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ABSTRACT

Of the dissertation for the degree in Biological Sciences

**COLLECTION, STUDY, AND UTILIZATION OF FOLK
VARIETIES OF PEAR AND THEIR WILD RELATIVES IN
THE SHEKI-ZAGATALA REGION**

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INTRODUCTION

The actuality of the topic. The formation of a unique national food market in Azerbaijan and its protection from foreign competition, as well as meeting the pear needs of the population in a wide range at an inexpensive price through local production, as well as the raw materials procurement for the fruit processing industry, etc. is one of the issues.

The area of pear orchards in Azerbaijan is 5239.6 thousand hectares, of which 1221.5 thousand hectares are in the Sheki-Zagatala region. The yield of these orchards is about 102.3 q/ha. "In Azerbaijan, 28 wild relatives of the pear are found mainly in the Greater Caucasus, the Lesser Caucasus, the Talysh Mountains and the Nakhchivan Autonomous Republic¹.

The swift advancement of pear cultivation in the primary sector of industrial horticulture carries significant scientific, theoretical, and practical implications. This has been reiterated by the "National Strategy of the Republic of Azerbaijan on Conservation and Sustainable Use of Biodiversity for 2017-2020," which was endorsed by the President of Azerbaijan via a decree dated 3 October 2016².

The purpose and objectives of the study: In the Sheki-Zagatala district of the Republic of Azerbaijan, 17 folk cultivars, 7 cross-breeds and 2 wild pear cultivars have been studied in industrially important plantations, farms, homesteads and forests.

The object and purpose of the research: In the Sheki-Zagatala district of the Republic of Azerbaijan, 17 folk varieties, 7 promising and 2 wild forms of pear have been studied in industrially important plantations, farms, farmlands and forests.

The purpose and objectives of the study: The main goal is to determine the biological and economic characteristics, diversity,

¹ Məmmədov, T.S. Azərbaycan dendroflorası / T.S. Məmmədov - Bakı: Elm, - 2018. c. IV, - 380 s.

² Azərbaycan Respublikasında kənd təsərrüfatı məhsullarının istehsalına və emalına dair Strateji Yol Xəritəsi: [Elektron resurs] / – Bakı: Fərman, – 6 dekabr, 2016. <https://president.az/az/articles/view/22110>

height and development parameters, leaf and pollen sizes, yield parameters, the maturity period of pear folk varieties, as well as wild relatives that are distributed according to the existing soil and environmental conditions in the horticulture industry sector of the Sheki-Zagatala region to study their pomological, biochemical indicators, resistance to diseases and pests, select quality ones and introduce them into production. To achieve the goal, the following was determined.

- Study and mapping of the area of distribution of popular breeding pear varieties and forms, as well as wild relatives in forests and orchards;
- Selection of identified folk varieties and their wild relatives, as well as new ones from wild-growing species for our republic;
- Study of growth stages and the characteristics of the identified folk varieties and their wild relatives, as well as of wild relatives;
- Study of duration of main development stages and peculiarities of their development on open varieties of folk varieties and different forms, as well as on wild types;
- Plant stem density, annual growth of branches, as well as determination of leaf parameters and pollen viability of varieties and wild relatives;
- Study of the impact of soil and climatic conditions on the elements of the yield structure, pomological parameters, biochemical composition, diseases and pests resistance of pear varieties and their wild relatives;
- Selection of promising varieties with higher quality parameters from identified forms and determination of the economic efficiency of their use, as well as the creation of gene pool-collection orchards, taking into account their high genetic features.

The main regulations of the dissertation defense:

1. The main factors impacting pear productivity were evaluated in a study of folk varieties of pear plant, as well as their different forms and wild types found in the Sheki-Zagatala region. These factors include leaf size, pollen fertility, annual growth height, and fruit development.

2. When examining folk varieties, different forms and the wild relatives of pear plant grown in Sheki-Zagatala, we discovered a positive correlation between the crown projection, leaf surphase, and the productivity. This suggests that certain pear varieties may be more productive than others.

3. New folk varieties of pear adapting to environmental conditions, and the stable parameters of productivity that meet required standards facilitate an increase in pear production and are competitive in market conditions. The selection of the most optimal samples from a range of variations can be used to create orchards that are economically viable in the future.

Scientific innovations: In the Sheki-Zagatala region, 3210 pear plants were studied and 25 of them new varieties were selected. As a result of biomorphological studies of the folk variety-form diversity of the pear plant, the varieties superior to others in resistance to abiotic and biotic stress factors in the soil and climatic conditions of the region, the rich orchards of the gene pool and the genotypes involved in the study were studied and as a result, and the existing polymorphism among the samples was found.

For the first time, satellite coordinates and heights above sea level of the locations of the studied varieties were studied and recorded. For the first time, a collection orchard of 32 folk varieties and wild relatives of pear plant in 3 replicates has been established on the Gene pool experimental area.

The theoretical and practical significance of the investigation: The conservation of the existing gene pool of folk pear varieties and the creation of a collection orchards in the Sheki-Zagatala region are of practical importance. 4 disease and pests-resistant varieties were considered to be adapted to the soil and climatic conditions of the region, more productive, resistant to storage and transportation, high quality, and promising for planting the intensive orchards of a new industrial value and meet the required standards and are cost-effective.

Seedlings obtained from them were planted in the gene pool garden of ANAS of Sheki RES with the purpose of using them in agriculture.

Approval of the work: The main results of the dissertation work were presented at the International Conference on the 70th anniversary of Plovdiv Agrar University in Bulgaria (2015) on the topic "Traditions and challenges facing agricultural education, science and business", at the International conference on the topic "Modern production technologies of environmentally friendly products for the sustainable development of agriculture" in Georgia (2016)), in the Genetic Resources Institute.

13 scientific works (9 articles, 1 book, 3 theses) reflecting the main provisions of the dissertation work have been published, 3 of them were published in abstracted journals indexed in international databases (Web of science, Agris).

The organization where dissertation work was conducted: The dissertation work was carried out in 2014-2019 at the "Fruit Plants" Department of the Genetic Resources Institute of NASA and the "Plant Biodiversity and gene pool" Department of the Sheki REC of NASA.

Structure and volume of the dissertation: The thesis consists of 193 pages including introduction, 6 chapters, conclusions, recommendations, list of used literature and appendix. In the main part, 26 tables and 13 figures have been used. The dissertation consists of 218792 characters. Including introductory section, title page and table of contents 17600 marks, chapter I - 51596 marks, chapter II - materials and methods section 32248 marks, chapter III - 45151 marks, chapter IV - 43724, chapter V - 16923, chapter VI - 8371 marks, conclusions 2557, recommendations consist of 622 characters. The thesis is completed with 20 pages, 10 tables, 17 figures and 1009 symbols. 165 publications have been cited in the research work, of which 57 in Azerbaijani, 10 in Turkish, 75 in Russian and 18 in English.

CHAPTER I. BASIC WORK CONTENT THE SCIENTIFIC HISTORY OF PEAR PLANT (*Pyrus* L.), DEVELOPMENT, ECONOMICAL SIGNIFICANCE AND BIOECOLOGICAL CHARACTERISTICS

This chapter outlines and analyses the sources of literature on the biological characteristics of pear, such as the history of pear plant cultivation, its distribution area, national economic significance, total yield, taxonomy and botanical description, ecological characteristics, relationship with abiotic and biotic factors, as well as diseases and pests resistance, the role of the anthropogenic factor.

CHAPTER II. OBJECT, MATERIAL AND METHODOLOGY IN RESEARCH

2.1. Research conditions. The lowlands and foothill part in our study areas belong to the semi-moist, temperate-warm, subtropical climate type. The region features grassy mountain meadows and brown mountain forests with soils varying in mechanical composition from heavy loams to light loams. The soils are characterised by rich reserves of nitrogen and humus. The region has a semi-moist subtropical climate with an average annual precipitation ranging between 729-1022 mm. The annual precipitation in the western districts is 922 mm, whereas in the eastern districts it is 836 mm. The average annual air temperature ranges from 10.30-13.640C. The natural-climatic conditions, combined with the heat and precipitation, facilitate the normal development of pear trees in this region.

