh. rootstocks reached the higher profitability in stone tree production and the reduction in costs per tree by about 0.17 PZL. That was caused by higher demand for cherry and plum trees, which in result caused the growth in prices of *Prunus avium* L. and *Prunus mahaleb* L. rootstocks from 0.05-0.08 PZL to 0.5-0.6 PZL per rootstock and for cherry trees from 2.6 PZL in 1994 to 5.0 PZL per tree in 1996.

The own vegetative rootstock production caused the reduction in costs per tree in pome tree in the first year after budding production on average by 0.13-0.14 PZL. In the years 1993-1996 the unit costs of vegetative rootstock production were on average 0.09, 0.09, 0.11, 0.18 PZL and were lower than selling prices, which were on average 0.32, 0.48, 0.45, 0.63 PZL. Comparing unit costs and purchase prices of the most common vegetative rootstocks such as M9 and M26 the conclusion is drawn that the unit costs were lower respectively by 400, 567, 355, 289% for M9 rootstock and 233, 300, 263, 178% for M26 and for generative rootstock such as *Prunus mahaleb* L. and *Prunus cerasifera* var. *divaricata* Borkh. in 1993, 1995, 1996 these costs were lower respectively by 33, 150, 354% for *Prunus mahaleb* L. and 33, 275, 173% for *Prunus cerasifera* var. *divaricata* Borkh.

The unit costs in tree and rootstock production in nurseries in the region of Lublin were similar to such costs in other regions of Poland. According to Maziarka (1996), the research conducted in three nurseries in the region of Rzeszów and Krosno, the cost per vegetative rootstock in the years 1995-1996 was between 0.11-0.13 PZL and per apple tree 0.94-1.96 PZL.

In the structure of costs in fruit tree production the share of initial material is very high. The cost of initial material constituted 23.3 to 33.3% of

total costs in pome tree in the first year after budding production and 14.1-19.0% for stone trees. Over the years the structure of costs in fruit tree production did not change much. A similar relation between total and rootstock costs was stated by Taranek (1984). In his research the rootstock costs constituted 23.5%, material costs 37.7% and labour costs 22.5% of total costs in plum tree production. In the region of Lublin the share of material costs in total costs in stone tree production was lower (from 22.1 to 26.9%). The level of material costs was determined by the costs of rootstocks and scions. In tested production cycles these costs constituted 74.5-83.3% of the material costs in pome tree production and 63.8-70.8% for stone trees. The low profitability of cherry and plum fruit in the years 1993-1994 caused little demand for those trees and kept the prices of rootstocks and scions at a fairly low level.

The share of labour costs in the structure of total costs was lower than in the seventies. That was caused by higher labour consumption of production, which was the result of some changes in technology of production (shaping of trees in a nursery, using pegs for growing trees and some others) and higher payments for hired workers caused by high inflation and the changes in the insurance system for farms. A similar relation between labour and total costs was stated by Maziarka (1996) in the years 1995-1996 (the labour costs constituted 12.7 to 22.0% of total costs). In this research the share of direct cost was higher than in the nurseries in the region of Lublin (about 76.6% of total costs, while in Lublin it was 68.5% for pome tree and 64.5% for stone tree production). The dissimilarity might be the result of different methods of cost calculation and various economic and production conditions in tested farms.

A certain constancy in the structure of fruit tree in the first year after budding production is confirmed by the results of the research by Grochowski (1970) conducted in the years 1964-1966. In that research the share of direct costs in the structure of total costs was about 65%. The author's own research of fruit tree in the first year after budding production in the years 1993-1996 showed that the share of direct costs in the structure of total costs constantly increased. That share in the subsequent cycles was 58.4, 64.8, 68.5% in pome tree nursery and 57.5, 60.3, 64.3% in stone tree.

In nursery economics the level of fruit tree production cost in the following years can be represented by the equivalence of trees and vegetative or generative rootstocks. The costs of pome tree in the first year after budding production were equivalent (in the years 1993-1996) to the value of

70.54, 92.14, 115.25 thousand vegetative rootstocks or 13.8, 10.9, 12.0 thousand apple trees of best quality. The costs of stone tree production were equivalent to the value of 143.48, 160.81, 222.05 thousand generative rootstocks or 15.0, 11.5, 10.1 thousand trees. According to the calculation by Krzysiak and Martyna (1977) based on the prices from the year 1975, the costs of apple tree production were equivalent to the value of 9.77 thousand trees of best quality. This comparison indicates a little worse relation between the prices and the costs in the years 1995/1996 and a bit better in the 1993/1994, compared to the seventies. In a similar research conducted in Italy in the province of Ravenna in the years 1990/1991, the costs of apple tree production in the first and second years were equivalent to the value of 203.33 thousand vegetative rootstocks (Ceroni, Farinelli 1992). In Poland the costs of tree production were relatively lower in spite of worse relations between the price of a rootstock and a tree in the first year after budding. According to Makosz (1994) in 1993 the share of the price of a rootstock in the price of a tree in the first year after budding in Southern Tyrol (Italy) was 9.6% and in Poland about 12%. Lower costs of the production of fruit trees of lower quality in Poland may not be enough to compete with a modern and highly efficient orchard nursery in the European Union.

CONCLUSIONS

1. The unit costs in pome trees in the first year after budding production in nurseries in the region of Lublin during the tested period were on average 1.34, 1.64, 1.93 PZL per tree and in stone tree production respectively 1.02, 1.22, 1.73 PZL per tree.

2. The research showed that the nurseries which used their own rootstocks reached higher profitability in pome and stone tree production and the reduction in costs per tree.

3. The research of fruit trees in the first year after budding production in the years 1993-1996 showed that the share of direct costs in the structure of total costs constantly increased. That share in the subsequent cycles was 58.4, 64.8, 68.5% in pome tree nursery and 57.5, 60.3, 64.3% in stone tree one.

4. In the structure of costs in fruit tree production the share of initial material is very high. The cost of initial material constituted 23.3 to 33.3% of total costs in pome tree in the first year after budding production and 14.1-19.0% for stone trees one.

5. The costs per hectare of pome tree in the first year after budding production were equivalent (in the years 1993-1996) to the value of 13.8, 10.9, 12.0 thousand apple trees of best quality. The costs of stone tree production were equivalent to the value of 15.0, 11.5, 10.1 thousand trees.

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STRESZCZENIE

Badano poziom, strukturę i dynamikę kosztów produkcji drzewek owocowych w latach 1993-1996 w specjalistycznych gospodarstwach szkółkarskich położonych na Lubelszczyźnie. Analizę kosztów przeprowadzono na podstawie całkowitych kosztów własnych. W celach porównawczych sporządzono dwa rachunki kosztów różniące się metodą wyceny podkładek własnych. Stwierdzono, że produkcja drzewek na podkładkach własnych powodowała obniżenie kosztów, a tym samym zwiększenie opłacalności produkcji okulantów. Całkowite koszty produkcji okulantów drzew ziarnkowych w trzech badanych cyklach produkcyjnych równoważyły wartość odpowiednio 13,83, 10,92, 11,96 tys. sztuk okulantów tych drzew, a 15,00, 11,49, 10,12 tys. sztuk drzewek pestkowych.