

## **Analysis of progress implementation in horticultural production technical equipment taking an example of the selected region of Poland**

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**Abstract:** *Analysis of progress implementation in horticultural production technical equipment taking an example of the selected region of Poland.* The paper presents problems of technical progress implementation in horticultural production, taking an example of the group of farms from the Masovian region. The survey investigations were carried out on the group of 30 horticultural producers. There were considered utilization of innovative technical solutions in nursery material planting, pruning of trees, fertilizing and chemical cultivation of orchards, fruit harvesting and storage, as well as the methods for acquiring knowledge on innovations in horticultural production. The analysis on introduction of innovative solutions showed that in majority of investigated farms (60%) no activities towards implementation of any innovations were planned.

*Key words:* progress, horticultural production, technical equipment, evaluation indices.

### **INTRODUCTION**

Poland has been numbered among important fruit producers in Europe, in spite of considerable division of production and farm diversification in respect of the equipment and technologies used as well as low level of market organization [Andrzejewska 2012]. The fruit production has increased in recent years and the

quality standards have been improved; the number of Polish farms that product the fruits on a world level has increased also. A high level of fruit-growing, processing and nursery-production is a source of optimistic perspectives for production development [Makosz 2012]. At the same time, it is believed that specialistic orchard production is a chance for the farm owners in Poland; in spite of technologies that are difficult for mechanization, as a result of production transformations one can create circumstances for an increase in production profitability [Gaworski, Malinowski 2011].

Mechanization of some production processes promotes the fruit quality improvement and an increase in yield [Makosz 2006]; this points out at importance of technical mean potential utilization in orchard production and advantages that can result from technical progress utilization in fruit-growing.

Undertaking of technical progress problems in the area of obtaining plant raw materials, including fruits, promotes searching for evaluation criteria in implementation of progress in the farms, including the fruit-growing farms. Apart

from the wide set of indices that can be used to express effectiveness of technical progress implementation in agriculture [Kowalski et al. 2002], the progress can be practically considered from the viewpoint of its application, to be determined by users of technical equipment in the farms, including fruit-growing farms.

This work aimed at analysis of problems in implementation of technical progress in fruit production, taking an example of the selected farm group from Masovian region.

## MATERIAL AND METHODS

In realization of undertaken aim of the work there was used a diagnostic sounding method, so called a survey sounding. It is the way for collecting knowledge on the structural and functional advantages and dynamics of social phenomena, beliefs and opinions of given communities, intensifying and directions of certain phenomena and of other not localized phenomena, basing on a specially selected group that represent general population, where a given phenomenon takes place [Pilch 1998].

In the diagnostic sounding there was used the survey technique as a tool for acquainting oneself with community attributes, facts and opinions on the events. The anonymous survey covered 30 fruit-growers of Masovian province. This selection of investigation site can be justified, since about 30% of Polish orchards' area is situated in the Masovian region, and over 40% of inland fruit production is obtained there.

Male participants predominated in the investigated group (86.7% – 26 persons), while female participants took only 13.3%

(4 persons). It could result from physical limitations and predispositions to execution of the working tasks.

The investigations were carried out on several age groups. The group up to 30 years of age included 12 persons (40%), the group of 51 years and above – 15 persons (half of participants). The age of one person ranged to 31–40 years, and of two persons to 41–50 years. According to GUS statistical data GUS [2008], the middle age persons were involved in orchard cultivation, thus, between 30 and 59 years of age.

The education level of investigated persons can be regarded as high, since as many as 53.3% of them (16 persons) were university graduates, about 33.3% (10 persons) almost completed university education, and 13.4% (4 persons) secondary education. No elementary education was declared by the surveyed persons. According to GUS data, among the fruit growers only 10% were educated in horticultural specialization, 60% of them completed professional courses, 20% completed secondary education, and only 6.6% completed higher education. The last group includes mainly the persons up to 29 years of age [GUS 2008].