2.2. Research methods. In research, phenological observations, morphological characteristics, varieties and forms, as well as per plant yield from wild relatives, pomological parameters of fruits, disease and pests resistance, were studied based on programs and

methods prepared by the staff of the All-Union Botanical Institute and other scientific research institutes^{3, 4, 5}.

The viability of pollen was determined by the aceto carmine method of Z.P. Pausheva⁶.

Biochemical analyzes were carried out in the Department of Plant Biochemistry of the Sheki Regional Scientific Center. The fruit moisture content was dried until a constant stable weight was obtained. Vitamin C was determined by the Tillmans method. The amount of total sugars was determined according to the Bertrand method by measuring with a universal polarimeter-saccharimeter brand SU-4. The fruit mass was determined by weighing 50 pieces of each sample on a VLK-500 scales

The reaction of the soil solution in the prepared soil samples was determined by the potentiometric method, determination of carbonization (calcimeter) according to Scheibel, total humus according to I.V. Tyurin, total nitrogen according to the method of K.E. Ginzburg, active phosphorus according to B. P. Matsygin, exchangeable potassium P V. Protasova.

Economic efficiency was calculated based on yield in money. Experimental materials obtained during tests of dispersion analysis B.A. Dospekhov⁷, G.F. Lakin⁸, express calculation was developed according to the method of B. T. Kaplan⁹.

³ Программа и методика сортоизучения плодовых, ягодных и орехоплодных культур / Г.А.Лобанов, Т.В.Морозова, А.С.Овсянников [и др.], – Мичуринск: – 1973. – 251 с.

⁴ Методы изучения устойчивости к болезням семечковых плодовых культур / Под Ред. Кол. – Ленинград: ВИР, – 1978. – 78 с.

⁵ Методика фенологических наблюдений в ботанических садах СССР/Под Ред. Кол. –Москва: Главного Ботанического Сада АН СССР, – 975.с. 45-117.

⁶ Паушева, З.П. Ацетокарминовый метод/ Практикум по цитологии растений // З.П.Паушева. – Москва: «Колос», –1974. –213 с.

⁷ Доспехов, Б.А. Методика полевого опыта с основами статистической обработки результатов исследований /Б.А.Доспехов.–Москва: Агропромиздат: – 5-е изд.,– 1985. – 351 с.

⁸ Лакин, Г.Ф. Биометрия / Г.Ф.Лакин, – Москва: Высшая школа, –1990.-352 с.

⁹ Каплан, Б.Т. Экспресс-расчет основных математико-статистических показателей / Б.Т.Каплан, – Баку: Маариф, – 1970. – 446 с.

CHAPTER III. SPECIFIC FEATURES OF DETECTED FOLK VARIETIES AND FORMS OF PEAR PLANT (*Pyrus L.*) AND THEIR WILD RELATIVES

3.1. The results of phenological observations on folk varieties of pear plant and their wild relatives. One of the main conditions for the beginning of the vegetation period of landraces and forms of pear, as well as their wild relatives, is the air temperature not lower than $+8^{\circ}\text{C}$, and for the flowering stage more than $+9^{\circ}\text{C}^{10}$.

In Table 1, phenological observation was conducted, bud opening, flowering, flowering duration and the period from inflorescence to mass flowering in 2014-2019 research years were analysed. As with other fruit and berry plants, the relationship of pear plants to external environmental factors varies according to their current age, season and phenological phases¹¹.

The fact that the average length of the annual vegetation period of a pear plant is 83-200 days is determined by identifying four main phases of its development.

As a result of the research, it is clear from the experiments that the phenological phases are affected by climatic factors, but they cannot change the biological characteristics of varieties and forms. During the experiment, some varieties were early blooming quickly and belonged to the winter group, and there were cultivars that bloomed so late that they were assigned to the summer group.

According to the flowering stage, they are divided into three groups: early-flowering, medium-sized and late-flowering. Percentage of different cultivars, forms and wild relatives of pear: 11.5% early flowering; mid-term flowering 65.4%; 23.1%, late flowering (Figure 1).

¹⁰ Мамедов, Дж.И. О сроках и продолжительности цветения груши местных сортов и диких форм, распространенных в Шеки-Закатальском районе Азербайджана //– Саратов: Аграрный Научный Журнал, – 2021. № 4, -с.21-23.

¹¹ Həsənov, Z.M. Meyvəçilik, Dərslik / Z.M.Həsənov, C.M.Əliyev – Bakı: “MBM” nəşriyyatı, –2011.–520 s.

Table 1

Bud opening and flowering period of pear varieties and forms and wild species found in Sheki-Zagatala district (average for 2014-2019)

Maturity	Variety and form	Date			The period from blossoming to flowering	Period from blossoming to ripening stage
		Opening of buds	Flowering	Fruit ripening		
Summer	Agha-bey gormez	15.III	07.IV	15.VI	33±1,08	83±2,19
	Bughdabichen	02.IV	25.IV	25.VI	23±0,77	84±2,41
	Sheyxlarm ar.-d	25.III	27.IV	03.VII	33±1,10	100±2,98
	Manjyliq	31.III	16.IV	28.VI	160±,42	90±2,67
	Sari goncha	20.III	10.IV	27.VII	21±0,71	116±3,44
	Bughdabichen	02.IV	25.IV	25.VI	23±0,77	84±2,41
	Sheyxlarm ar.-d	25.III	27.IV	03.VII	33±1,10	100±2,98
	Manjyliq	31.III	16.IV	28.VI	160±,42	90±2,67
	Sari goncha	20.III	10.IV	27.VII	21±0,71	116±3,44
	Sheki khorasani	05.IV	26.V	27.VII	21±0,60	113±3,48
	Goum armud	21.III	12.IV	14.VII	220±,79	115±3,46
	Oghuz agh arm.	26.III	24.IV	02.VIII	31±1,12	129±3,96
	F//Gkha – 1	28.III	18.IV	22.VII	21±0,64	108±3,21
	F//Gav – 9	15.III	09.IV	24.VI	250±,86	101±3,00
Autumn	Gurguley	02.IV	24.IV	01.IX	22±0,83	165±4,84
	Balakan agh gulabisi	23.III	11.IV	15.IX	19±0,48	176±5,08
	Tatir armud	18.III	12.IV	20.VIII	25±0,98	155±4,43
	Sunu armud	25.III	16.IV	29.VIII	22±0,65	152±4,56
	Kifir armud	19.III	12.IV	15.IX	24±0,78	180±5,76
	Zagatala iryalı	05.IV	24.IV	10.VIII	19±0,55	135±4,08
	F//Shbg – 7	26.III	18.IV	15.VIII	23±0,57	142±3,78
	F//Shz – 25	25.III	18.IV	25.VIII	24±0,67	153±4,58
	F//Zt – 32	26.III	16.IV	27.IX	21±0,69	185±5,07
F//Ot – 31	21.III	11.IV	19.VIII	21±0,70	151±4,31	
Winter	Nararmud	30.III	17.IV	03.X	18±0,54	192±5,55
	Sheki dash arm.	24.III	26.IV	01.X	32±1,09	200±6,01
	Gishlig armud	30.III	20.IV	08.X	21±0,65	192±5,38
	F//Bk – 26	25.III	17.IV	07.X	23±0,72	196±5,61
	Soyudyarpag	25.III	18.IV	10.X	24±0,68	199±6,00
	Adi armud	24.III	13.IV	14.X	20±0,56	174±5,17

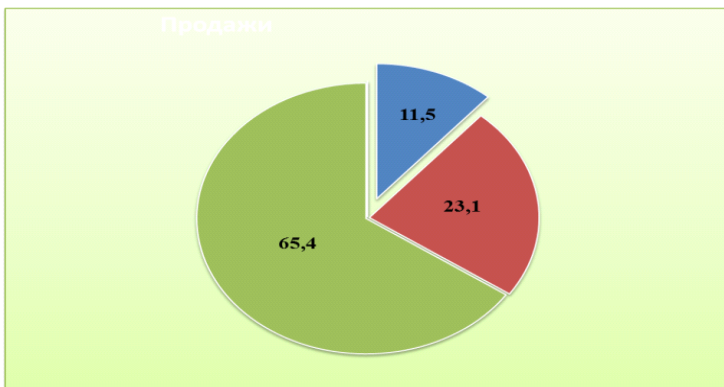


Figure 1. Percentage of different varieties, forms and wild species of pear plant that differ in flowering period.

