WESTERN caspian UNIVERSITY

e-ISSN 3005-9070
p-ISSN 3005-9062

Vol II, No 1, 2024

JOURNAL OF ENDEMISM: biodiversity & environment

JOURNAL OF
ENDEMISM:
biodiversity & environment

Vol II, No 1
March, 2024

Western Caspian University

BAKU-2024

E-ISSN: 3005-9070
P- ISSN:3005-9062

Western Caspian University

Journal of Endemism: biodiversity & environment

Vol 2, No 1
March, 2024

DOI:10.54414/UPXH5896

© Western Caspian University, 2024

www.ebe.wcu.edu.az

Editorial Board

Editor-in Chief:

Husseyn Baghirov Prof., Western Caspian University, Azerbaijan

Editorial Board:

Ahmet Ipek Prof., Uludag University, Türkiye

Sezai Ercisli Prof., Ataturk University, Türkiye

Han Jianlin Dr., International Livestock Research Institute, China

Nguyen Van Tiep Prof., Joint Institute for Nuclear Research, Russia

Ismail Turkan Prof., Ege University, Türkiye

David Bedoshvili Dr., Georgian State Agricultural University, Georgia

Marco Maccaferri Prof., University of Bologna, Italy

Nevena Alexandrova Dr., FAO, Rome, Italy

Cristobal Uauy Prof., John Innes Centre, United Kingdom

Yaroslav Blume Prof., Institute of Food Biotechnology and Genomics, Ukraine

Zeliha Selamoglu Prof., Niğde Ömer Halisdemir University, Türkiye

Firuza Nasyrova Prof., Tajikistan Botanical Institute, Tajikistan

Ram Chandra Sharma Dr., ICARDA, Uzbekistan

Zafar Ziyaev Dr., Plant Institute, Uzbekistan

Mikael Sukkov Dr.Natural Heritage Foundation, Germany

Matlab Mirzayev Prof., Joint Institute for Nuclear Research, Russia

Florian Rupp Prof., Kutaisi International University, Georgia

Ilham Shahmuradov Prof., Institute of Biotechnology and Molecular Biology, Azerbaijan

Mehraj Abbasov Assoc.Prof., Institute of Genetic Resources, Azerbaijan

Naila Guliyeva	Dr., Western Caspian University
Saltanat Aghayeva	Dr., Western Caspian University
Ayaz Mammadov	Dr., Western Caspian University

CONTENT

VEGETATIVE PROPOGATION OF SOME ONION VARIETIES INSTRUMENTED IN DRY SUBTROPICAL CONDITIONS OF ABSHERON

SEVINJ GULIYEVA, GUNAY MAMMADOVA 6

FEATURES OF THE COMPLEX USE OF WOOD RAW MATERIALS OBTAINED FROM INTERMEDIATE CUTTINGS IN THE BEECH FORESTS OF AZERBAIJAN

AYDIN YAHYAYEV, ELSHAD GURBANOV 10

IMPACT OF ALTERNATIVE ENERGY SOURCES ON THE ENVIRONMENT

AYDIN ALEKPEROV 19

DISEASES AND PESTS OF APPLE (MALUS MILL.) SPECIES INTRODUCED IN ABSHERON

AYUR ARABZADE 24

ANALYSIS OF RESISTANCE TO DROUGHT AND HEAT AMONG INTRODUCED FLORIBUNDA ROSE VARIETIES IN ABSHERON

OFELIYA GAFAROVA 29

IMPACT OF NANOTECHNOLOGY DEVELOPMENT ON ECOLOGY AND ENVIRONMENT

A.S.ABIYEV 35

VEGETATIVE PROPOGATION OF SOME ONION VARIETIES INSTRUMENTED IN DRY SUBTROPICAL CONDITIONS OF ABSHERON

Sevinj Guliyeva[1], Gunay Mammadova[1]
[1]Institute of Dendrology, Ministry of Science and Education of tle Republik of Azerbaijan
[2]Baku State University

Abstract: The article studies the vegetative propagation of wild species of the genus *Allium* L., introduced from the flora of Nakhchivan into the dry subtropical conditions of Absheron. In the course of the research, the coefficient of vegetative propagation of some studied species was determined. According to the results obtained, the species A. *schoenoprasum* has the highest coefficient of vegetative reproduction. The species A. *materculae* and A. *leucantum* are distinguished by a very low coefficient of vegetative propagation. The vegetative propagation coefficient of most of the studied onions ranges from 1.71-3.2.

Keywords: *Allium L.*, wild species, introduction, dry subtropical conditions, vegetative propagation, reproduction rate.

***Corresponding Author:** sevinj_quliyeva_1977@mail.ru

Received: 28 December 2023; **Accepted:** 22 February 2024; **Published:** 30 March 2024

DOI: 10.54414/DFYF3658

Introduction:

It is known that Absheron is one of the most important regions of Azerbaijan. Economic development in this region has caused some problems. The increase in the number of enterprises also affects the biological environment. The destruction of plants causes new problems. Therefore, it is necessary to study the factors influencing the biological environment and control the processes. It is known that the number of people living in Absheron is increasing. An increase in population leads to an increase in the anthropological factor. These factors also cause biological problems. To prevent them, it is important to grow plants, create gardens and create parks. It is known that the different soil cover on Absheron creates difficulties in growing many plants. Therefore, studying the possibilities of growing plants in this region is one of the main areas of research in biological science.

Vegetative propagation plays an important role in plant life (Kestre & Khartmann, 2002; Levina, 1964; Lyubarskiy, 1967; Shalit, 1960). The study of vegetative propagation of plants has not only theoretical, but also practical significance. In order to obtain mass planting material (in landscaping, agriculture), to preserve the purity of species and varieties (in fruit growing, horticulture), it is important in all respects to know the features of vegetative propagation. Of great importance is the study of the method of plant propagation, including vegetative propagation of rare and endangered plants by elements of various plant groups. When introducing plants, vegetative propagation is of particular importance (Mazurenko & Khokhryakov, 1971; Tukhvatullina, 1999, 2003, 2006). Thus, under the conditions of a new introduction, plants often reproduce only vegetatively.

A very common method of natural vegetative propagation of onions is the formation of several axillary buds in the leaf axil. These shoots become independent bulbs. When the leaves of the mother plant dry out, they become detached from the mother plant and can then develop on their own.

Vegetative propagation is also possible by dividing the clump formed by the plant. In nature, vegetative propagation in rhizome bulbs is observed when some parts of the rhizome dry out, as a result of which several young individuals are formed from the grown mother bush. This method is especially often used when growing perennial bulbs, since in this case reproduction occurs faster.

Under cultural conditions, onion development occurs quite quickly, flowering and fruiting are observed almost every year. Natural vegetative propagation is observed in many rhizomatous species in our collection. Most types of onions can be propagated by dividing rhizomes, rhizomes, bulbs, and aerial bulbs.

From this point of view, one of the important issues is the study of the biological characteristics and vegetative propagation of *Allium L.* species growing in the flora of Nakhchivan MR and introduced into the dry subtropical conditions of Absheron. This work is devoted to the study of plants growing in Absheron. During the research, vegetative propagation of wild species of the genus *Allium L.* introduced from the flora of Nakhchivan into the dry subtropical conditions of Absheron was studied.

Research Methods:

Extensive research was carried out on Absheron to study the vegetative propagation of wild species of the genus *Allium L.* At this time, standard methods used to study plants in certain conditions were applied. The research was carried out at the Central Botanical Garden (Baku, Azerbaijan) in 2010-2017. The object of the study was 25 species of wild onions of the Nakhchivan flora. The ornamental properties of plants were assessed according to the methodology adopted by breeders when assessing ornamental herbaceous plants (Kestre & Khartmann, 2002; Levina, 1964).

Vegetative propagation was studied using the method of M.S. Shalit (Shalit, 1960). We assessed the vegetative propagation of wild onions under cultural conditions and determined the reproduction coefficient.

Results and Discussions:

Most onion species introduced from the natural flora of Nakhchiva into the dry subtropical conditions of Absheron reproduce both by seeds and vegetatively. However, some species of onion are an exception (*A. caeruleum*) because they produce bulblets (aerial bulbs) rather than seeds and therefore only reproduce vegetatively. Seed propagation of the species *A. pseudoampeloprasum* and *A. caeruleum* in the dry subtropics of Absheron during the research period was not successful, since they do not produce seeds. The main way of vegetative regeneration of onions is the formation of a replacement bulb. It continues the life of the plant vegetatively. Note that if replacing the bulb is the only way of regeneration, then the coefficient of vegetative propagation is equal to one (only one bulb is formed in place of the destroyed bulb) and the number of plants does not increase. But this is rarely observed.

Some types of onions can also be propagated artificially by cutting off the lower part of the bulb or dividing the bulb into two parts, in which case two young plants are obtained from one bulb. In addition, in the floral group of some "flowering" onion species (*A. caeruleum*), small bulbs called bulbs (aerial bulbs) are formed along with the flower, giving rise to a new plant. In many bulbs, any disturbance in the formation of the flower leads to the formation of bulbs. This can be achieved artificially by carefully cutting off the buds from the axis of the flower. This is another way of vegetative propagation of onions.

Natural vegetative propagation was observed in most rhizome species in our collection. During the researches, it was determined that it is possible to reproduce most types of onions by dividing the rhizome, root, bulb, bulb. Among the onion species we have introduced are those that have lost sexual reproduction and are only propagated vegetatively with aerial bulbs and underground bulbs.

During the research, we evaluated the vegetative propagation of onions under culture conditions. For most species, multi-year otra numbers were used during the introduction experiments. As a result of observation during the year, the average figures obtained on the vegetative reproduction of onions are given in table 1.

Table 1. Vegetative propagation of onions under introduction conditions.

Number	Type	Numbder of generative shoot	Vegetative propagation coefficient
1	*Allium callidictyon*	1,04 (1)	1,53 (1-3)
2	*A. lacerum*	2,07 (1-4)	2,30 (1-5)
3	*A. dictyoprasum*	1,52 (1-3)	1,79 (1-3)
4	*A. scabriscapum*	1,06 (1)	2,05 (1-3)
5	*A. affine*	1,91 (1-3)	2,47 (1-4)
6	*A. fuscoviolaceum*	1,09 (1-2)	3,58 (2-8)
7	*A. caeruleum*	1,00 (1-2)	4,66 (2-10)
8	*A. waldsteinin*	1,30 (1-2)	2,80 (1-8)
9	*A. materculae*	1,24 (1-2)	1,03 (1-2)
10	*A. pseudoflavum*	5,09 (3-9)	6,01 (3-11)
11	*A. rubellum*	1,47 (1-3)	1,42 (1-3)
12	*A. pseudoampeloprasum*	1,00 (1)	1,50 (1-3)
13	*A. mariae*	1,23 (1-2)	2,36 (1-5)
14	*A. viride*	2,05 (1-4)	2,59 (1-5)
15	*A. paczoskianum*	2,17 (1-4)	1,93 (1-4)
16	*A. cardiostemon*	4,82 (2-8)	4,60 (1-9)
17	*A. kunthianum*	1,84 (1-2)	1,78 (1-3)
18	*A. leucanthum*	1,06 (1-2)	1,21 (1-2)
19	*A. atroviolaceum*	1,07 (1-2)	1,36 (1-2)
20	*A. vineale*	3,65 (1-7)	2,70 (1-5)
21	*A. woronovii*	1,65 (1-3)	1,71 (1-4)
22	*A. rotundum*	1,03 (1)	1,54 (1-2)
23	*A. schoenoprasum*	9,20 (6-15)	10,23 (4-17)
24	*A. szovitsii*	1,07 (1)	1,56 (1-3)
25	*A. akaka*	1,33 (1-2)	1,75 (1-4)

Conclusion:

The data obtained as a result of the research are shown in Table 1. From the data given in the table, it is clear that *A. schoenoprasum* has the highest vegetative propagation rate. It was established that the species *A. pseudoflavum* also reproduces intensively vegetatively. The species *A. materculae* and *A. leucantum* are distinguished by a very low coefficient of vegetative propagation. The coefficient of vegetative propagation of most onion species introduced from the flora of Nakhchivan into the dry subtropical conditions of Absheron was 1.71-3.2.

References:

1. Kestre D.E., Khartmann Kh.T. 2002. Plant propagation. Moscow, Centerpolygraph. 368 p.
2. Levina P.E. 1964. Diversity and evolution of plant reproduction forms. Moscow, Pros-vesheniye, 68 p.
3. Lyubarskiy E.L. 1967. Ecology of vegetative propagation of higher plants. Kazan, KSU, 184 p.