The farm area belonging to surveyed persons ranged from 1 to 10 ha – 14 persons, and from 11 to 50 ha – 14 persons. Only two persons declared the farms below 1 ha and above 100 ha. Small orchards predominate in Poland, up to 1 ha – 77% of total number of fruit-growing farms. The farms above 20 ha take only 0.25% of total number of fruit-growing farms. The average orchard area in Masovian province amounts to 7.2 ha [GUS 2008].

## RESULTS OF INVESTIGATIONS AND DISCUSSION

One of the investigated aspects, connected with implementation of technical progress in the fruit-growing farms, was the problem of preference in selection of equipment used in nursery material planting in orchards. Results of investigations are presented in Table 1.

TABLE 1. Number of trees (bushes) planted annually by given planting method

Planting method	Species	Mean [pcs/year]
Mechanical augers	Apple tree	2500
	Cherry tree	850
	Sweet cherry tree	550
	Pear tree	300
Hydraulic augers	Apple tree	6500
	Cherry tree	1267
	Sweet cherry tree	2000
	Pear tree	5000
	Plum tree	300
Tractor planters	Apple tree	2400
Manual planting	Currant	2000

Source: own investigations.

Comparing mean values for particular solutions one can find the best results for the hydraulic augers, then for mechanical augers and, finally, for tractor planters. For instance, in planting of apple trees the application of hydraulic augers enabled to plant more trees by 35.9% when compared to tractor planters, and by 35.1% when compared to mechanical augers. Comparing the hydraulic and mechanical augers one can find better results for hydraulic augers: on the average more planted cherry trees by 1267

(59.8%), 2000 of sweet cherry trees (78.4%), 5000 of pear trees (94.3%) than in the case of mechanical augers. In the light of obtained results one can find the highest level of modernity and functionality in the hydraulic augers; they are also predominant in respect of utilization in the investigated farms.

The tree pruning technique in orchards was investigated also. A substantial part of investigated persons still use the hand pruning shears (17 persons), while less than half of them (11 persons) use the pneumatic shears. Nobody used the electric shears. Therefore, outputs achieved with the use of mentioned technical devices, that represented various level of modernity and technical development, were taken into account.

As it is evident from data collected in the survey, the apple trees are pruned with the use of hand shears with output of 30–35 trees per hour (3 persons), 36–40 trees per hour (2 persons), 46–50 trees per hour (3 persons); it can be averaged to 39.6 trees per hour. With the use of pneumatic shears, the same trees are pruned with output of 56–60 trees per hour (2 persons), 61–65 trees per hour (3 persons), and even 66–70 trees per hour (1 person), on the average 62.1 trees per hour. It means that pneumatic shears are more effective than hand shears by about 22% (Tab. 2).

The results of survey investigations on fertilizing methods, thus, on technical means used, are presented in Figure 1.

The survey participants use mainly foliar fertilizers – 17 persons, 7 persons opt for fertilizing by spreading mineral fertilizers over the soil surface with the use of a spreader. Fertilizing with fluid

TABLE 2. Output obtained during pruning of investigated groups of trees

Species	Method for pruning of trees (bushes)			Number of trees [pcs/h]	Mean [pcs/h]
	Hand shears	Pneumatic shears	Other		
	[Number of surveyed persons]				
Apple tree	3			30–35	39.6
	2			36–40	
	0			41–45	
	3			46–50	
		2		56–60	62.1
		3		61–65	
		1		66–70	
Pruning difference between two methods					22.5 (22%)
Cherry tree	1			20–25	30.4
	1			26–30	
	1			31–35	
	1			36–40	
		1		41–45	45.5
		1		46–50	
Pruning difference between two methods					15.1 (20%)
Sweet cherry tr.	1			25–30	30.25
	1			31–35	
		1		45	45
Pruning difference between two methods					14.75 (19.6%)
Pear tree	1			32	32
		1		40	40
Pruning difference between two methods					8 (11.1%)

Source: own investigations.