Folk varieties and different forms are divided into three parts according to the ripening stage: 23.1% of pear folk varieties and different forms and wild-growing samples of ancestors are early-ripening (summer): 38.45% are mid-ripening (autumn), 38.5% are late-ripening (winter) (Fig. 2).

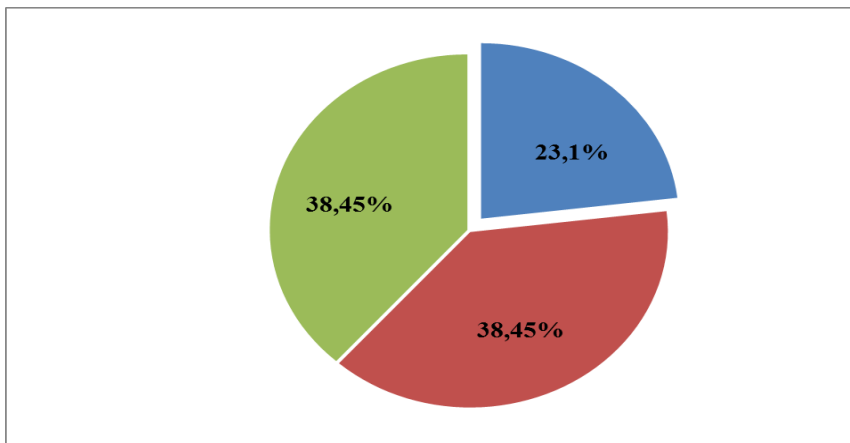


Figure 2. The percentage of different varieties, forms and wild samples of the pear, differing from each other according to the ripening period: 23.1%-early; 38.45%-mid.; 38.45% late ripening

If we do not consider deviations, then we can say that there is a pattern between the phases of flowering and fruit ripening. So early flowering of mid-ripening species causes early fruit ripening.

3.2. Characterization of pear according to biomorphological parameters.

3.2.1. Stem density of trees and annual growth of branches. In horticulture, the annual stem density and the growth of annual branches of fruit plants are considered "one of the indirect elements" that affect yield.

Depending on the plants, the stem density is about 48.28-51.85 cm in the found pear folk varieties and wild relatives, and the average number of branches per plant is 29.6-31.7 in Sheki-Zagatala region conditions. The largest number of branches was recorded in the form F//Bk-26 (36.7 pcs). Varieties are distinguished by their branch number (the number of branches is 30.7 pcs in summer, 37.4 pcs. in autumn, and 46.8 pcs. in winter varieties).

The average annual growth of pear plant branches in different varieties and forms, as well as in wild relatives was 9.1 m in summer, 9.8 m in autumn, and 14.7 m in winter varieties. The final difference was 5.6 m depending on the ripening time.

The annual growth of the plant stem reached 1.4 cm in summer-ripening, 1.0 cm in autumn-ripening and 1.1 cm in winter-ripening varieties, so a great difference was not recorded.

3.2.2. Leaf parameters of pear cultivars and their wild relatives. The length dimensions of the leaves of different pear varieties, as well as wild relatives, varied from 5.76 to 7.88 cm.

We found that the highest number of stoma that can be placed on 1 mm² is 136 in Yabani Soyudyarpag, while the lowest is 90 in Agabey gormez. According to these indicators, the varieties and their wild types differ from each other: the stoma are of anomasitic type (Fig. 3.).

According to the first group: the leaf length of Sheki dasharmudu, F//IIIz-25, F//Zt-32 and Soyudyarpag pear varieties is 5.88-6.00 cm; in the second group: Sheikhlar pear, Boghdabichen, Manjiliq, Oguz agh gulebisi, Tatir, Nar armud varieties is 6.14-7.00 cm; in the third

group: Aga-bey gormez pear, Zagatala iryali, Gurguley, Goum armud, Sari gonche, Kifir, Sunu armud and Gishlig armud varieties, the length of leaves of F//Gav-9, F//Gxa-1, F//Gt-31 , F//Bk-26 forms was 7.10-7.88cm.

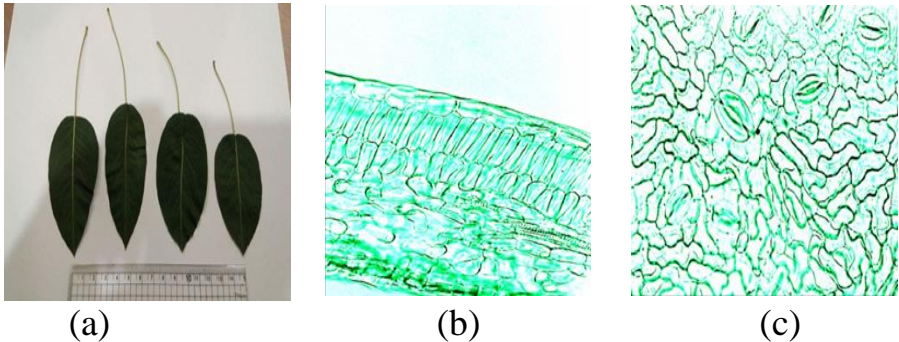


Figure 3. Anatomical structure of the leaf in Sheki Khorasani pear variety: a)The appearance of the leaf, b) Cross-section, c) Mouth cells

The varieties are divided into three groups according to their width. The width of the first group is up to 5.00 cm: the width of the second group is up to 6.00 cm; the third group includes the varieties with a width of up to 7.00 cm. The minimum-maximum range is 2.67 cm.

The leaves of the common pear are 4-5 cm wide, 10-15 cm long, rounded at the base, toothed at the edges¹².

The leaf surface dimensions varied from 27.31 cm² (Manjilik variety) to 51.23 cm² (Gishlig armudu variety). The large leaf surface ensures better plant development and can change yield in a positive direction. It was determined that the leaf index varies from 1.13 to 1.70 in leaves and varies from light green to dark green.

The pattern was recorded in the leaves of cultivated wild pear varieties investigated in the Sheki-Zagatala region, even if they differ

¹² Əzizov, F.Ş. Azərbaycanın şimal-qərb bölgəsinin müalicəvi və təsərrüfat əhəmiyyətli bitkiləri / F.Ş.Əzizov, C.İ.Məmmədov, Y.M.Bəkirova – Bakı: Elm – 2020. – 276 s.

from each other in the thickness of the cuticle layer, cell height and width in the upper epidermis. While the numbers between the height and width of the cell in the upper epidermis indicators are close to each other, the numbers between the height and width in the septal parenchyma are opposite to each other. This indicator increased from 32.10 mkm (Gishlig armudu variety) to 73.82 mkm (Iryal variety) in the found pear varieties, as well as in their wild relatives. Its width ranges from 5.08 to 8.26 mkm. Spongy parenchyma is also selected according to the size (between 90.17-147.58 mkm). Spongy parenchyma is also selected according to the size (between 90.17-147.58 mkm). The length of the largest stoma was recorded in the Khan armud variety (47.30 mkm), while the smallest stomata (36.16 mkm) was determined in the Zagatala Iryali folk variety.