4. Mazurenko M.T., Khokhryakov A.P. 1971. Vegetative propagation of plants in connection with introduction. Bulletin of the Main Botanical Garden 79: 26-33
5. Tukhvatullina L.A. 1999. Introduction and experience of propagation of onions at the Botanical Garden-Institute of the UC RAS. Bulletin of the Botanical Garden named after I.S. Kosenko. Krasnodar: 65-66
6. Tukhvatullina L.A. 2003. Experience of propagation of wild onions during introduction. // Biological diversity. Introduction of plants. (Proceedings of the 3rd International Scientific Conference, St. Petersburg). St. Petersburg: 424-426
7. Tukhvatullina L.A. 2006. On vegetative propagation of wild onions. Biodiversity and bio-resources of the Urals and adjacent territories. Materials 3rd International scientific conference. Orenburg: 111-112
8. Shalit M.S. 1960. Vegetative propagation and renewal of higher plants and methods of its study. Field Geobotany. Moscow. Publishing House of the USSR Academy of Sciences: 163-205

FEATURES OF THE COMPLEX USE OF WOOD RAW MATERIALS OBTAINED FROM INTERMEDIATE CUTTINGS IN THE BEECH FORESTS OF AZERBAIJAN

Aydin Yahyayev[1], Elshad Gurbanov[2]
[1]Western Caspian University
[2]Baku State University

Abstract: The article is devoted to the study of the issue of the complex use of wood raw materials obtained from intermediate use cuttings in the beech forests of Azerbaijan. In this regard, it was necessary to establish the volume and structure of the resulting wood raw materials. For this purpose, one sample areas was allocated for each type of care cuttings and selective-sanitary cuttings with separation of its 7-10 section where plots are laid. A total of 43 plots were laid with a total area of 26 hectares. Cuttings were carried out with intensity of 7.0-18.3%. The total volume of wood raw materials harvested was 508.16 m^3 (19.6 m^3/ha) including commercial wood - 53.1%, technological raw materials - 28.0%, technical greens (fitomass) - 18.9%. In turn, commercial wood in the amount of 269.88 m3 by size categories was distributed as follows: large - 38.6%, medium - 29.6%, small - 31.8%. Mathematical models of yield of categories wood raw materials depending on age and wood stock of forests have also been derived from the work. The article also indicates the possibilities of rational use of these raw materials and developed the corresponding technological scheme of the wood-processing complex for the production of finished products.

Keywords: wood raw materials, intermediate use cuttings, beech forests, commercial wood, technical greens, low-quality roundwood, felling waste, technological scheme.

***Corresponding Author:** aydin_yahyayev@wcu.edu.az

Received: 26 December 2023; **Accepted:** 18 February 2024; **Published:** 30 March 2024

DOI: 10.54414/ZKFX6288

Introduction:

In the forest of the Republic in the past, unsystem cuttings, forest pasture, agricultural use and other anthropogenic effects have led to a state of exhaustion and upset, as a result of which their productivity and sustainability have decreased. Therefore, since 2000 in all farms it is allowed to carry out only cuttings of care cutting and selective-sanitary cuttings. During these cuttings commercial and low-quality wood is harvested and felling waste is generated in large volumes in the form of small sticks, boughs, branches, tops, stubs, roots, etc. (Yakhyaev, 2004; Yakhyaev, 2015).

In the forestry practice of Azerbaijan, assortment technologies used with partial use of harvested wood raw materials. Felling waste and low-quality roundwood generated in felling areas, as well as sawmill waste generated at primary processing points of roundwood are partly used for firewood. The rest, including the small waste, is collected in a heap and left to rot (Yakhyaev and Safarova, 2015).

As can be seen, the low-quality wood and felling waste obtained from felling and primary processing of wood raw materials have not yet found effective production use (Yakhyaev and Abiyev, 2015). Here, the main constraints are the lack and imperfections of technical means available to enterprises for harvesting, transportation and processing, as well as the form of organization of forestry and logging production in farms. and the Republic as a whole. On the other hand, the use of waste-free technologies in a sparsely wooded Republic is a priority for increasing the efficiency of forestry production (Gensurik, 1986).

The purpose of this work is: 1. Determination of the volume and structure of wood raw materials obtained from intermediate use cuttings, 2. Identification of the possibility of complex use of wood raw materials obtained from intermediate use cuttings in the production bases of the Republic, 3. Development of a technological scheme for complex use of wood raw materials obtained from intermediate use cuttings of finished products.

Objects and Methods of Research:

The research was carried out on the forests of the Alpan forest area of the Guba Forestry (41º21/ N, 48⁰30/ E) region of Azerbaijan. Mountain-forest brown soils are mainly distributed in the research area. Here, the average annual temperature varies between 8,6-11.9 ºC, the annual precipitation is 570-694 mm. For this purpose, one sample areas was allocated for each type of care cuttings and selective-sanitary cuttings with its division into 7-10 sections, where plots are laid (PP with area of 0.55-0.65 ha). The plots were allocated by age groups to the appropriate types of care, and the sections - to the related forestry-taxation indicators of plantings. At the same time, the requirements of the regional standarts (OST 56-69-83: 1983) and the methodological instructions of L.B. Mahatadze and I.D. Popov (1965) in fescue and herbaceous forest types with a stand density of 0,62-0,78 (Table 1).

Table 1. Material evaluation of raw wood materials obtained from cutting intermediate.

Plot No	Composition by number	Averageage, (year)	Stand density	Stand volume, (m^3. ha^{-1})	Type of cuttings	Intense thinning, %	Total volumes of raw wood materials					
							commercial, m^3				techn. raw m^3/%	tech. green t / %
							large	medium	small	general		
P1-7	60Be40Hb+As+Mp	23,3	0,79	27,9	release cut.	13,6	-	-	-	-	8,87/31,9	18,96/68,1
P8-15	50Be40Hb10Mp+O	40,9	0,78	53,1	improve cut.	11,3	-	-	3,41	3,41/7,1	18,16/37,5	26,83/55,4
P16-25	50Be40Hb10O+Mp	63,3	0,77	92,9	thinning	10,8	5,81	15,43	31,71	52,95/53,2	29,06/29,2	17,47/17,6
P26-35	70Be20Hb10Mp	103,6	0,73	171,3	selvage cut.	9,1	40,33	31,49	31,04	102,9/66,6	33,95/21,9	17,7/11,5
P36-43	90Be10Hb+O+Mp	127,3	0,69	213,3	sel.-san. cut.	10,7	57,95	33,07	19,66	110,7/62,2	52,08/29,3	15,19/8,5
Total raw wood materials		-	-	-		-	104,09	79,97	85,82	269,88/53,1	142,1/28.0	96,15/18,9

Be – beech (*Fagus orientalis* Lipsky); Hb – hornbeam (*Carpinus caucasica* A. Grossh.); Ac – acer (*Acer platanoides* Lipsky); Mp – maple (*Fraxinus excelsior* Lipsky); O – oak (*Quercus iberica* Stev.).

All types of care cuttings were carried out in August-September, selective-sanitary cuttings in October 2014-2016, by the help of the Guba Forestry enterprise with the use of assortment technology and the full use of harvested wood raw materials. As a system of machines, gas-powered saws, horse transportation (in less accessible places) and a TDT-55 tractor (Russian) used.

After the felling trees, clearing them of boughs, branches and tops, as well as crosscutting of long whiplash into assortments were carried out. The whole wood mass collected on the area cuttings was transported to the feet of the mountains to the lower timber yard. At the end of each type of cuttings, the areas was cleaned from cuttings residues with cutting and spreading over the whole area (Grokhovsky, et al, 1980; Grunyansky and Tupytsya 1972).

In the lower timber yard, the wood delivered was sorted into separate categories of raw materials. Commercial wood was classified by diameter into three dimensional-qualitative groups of assortments: small 6-13 cm (in the upper end without bark); medium -14-24 cm, large - 26 cm and above (Atrokhin and Ievin, 1985). Non-commercial wood was conditionally divided into two groups: technological raw materials - trees with a diameter at a height of 1.3 m to 6 cm, as well as boughs, branches thicker than 0.8 cm, small sticks and other weight waste; technical greens - branches up to 0.8 cm thick with leaves (https://www.activestudy.info/kompleksnaya-pererabotka-lesnoj-rastitelnosti/). Allocated categories of wood raw materials were taxed: technical greens – by weight method; technological raw materials –with raum meters (https://www.britannica.com/science/wood-plant-tissue/Harvesting-of-wood/). Commercial wood accounting was carried out on the basis of volumetric tables of the corresponding species (Gensurik, 1986, Gagoshidze, 1979).

In order to identify the possibilities of complex use of harvested wood raw materials in the Republican production bases, statistical data of leading companies of forest and wood-working industry of the Azerbaijan were used. At the same time, their technological capabilities and interests of the domestic market were taken into account (statistics 2012-2020).

In the development of the technological scheme of the wood-processing complex, the corresponding typical technological schemes of D.K. Verhov and Y.V. Shelgunova (1981), recommendations of K. Smelevsky (2011) developed for the complex use of harvested wood raw materials (Malkov and Popov,1992) were used.

Results:

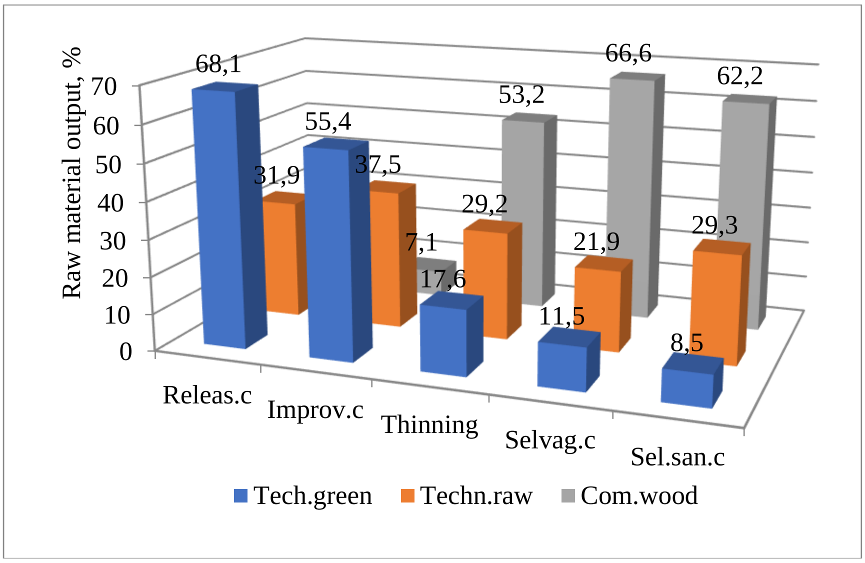
The results obtained to determine the volume and structure of harvested wood raw materials by type of cutting were as follows: In the process of release cutting (P-1 - P-7) of valuable species and improvement cutting (P-8 - P-15) of the young composition of future stands, the main mass of the raw materials was technical greens (55.4-68.1%) and small-dimensional wood in the form of small sticks (31.9-37.5%).

During thinning of plantings (P-16 - P-25), carried out in order to form stems trees of valuable species, there was a sharp increase in the output of commercial wood to 53.2% (7.5 times), in which a large category - 11.0%, medium -29.1%, small - 59.9%. At the same time, the output of technological raw materials remained at the level of 30%, and technical greens decreased to 17.6% (3.9 times).

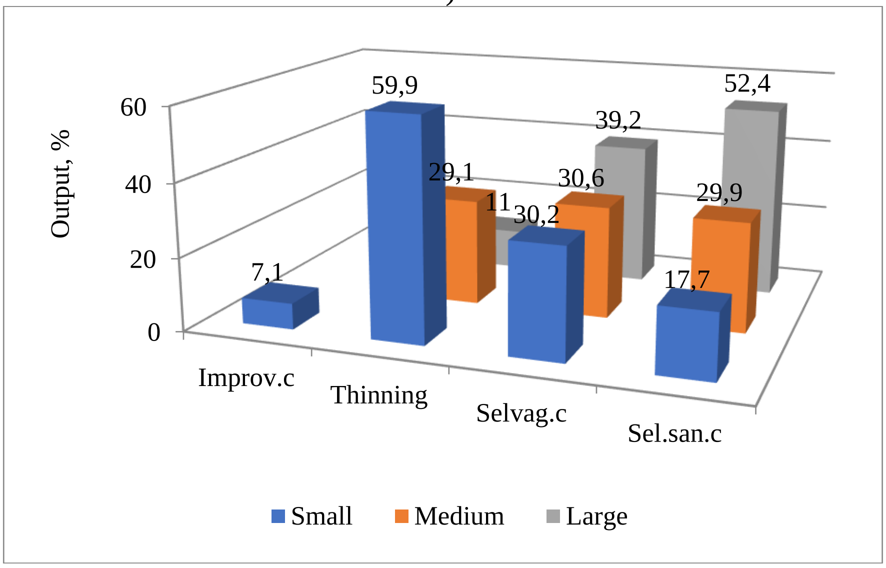
In the selvage cuttings (P-26-P-35), carried out in order to increase the growth of valuable species, the main mass of the harvested raw materials was commercial wood - 66.6%. By size category, it consists mainly of large wood (39.2%), and the output of medium and small wood were at 30%. The output of technological raw materials and technical greens decreased to 21.9% and 11.5%, respectively, compared to similar values in thinning.

Selective-sanitary cuttings (P-36-P-43) in the harvested raw materials were dominated by the output of commercial wood (62.2%), the lowest output was observed in technical greens (8.5%). The main mass of commercial wood was large (52.4%) and medium (29.9%) wood. The output of the technological raw materials was about 30%.