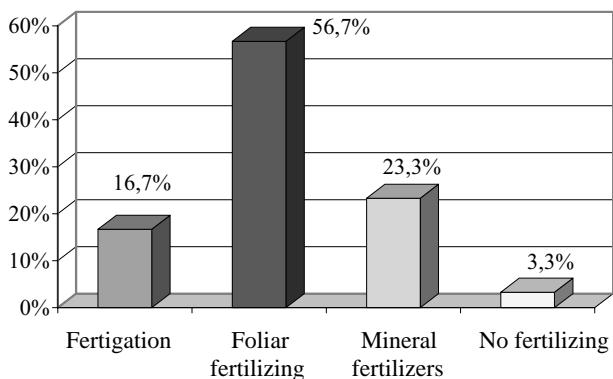


FIGURE 1. Preferred fertilizing methods according to survey participants

Source: own investigations.

nutrients (so called fertigation) apply 5 fruit growers, while one person uses no fertilizing at all.

The hitherto experiments point out that the least consumption of fertilizers was found in fertigation, little higher in foliar fertilizing, but in mineral fertilizer spreading the difference was quite big. Difference between fertigation and foliar fertilizing of apple trees amounts to 0.1 t (1%) only, in cherry trees – 0.2 t (3%).

Detailed results of survey investigations on technical aspects of orchard protection are presented in Figure 2.

Majority of investigated fruit growers (24) use traditional fan sprayers in orchard protection, only three persons use the ejector atomizers, two persons – double-fan sprayers, and one person only uses a tunnel sprayer in apple trees spraying; this last solution is characterized by the highest level of modernity in orchard chemical protection.

The question connected to the fruit harvesting methods used was also included in the questionnaire. As it is evident from the obtained answers, 26 owners of orchard farms (87%) use the hand harvesting methods, and only 4 fruit producers use the combines; application of this

modern technique determines possibility of obtaining high productivity.

The part of questionnaire connected to post-harvest yield processing included question of fruit storage methods and technical infrastructure used. Nine fruit growers store the fruits after harvest with the use of cold stores equipped with cooling installation. Five persons keep fruits in traditional stores (cellars), while four persons declare placing the fruits in chambers equipped with a standard controlled atmosphere (AK). One person uses the chambers with low oxygen atmosphere (ULO) and one person applies SmartFresh system that enables to reduce the ethylene production due to an active substance 1-MCP. Detailed results of investigations on fruit storing time in particular stores are presented in Table 3.

The final part of investigations concerned availability of knowledge in respect to modernity and innovations in fruit production. Distribution of answers connected to the methods for acquiring knowledge on innovations in fruit production is presented in Figure 3.

Majority of questioned persons (10) use the professional scientific journals or popular science publications to improve

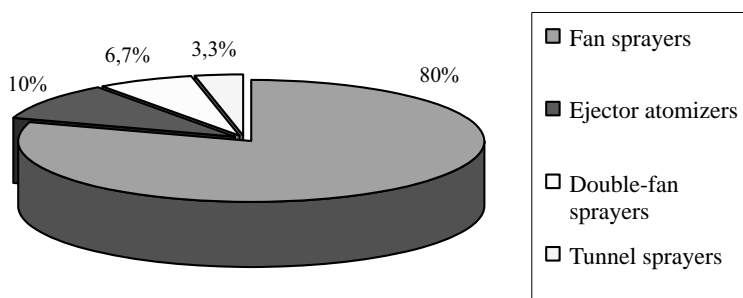


FIGURE 2. Technical means in orchard protection according to survey investigations  
Source: own investigations.

TABLE 3. Fruit storing time in particular stores (survey investigations)

Type of storing		Storing period [number of answers]											
		Traditional			Cold store			AK chambers				ULO	Smart-Fresh
Months		2	3	4	3	4	5	5	6	7	8	5	6
Species	Apple	–	1	–	–	2	2	1	1	1	1	1	1
	Cherry	1	–	–	1	2	–	–	–	–	–	–	–
	Sweet cherry	–	1	–	–	1	–	–	–	–	–	–	–
	Pear	1	–	–	–	–	1	–	–	–	–	–	–
	Prune	–	–	1	–	–	–	–	–	–	–	–	–
Average storing period		2.8			4.2			6.5				5	6

Source: own investigations.