3.2.3. Morphology of pear pollen, fertilization ability. One of the positive factors that affect the formation of yield is the high fertilization ability of pollen. The length of pear pollen varies from 27.67 to 32.58 mkm, and the width varies from 26.16 to 30.06 mkm. According to the shape, the pollen grains are oblong-oval (fig.4).

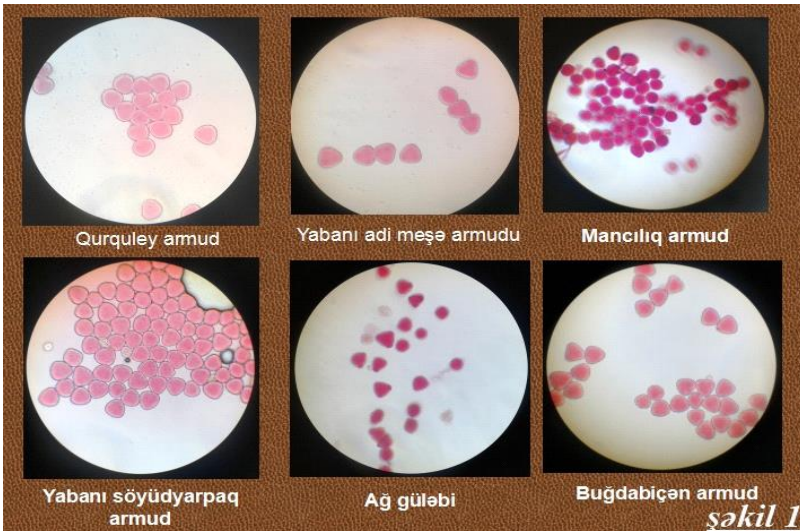


Figure 4. Description of pollen of cultivated pear varieties and their wild relatives

The fertility parameter of pollen varies between 85.5-100%. Thus, among the various pear folk varieties, as well as wild relatives, the least fertile is the F//Bk-26 form (85.5%), while the highest fertility was found in the Bughdabichen pear variety (100%) and the Adi armud (was 100%).

CHAPTER IV. STUDY OF YIELD STRUCTURAL ELEMENTS OF DETERMINED VARIETIES AND FORMS OF PEAR PLANT (*Pyrus* L.) AND THEIR WILD RELATIVES

4.1. Study of the yield parameters of determined pear species and their wild relatives. Mathematical calculations and analyses of 17 pear folk varieties, 2 wild relatives and 7 different promising forms conducted to determine the yield of pears during the research years (2014-2019) showed a positive correlation between the crown projection area 1m^2 and yield per tree in summer, autumn and winter pear cultivars. The existence of a positive correlation is reflected in the tables of the dissertation. The comparative yield coefficient according to tree crown parameter, leaf surface and the nutrient area is recorded in Table 2.

Thus, the normal correlation in the newly found summer pear varieties $r=+0.600\pm 0.203$, weak in autumn varieties $r=+0.376\pm 0.082$, and higher than both groups in winter varieties $r=+0.931\pm 0.060$ was observed depending on the maturity period.

Thus, in Table 2, the totality of the elements of yield is given very clearly. Thus, the productivity index in the mentioned table obtained according to the area of tree nutrition, 1 m^2 crown projection area, and 1 m^2 leaf surface depending on the maturity of varieties and wild samples' features were also studied. The correlation between the crown projection area and the leaf surface, which forms the elements of yield in varieties selected according to the degree of maturity (summer, autumn and winter), was as following: $r= +0.429\pm 0.258$ (summer), $r= +0.622\pm 0.200$ (autumn) and $r= +0.633\pm 0.199$ (winter).

Table 2

Comparative yield of established pear folk varieties and forms,
as well as their wild relatives

Maturity period	Name	Crown projection area, m ²	Leaf surface area, m ²	Yield index		
				According to 1 m ² crown projection area, kg	According to 1 m ² leaf surface area, kg	Per plant, kg
Summer	Agha-bey gormez	30,52	45,16	2,52	1,70	76,9±2,40
	Bughdabichan	39,01	31,00	2,51	2,52	78,2±2,42
	Sheyklar ar.	28,50	29,47	2,13	2,06	60,7±1,90
	Manjilig	39,97	27,31	1,64	2,40	65,5±1,91
	Sari gonche	32,77	39,03	1,36	1,13	44,5±1,13
	Sheki khorasani	40,39	35,14	1,54	1,77	62,3±1,91
	Goum ar.	23,45	48,75	1,95	0,94	45,8±1,41
	Oghuz agh ar.	18,41	37,08	2,07	1,03	38,2±1,90
	F//Gxa – 1	41,38	35,14	1,55	1,82	64,1±1,90
	F//Gav – 9	30,06	45,32	2,98	1,97	89,3±2,81
Autumn	Gurguley	49,44	42,24	2,64	3,10	130,9±3,92
	Balakan agh gulabisi	47,61	34,97	2,52	2,52	88,3±2,75
	Tatir	41,87	33,31	2,39	2,96	100,3±3,05
	Zagatala iryali	43,77	38,97	2,73	3,07	119,7±3,44
	Kifir	44,51	43,99	2,03	2,47	98,8±2,96
	Sunu armud	30,78	31,6	2,73	2,66	84,1±2,47
	F//Shbg – 7	42,53	42,01	3,13	3,18	133,8±3,89
	F//Shz – 25	31,62	28,15	3,21	3,60	101,5±3,00
	F//Zt – 32	40,29	31,26	2,50	3,13	101,0±3,00
	F//Ot – 31	40,42	44,69	2,77	2,51	112,4±3,12
Winter	Nararmud	40,08	48,75	2,57	2,11	103,2±3,03
	Sheki dash ar.	41,42	28,70	2,43	3,51	100,7±2,92
	Gishlig arm.	39,55	51,23	2,16	1,67	85,5±2,16
	F//Bk – 26	43,27	45,46	2,96	2,82	128,3±3,62
	Soyudyarpag	45,87	30,00	0,69	1,05	88,3±2,04
	Adi armud	46,53	33,16	0,74	1,07	105,4±2,95

Table 3 defines the correlation between the crown projection area and the leaf surface of a tree in spring pear varieties. The yield parameters for the average difference, the mean error of the experiment (m), as well as the accuracy of the experiment (P) were calculated according to the accepted method, and the varieties selected from the control variety, due to their high yield, as in wild relatives, were again specified by mathematical analysis (form.1-2).

Table 3

Determination of the correlation between the tree crown projection area (m²) and tree leaf surface(m²) in summer pear varieties

Maturity period	Name	Crown projection area (m ²)	Leaf surface (m ²)	Deviation from the mean value (m ²)		The sum of deviations of values from their mean	Squares of deviation from the mean	
				v ₁	v ₂		v ₁	v ₂
SUMMER	Agha-bay gormaz	30,52	45,16	1.93	-7,82	-15,1	3,73	61,15
	Bughdabichan	39,01	31	-6,56	6.34	-41,6	43,03	40,2
	Sheykhlarin armud	28,5	29,47	3.95	7.87	31,1	15,6	62
	Manjilig	39,97	27,31	-7,52	10.0	-75,43	56,6	100,6
	Sari Gonche	41,38	35,14	-8,93	2.19	-19,6	79,8	4,8
	Sheki khorasani	32,77	39,03	-0,32	-1,69	0,54	0,1	2,86
	Goum armud	40,39	35,14	-7,94	2.2	-17,5	63,04	4,84
	Oghuz agh armudu	23,45	48,75	9.00	-11,4	-102,7	81	130,2
	F//Gxa-1	18,41	37,08	-14,04	0.96	3,65	197,12	0,1
	F//Gav-9	30,06	45,32	2.39	-7,98	19,1	5,71	63,7
		32,45	37,34			∑V ₁ V=217,54	∑V ₁ =545,7	∑ ² ₂ =470,4

$$m_2 = \frac{1-r^2}{\sqrt{n}} = \frac{1-(0,429)^2}{3,16} = \frac{1-0,184}{3,16} = \pm 0,258 \quad (\text{formula 1})$$

$$r = \frac{\sum V_1 V_2}{\sqrt{\sum V_1^2 \cdot \sum V_2^2}} = \frac{217,54}{\sqrt{545,73 \times 470,45}} = \frac{217,54}{506,7} = +0,429 \quad (\text{formula 2})$$

$$r = +0,429 \pm 0,258$$

These recorded high yield indicators were obtained from crown projection area of 42.53 m² (for F//Sbg - 7) and 49.44 m² (for the Gurguley pear variety). The yield of varieties with a larger crown projection area was significantly higher than that of cultivars with a smaller crown area. The credibility of this fact was determined not only by logic but also by the mathematical calculations carried out by us.