Analysing the obtained data, it can be noted that 508.16m3 (19.7m3/ha) wood raw materials were harvested in intermediate use cuttings. While the output of certain categories was: 53.1% (10.5 m^3/ha) - commercial wood; 28.0% (5.5 m^3/ha) - technological raw materials; 18.9% (3.7 m^3/ha) - technical greens. In turn, the total output of commercial wood was 269.88 m^3. The size categories are divided into large -38.6% (4.0 m^3/ha), medium - 29.6% (3.1 m^3/ha) and small wood -31.8% (3.3 m^3/ha) wood (Figure 1 *a*, *b*).



a)



b)

Figure 1. Distribution: a) – harvested volume by category of raw materials, b) - commercial wood by size categories.

The use of the obtained data removed the mathematical models showing an output of categories of wood raw materials depending on an age and also an output of commercial wood on categories of large-size depending on an age and a wood stock of plantings (table. 2)

From the derived mathematical models, it can be seen, between an age of plantings and to output of commercial wood and technological raw materials exists close connection. Since the value of the reliability of the approximation is more than 68% (R^2 = 0.774-0.880). and the connection of age with technical greenery is very weak (R^2 = 0.224). Between an age and a wood stock of plantings and with output of large and medium category of commercial wood rather close connection (R^2 = 0.745-0.874), with small wood - very weak is also observed (R^2 = 0.112-0.133). In this case, a great influence, for certain, features of selection and cutting of the chosen trees, a share and the pedigree list of a thin log in planting, etc. had on an output of small wood the size of stems and boughs (Yakhyaev, Safarova, 2015).

Table 2. Established mathematical models.

Name of category	Percent of output	Mathematical model	R^2	*r*
By categories of raw materials				
Commercial wood	53.1	$P_{com} = 0.135A – 3.839$,	0.881	0.938
Technological raw	28.0	$P_{tech/r} = 0.039A + 0.443$,	0.683	0.826
Technical greens	18.9	$P_{tech/g} = - 0.010A + 2.991$	0.224	-0.473
By size categories commercial wood				
Large wood	38.6	$P_{l.} = 0.088A – 4.736$,	0.847	0.920
		$P_{l.} = 0.047M – 3.588$,	0.874	0.935
Medium wood	29.6	$P_{m.} = 0.035A - 0.504$,	0.745	0.863
		$P_{m.} = 0.020M – 0.204$,	0.854	0.924
Small wood	31.8	$P_{s.} = - 0.009A+3.775$,	0.133	-0.365
		$P_{s.} = - 0.004M + 3.591$,	0.112	-0.334

P_{com}, $P_{tech./r}$, $P_{tech/g}$, P_l , $P_{m.}$, P_s – output of commercial wood, technological raw, technical green, large, medium, small wood, m^3; A – average age of plantings, year; M – stand volume of plantings, $m^3. ha^{-1}$.

As is known, the main goal of timber production in the world is to increase the volume of output of the products by 1 m3 of harvested raw materials (Grigoryev and Svojkin, 2011). In the forestry practice of our republic, on the example of our data, only 36.2% of the harvested total volume (508.16m3) of wood raw materials for the needs of the national economy in the form of large and medium wood is used. The remaining 63.8% raw materials in the form of small and low-quality wood and felling waste are either partially used for firewood, i.e. irrational, or burned or left for decay at all. On the other hand, in the existing technological bases in the Republic, this part of wood raw materials can be used in two directions: 1) for wood fibrous mass suitable for use in wood board production and bioenergy; 2) technical green mass suitable for obtaining a number of valuable biologically active products of therapeutic-preventive, fodder and other purpose. To mean, wood raw materials harvested during intermediate use cuttings in our forests are in demand, and there are prospects for its complex use in the Republic.

For this purpose we have developed a technological scheme of the wood - processing complex with the output of finished products (Figure 2). In this complex it is planned to organize the following production sites: sawing-parquet-tare; small tickers; technological spill; technical greens.

As raw material for the sawing-parquet-tare site is round timber with diameter of 16 cm and higher, length of more than 2 m. Here it is planned to produce standard lumber for woodworking and furniture industries, billets for the manufacture of parquet, agricultural boxes and pallets. In the small tickers site, it is planned to use thin log and low-quality round timber with a diameter of 6 to 16 cm and a length of more than 1 m. In this site it is planned to produce a wide range of strict and profiled lumber intended for the special market - Do it yourself (DIY).

The products of this group include parts and products for the design and arrangement of special purpose objects.

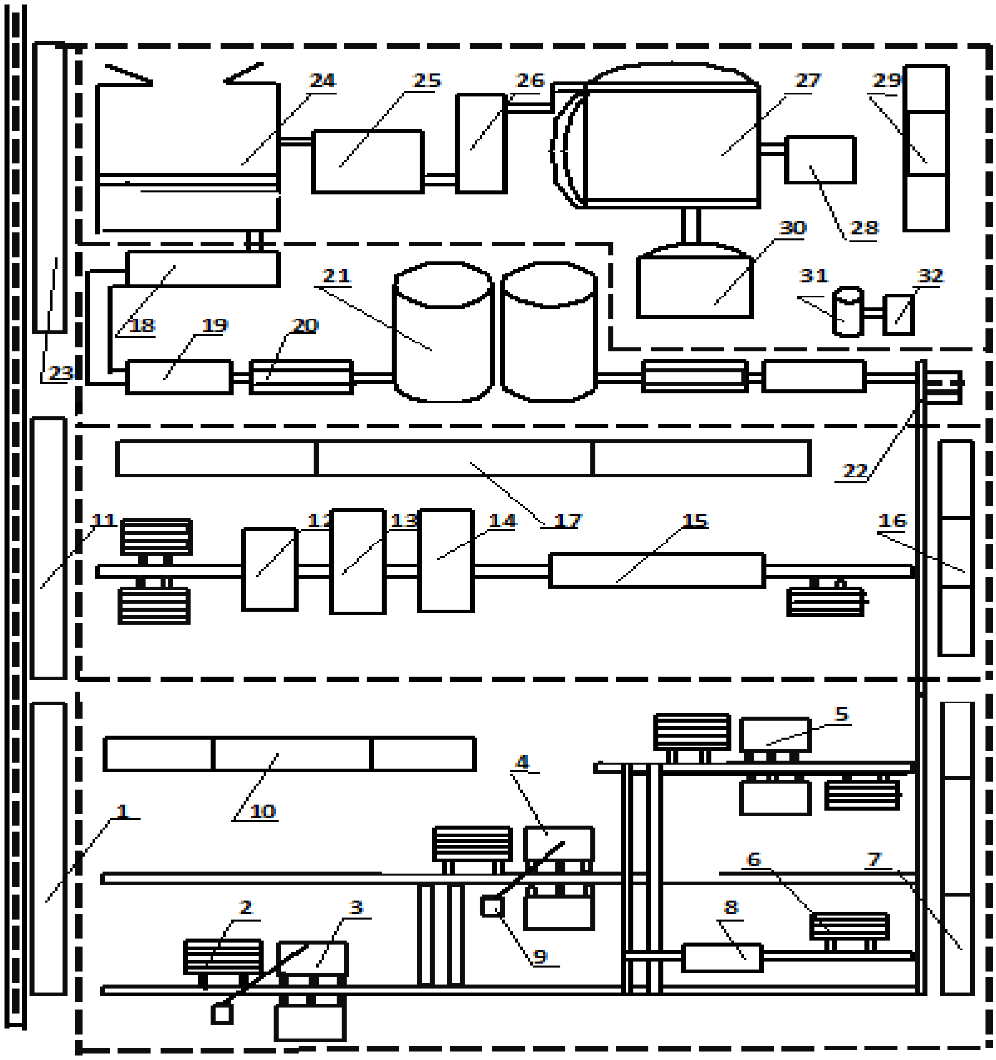


Fig. 2. Technological scheme of the wood-processing complex: 1 - commercial timber yard; 2 - a stack of round assortments; 3 - module of large-sized assortments of the 1st row; 4 - module of medium and short assortments of the II row; 5 - module of container blanks; 6 - lumber stack; 7 - lumber warehouse; 8 - lumber processing center; 9 - waste bin; 10 - auxiliary facilities; 11 - timber yard for small-sized and low quality wood; 12 - billet feeding module; 13 - module for generating explicit base surfaces; 14 - module for longitudinal dividing of a semi-finished product; 15 - ready lumber receiving module; 16 - workshop for the production of tickers; 17 – warehouse for tickers products. 18 - bunker for non-conditioned wood; 19 - chipper; 20 - sorting plant; 21 - bunker for chips; 22 - storage for the slab. 23 - green timber yard; 24 - separating plant of green mass and wood part; 25 - bunker of green mass; 26 - preparatory department of green mass; 27 - capacity for extracting green mass; 28 - bunker of green mass after extraction; 29 - capacity of the solution of the extracted substances; 30 - finished products warehouse; 31 - fuel waste bunker; 32 - gas generator.

Raw materials for the site of receiving technological spill are felling waste, waste of sawing and woodworking sites of a wood-processing complex, firewood and low-quality stem wood. The technological spill are planned to be used mainly in the production of wood boards. Branches up to 0.8 cm thick are used in the technical green processing site with leaves.

Products of technical greens as a natural product are intended to be used for industrial and agricultural purposes.

Discussion:

During the release cutting and improvement cutting technical greenery prevails in the structure of harvested wood raw materials in the volume of 0.729 t/ha, reaching a maximum value of 1.03 t/ha during the improvement cutting. And with subsequent types of care cutting, this indicator is slightly decreasing and stabilized (Table 1). This was mainly due to the timing of these cutting (by the autumn) and the age structure of these stands. A similar dynamics is characteristic of the concentration of technological raw materials, the maximum volume of which is formed during thinning (1.18 m^3/ha) and selvage cuttings (1.31 m^3/ha).

Carried out in the beech forests of the North Caucasus care cutting the mass of technical greens was similar to our indicators (Kotlyarov, 1989) and on the mixed (beech-spruce) forests of the Carpathian Mountains of Ukraine, the yield of technical greenery during release cutting and improvement cutting amounted to 1.51 t/ha and 3.22 t/ha, and in thinning and selvage cutting corresponded to our indicators. In these types of cutting, the yield of technological raw materials in the Carpathian forests was 1.24 and 2.29 m^3/ha, respectively. Both categories of wood raw material obtained in the Carpathian forests were mainly associated with the mixed composition, age structure and stand density of the young generation of these plantings (Kosyakov and Prokopchuk, 1979).

During the improvement cutting, commercial wood is obtained in a small category and in an insignificant volume (0.13 m^3/ha), and a sharp increase in this wood is observed in thinning (2.04 m^3/ha). This was due to care cutting in the second layer and on the upper canopy of plantings, where mainly small-sized trees and trees of medium and small numbers of large sizes are common.

With selvage cutting, an increase in the yield of commercial wood to 3.96 m^3/ha, including large-sized wood up to 1.55 m^3/ha, is explained relatively high age of plantings. During selective-sanitary felling, the predominance of commercial timber output (4.26 m^3/ha) was greatly influ-enced by the condition and size of damaged trees and the species composition of these plantings.

In our experience of forest care, 19.54 m^3 of raw wood were removed from one hectare of which commercial wood was 10.38 m^3/ha. Of this volume of commercial wood, 4.34 m^3/ha was classified as large, 3.08 m^3/ha of the middle category, which was associated with their purpose in the production of parquet products, small goods and in the arrangement of cultural and household facilities, the products of which are mainly characterized by small sizes and lower quality requirements (Yakhyaev, Safarova, 2015). Where as, in the North Caucasus, the volume of raw wood materials harvested during intermediate cutting amounted to 13.7-13.9 m^3, including commercial wood - up to 10 m^3 (Kotlyarov, 1989). In the Ukrainian forests, these indicators were respectively: 25-30 m^3/ha and 10-15 m^3/ha (Forest policy Ukraini, 2014).

As you can see, during care cutting, mainly large and medium categories of commercial wood are harvested, which is associated with the spread in the beech forests of the region of a sufficiently large number of trees of ripe and overmature age. This situation indicates that in the past, in the developed beech forests, care cutting was carried out not in a timely manner, and not in a high quality, which is typical for all forests in the region. This makes it necessary to develop and apply a comprehensive program for intermediate cutting in all forests of the Republic.

As noted above, in the Republic, 63.8% of timber harvested during intermediate cutting in the form of low-size and low-quality wood and felling waste are used partially and irrationally. This situation is also found in countries where timber production is poorly developed (Atik and Yilmaz, 2014; Obed, et al, 2020). On the other hand, the needs of the Republic for timber industry products are mainly provided through foreign delivery. In the last decade in the world market, prices for forest products, including beech, have a tendency to increase (Anna and Jan, 2020; Bouriaud, et al, 2019), which makes the issue of the integrated use of wood raw materials harvested during intermediate cutting in our forests an urgent task. For this purpose, the technological scheme of the wood-processing complex developed by us includes four production sites that produce finished products for the domestic market (https://www.activestudy.info/ekonomicheskie-osnovy-rubok-uxoda-za-lesom/). When developing the technological scheme, we took into account the peculiarities of the raw material base, communications, market needs, a technological base in the republic for processing these categories of wood raw materials, as well as typical technological schemes in forestry practices of nearby regions (Yakhyaev and Abiyev, 2015). The wood-processing complex is planned to be located in the northern region of the Republic, where more than 100 thousand hectares of the region's forests will serve as a raw material base.