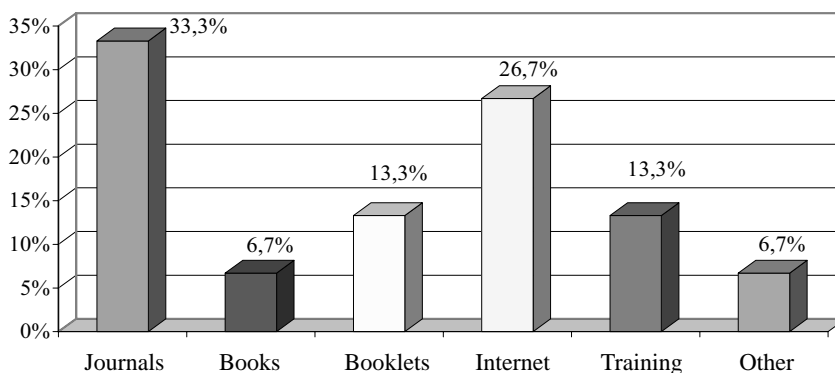


FIGURE 3. Distribution of answers connected to the methods for acquiring knowledge on innovations in fruit production

Source: own investigations.

own knowledge in respect to carried out fruit growing activity. The next major group (8 persons) acquire knowledge on the innovations from internet, 4 persons from information booklets of firms, and 4 persons take part in professional seminars or trainings. Only two persons declared making use of the subject books, and two other persons acquire knowledge from neighbours or acquaintances that deal with fruit production. All questioned persons that take part in seminars or trainings completed or almost completed the university education.

## SUMMARY

As far as the introduction of innovative solutions is concerned it was found, that in the 60%-group of investigated persons no activities towards introduction of any innovations were planned, while 40% of persons were ready to introduce the innovations. The latter persons intend to expand the production forms, e.g. by introduction of 100%-natural juices or dried apples. This speaks well for their initiative and ability to create new ideas of expanding activity. Some persons are

focused on quality by introduction of micro-irrigation and the AK chambers. More persons opted for purchasing machines (two answers more than the negative answers). It means that the producers find modern technology good, they have the courage to accept modern solutions, and more and more often reject traditional methods and means of production. They are aware that keeping pace with technological advance and innovations is a source of profitability.

The producers' mentality changes slowly; they search for professional knowledge more often and find the creative ideas of modern technology good. The technical and technological innovative solutions speak for better quality of fruits and nursery material; thus, fruit growing becomes more efficient and profitable. Basing on carried out investigations one can point out at many elements in Polish fruit growing that should be changed, especially the old and less effective machines and implements. At the same time, comparing the state of technical and technological advance of last 30–40 years one can find changes that determine the dynamic process of Polish orchards modernization. The producers are focused, first of all, on product quality and satisfaction of customers. A substantial part of fruit growers are focused on the current and perspective changes that determine development with the use of modern technology [Jednaszewska 2013].

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- Streszczenie:** *Analiza wdrażania postępu w zakresie technicznego wyposażenia produkcji sadowniczej na przykładzie wybranego regionu Polski.* Celem pracy była analiza problemów wdrażania postępu technicznego w produkcji sadowniczej na przykładzie wybranej grupy gospodarstw z regionu mazowieckiego. Przeprowadzono badania ankietowe obejmujące grupę 30 producentów sadowniczych. W badaniach uwzględniono kwestie korzystania z innowacyjnych rozwiązań technicznych w zakresie nasadzeń materiału szkółkarskiego, przycinania drzew, nawożenia i pielęgnacji chemicznej sadu, zbioru i przechowywania owoców, a także metod czerpania wiedzy na temat innowacji w produkcji sadowniczej. Analizując kwestię wprowadzenia innowacyjnych rozwiązań, w grupie obejmującej 60% badanych nie stwierdzono planowania działań związanych z wdrażaniem jakichkolwiek nowości.

*MS. received March 2013*

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