4.2. Mechanical and pomological characteristics of pear. In 2014-2019, a complex study of the physical-mechanical and pomological indicators of the pear folk varieties was carried out according to the existing methodology.

The pears, detected during the research on the study of the variability of the folk pear varieties, as well as wild relatives in the Sheki-Zagatala region, both in farmlands and farms, are divided into 6 groups by shape: oblong (42.3%) in 11 replicates, oblong-ovate shaped (7.7%) 2, rounded oblong shaped (26.9%) 7, round shaped (11.5%) 3, round flat shaped (7.7%) 2, oblong-spherical shaped (3.8%) in 1 replication. The oblong and oblong-ovate shaped fruits are more common in this region.

The fruits are mostly sweet and acidic in taste, and yellow, white-yellow, green-black, yellow-red, yellowish, lemon-yellow, dark green, and yellow-green in colour. White-yellow and yellow colours are found in Balakan and Zagatala regions, and green and green-yellow colours are more common in farmlands in the Sheki region.

The study found that the absence of grit cells (61.5%) is observed in 16 varieties, a small amount (19.2%) in 5 varieties, a moderate amount (7.6%) was observed in 2 varieties, a large number (11.5%) in 3 varieties, the most amount of grit cell was recorded in Soyudyarpag and Sunu pear varieties.

According to the colour of the fruit flesh, there were 14 replications of white (53.8%), 8 replications of yellowish (30.7%), 3 replications of brown (11.5%) and a replication of dark brown (3.8%) flesh.

As a result of the research, the height of summer pear fruits ranges from 5.6-12.2 cm, depending on the variety under regional conditions. The form F//Gav – 9 was recorded as the largest fruit (12.2 cm) while the Sheki Khorasan pear was the smallest variety (5.6 cm) according to the analysis of the fruit diameter (Table 4.). The height factor of the large pear group was 7-8 cm. Thus, the diameter of the F//Qav - 9 form was 10.6 cm, and it was 3.8 cm in the Manjilig pear variety. In summer pear varieties, the fruit index is characterized by a value of approximately 1.0 to 1.4. The size of the seeds of the investigated varieties also were different. So, in terms of seed height, the largest seed was observed in Gurguley pear (1.12 cm), while the Sunu pear was 1.11 cm, and the smallest seed was in Manjilig pear (0.37 cm). In terms of seed diameter, the largest was observed in the Gışlıg pear (0.64 cm), Zagatala Iryali pear (0.62 cm), and the smallest in the Manjilig pear (0.34cm)

In terms of productivity, although summer varieties ripen quickly, they are characterized by low productivity indicators, and autumn and winter varieties are characterized by high productivity indicators, so it is a very important information material for initial breeding work. Among the early maturing cultivars, the late ripening wild-growing sample parameters attract attention with their low productivity (Table 4). The quality of pear fruit is regulated by the meeting of the Standards of the Republic of Azerbaijan (RST 289-76)¹³.

The leaves of the common pear are 4-5 cm wide, 10-15 cm long. In terms of seed diameter, the largest size was 0.64 cm in Gışlıg pear, 0.62 cm in Zagatala Iryali and the smallest 0.34 cm in Manjilig pear. The seed size of the varieties studied varied. The largest seed height was 1.12 cm in Gurgulei pear, 1.11 cm in artificial pear and the smallest was 0.37 cm in Manjilig pear.

The glyceic index is characterised by a value of about 1.0 to 1.4 in summer pear varieties.

¹³ Əhmədov, Ə.İ. Meyvə və tərəvəzin əmtəəşünaslığı/ Ə.İ.Əhmədov, N.T. Əliyev – Bakı:“ADİU”, -2009. - s.289.

Table 4.
Mechanical composition and pomological description of determined pear varieties and forms, as well as their wild relatives

Maturity period	Name	Fruit						
		Shape	Taste	Colour	Height, cm	Diameter cm	Stalk length cm	Fruit weight, gr
1	2	3	4	5	8	9	10	11
Summer	Agha-bay gormaz	rounded oblong	sweet	white-yellow	10,1	8,5	5,2	135,23
	Bughdabichan	rblong	sweet	yellow-red	9,5	7,2	3,5	70,12
	Sheyxlarin armud	rblong	sweet	yellow	7,3	6,7	4,5	150,34
	Manjilig	round	sweet	yellow	5,5	3,8	1,6	68,54
	Sari goncha	oblong globe	sweet	yellow	7,5	5,3	4,6	130,22
	Sheki Khorasani	rounded oblong	sweet	yellow-green	5,6	4,2	4,1	72,14
	Goom armud	oblong	sweet	yellow -grn	6,9	5,3	1,9	151,32
	Oghuz agh armudu	Oblong	sweet	yellow	8,5	6,2	2,8	98,87
	F//Gxa-1	rounded oblong	sweet	yellowish	7,5	6,8	2,7	97,56
	F//Gav-9	Oblong	sweet	yellow	12,2	10,6	1,5	115,45
Autumn	Gurguley	Oblong	sweet	elylow	12,5	6,1	2,8	162,86
	Balakan agh gulabi	Oblong	acid	white- yellow	7,2	5,4	1,7	112,57
	Tatir	rounded oblong	sweet	yellow	4,1	4,9	4,1	31,32

table 4. (continued)

2	3	4	5	8	9	10	11
Zagatala iryali	Oblong	sweet	yell. lemon	10,3	6,8	3,9	154,28
Kifir	Oblong	acid	yello.green	8,5	5,4	4,5	105,86
Sunu	rounded oblong	acid	green	9,2	7,1	8,6	271,44
F//Shbg-7	Oblong	sweet	yellow	10,4	8,4	4,3	270,72
F//Shz-25	ovate oblong	sweet	yellowish	12,7	9,3	2,2	255,28
F//Zt-32	Oblong	sweet	green-black	8,5	6,5	4,2	190,32
F//Ot-31	round spherical	sweet	yellowish	8,5	5,8	2,6	159,43
Nararmud	oblong-ovate	acid	yello.green	10,4	9,3	7,2	208,21
Sheki dash ar.	round- sphere	acid	dark green	5,9	5,4	3,3	98,57
Gishlig arm.	ovate	acid	yello.green	6,1	5,6	3,8	106,76
F//Bk – 26	oblong-ovate	sweet	yellow	10,6	7,8	4,1	245,63
Soyudyarpag	ovate	aci	brown	2,1	2,4	0,6	21,31
Adi armud	oblong-ovate	acid - sweet	yellow	3,1	3,2	1,8	45,62

Winter

4.3. Biomorphological characteristics of promising varieties and forms of pear and their wild relatives. During the research years, biomorphological features of breeding pear varieties and forms, and wild relatives were studied and a permanent object of research was selected. The place of plant growth, tree height, stem density, crown shape, number of branches per tree, annual growth of branches, leaf index, description of leaf blade, length, width, stem length, flowering, fruit ripening, weight, taste, shape, color, size, stem length, diseases and pests resistance, economic efficiency, etc., were studied based on the accepted methodology and are listed in this work.