Conclusion:

1. It is established that, during cuttings of the intermediate use in beechen forests 19.7 m^3/ha of wood raw materials of which 10.5 m^3/ha commercial wood, 5.5 m^3/ha made technological raw materials and 3.7 m^3/ha of technical greens were harvested.
2. Mathematical models are obtained, describing the regularities of the output of categories of wood raw materials and commercial wood dependence on age and wood stock of plantings.
3. It has been established that about 2/3 of the harvested wood raw material belongs to low-quality wood and wood waste, which is partially used for firewood, and the rest is left for decay.
4. For the integrated use of harvested wood raw materials, a technological scheme of the wood-processing complex with the output of finished products has been developed, in which it is planned to organize the following production sites: sawing-parquet-tare; tickers; technological spill; technical greens.

References:

Atik A., Yilmaz B. 2014. Factore affecting industrial wood? Material production yield in Turkeys natural beech forests. Annals of Forest Research 57(1): 149-162

Atrokhin V.G., Ievin I.K. (1985): Thinning. Moscow: 254. (In Russian)

Bouriaud O., Don A., Janssens I., Marin G., Schulze E. (2019) Effects of forest management on biomass stacks in Romanian beech forests. Forest ecosystems 6: 19

Gagoshidze I.A. (1979) Nondischarge mass tables for the main forest-forming species of Transcaucasia. Tbilisi: 322. (in Russian)

Gensurik S.A. (1986) Use and reproduction of forest resources of the Ukrainian SSR. Kiev: 312. (in Russian)

Grigorev I., Svojkin F. (2011) The mastering of hard-to-reach forests. Wood. RU. 4: 72-74. (in Russian)

Grokhovsky K.F., Kalinovsky V.P., Livshits, I.V. (1980): Technology and machines for logging and logging operations. Moscow: 376. (in Russian)

Grunyansky I.I., Tupytsya Y.Y. (1972) Economics of integrated forest enterprises. Moscow: 168. (in Russian)

https://www.activestudy.info/kompleksnaya-pererabotka-lesnoj-rastitelnosti/

https://www.britannica.com/science/wood-plant-tissue/Harvesting-of-wood/

https://www.activestudy.info/ekonomicheskie-osnovy-rubok-uxoda-za-lesom/

Kosyakov M.N., Prokopchuk V.D. (1979) Use of logging wastes, small-sized wood and technical greens. Forestry 2: 53-56 (in Russian)

Kotlyarov I.I. (1989) Thinning and their role in the structure of forest management. Forestry 5: 27-28 (in Russian)

Kozuch A., Banas J. (2020) The dynamics of beech roundwood prices in selected Central European markets. Forests 11(9): 902

Forest policy and strategy of Ukraine: assessment, problems and ways to solve them. Regional program "ENPI EAST FLEG" (2014): Kiev: 132. (in Russian)

Malkov G.N., Popov N.N. (1992) State and problems of forest management in the North Caucasus. Forestry 1: 16-19. (in Russian)

Mahatadze L.B., Popov I.D. (1965) Types of Forests in Transcaucasia. Timber industry: Tbilisi: 112. (in Russian)

Obed A., Suvi K., Jones A., Ebo T., Dastan B., Charles M., Ari P. (2020) Assessing wood waste by timber industry as a contributing factor to deforestation in Ghana. Forests 11(9): 939

OST (1983) 56-69-83. Trial areas for forest management. Method of bookmarking. TSBNTI State Forestry of the USSR. Moscow: 10 (in Russian)

Smelevsky K. (2011): What can be done from waste. Wood Ru. 1: 90-94 (in Russian)

Verkhov D.K., Shelgunov Y.V. (1981): Technology and machines of logging and store works: Moscow: 364. (in Russian)

Yakhyaev, A.B., Safarova, E.P. (2015) Structure and volumes of wood raw materials received from thinning in the beech forests of the Greater Caucasus. Forest Information. VNIILM, No 4:73-80. (in Russian)

Yakhyaev A.B. (2004): On the use of raw wood materials of the forests of Azerbaijan. Proceedings of Inst. Botany NAS of Azerbaijan. XXV:118-122. (in Azerbaijan)

Yakhyaev A.B. (2015): Features of the use of raw wood of beech forests of the Greater Caucasus. Bulletin of the Kazan SAU. 2(36): 164-168. (in Russian)

Yakhyaev A.B., Safarova E.P. (2015) The current state of the stock and use of raw woody materials in the Forests of Azerbaijan. Collection of scientific works of the Institute of Dendrology NAS of Azerbaijan: 73-81 (in Azerbaijan)

Yakhyaev A.B., Abiyev Y.T. (2015) Organizational-technological features of the use of raw wood materials obtained from intermediate cuttings in beech forests of the Greater Caucasus. Forestry journal. Voronezh. 1(17): 197-206. (in Russian)

IMPACT OF ALTERNATIVE ENERGY SOURCES ON THE ENVIRONMENT

Aydin Alekperov[1,2]
[1]Azerbaijan State Pedagogical University
[2]Western Caspian University

Abstract: This paper provides extensive information about alternative energy sources. The principle of operation of solar panels, which began to be used quite recently, is shown. Their ease of use is assessed. Nuclear power plants that are considered environmentally friendly are analyzed and the difficulties encountered in ensuring their safety are shown. Information was presented about wind engines, thermal water sources, various biomass, hydrogen energy, which are considered sources of green energy.

Keywords: solar panels, green energy, alternative energy, ecology.

***Corresponding Author:** aydin60@inbox.ru

Received: 15 December 2023; Accepted: 28 February 2023; Published: 30 March

DOI: 10.54414/UWZB8596

Introduction:

One of the most pressing problems facing humanity in the modern era, when the fourth industrial revolution is taking place, is the issue of energy. When we look at the economic map of the world, we see that about 30 years ago we can show the USA, the European Union, the USSR and Japan as industrial centers. But now China, India, South Korea, Southeast Asia, South Africa, and Brazil have been added to this geography. If we add to the aforementioned industrial centers billions of cars, incessant forest fires, deforestation, desertification processes in Africa and South America, and rapid population growth, we see that the world's environmental problems are increasing even more. Moreover, as the influence of anthropogenic factors increases, environmental problems increase (Regmi & ets, 2022; Razak & Sharip, 2019; Ngayakamo, 2020). It is necessary to solve a number of problems in order to eliminate these causes that determine the destruction of humanity. The first radical steps that need to be taken in this direction include the following measures:

- In a short time, the world's most advanced automakers must ensure a transition from the production of cars running on gasoline and diesel fuel to the production of electric vehicles. Because these cars account for 80% of the toxic gases emitted into the atmosphere.
- The management of plants and factories for various purposes should be required to use filter systems that meet modern requirements. This method should prevent pollution of the atmosphere and water bodies.
- Traditional energy sources that provide light and thermal energy to all industrial and agricultural enterprises, residential buildings and other social facilities must be replaced by renewable “green” energy sources.

If these factors are taken into account, many environmental problems will be solved. Therefore, extensive research has been carried out in this direction recently. Smart technologies, green technologies, and biotechnologies are developing. According to this direction, the green economy is developing rapidly. Various studies are carried out using both experimental methods and mathematical modeling (Guseynov & ets, 2014; Darby, 2018).

Advances in technology have meant that more energy can be obtained from alternative energy sources. It is known that the development of semiconductor physics leads to the purchase of new converters. Therefore, recently extensive research has been carried out in the direction of purchasing and researching new semiconductors (Abdinov & ets, 2012; Abdinov & ets, 2014; Abdinov & ets, 2004). Obtaining inverters with higher efficiency leads to the creation of more efficient alternative energy systems. Technological capabilities are developing towards the acquisition of wind and hydroelectric power. Due to the reduction of water resources, hydroelectric power plants are considered not a very promising area. In the presented work, alternative energy sources were investigated and their technological and economic capabilities were shown. It is shown that the development of green energy can lead to the beginning of a new era in many areas.

Research methods:

Alternative energy sources are explored, the advantages and disadvantages of these methods are shown. Using this method, both energy consumption and environmental impact factors were shown. It is known that alternative energy sources are diverse. Electricity is obtained from these sources using different methods. Each method has its own advantages, as well as environmental impacts. Each of these effects was investigated in the presented work. Scientific innovations in the direction of green energy with the development of smart technologies are analyzed.

Results and discussions:

It is known that there are various sources of energy in nature. Recently, extensive research has been carried out towards the discovery of renewable energy sources and the use of these energies. Because without these energy sources, the energy sources may run out after a certain period of time. The increase in the number of industrial plants and automobiles has further increased the demand for energy. Therefore, the search for new energy sources and energy production is one of the pressing problems of science and technology. Currently, ~80% of the energy produced on Earth comes from traditional or portable energy sources. We can include fuel sources such as oil, gas, coal, fuel oil and peat. It is a well-known fact that these fuels deplete over time. Therefore, it is important to conserve these energy sources. On the other hand, when these energies are used, the atmosphere, water bodies and large land areas are polluted. Such processes cause environmental problems. When extracting fuel, soil and water bodies are polluted. Atmospheric pollution occurs when fuel is used. As a result of the combustion of these types of fuel, millions of tons of carbon dioxide, nitrogen oxides, and sulfur compounds are released into the atmosphere. Carbon and many of its stable compounds have the property of adsorbing solar energy, preventing the dissipation of energy absorbed by the Earth from the atmosphere. Therefore, there is a gradual increase in temperature on Earth, which ultimately leads to global warming. As a result of the reaction of nitrogen and sulfur with water in the atmosphere, acid rain occurs, which leads to the destruction of living things and vegetation, as well as biodiversity in general. Therefore, it is important to study these processes and prevent the occurrence of environmental problems.

It is known that hydroelectric power plants are considered environmentally friendly. However, these plants also cause significant damage to the environment and human lives. When a hydroelectric power station is created, hectares of usable land remain under water. Therefore, the construction of these stations is not economically profitable. It is more expedient to plant forests on these lands and use them for agricultural purposes. Another harmful aspect of hydroelectric power plants is that they seriously impair the free movement of fish and other creatures in rivers. On the other hand, hydroelectric power stations limit movement along rivers and narrow the geography of navigation. Water basins occupying a large area cause climate changes in the area: increased humidity, increased hail and rain, and the creation of winds. Figure 1 shows a schematic diagram of a hydroelectric power station. As can be seen from the diagram, in order to raise the price of mechanical (potential) energy, it is necessary to raise the water level. At this time, a large area is flooded. When the water level decreases, the price of mechanical energy decreases. It is known that the resulting electrical energy is called mechanical energy. Therefore, as the price of electricity produced increases, the area of land under water also increases. Given this, hydroelectric power is not considered a very effective method of use as an alternative energy source. From Figure 1 it can be seen that water, passing through the station, continues its movement, forming a river. This water can be used for irrigation. However, it is impossible for fish and other creatures to live in the water passing through the station. It is very important to study the impact of hydroelectric power plants on the environment, to predict events that may occur during their creation and use.

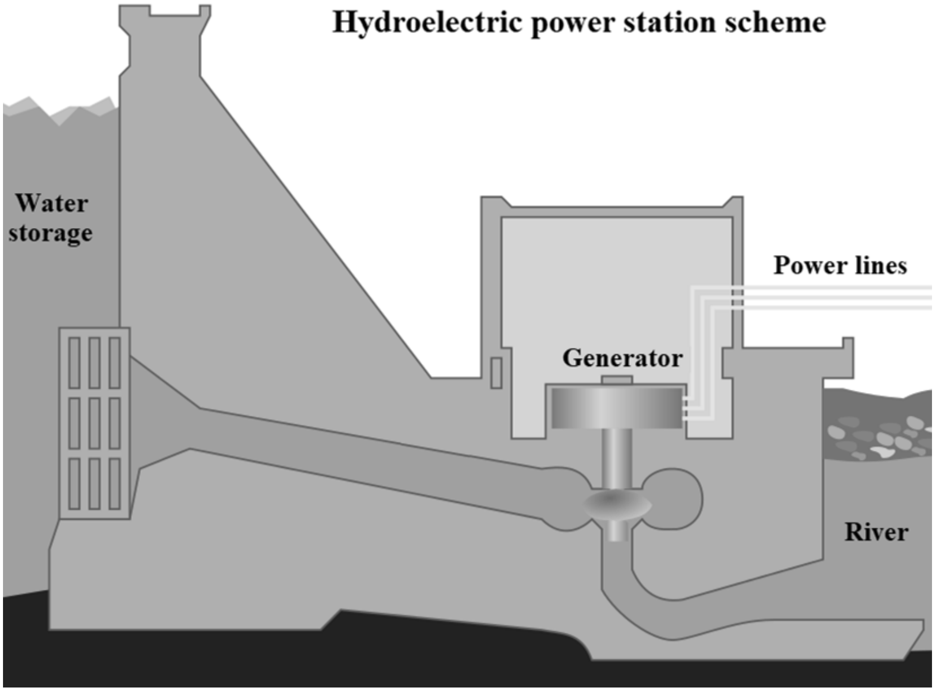


Figure 1. Hydroelectric power station scheme.