4.4. Biochemical composition of cultivated varieties and wild relatives of pear fruits in the Sheki-Zagatala region. One of the main parameters that shape the taste in fruits is the amount of dry matter that can be dissolved in water¹⁴. The content of dry matter in the fruits of summer pear varieties growing at an altitude of 351-1068 m above sea level, as well as their wild relatives, is 15.60-21.10%, total sugar 9.60-11.80%, acidity 0,15 - 0.30%, vitamin "C" - 3.51-4.61 mg %. The highest sugar-acid ratio (69.30%) was recorded in the pear varieties distributed at an altitude of 352 m above sea level under different conditions of Gakh region in the Sheki-Zagatala region (Table 5). A positive correlation was found between variety yield, total sugar and vitamin "C". These indicators were $r=+0.600\pm 0.203$ and $r=+0.207\pm 0.299$ in summer, $r=+0.830\pm 0.100$ and $r=+0.633\pm 0.200$ in autumn, $r=+0.608\pm 0.260$ and $r=+0.904\pm 0.04$ in winter varieties. A biochemical study of cultivated pear varieties and their wild relatives grown in the Sheki-Zagatala region showed that the amount of dry matter in fruit is 15.60-21.10%, total sugar is 9.60-11.57 %, acidity 0.15-0.30%, vitamin "C" 3.51-4.61 mg /%, and the ratio of sugar to acid ranges between 37.33-4.61%. The amount of total sugar amount is reorded in summer pear varieties Manjilik (11.80%), Gurgulei (12.10%), Sarykonche

¹⁴ Karadeniz, T., Çorumlu, M.S. İskilip Armutları // Akademik Ziraat Dergisi, – 2012. 1(2), –s. 61-66.

(11.20%), Agha-bey kirmaz (11.50%), Bugdabichen (11.40%) grown at an altitude of 300-500 m a.s.¹⁵.

Table 5
Biochemical composition of fruits of folk varieties,
different forms of pear plant and as well as their wild relatives of
Sheki-Zagatala region

Maturity	Varieties and forms	Altitude above sea level, m.	Content of dry matter %	Total sugar %	Acidity %	Sugar -acid ratio %	Vitamin C, mg/%	Detection of satellite coordinates of varieties and their wild relatives
1	2	3	4	5	6	7	8	9
Summer	Agha-bay gormaz	463	21.10	11.50	0.24	47.91	3.74	46.69687 E 41.65420 N
	Bughda Bichan	443	20.70	11.40	0.25	45.60	4.61	46.70170 E 41.56604 N
	Sheyxlarin armud	844	16.80	10.60	0.23	46.08	3.51	47.12653 E 41.30072 N
	Manjilig	441	19.20	11.80	0.18	65.55	3.72	46.41418 E 41.33584 N
	Sari goncha	351	17.30	11.20	0.30	37.33	4.22	46.69482 E 41.56613 N
	Sheki Khorasani	809	20.80	9.60	0.16	60.00	3.86	47.07146 E 41.18001 N
	Goom armud	1068	18.60	10.60	0.19	55.79	3.93	47.02294 E 41.23244 N
	Oghuz agh armudu	774	15.60	9.80	0.26	37.69	4.11	47.11728 E 41.29948 N
	F//Gxa-1	352	17.80	11.40	0.15	69.30	4.51	46.99638 E 41.45728 N
	F//Gav-9	807	20.52	11.57	0.24	48.21	4.37	47.97391 E 40.93579 N

¹⁵ Məmmədov, C.İ. Şəki-Zaqatala bölgəsində yayılmış yerli armud sortlarının və yabanı formalarının meyvələrinin biokimyəvi tərkibinin tədqiqi / C.İ. Məmmədov, Z.M.Xəlilov // Azərbaycan Milli Elmlər Akademiyasının Xəbərləri, – Bakı: – 2018. № 3, – s. 136-139.

4.5. The study of the shelf life and natural loss of pear fruits.

Naturally, the ripen fruit falls from the tree. The percentage of natural fruit loss of the studied winter pear varieties, as well as in their wild relatives is 11.8% is lower than summer varieties by 2.7% and higher than autumn varieties by 2.2%. So the least natural loss was recorded in autumn pear varieties.

The longest shelf life was recorded for winter varieties with an average of 94.2 days, it is 75.6 days longer than summer varieties and 36.4 days longer than autumn varieties. This allows people to use winter pear varieties for longer period.

CHAPTER V. DISEASES AND PESTS CONTROL OF DETERMINED PEAR VARIETIES AND THEIR WILD RELATIVES

The infestation of the varieties and forms of the Sheki-Zagatala region to scab (*Venturia pirina*), pear leaf curl (*Exoacus daformans*), powdery mildew (*Podosphaera leucotrcha*) and pear fruit moth (*Cydia pyrivora*), pear psyllid (*Psylla pyri*), the southern pear-bedstraw aphid (*Dysapis pyri*) have been studied. Table 6 shows the disease resistance of varieties and forms.

Although the presence of some diseases and pests of the pear plant, an infestation of 26 varieties and their wild relatives from different regions above 0.8 points was not detected.

One of the main problems in fruit growing is the proper organization of the fight against diseases and pests. For this, it is important to use genetically resistant varieties against diseases and pests. During the research conducted in 2015-2019 on pear folk varieties-forms and their wild relatives first found in Sheki-Zagatala district, the resistance of these species to diseases and pests was observed. The highest diseases and pests resistance was observed in Gurgulei, Zagatala Iryaly, F// Shbg - 7, F// Bk - 26 varieties and forms.

Table 6

Pear folk varieties, forms and their wild relatives in the Sheki-Zagatala region, selected for the pathogen's resistance (5 points) (average for 2015-2019)

Maturity	NAME	Scab		Leaf curl	Powdery Mildew
		Fruit	Leaf		
Summer	Agha-bay gormaz	0,4±0,01	0,5±0,03	0,6±0,05	0,4±0,01
	Bughdabichan	0,3±0,01	0,4±0,03	0,4±0,03	0,3±0,01
	Sheyxlarin armud	0,4±0,03	0,5±0,06	0,6±0,05	0,6±0,03
	Manjilig	0,6±0,05	0,7±0,03	0,8±0,09	0,7±0,08
	Sari goncha	0,7±0,06	0,9±0,06	0,9±0,05	0,8±0,09
	Sheki Khorasani	0,6±0,03	0,7±0,05	0,8±0,06	0,7±0,05
	Goom armud	0,6±0,05	0,6±0,04	0,7±0,01	0,6±0,09
	Oghuz agh armudu	0,7±0,05	0,8±0,05	0,9±0,07	0,8±0,03
	F//Gxa-1	0,6±0,05	0,7±0,05	0,8±0,05	0,6±0,05
F//Gav-9	0,3±0,01	0,3±0,05	0,4±0,01	0,2±0,01	
Autumn	Gurguley	0,1±0,00	0,0±0,00	0,0±0,00	0,0±0,00
	Balakan agh gulabi	0,3±0,05	0,5±0,03	0,5±0,03	0,5±0,01
	Tatir	0,5±0,03	0,6±0,07	0,5±0,05	0,7±0,07
	Zagatala iryali	0,1±0,05	0,0±0,04	0,1±0,08	0,2±0,09
	Kifir	0,4±0,05	0,5±0,05	0,5±0,01	0,6±0,04
	Sunu	0,5±0,00	0,6 ±0,00	0,6± 0,00	0,7±0,01
	F//Shbg-7	0,0±0,00	0,0±0,00	0,0±0,00	0,0±0,0
	F//Shz-25	0,3±0,01	0,2 ±0,05	0,4±0,03	0,2±0,01
	F//Zt-32	0,3±0,05	0,2 ±0,01	0,2±0,01	0,4±0,03
	F//Ot-31	0,2±0,03	0,2±0,03	0,3±0,03	0,1±0,01
Winter	Nar armud	0,6±0,03	0,7±0,09	0,7±0,09	0,8±0,09
	Sheki dash armud	0,5±0,05	0,6±0,07	0,6±0,08	0,7±0,08
	Gishlig armud	0,4±0,03	0,5±0,03	0,6±0,03	0,7±0,06
	F//Bk – 26	0,3±0,05	0,4±0,03	0,5±0,01	0,3±0,01
	Soyudyarpag armud	0,8±0,07	0,9±0,05	0,8±0,03	0,8±0,05
	Adi armud	0,5±0,05	0,6±0,05	0,7±0,09	0,7±0,03

CHAPTER VI. EFFICIENCY OF POPULAR BREEDING VARIETIES AND WILD RELATIVES OF PEAR (*Pyrus L.*) IN SHEKI-ZAGATALA REGION AND DEVELOPMENT OF GENE-POOL COLLECTION ORCHARD

Of course, without research, it is scientifically impossible to ensure that in the future, pear trees will be cultivated on private or peasant farms, that planted pear orchards will be economically viable and will be able to compete on the market for a long time to come. The main aim and objective of modern horticulture, which is considered to be one of the structural elements of science-based agriculture, is to obtain the maximum production from each hectare with the minimum amount of labour and capital investment.

6.1 Calculation the economic profitability. The main goal and task in modern husbandry, which is considered one of the structural elements of science-based agriculture, is the cost of less labour per unit of output.

It is necessary to select more productive, high-quality, disease and pest-resistant samples that have been adapted to the soil and climatic conditions of the region for many years to increase the economic efficiency of the studied varieties and their wild relatives.

Taking into account the pomological features of varieties and their wild relatives, the use of complex agrotechnical measures in existing plots, orchards, etc is also of great importance.

In 2014-2019, the economic efficiency of various varieties, forms, as well as wild varieties of pear plants under the of the Sheki-Zagatala region conditions of Azerbaijan was determined in advance, and technological maps for the region were adopted and approved on the basis of agrotechnical care utilization in orchards and household plots selected for the experiment, so approximately 4,000 manats was spent for per hectare a pear orchard cultivation, and taking into account the average yield, the average price of the collection of 1 kg of fruit was determined 0.02 manat, and 1 kg of fruit 0.42 manat.

The results obtained are reflected in Table 7 and Figure 5. The net income generated has been determined based on all costs and the market price of additional product.

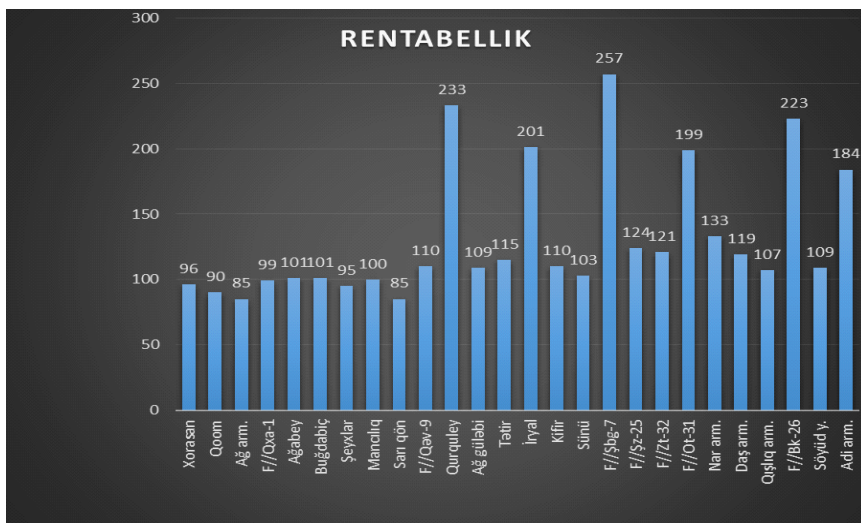


Figure 5. Graphic description of the economic profitability of folk varieties, promising forms and wild relatives of pear in the Sheki-Zagatala region

According to the indicators in the tables, the fruit yield of different varieties, forms and wild-growing pear samples differs from each other. This difference is also observed when comparing the degree of maturity of the fruit. This was once again confirmed in the course of economic analysis. Thus, with an average yield of spring pear varieties and forms of 156.4 q/ha, the cost of products obtained from 1 ha is 4,011.0-9,378.0 manats, and the net income indicator is 1,838.4-4,916.5 manats. Costs per hectare amounted to 2172.6-4461.5 manats. As a result, the cost of 1 centner of production ranged between AZN 11.76-36.27. Table 6.2 shows the level of profitability of the summer varieties and forms (84.61-110.20%). A high level of profitability was observed in the F//Qav-9 form (110.2%), and the Bugdabichen variety (101.24%).

Table 7

Economic efficiency of pear folk varieties, promising forms and their wild relatives in Sheki-Zagatala region

Maturity period	Variety and form names	Productivity, s/ha	Cost per hectare, AZN	The value of the product from one hectare, AZN	Net income per hectare, AZN	The cost of one center of product, AZN	Level of profitability, %
Summer	Agha-bay gormaz	192,3	4024,8	8076	4051,2	20,93	100,65
	Bughdabichn	195,5	4080,1	8211	4130,9	20,87	101,24
	Sheyxlarin armud	151,7	3273,7	6371	3097,3	21,58	94,61
	Manjilig	163,7	3445,9	6875	3429,1	21,05	99,51
	Sari goncha	111,3	2524,3	4674	2149,7	22,68	85,16
	Sheki Khorasani	155,7	3328,9	6539	3210,1	21,38	96,43
	Goom armud	114,5	2535,0	4809	2274,0	22,14	89,70
	Oghuz agh ar.	95,5	2172,6	4011	1838,4	22,75	84,61
	F//Gxa-1	160,2	3381,8	6728	3346,2	21,11	98,95
	F//Gav-9	223,3	4461,5	9378	4916,5	19,98	110,20
Autumn	Gurguley	327,2	4122,7	13763	9640,3	12,60	233,83
	Balakan agh gulabi	220,7	4444,9	9269	4824,1	20,14	108,53
	Tatir	250,7	4906,2	10529	5622,8	19,57	114,61
	Zagatala iryali	299,3	4175,2	12570	8394,8	13,95	201,06
	Kifir	247,1	4937,1	10378	5440,9	19,98	110,20
	Sunu	210,0	4334,4	8820	4485,6	20,64	103,49
	F//Shbg-7	331,5	3898,4	13923	10024,5	11,76	257,14
	F//Shz-25	253,8	4766,4	10659	5892,6	18,78	123,63
	F//Zt-32	252,5	4792,4	10605	5812,6	18,98	121,29
	F//Ot-31	281,1	3955,1	11806	7850,9	14,07	198,50
Winter	Nar armud	258,0	4656,9	10836	6179,1	18,05	132,69
	Sheki dash armudu	251,8	4819,4	10575	5755,6	19,14	119,42
	Gishlig armud	214,5	4360,8	9009	4648,2	20,33	106,59
	F//Bk – 26	320,8	4176,8	13473	9296,2	13,02	222,57
	Soyudyarpag armud	34,2	1240,6	1436	196,6	36,27	15,84
	Adi armud	33,4	1154,2	1402	247,8	34,55	21,46

The yield of autumn varieties ranges between 210-331.5 c/ha (for sun pear and F//IIIbg-7), the highest yield index was recorded in F//Shbg-7. Although the cost of 1 hectare of F//Shbg-7 orchards was 3,898.4 manats, the cost of 1 centner of this form was 11.76 manats, and the level of profitability increased to 257.14%. This form had both the highest yield index and proved to be the best form in terms of economic efficiency. It should also be noted that the Gurguley variety is of great importance among the newly isolated pear varieties of folk selection, both from an economic and biological point of view. Per centner cost of the product was 12.60 manats, and the level of profitability was 233.83%.