Nuclear power plants are environmentally friendly, but not safe. Accidents and leaks of radioactive substances at the Chernobyl and Tokoshima nuclear power plants have significantly reduced confidence in these energy sources. Another harmful aspect of nuclear power plants is the release of hot water used to cool the nuclear reactor into rivers and other bodies of water. The service life of radioactive elements used in modern nuclear power plants is ~20 years. After this period, disposal of this waste becomes a problem. When nuclear reactors shut down, the materials used in that reactor become radioactive for a long time. Using them and standing next to them is quite dangerous. Therefore, nuclear reactors, including nuclear power plants, are environmentally hazardous. They manifest their negative impact not only on humans, but also on other creatures around him. The Russian-Ukrainian war, which began in 2022, has made nuclear issues even more pressing. Because the processes occurring around nuclear power plants can lead to the emergence of another danger. Despite safety measures, any explosion at this station could cause radioactive contamination of these areas for many years. Therefore, nuclear power plants in a combat zone are more dangerous. It is known that the use of nuclear weapons during war is unacceptable. Explosions at nuclear power plants can also be equated to nuclear weapons.

Green energy sources occupy a special place among alternative energy sources. Such energy sources include wind engines, thermal water sources, various biomass, hydrogen, etc.

includes. Although their share in the modern global energy market is insignificant, recently interest in these sources and the accumulation of energy produced from them has been growing rapidly. Wind energy is known to be the most widely used green energy source. Wind energy facilitates the conversion of mechanical energy into electrical energy. The main advantage of this method over other alternative energy methods is that it is environmentally friendly. When using wind energy, a small area is used. There is no pollution in this area. Depending on the wind power, more energy can be generated. Recently, the use of hydrogen energy has become more relevant. Extensive research is being conducted in the direction of obtaining hydrogen energy using various physicochemical methods (Imanova & ets, 2023; Ali & ets, 2021).

It is known that the most inexhaustible and reliable source of energy is the Sun. The idea of turning solar energy into electricity belonged to Lavoisier, a French scientist who lived in the 19th century. Even after many years, this question is still relevant. The previous generation of solar inverters temporarily lost their relevance due to high cost, rather low efficiency (~10%), limited resources (Se, Cd, Pb, etc.). However, the fourth industrial revolution, the widespread use of intelligent systems, an increase in the efficiency of solar cells (~22-30%), the fact that the basic element (silicon) has very large reserves, led to the rapid development of solar energy. Currently, the developed countries of the world are considering the possibility of using solar energy at any time of the year. This type of energy is increasingly used in southern countries. Like other energy sources, panels made from semiconductor polycrystals, monocrystals and thin films occupy a significant area. Recently, these panels are placed on the roofs and balconies of individual houses, but in case of huge energy production, these panels occupy hectares of land. To organize continuous operation of energy panels of this type, it is necessary to ensure that the surface is clean and that the sun's rays fall perpendicular to the surface. Figure 2 shows solar panels.

Figure 2. Solar panels for used to generate electricity.

After the end of the service life of modern solar panels (~25-30 years), the problem of their disposal will arise. Decommissioning silicon panels, considered environmentally toxic, and replacing them with new ones is a serious problem awaiting solution. Therefore, solving the following tasks to include environmentally friendly, reliable solar panels as a source of “green energy” in our daily lives are the main tasks facing modern energy:

- increase the efficiency of semiconductor photoconverters;
- develop supercapacitors for storing energy generated by solar inverters and organize their mass production;
- ensure the recycling of solar panels that have expired, while protecting the environment.

As you can see, each method of using alternative energy has its own advantages and disadvantages. However, by using renewable energy, a number of environmental problems can be solved and energy can be obtained cheaper.

Conclusion:

Alternative energy sources were explored and methods for solving environmental problems were analyzed. The impact of alternative energy sources on the environment has been studied. The study examined the environmental issues of hydroelectric and nuclear power plants. It has been determined that each method of using alternative energy sources has advantages and disadvantages. It has been determined that it is important to increase the efficiency factor when using renewable energy sources. At the same time, by obtaining more energy, you can also increase the economic efficiency of the work performed.

References:

Abdinov, A.Sh., Babayeva, R.F., Amirova, S.I., Ragimova, N.A., Rzayev, R.M. (2014) Effect of light on the mobility of free carriers in indium monoselenide crystals. Semiconductors 48:981-984

Abdinov, A.Sh., Babaeva, R.F., Rzaev, R.M., Gasanov, G.A. (2004) Photoluminescence of rare-earth-doped InSe and GaSe single crystals. Inorganic materials 40:567-569

Abdinov, A.Sh., Babaeva, R.F., Rzaev, R.M. (2012) Electric field effect on photoconductivity decay in *n*-InSe single crystals. Inorganic Materials 48:781-785

Ali, I., Imanova, G.T., Garibov, A.A., Agayev, T.N., Jabarov, S.H., Almalki, A.S.A., Alsubaie, A. (2021) Gamma rays mediated water splitting on nano-ZrO_2 surface: Kinetics of molecular hydrogen formation. Radiation Physics and Chemistry 183:109431

Darby, S.J. (2018) Smart technology in the home: time for more clarity. Building Research & Information 46:140-147

Imanova, G., Asgerov, E., Jabarov, S., Mansimov, Z., Kaya, M., Doroshkevich, A. (2023) Hydrogen generation during thermal processes of water decomposition on the surface of nano-ZrO_2+ 3mol.% Y_2O_3. Trends in Sciences 20:4684-4684

Guseynov, Sh.E., Aleksejevs, R., Aleksejeva, J.V., Rimshans, J.S. (2014) On mathematıcal modellıng of some ıssues arısıng ın the optımızatıon of bıogas productıon ın solıd waste landfılls. Green Economıcs 2:80-101

Ngayakamo, B.H., Bello, A., Onwualu, A.P. (2020) Development of eco-friendly fired clay bricks incorporated with granite and eggshell wastes. Environmental Challenges 1:100006.

Razak, A., Sharip, Z. (2019) Spatio-temporal variation of zooplankton community structure in tropical urban waterbodies along trophic and urban gradients. Ecological Processes 8:44

Regmi, T., Ghimire, M., Shrestha, S.M. (2022) Impact evaluation with potential ecological risk of dumping sites on soil in Baglung Municipality, Nepal. Environmental Challenges 8:100564

DISEASES AND PESTS OF APPLE (MALUS MILL.) SPECIES INTRODUCED IN ABSHERON

Aynur Arabzade[1,2]
[1]Central Botanical Garden
[2]Ministry of Agriculture of the Republic of Azerbaijan Scientific Research Institute of Fruit and Tea Growing, Absheron experimental station

Abstract: The article first studied the diseases and pests found in wild apple varieties introduced in Absheron. The researches were carried out in the collection area of the Central Botanical Garden, 23 wild apple varieties were taken as objects of research. One of these species was introduced from the flora of Azerbaijan, and other species were introduced from North America, and Central and East Asia. The purpose of the study was to determine which diseases and pests were found in the species studied in the conditions of Absheron, as well as to select resistant diseases and pests and use them as a breeding ground for the selection of resistant varieties. As a result, powdery mildew was found in the leaves of *M.niedzwetzkyana*, various silkworms in the leaves of *M.purpurea*, apples in the fruits of *M.pumila*, and pears in the leaves of *M.cerasifera*. The causative agent of powdery mildew was *Podosphaera leucotricha*. The leaves and shoots of the infected apple plant were damaged. As a result, infected leaves harden, and the shoots stop growing. The caterpillars of the variegated silkworm have eaten the moon and stalks of the leaves, destroying the damaged tree. In apple trees infested with apple worms, most of the fruit became unusable and productivity declined. Pear larvae are found in colonies on the undersides of leaves. As these colonies suck the sap from the leaves, the leaves fade, become discoloured and contaminated with black sticky excrement at the bottom, become discoloured and contaminated with black sticky excrement at the bottom, and the three turn brown from head to toe. Later, the leaves withered and fell off, and productivity declined. No diseases or pests were found in other species. In this regard, other wild species studied can be used as a breeding ground for selection diseases and pests.

Keywords: Absheron, *Malus*, introduction, diseases, pests.

***Corresponding Author:** aynurarabzade@gmail.com

Received: 25 December 2023; Accepted: 28 February 2023; Published: 30 March 2024

DOI: 10.54414/JRPN1172

Introduction:

The apple tree, like many other plants, is affected by various diseases and pests. These diseases and pests damage not only the fruits but the entire plant and even lead to its death. In such plants, the assimilation process is disrupted, the plant cannot develop normally, its productivity decreases and it loses its aesthetic properties. It has been established that the damage and losses caused by phytopathogenic organisms to plants are extremely high. Pests and diseases of fruit plants have been studied by several researchers (Arabzade, 2012); (Arabzade, 2021).

M.R. Gurbanov determined the phytosanitary status of apple orchards, D.N.

Agayeva determined the mycobiota of Absheron, I. Jafarov determined plant diseases, A.R. Aliyeva identified the natural pests of the main insects damaging fruit trees in the Lankaran region (Gurbanov, 2009); (Aghayeva, 2014); (Jafarov, 2012); (Aliyeva, 2013). K.F. Bakhshalieva and others, monitoring phytopathogenic microorganisms on some trees, Z.M. Mamedov studied the bioecological characteristics of the codling moth and apple fruit eater in the Sheki-Zagatala region of Azerbaijan (Bakhshaliyeva, 2014); (Mammadov , 2011). N.G. Andrianova and others discovered that apple fruits are susceptible to various fungal diseases during storage (Andrianova, 2016). Sometimes overripe fruits darken, lose their aroma and become tasteless. N.I. Savelyev and N.N. Savelyeva studied the characteristics of powdery mildew disease in apple trees due to sudden temperature changes (Saveliev, 2008). According to L.M. Yaremenko, wild small-fruited apple tree varieties are more resistant to diseases and pests than large-fruited cultivated apple tree varieties (Yaremenko, 1964). Diseases and pests are rare in wild apple trees of East Asian origin. As per the research conducted by A.L. Lip, the species *M.prunifolia* shows more resistance to fungal diseases (Yaremenko, 1964). J.Schovankova and H.Opatova have studied the impact of fungal infections on phenolic compounds and phenylalanine-ammonia lyazine activity in apple fruits (Schovankova, 2011). H. Hajnari and A. Mizani researched the effect of viral infections in the soil on the quality of fruits (Hajnajari. 2014). They infected the fruits with the root of the plant. It is crucial to identify various diseases and pests to purchase high-yielding fruit varieties. Thus, it is of utmost importance to study the diseases and pests of the wild apple species introduced in Absheron and identify resistant species. The identification of resistant species will aid in the procurement of new varieties using them as seedlings.

Materials and Methods:

The research was conducted on 23 new and newly introduced wild apple species in the collection area of the Central Botanical Garden, including *Malus spectabilis* Ait., *M. hupehensis* Pamp., *M. sargentii.* Rehd., *M. floribunda* Sieb., *M. zumi* Mats., *M. prunifolia* Borkh., *M. mandshurica* Kom., *M. halliana* Koehne., *M. micromalus* Max., *M. prattii* Hemsl., *M. baccata* L., *M. hissarica* S. Kudr., *M. kirghisorum* Al. et An., *M. niedzwetzkyana* Dieck., *M. sieversii* Ledeb., *M. cerasifera* Spash., *M. pumila* Mill., *M. purperea* Rehder., *M. orientalis* Uglitzk., *M. coronaria* L., *M. ioensis* Britton., *M. platycarpa* Rehd., *M. toringo* Siebold.

The Absheron region has a mild-hot and dry subtropical climate due to its flatness, making it a semi-desert area. The average annual air temperature ranges between 13.6 to 14.9°C, while the average annual precipitation is 203.3 mm. It has been observed that the Central Botanical Garden has grey-brown soils suitable for the Absheron peninsula (Mammadov, 2012). Various researchers including D.N. Aghayeva, I. Jafarov, O. Mirzayev, K. Asadov, H. M. Shikhlinski, A. B. Yahyayev, Y. Lanak, etc. have conducted studies based on references (Aghayeva, 2014; Jafarov, 2012; Mirzayev, 2012; Shikhlinski, 2014; Yahyayev, 2011; Hajnajari, 2014).

Results and discussions:

Phytopathological studies were conducted on the introduced apple varieties and identified diseases and pests. During the research, the following diseases and pests were found in the apple varieties in the Central Botanical Garden collection area.