A significant difference in the level of profitability is observed the group of winter pear varieties, wild species group and forms. This indicator ranges between 214.5-251.8 c/ha, and F//Bk-26 - 320.8 c/ha for the folk varieties (Sheki dasharmudu and Gishlig armud), while this indicator is very low in wild species (this figure was 33.4-34.2 c/ha). However, as an average figure, this indicator was 258.0 c/ha in the control variety. From an economic point of view, while the level of profitability for wild-growing samples in this group is 6.65-22.95%, the level of profitability for cultivated varieties ranges between 84.61-257.14%. Quantitative variability occurs due to the impact of various factors, they differ in indicators corresponding to autumn varieties and forms and have significantly higher utility indices than in summer varieties and forms. Therefore, as a proposal for production, the planting of new pear orchards from these varieties and forms is recommended by us.

Economic analysis shows that the level of profitability of pear grown in the farms of the Sheki-Zakatala region reaches 257.14%. Among the studied pear folk varieties Gurguley, Zagatala Iryali and promising varieties F//Shbg-7, F//Bk-26 have been distinguished by high yield features.

In addition to adaptability to the ecological and soil-climatic conditions existed for hundreds of years the local folk varieties demonstrate tolerance under any adverse conditions of the Sheki-Zaqatala region.

From an economic point of view, the planting and propagation of orchards of these four identified and selected varieties is considered to be more productive and very effective based on the calculations and analyses carried out in the existing orchards and in household plots of individuals of the Sheki-Zagatala region. Therefore, it should be kept in the spotlight as one of the sources of income in increasing the republic's currency reserves.

6.2 Establishment of the gene pool collection orchard of pear plant. It should be noted that the coordinates and altitude of the location of the newly identified pear varieties and wild pear samples were recorded using the Garmin eTrex-20 device for the first time by us (Figure 6).

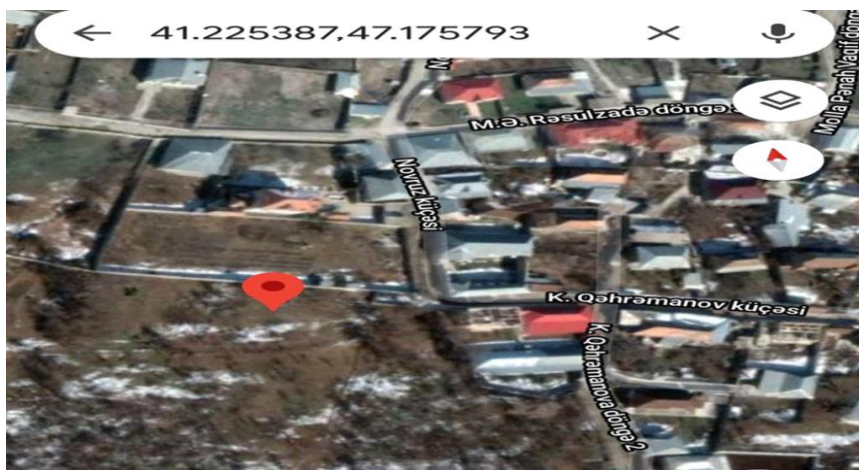


Figure 6. Satellite image and coordinates of the genefond garden.

So, the grafting material was initially collected from those varieties and forms determined in advance locations and propagated in the nursery to enrich the gene pool. Two-year-old seedlings were prepared for planting in the succeeding years. The establishment of a unique gene pool-collection orchards of plant materials was arranged by us.

The field reserved for the planting of orchards in the experimental area of the Sheki Regional Scientific Center of ANAS was first cleared of stones, tree roots, as well as overgrown bushes for the establishment of the collection orchard. Later, a trenching was conducted in the area. After that, the field was harrowed and put in a usable condition (Figure 7)



Figure 7. The current state of the genefond garden.

In 2016, the cuttings of 2 wild forms were planted according to the appropriate agronomic principles and the cuttings of 34 folk varieties collected during the expedition were planted in a strip plot of 8x5 meters with 3 replications in the succeeding years.

So, the regular agricultural works are performed in the collection orchard. The newly created gene pool orchard already has fruit yield and we will utilise this collection orchard for research and establishing new orchards in the future.

We provide information about the existence of this gene pool-collection orchard in the agricultural events organized in the Sheki-Zagatala region. Recently, the collection orchard is of interest to local and foreign experts.

RESULTS

1. A total of 3210 pear trees have been identified through gene pool studies of both pear cultivars and wild species in the research area. Various variations including age, crown shape, height, yield, flowering, ripening, storage periods, fruit shape, color, and flavor have been determined. Differences in leaf parameters, anatomical indicators, economic importance, and other biological characteristics have been observed. The study has identified seventeen folk varieties, seven new forms, and two wild species. Within that fund, there are 10 summer varieties, 10 autumn varieties, and 6 winter varieties.

2. The pollen grain morphology of the identified variety forms and wild types of pear is predominantly girdle-oval and significant differences were not found. The pollen length and width is between 27.63-32.58 μm and 26.16-30.6 μm correspondingly. Pollen fertility ranges between 85.5-100%. Our findings show high fertility in pollen samples collected from the region. One of the factors that contributes positively to the development of the examined types of cultivated and wild pear species is the high fertility capacity of pollen (fertilization). These can be used to pollinate new orchards in the future.

3. Biochemical analysis revealed that the dry matter content in the fruits of both wild pear species and cultivated pear varieties prevalent in the area ranged from 15.60% to 21.10%, while the total sugar content ranged from 9.60% to 11.57% and the acidity ranged between 0.15% and 0.30%. Furthermore, vitamin C content ranged between 3.51mg/% and 4.61mg/% and the sugar-to-acid ratio varied between 37.33% and 4.61%. These main chemical parameters determining fruit quality are at satisfactory levels in the varieties and shapes studied.

4. Scab, leaf curl, and powdery mildew infestation averaged 0.3-0.9 points for the cultivars and wild species studied, while pear fruit fly, pear psylla, and southern pear moth infestation averaged 0.2-0.6 points. The resistance of the varieties and wild species to

diseases and pests was found to be higher than that of the control. This proves that detected folk varieties are more resistant to diseases and pests.

5. The four selected pear variety forms (Zagatala Iryaly, Gurguley, F//Bk-26, F//Shbg-7) were found to be superior to other forms and varieties, as evidenced by their exceptional biomorphological traits and economic value. Each tree produced an average of 119.7-133.8 kg, with an overall yield of 299.3-331.5 kg per hectare (using an 8x5 meter planting design). These varieties also boasted profitability levels ranging between 201.06 and 257 (14%).

6. For the first time, throughout years of research, we established a gene pool-collection orchard in the Sheki-Zagatala district to protect and conserve 32 endangered folk varieties for future breeding.

RECOMMENDATIONS

1. According to all biomorphological features, 3 pear varieties selected and recommended for production, as well as their economic importance are superior to our other selections, it is advisable to submit economically highly profitable forms F//Shbg-7, F//Bk-26, Gurguley and Zagatala Iryali varieties to the State Commission on testing and conservation of breeding achievements.

2. The widely utilization of the above-mentioned varieties to enrich the existing gene pool and plant new pear orchards in the Sheki-Zagatala region, as well as in private backyards is recommended.

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A handwritten signature in blue ink, consisting of a large, stylized loop followed by a horizontal line extending to the right.

The defence of the dissertation will be held on 15 December 2023, at 11⁰⁰ the meeting of Dissertation council - ED 1.26, operating at the Institute of Botany of Ministry of Science and Education of the Republic of Azerbaijan.

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