Powdery mildew disease was discovered in *M. niedzwetzkyana* caused by a fungus named *Podosphaera leucotricha* Salm. This fungus mainly attacks the leaves and pods of the apple plant. The disease was first noticed between April 3rd and May 10th. Infected plant parts had a greyish-white coating. Both surfaces of the leaves were entirely covered with the fungus, which reduced the assimilation surface in the infected leaves, and the assimilation-dissimilation processes were disrupted. Leaves that were infected with the disease became hardened, curled, and deformed, and the development of buds stopped. In the summer, black dots appear on the white cover, which is the fruit body of the mushroom. These black dots contained spores that would be shed and spread by wind and insects, infecting other plants. Our research has shown that harsh winters have weakened the development of powdery mildew. On the other hand, in mild winters and dry years, the disease is more developed, and pests are more common in plants infected with powdery mildew (Fig. 1.a).

Ocneria dispar L. has been discovered on the leaves of *M. purpurea*. This pest is known to cause significant damage to fruit trees. The caterpillars of the modified silkworm form inside the eggs and overwinter on tree bark and branches. In early spring, the caterpillars emerge from their cocoons and start feeding on buds, flowers, shoots, and leaves, before moving on to the bark. The caterpillars are covered in long hairs, which makes them easily spread by the wind from one part of the plant to another and from one tree to another. These pests can withstand very low temperatures, causing severe damage to trees over extended periods, ultimately leading to the destruction of the affected trees (Figure 1. b).

The fruit of *M. pumila* species is infested by the Apple Fruit Borer (*Carpocapsa pomonella L.*), which is often referred to as the primary pest of apple plants. During the summer, the caterpillars, which emerge from eggs, mainly feed on the pulp of the fruit and render the fruit completely useless. Each caterpillar usually damages 1-2 fruits before it moves to the edge of the fruit, creates a way out, and drops down on web threads. As a consequence, most of the fruits in the apple trees that were infected with the apple worm become inedible, resulting in a decrease in productivity (as shown in Figure 1. c) with 60-90% of the fruits being wormed.

The pear woodworm, also known as *Stephanitis pyri F.* or *Corythucha padi*, has been found on the leaves of *M. cerasfera* trees. This pest spreads during the flowering season when female woodworms lay their eggs on the underside of the leaves. Once hatched, the larvae form colonies on the underside of the leaves and feed by sucking cell sap. This feeding causes the leaves to lose their colour and become discoloured, with the lower part being contaminated with black, sticky excrement, and the upper part turning brown. Eventually, the leaves dry out, fall off and the buds stop developing. Affected trees also experience weakened height growth, failure to form fruit buds, and a sharp drop in productivity (as shown in Figure 1.d).

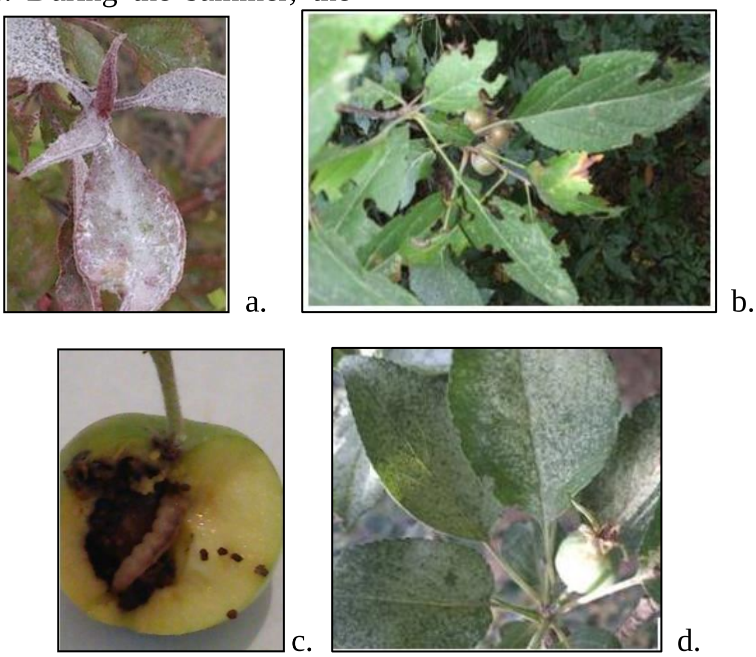


Figure 1. a. Powdery mildew disease in the spikelet of *M. niedzwetzkyana* species; b. Damage to leaves of *M. purpurea* species by the modified silkworm; c. The damage caused by

the apple fruit borer to the fruits of the species *M. pumila*; d. Damage caused by pear wood-worm to leaves of *M. cerasfera* species

To prevent diseases and pests from harming the trees, agrotechnical and chemical control measures were taken. In the autumn, after the leaves had fallen, eggs that were found on the trunks and branches of the trees, as well as any dried leaves, branches, and fruits that had fallen on the ground, were burned. Various chemical preparations were also used to combat diseases and pests. Sulfur-containing fungicides, Almaz hundazole, Sakozeb M-45, Bekchi-5 SG were used to tackle silkworms, Croyl-250 for apple fruit-eaters, and Valsarel and Hequidor for pear woodworms. Powdery mildew was also treated with these chemicals, and the chemical control was repeated 2-3 times throughout the year.

Conclusıon:

During the research conducted on some wild apple species introduced in Absheron, various diseases and pests were detected. For instance, powdery mildew was found in the pods of *M.niedzwetzkyana*, silkworm in the leaves of *M.purpurea*, apple fruit borer in the fruits of *M.pumila*, and pear woodworm in the leaves of *M.cerasfera*. However, the other studied apple varieties did not show any diseases or pests. This means that the other wild species that were studied in the selection process can be utilized as breeding stock. They can be used to obtain varieties that are more resistant to diseases and pests.

Gratitude:

I would like to express my gratitude to the staff of the Institute of Botany and Zoology for their invaluable assistance during the research.

References:

Aghayeva, D.N., Sadigov, A.S. (2014) Mycobiota of Absheron. Baku: Elm, 264 p.

Mammadov, G., Yusifov, E., Khalilov, M. (2012) Azerbaijan: Ecotourism potential. Baku: , Part I: 359 p.

Jafarov, I. (2012) Phytopathology. Baku: Science: 550 p.

Aliyeva, A.R. (2013) Natural pests of major fruit tree pests in Lankaran region. ANAS News, Biology and Medical Sciences 68,1:126

Bakhshaliyeva, K.F., Ismayilova, L.M., Arabzade, A.A. (2014) Monitoring of phytopathogenic microorganisms in pome fruit trees in some regions of Azerbaijan. Proceedings of ANAS Central Botanical Garden 12: 86-89

Gurbanov, M.R. (2009) Programming the phytosanitary status of apple orchards. Scientific innovation center of ANAS, The role of scientific innovation in the country's economy. Proceedings of the III International Scientific-Practical Conference. Azerbaijan Scientific Research Institute of Horticulture and Subtropical Plants. Baku: Science: 22-23

Mammadov, Z.M. (2011) Bioecological characteristics and natural pests of apple moth (Yponomeuta malinellus L.) and apple fruit borer (Laspeyresia pomonella L.) in Sheki-Zagatala region. Baku: Proceedings of ANAS Institute of Zoology 29:180-186

Mirzayev, O., Asadov, K., Mahmudov, R. (2012) Combating pests and diseases of forests and gardens. Baku: 68 p.

Shikhlinski, H.M. (2014) Pests, diseases and control methods of fruit and grape plants. Baku: 304 p.

Yahyayev, A.B. (2011) Basics of forestry. Textbook. - Baku: Educational Publishing Printing Center: 376 p.

Andrianova, N.G., Izlivanova, L.V., Likhacheva, T.V. (2016) Fruit diseases of apple and pear varieties during storage, Materials of the 6th International Scientific Conference "Biological diversity. Introduction of plants". Russia: Saint Petersburg: 394-396

Arabzade A.A. (2012) Introduction of apple trees in the Central Botanical Garden of the National Academy of Sciences of Azerbaijan, Monthly theoretical and practical scientific journal, established by the Ministry of Agriculture of the Russian Federation and OOO "Editorial journal of the journal "Achievement of science and technology of APK" 05 May: 21-22

Arabzade A.A. (2021) Apple tree (Malus Mill.) species introduced to Absheron and their pests. Works on the introduction and acclimatization of plants. /pod.red. A.V. Fedorova; Udm.FITS UrORAN. Izhevsk, 1: 3-8.

Lanak, Ya., Shimko, K., Vanek, G. (1972) Atlas of diseases and pests of fruit, berry, vegetable crops and grapes. Bratislava: 332 c.

Saveliev, N.I. Savelyeva, N.N. (2008) Resistance of apple varieties immune to scab to sharp temperature changes after thawing. Vestnik PACXH, 6: 38-39

Yaremenko, L.M. (1964) Biological features of ornamental species of the apple genus (Malus Mill.) and persuasive use of them: dissertation abstract for the doctoral degree in biology. Kiev: 23 c.

Hajnajari, H., Mizani, A. (2014) Neglected aspects of seed rootstocks for fruit quality sensorial analyzes and tolerance to virus infections. 2nd International Symposium on Wild relatives of subtropical and temperate fruit and nut crops. Azerbaijan: Baku, ISHS Acta Hortic., 2015, 1174:. 119-124

Schovankova, J., Opatova, H. (2011) Changes in phenols composition and activity of phenylalanine-ammonia lyase in apples after fungal infections. Hort. Sci. (Prague). 38, 1: 1–10.

ANALYSIS OF RESISTANCE TO DROUGHT AND HEAT AMONG INTRODUCED FLORIBUNDA ROSE VARIETIES IN ABSHERON CONDITIONS

Ofeliya Gafarova
Central Botanical Garden

Abstract: The article presents data from a study on ten varieties of floribunda roses (*'Anabell', 'Bella Rosa', 'Charleston', 'Eutin', 'Frisko', 'Krasnij Mak', 'Masquerade', 'Mecta, 'Regensberg', 'Rosemary Rose'*) that were observed in the conditions of the Absheron Peninsula. The study showed that the flowering of roses in these conditions stops with the onset of intense heat (from 39°C to 41°C and above) in the second half of July and until mid-August. The varieties differed in the level of water deficiency in the presence of regular watering. It was found that different varieties of roses have different water regimes in their leaves. The lack of watering causes a decrease in the length and width of the leaves in the studied varieties of roses, and the changes in width are more significant. The '*Charleston*' variety was found to have a relatively low water deficit and a smaller amplitude of changes, which may be due to the relatively high water-holding capacity of leaf tissues. The research revealed that high temperatures cause the greatest damage to young plants' leaves since actively growing tissue is less resilient than older tissue. This suggests that water-holding capacity indicators depend on varietal characteristics. The study also revealed that the following varieties are characterized by the highest water-holding capacity and minimal daily water loss: *'Masquerade'*, *'Bella Rosa'*, *'Eutin'*, *'Mesta'*, *'Regensberg'*. Furthermore, the most promising varieties in heat resistance are: *'Anabell'*, *'Bella Rosa'*, *'Eutin'*, *'Masquerade'*, *'Mecta'* and *'Regensberg'*, which are recommended for use in landscaping the region, as well as in breeding work.

Keywords: floribunda rose, drought resistance, heat resistance, water regime, Absheron.

***Corresponding Author:** ofeliya.qafarova@gmail.com

Received: 29 December 2023; Accepted: 24 February 2023; Published: 30 March 2024

DOI: 10.54414/CBYC5669

Introduction:

The Central Botanical Garden houses many introduced varieties of roses belonging to different garden groups, including roses of the floribunda group (Kafarova, 2014). Studying the biological and economically valuable traits of roses is important because it helps to identify their potential in new soil and climatic conditions.

The goal of the study was to identify highly decorative varieties of floribunda roses that are most suited to the conditions of Absheron, especially in years with abnormal weather conditions. This will help to create a crop assortment and select the best varieties for breeding, as well as their use in green construction.

The soils of Absheron are mainly "arid" semi-desert soils, with predominantly sandy and carbonate soils along the Caspian coast. The Botanical Garden's main soil type is brown loam and grey soil, where the research was conducted.

The climate of Absheron is characterized by very hot and dry weather in spring and summer, with January-February as the coldest months and July and August as the hottest months. The average air temperature is 27.3°C, with maximum temperatures reaching up to 35.8°C and sometimes even up to 40°C or higher. High maximum temperatures and prolonged drought make July and August the most unfavourable months for plant growth and development. (Isaeva, 2012), (Ruzaeva, 2008)

Drought is one of the most important factors affecting plants, and it is crucial to understand its negative effects to recognize the importance of plant adaptation to unfavourable environmental conditions. Therefore, several morphophysiological parameters characterizing the drought resistance of some varieties of floribunda roses were analyzed from 2014 to 2016 in the dry subtropical conditions of Absheron. Additionally, it is necessary to evaluate the breeding material's heat resistance when developing new rose varieties.

Research methods:

Ten varieties of roses from the floribunda group were introduced in the research material, including *'Anabell', 'Bella Rosa', 'Charleston', 'Eutin', 'Frisko', 'Krasnij Mak', 'Masquerade', 'Mecta, 'Regensberg', and 'Rosemary Rose'*. The studies were carried out between 2012 and 2016 at the experimental site of the Central Botanical Garden. The variety study of floribunda roses was conducted using the methodology of variety assessment and variety testing of ornamental crops (Bylov, 1971). The heat resistance of rose varieties was determined using the method of V.P. Tarabrin (Tarabrin, 1969). The water regime of plants was assessed according to the method of N.A. Gusev, taking into account the degree of damage to the leaf blades of experimental plants (Gusev, 1960). The study of water-holding capacity was carried out at different phases of plant development. The method used is based on the reaction of replacing hydrogen ions from the cells of the chloroplast membrane with magnesium ions in the chlorophyll molecule under the influence of high temperatures, which subsequently turn into brown pheophytin.

During the experiment, the leaves were submerged in a water bath at a temperature of 40°C and left there for 30 minutes. Afterwards, they were removed and temporarily placed in a crystallizer filled with water at room temperature. This process was repeated five times, with the temperature increased by 5°C each time.

Following this, the leaves were taken out of the crystallizer and filled with a solution of 0.2 M HCl, which turned them brown. After 10-20 minutes, the leaves were thoroughly washed with water and placed on plates. The extent of damage to the leaf blade was noted as a percentage.

To determine the water regime of the plants, 10 leaf blades were selected, counted, weighed, and kept in a drying oven at a temperature of 100°C to 105°C for two hours.

Water content (W), water holding capacity (R), and moisture content (L) in leaf samples were determined using the following equation:

$$W= 100 \cdot (M-M_2)/MR=100\cdot ((M-M_2) -(M-M_1)/M = 100\cdot(M_1-M_2)/M$$

$$L = W-R$$

M – mass of fresh sample; M_1 – sample weight after 24 hours;

Results and discussion:

Research has shown that with the onset of extreme heat (from 39°C to 41°C and above) on Absheron, roses stop blooming from the second half of July until mid-August. During this period, we analyzed a number of morphophysiological parameters characterizing the drought resistance of roses.

When studying the dynamics of soil moisture, it was revealed that in January and February, due to low air temperatures and low evaporation rates, moisture along the soil profile changes within small limits (Table 2).

In January, the soil moisture level in the 0-25 cm layer ranges from 19.2-20.5% for irrigated plots and 19.0-17.2% for rain-fed plots. However, in the 1-meter layer, these indicators are 21.4% and 16.1% for irrigated and rain-fed areas respectively. In February, the soil moisture level is slightly lower, with 17.5% in the upper layer and 19.4% in the lower layers.

Table 2. Dynamics of soil moisture by phases of rose development for 2016 (%).

Sites	Depth, cm	Phases of development				
		Beginning of the growing season (I-II stages)		III-IV stages of organogenesis	V-VII stages of organogenesis	budding and flowering (stages VIII-IX)
		January	February	March	April	May
		Substrate humidity, %				
irrigation	0-25	19,2	17,8	23,2	22,1	21,7
	25-50	20,5	18,2	22,8	22,0	19,4
	50-75	20,2	18,0	20,7	17,4	16,1
	75-100	21,4	19,4	17,1	16,0	14,2
rainfed	0-25	19,0	17,4	16,7	15,3	14,6
	25-50	17,2	16,8	15,2	14,3	13,3
	50-75	16,4	15,9	13,8	12,4	12,1
	75-100	16,1	13,5	12,9	11,9	11,7

In March, the air temperature increases and 4 times of watering of 10 litres per bush is carried out, resulting in an increase in the humidity of the top layer of soil to 23.2% and 17.1% in the bottom layer. In April, irrigation is carried out in the same way as in March, but the soil moisture level in the 0-100 cm layer varies from 22.1% to 16.0% due to rising temperatures and increased evaporation.

In May, during the full flowering phase, the moisture level in the soil profile ranges from 21.7% to 14.2%. With the onset of the hot period, watering is increased to 8-9 times per month with 10-12 litres per bush (Bylov, 1971).

It is observed from Table 2 that the humidity of the substrate changes in irrigated and rainfed areas because of an increase in air temperature and irrigation rates. To assess the impact of drought and the resistance of roses to it, the following basic parameters need to be studied primarily: the total water content of the leaves, the water-holding capacity of leaves, and the rate of water loss from leaves during transpiration.

It has been discovered that different varieties of roses have different water regimes for their leaves, which implies that water-holding capacity indicators are dependent on varietal characteristics. Under the influence of drought, the water-holding capacity of leaves increases in numerous varieties of roses, and the variety 'Frisko' is characterized by the highest daily water loss, demonstrating its vulnerability to droughts (Fig. 1). The total water content of the studied varieties was found to be quite high.

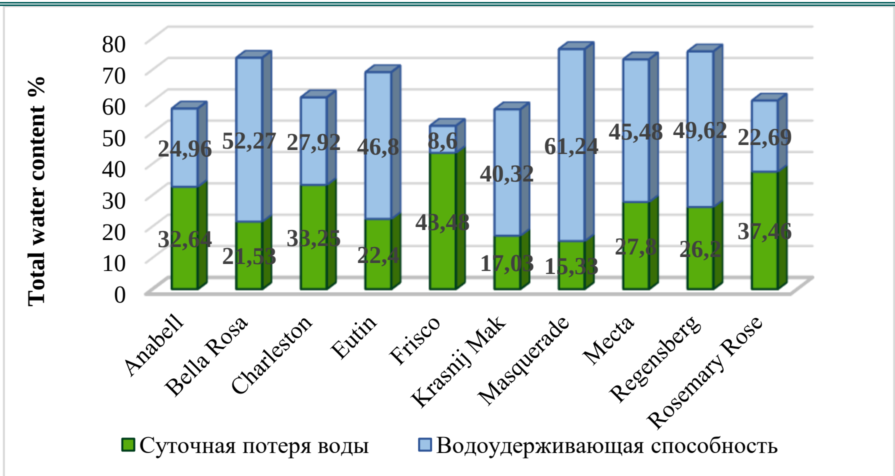


Fig. 1. Water regime of leaves of some varieties of floribunda roses.

It has been established that the rose varieties with the highest water-holding capacity and minimal daily water loss in Absheron are *'Masquerade', 'Bella Rosa', 'Eutin', 'Mecta', and 'Regensberg'*. In the irrigated area, the surface of the leaves of these roses appears smooth, glossy, and dark green with varying degrees of a waxy coating. However, roses grown on a rain-fed plot exhibit weak-leaved shoots and small leaves. Varietal differences were found in these varieties based on the response to growing conditions, as observed by measuring the length and width of the leaf blade. The water regime of leaves of some floribunda rose varieties is presented in Figure 1.

The conclusions drawn from the data obtained from Tables 1 and 2 are as follows: In the conditions of Absheron, the lack of watering causes a reduction in the length and width of the leaves of the studied varieties of roses. The changes in width are more significant. In the absence of watering, the leaves of some floribunda rose varieties fall off completely, while in regularly watered conditions, some varieties partially lose their leaves in autumn.

The study found that the varieties differed in the level of water deficiency, even with regular watering. The *'Charleston'* variety has a relatively low water deficit and a smaller amplitude of changes - 33.25%. This may be due to the relatively high water-holding capacity of leaf tissues, which is 27.92%. The results obtained when determining water deficiency in the leaves of the studied varieties of roses grown on a rain-fed plot are similar.

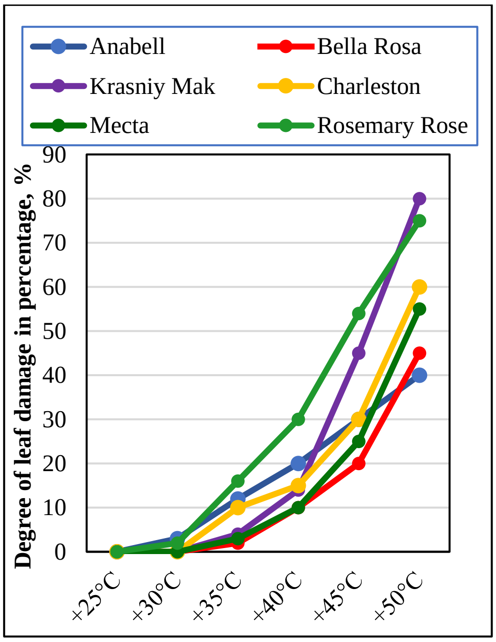
Table 1. Morphometric parameters of leaf blades for floribunda roses in irrigated and rainfed areas.

Sort	Sites	
	irrigation	rainfed
	Sheet length(cm)	
Anabell	5,4 ±0,1	3,0±0,1
Charleston	4,5±0,1	3,2±0,2
Frisko	5,6±0,2	3,1±0,4
Krasnij Mak	6,1±0,2	4,6±0,3
Rosemary Rose	5,7±0,15	3,6±0,2
	Sheet width (cm)	
Anabell	3,6±0,1	2,0±0,4
Charleston	3,1±0,1	2,2±0,3
Frisko	3,8±0,3	2,2±0,2
Krasnij Mak	4,2±0,4	3,4±0,4
Rosemary Rose	3,4±0,2	2,1±0,1

Based on the observations of water deficiency in the leaves of floribunda roses, it was found that the differences between the control and experimental variants are most prominent during the peak period of meteorological factors, particularly heat in July and August. Therefore, it is recommended to increase the number of waterings during this time by 8-9 times a month, which would require 86-98 litres of water per bush.

Additionally, a study was conducted to determine the heat resistance of some varieties of roses from the floribunda garden group. The results showed that the degree of leaf damage due to high temperatures varies widely among different varieties. Please refer to Figure 2 for further details.

Tests conducted on different varieties of roses have shown that the leaf blades of *'Frisco'* and *'Rosemary Rose'* are most susceptible to damage in hot weather when the air temperature ranges between +35°C to +40°C. At temperatures above +50°C, the leaves of these varieties completely die. However, other varieties like *'Krasnij Mak'*, *'Masquerade'*, *'Mecta'*, *'Regensberg'* do not exhibit any burns on their leaves even during the hottest periods of summer, and their leaves remain intact even at a high temperature of +45°C, which is the maximum temperature for tissue death.



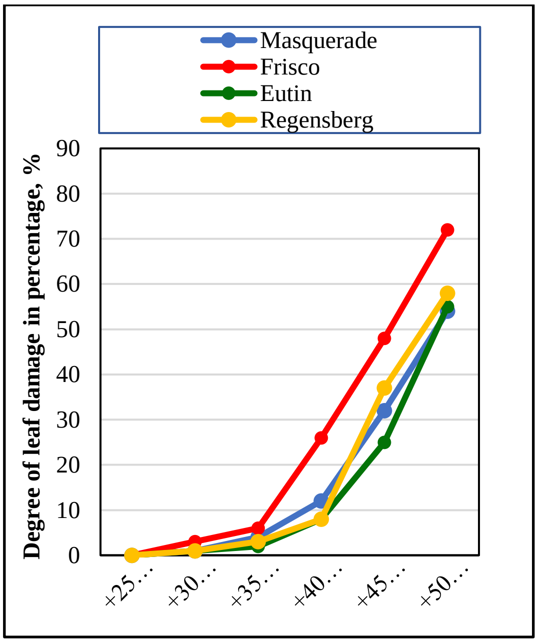


Fig. 2. Heat resistance of some varieties of floribunda roses.

The study shows that high temperatures cause more damage to young plant leaves, as they are less stable than old tissues.

Conclusıon:

A study was conducted on 10 different varieties of floribunda roses including *'Anabell'*, *'Bella Rosa'*, *'Charleston'*, *'Eutin'*, *'Frisko'*, *'Krasnij Mak'*, *'Masquerade'*, *'Mecta'*, *'Regensberg'*, *and 'Rosemary Rose'*. The study found that in Absheron, the roses with the highest water-holding capacity and minimal daily water loss were *'Masquerade'* at 61.24%, *'Bella Rosa'* at 52.3%, *'Eutin'* at 46.8%, *'Mesta'* at 45.5%, and *'Regensberg'* at 49.62%. If these roses are not watered enough, their leaves will become smaller in both length and width, with the changes in width being more significant. On the other hand, *'Frisko'*, *'Krasnij Mak'*, and *'Rosemary Rose'* are highly productive and have great decorative properties when regularly watered.

In conclusion, it was discovered for the first time that six varieties of roses introduced in the Central Botanical Garden (*'Bella Rosa'*, *'Charleston'*, *'Eutin'*, *'Masquerade'*, *'Mecta'*, *and 'Regensberg'*) have adapted well to the hot and dry conditions of Absheron. These roses are recommended for use in landscaping the region and in selection work.

References:

Azieva, I.A. (2015) Water regime for growing roses in a greenhouse. Strategic development of the agro-industrial complex and rural areas of the Russian Federation in modern international conditions: Materials of the international. scientific-practical conf. Volgograd: 186-190

Bylov, V.N. (1971) Fundamentals of variety study and variety assessment of ornamental plants during introduction. Bull. Head. Nerd. Sad Academy of Sciences of the USSR, 81: 69-77

Gusev, N.A. (1960) Some methods for studying the water regime of plants. Leningrad: All-Union. nerd. community 60 s

Zaitsev G.N. (1984) Mathematical statistics in experimental botany. M.: Science: 424 p.

Isaeva E.E., Gubanova T.B., Klimenko Z.K. (2012) Morphophysiological characteristics of some varieties of ground cover roses in the conditions of the Southern Coast of Crimea. Bull. GNBS, 105: 83-87

Kafarova, O.O., Klimenko, Z.K. (2014) On the introduction and selection of floribunda roses in the conditions of Absheron. Collection of scientific papers GNBS, Yalta, 136: 157-163

Morgun, V.V. (2010) Ecophysiological and genetic aspects of adaptation of cultivated plants to global climate change. Physiology and biochemistry of cultivated plants to global climate change, 42, 1: 3-21

Tarabrin, V.P. (1969) Heat resistance of woody plants and methods for its determination in the field. Bull. Ch. nerd. Sada AN USSR, 74: 53-56

Ruzaeva, I.V. (2008) Bioecological features of roses in the forest-steppe and steppe Volga region: abstract. dis. Ph.D. biol. Sci. Tolyatti: 19

Ovchinnikov, A. S. (2012) Methodology of calculation and justification of the wetting parameters in the open field and greenhouse. Environmental Engineering, 4: 29

IMPACT OF NANOTECHNOLOGY DEVELOPMENT ON ECOLOGY AND ENVIRONMENT

A.S. Abiyev
Joint Institute for Nuclear Research

Abstract: The study examined the impact of nanotechnology on the environment and ecology. It was found that smaller-sized materials are more active, hence nanomaterials have a significant impact on the environment. The study highlighted the importance of observing safety protocols when handling nano-sized materials. Furthermore, the study explored the resistance of nanomaterials to external factors such as pressure, temperature, and radiation. It was discovered that despite their high activity, nanomaterials are resistant to external influences and tend to maintain their shape and size. The use of bionanomaterials in medicine was found to solve several issues. The study also identified new opportunities and challenges that arise from the use of nanomaterials. Lastly, the study investigated different physicochemical properties of metal and metal oxide nanoparticles and indicated the issues surrounding their disposal.

Keywords: Nanomaterials, ecology, environment, disposal, external influences.

***Corresponding Author:** afsunabiyev@gmail.com

Received: 15 January 2023; Accepted: 28 March 2023; Published: 30 March 2024

DOI: 10.54414/RMBE7956

Introduction:

Nanotechnology has enabled new research in various areas. The study of materials at the nanoscale has revealed that their physicochemical properties change when they become smaller. Some materials become more active at smaller sizes, thus allowing us to discover new functions in them (Wongkaew, 2019; Gupta, 2022; Shah, 2020). Metals are commonly used materials due to their electrical conductivity and are used for the transmission of electrical energy. Aluminium and copper are the most commonly used metals in appliances and devices. The mechanical strength of metals allows them to be used in various devices as a defence system. Iron and steel, for example, can be used to obtain construction materials of different heights. However, recent studies have shown that metal nanoparticles and composite materials based on them have different properties. Metal nanoparticles are quite resistant to external influences, making them useful for various applications. When aluminium nanoparticles with a size of d = 40-60 nm were irradiated with an electron flood of energy E = 2-3 MeV at different intensities ($\Phi = 4.16\cdot10^{16}$ cm^{-2}, $1.2\cdot10^{17}$ cm^{-2}, and $1.03\cdot10^{18}$ cm^{-2}), no major changes occurred in their crystal structure (Abdullayeva, 2020; Jabarov, 2021). These nanoparticles have a highly symmetrical cubic structure that is resistant to electron flow, oxidation, and external influences. Although a small amount of oxidation is observed on their surface, the material retains its chemical properties. Similar properties are observed in differential thermal analysis studies conducted at high temperatures. Despite the increase in temperature, there is no structural phase transition, and the cubic symmetry is maintained (Abiyev, 2021).

Aluminium nanoparticles have a wide range of applications in producing composite materials. By adding aluminium nanoparticles to polymers, the electrical conductivity of the composite materials increases, making them electrically active (Gojayev, 2020). Polymer nanocomposite materials have higher flexibility and resilience to various external influences, making them suitable for use in devices where conventional aluminium wires cannot be used. Additionally, thin layers of materials with interesting physical properties have been widely studied due to the optical properties found in them. These discoveries expand the application possibilities of thin layers of materials (Ibrahimova, 2024).

Ongoing research is focused on studying nanomaterials and discovering their new functions. However, it is important to study the harmful effects of these materials as they retain their activity even after use. Nanoparticles are small enough to easily enter living organisms, which are typically made up of micrometre-sized cells. Therefore, living organisms should be excluded from nanomaterials. It's crucial to avoid touching nanoparticles by hand, as they can enter the body when we breathe. When working with them in labs to study their physicochemical properties, it's necessary to use masks and gloves. This study aims to investigate the impact of nanomaterials on ecology and the environment.

Research methods:

The study of environmental problems and the impact of nanomaterials on the environment has been carried out using various methods. The study examined the development stages of nanotechnology and the research methods and objects used in this field and analyzed the results obtained. It is known that as the properties of materials are discovered, new research methods are developed based on them. These new research methods allow for more accurate results. Therefore, the working principles and research possibilities of high-precision electron microscopes, atomic force microscopes, and tunnelling microscopes were defined. The obtained results were analyzed and new results obtained during the study of nanomaterials were investigated. The ecological problems of this data were investigated, and the difficulties arising due to smaller sizes were highlighted. It is important to note that all objects existing in nature are influenced by the environment. As a result of these effects, there is an interaction between substances and the environment. This interaction can lead to two cases: firstly, changes in the substance caused by the environment, and secondly, changes in the environment caused by the substance. In this study, each of these cases was investigated separately.

Results and discussions:

Nanomaterials are widely used in various fields, particularly in modern electronics. However, when electronic devices that use these materials reach the end of their service life, they can pose a risk to the environment. Disposing of nanomaterials can be challenging because of their hazardous nature. Capacitors are a common component in electronic devices, and capacitors made using nanomaterials are increasingly popular. Figure 1 shows a conventional capacitor and a capacitor made using nanomaterials.

Although these capacitors serve the same purpose, they differ in size. By purchasing thinner layers, it's possible to acquire multifunctional capacitors, leading to smaller-sized modern devices. Televisions have also undergone miniaturization due to obtaining functional properties in smaller sizes. By replacing the electron beam with smart screens, a better-quality image is achieved. Therefore, research is continuing to study known materials at the nanoscale.

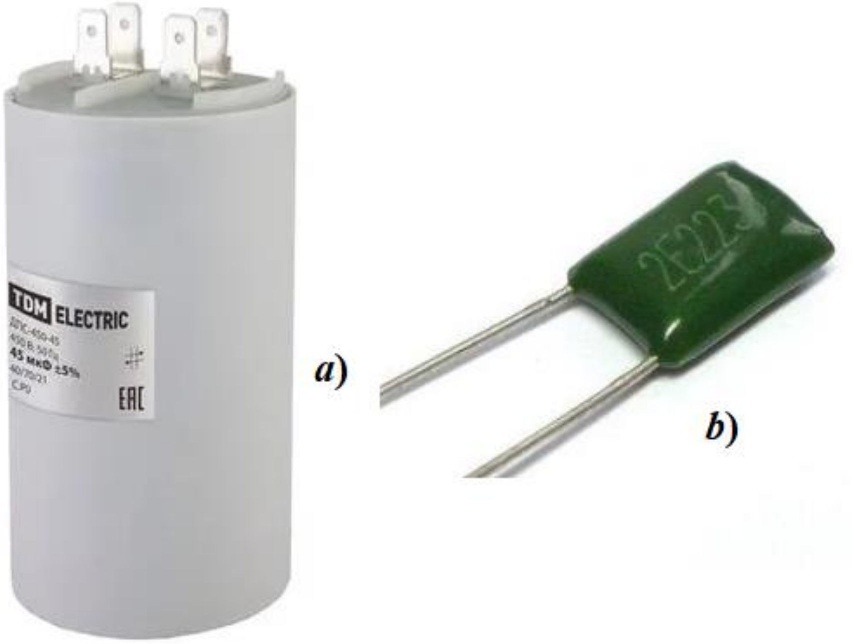


Figure 1. Conventional (a) and nanomaterials (b) capacitors.

With the advancement of nanotechnology, researchers have observed changes in the devices used for research. Figure 2 displays electron microscopes. In Figure 2a, an electron beam tube-based electron microscope is depicted. This device is relatively large and can provide enlarged images of research objects via its screens. Figure 2b shows a modern scanning electron microscope that has been made using nanomaterials. This microscope can be used to analyze not just the surface structures of materials, but also their chemical composition. This method can also be used to ascertain the percentage of chemical elements present in the sample being analyzed.

Atomic Force Microscopes (AFMs) allow for more extensive research, making it possible to study the surface structure of nanomaterials in 3D format. This leads to obtaining more information about the surface relief of these materials.

When compared to older devices, modern AFMs differ in terms of volume, functions, and accuracy. This is due to the advancements in nanotechnology. However, as nanotechnology progresses, it becomes increasingly important to consider the relationship between nanomaterials and nature. Powdered nanoparticles can easily enter living organisms, which is why safety rules should be followed when purchasing, studying, and applying these materials. Moreover, these materials should be properly disposed of at the end of their useful life. End-of-life devices should be disposed of in special containers, and many devices, such as electric batteries, have a special symbol indicating that they should not be placed in the same container as other waste.

New types of detergents have recently been introduced for car washing that creates a chemical layer on the surface of the car. This layer helps prevent dust particles and rainwater from sticking to the car and protects it for up to seven days. However, using these detergents can harm the environment as the thin layers formed on the surface are later thrown into the environment. Similarly, nanotechnology-based paints can be used to protect buildings from pollution, but these materials may undergo chemical transformations over time.

As technology continues to advance, we are discovering new environmental problems, and the development of nanotechnology is no exception. The primary concern is that nanomaterials, being smaller and more active, can have a greater impact on the environment. Therefore, it is not acceptable to dispose of them carelessly.

***a*)**

***b*)**

Figure 2. Electron microscope (a) and Scanning Electron Microscope (b).

Research into bionanomaterials is a key area of nanotechnology, which has helped solve many medical problems. The use of these materials has led to the development of new implants and nanocomposites, which are widely used in medical devices and the preparation of implants (Velu, 2022).

Conclusıon:

During the research, modern research methods and their possibilities were investigated. The advantages and disadvantages of nanotechnology were studied, and its impact on ecology and the environment was analyzed. It was discovered that materials with smaller sizes have more active physicochemical properties. The comparison of standard and nanotechnology transducers revealed a decrease in the volume of converters and an increase in functions. The side effect of nanotechnology was analyzed through the comparison of electron microscopes, which showed modern electron microscopes to be multifunctional devices capable of analyzing both surface structure and chemical composition.

The study also investigated the relationship between detergents and paints obtained through nanotechnology and their impact on the environment. It was determined that these materials are chemically active substances that can affect the environment after a certain period. The adverse effects of these materials become inevitable after their useful life, and their disposal should be considered simultaneously with their use to prevent any environmental harm.

References:

Wongkaew, N., Simsek, M., Griesche, C., Baeumner, A.J. (2019) Functional nanomaterials and nanostructures enhancing electrochemical biosensors and lab-on-a-chip performances: recent progress, applications, and tufure perspective. Chemical Reviews, 119: 120-194

Gupta, D., Varghese, B.S., Suresh, M., Panwar, C., Gupta, T.K. (2022) Nanoarchitectonics: functional nanomaterials and nanostructures – a review. Journal of nanoparticle Research, 24: 196

Shah, K.W., Huseien, G.F., Xiong, T. (2020) Functional nanomaterials and their applications toward smart and green buildings. New Materials in Civil Engineering, 2020: 395-433

Abdullayeva, T.T., Jabarov, S.H., Huseynli, S., Abdurakhimov, B.A., Abiyev, A.S., Mirzayev, M.N. (2020) Effect of electron beam on the crystal structure of nanoscale Al particles. Modern Physics Letters B, 34: 2050231

Jabarov, S.H., Abdullayeva, T.T., Huseynli, S., Mirzayev, M.N., Abiyev, A.S., Demir, E., Tashmetov, M.Yu., Abdurakhimov, B.A. (2021) Comparative properties of irradiated Al nanoparticles via vibrational spectroscopy and X-ray diffraction method. Modern Physics Letters B, 35: 2150512

Abiyev, A.S. (2021) Physicochemical processes in aluminum nanoparticles at high temperatures. Advanced Physical Research, 3, 3: 137-141

Gojayev, E.M., Aliyeva, Sh.V., Salimova, V.V., Jabarov, S.H. (2020) The effect of UV irradiation on the dielectric properties of bionanocomposites with fillers of biological origin and metal nanoparticles. Modern Physics Letters B, 34: 2050186

Ibrahimova, L.N., Abdullayev, N.M., Aliyev, M.E., Garashova, G.A., Aliyev, Y.I. (2024) Phase formation process in CdSe thin films. East European Journal of Physics, 1: 493-496

Velu, R., Calais, T., Jayakumar, A., Raspall, F. (2022) A comprehensive review on bio-nanomaterials for medical implants and feasibility studies on fabrication of such implants by additive manufacturing technique. Materials, 13: 92.