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ABSTRACT

of the dissertation for the degree of Doctor of Science

STUDYING, EVALUATION AND SELECTION OF THE POTATO AND EGGPLANT SORT SAMPLES

Speciality: 3103.04 – Selection and seedage

Field of science: Agrarian

Applicant: **Aladdin Gismat Eyvazov**

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The work was performed at the Selection, Potato growing and Seedage departments and Functional Analysis Laboratory of the "Scientific Research Institute of Vegetable Growing" public legal entity of the Ministry of Agriculture of the Republic of Azerbaijan.

Scientific consultant:	Doctor of agrarian sciences, professor, Corresponding member of ANAS **Zeynal Iba Akparov**
Official opponents:	Doctor of agrarian sciences, professor, academician **Maharram Pirverdi Babayev**
	Doctor of agrarian sciences, associate professor **Vugar Suleyman Salimov**
	Doctor of agrarian sciences, associate professor **Varis Mukhtar Guliyev**
	Doctor of agricultural sciences, professor **Mubariz Isa Mammadov**

Dissertation council BED 3.10 of Supreme Attestation Commission under the President of the Republic of Azerbaijan operating at the "Scientific Research Institute of Vegetable Growing" public legal entity of the Ministry of Agriculture.

Chairman of the Dissertation council: ______________	Doctor of agrarian sciences, associate professor **Aladdin Alirza Taghiyev**
Scientific secretary of the Dissertation council: ______________	PhD in agrarian sciences, associate professor **Aida Bahram Najafova**
Chairman of the scientific seminar: ______________	Doctor of agrarian sciences, associate professor **Aladdin Nemat Sadigov**

INTRODUCTION

Relevance and elaboration level of the topic. The main condition of the economic stability and social sustainability of the country is the reliable provision of the population with the food products. In order to effectively solve this problem, the increasing of the local production of the potato and vegetable plants is also significant importance along with the development of the grain plants. In the republic, the volume of the potato production reached 1031113.8 tons in 2021 and 1042872.0 tons in 2022. However the main part of the planted seed potatoes is imported from the other countries, which does not meet the necessary requirements. So along with the seed potatoes, the pathogens of dozens of the different diseases and pests is also infects the plantings with the entering the republic. Therefore,it is a very urgent matter to provide farmers with the good quality seed potatoes of local origin. The high-quality seed tubers of the optimal size (40-60 g) should be free from the causative agents of the fungal, bacterial and viral diseases.

A number of the viral diseases are widely observed in the potato plantings which is in the irrigated foothills and mountainous regions of the republic. However, in the mountainous regions the spread dynamics of this disease is much weaker than the irrigated lowland regions. This is due to the fact that some aphids that spread viral diseases are relatively few in the mountainous regions. That's why, it is too necessary to carry out the modern research on the selection and seedage of the potato in both lowland and mountainous regions.

In the "Strategic Roadmap for the production and processing of agricultural products in the Azerbaijan Republic" approved by the decree of the President of the Republic of Azerbaijan dated December 6, 2016, the target is to increase the cultivated areas of potatoes to 64 thousand hectares and the production of potatoes to 1400 thousand tons.[1] In order to achieve this target, it is of great importance to create, test the potato varieties with high yield and resistance to the major di-

[1] "Azərbaycan Respublikasında kənd təsərrüfatı məhsulları istehsalına və emalına dair Strateji Yol Xəritəsi". Azərbaycan Respublikası Prezidentinin 2016-cı il 6 dekabr tarixli fərmanı ilə təsdiq edilmişdir.

seases, to cultivate the seeds of the introduced varieties allowed planting in the republic. In this regard, the collection materials - varieties, hybrids intended for use in the selection program, collected in the "Scientific Research Institute of Vegetable Growing" public legal entity, plays too reliable source role for the creation of more productive and high-quality varietiesresistant to stress.

Although as a result of the extremely rapid development of the biotechnology science, the usage possibilities of the virus-free potato seeds reactivates the stagnant situation in the potato production, the radical solution of the problem is very depends on the creation of new high-yielding, high-quality and resistant varietiesof the potatoes on modern scientific bases, on the improvement of the seedage organization and management methods.

The eggplant varietysamples of the second type were taken as the object of the study.

The eggplant is a food product widely used by our people among the vegetable plants. It is cultivated in a fairly wide area. According to the statistical data on the cultivationareas, production and average productivity of the eggplant, in the territory of the Republic, as well as in the Absheron economic region and Baku city from 2008 to now, the eggplant planting areas have increased from 4320.1 ha to 6098 ha, the production has varied between 76248-105931 tons by years. At this time, the average productivity was 134-189.3 cwt/ha. The highest cultivated area and crop production were recorded in 2010 (6,098 ha and 105,931 tons, respectively). According to 12-year data, in the republic the planting area of the eggplant was 5,325,175 ha, and production was 86,519.73 tons, and at that time, the average productivity was 162,775 cwt/ha. The most planting area was 49 ha in 2014 in the Absheron economic region, and 99.6 ha in 2019 in the Baku city. In the Absheron economic region the highest eggplant harvest was collected in 2011, at that time, the average productivity was 143 cwt/ha. In the Baku city a record harvest of 11,763.4 tons was recorded in 2019 (data as of October 1), and at that time, the average productivity was 1,184.6 cwt/ha. The fact that the numbers are so high in 2019, is probably related to the fact that the eggplants have been planted in the greenhouses around Baku in the recent years.

In general, the productivity is 15-20 t/ha in the farms of the republic. However, the productivity of the eggplant may reach 60-80 t/ha under normal conditions. It has many reasons. The main reason is not planting varieties suitable to the soil-climate conditions of the regions and not using the correct cultivation technology.

In the Independent Azerbaijan Republic, in connection with the transition to a new agrarian policy as in other fields of the agriculture, the process of the reconstruction of the production-commodity relations continues in terms of the requirements of the market economy in the vegetable growing field, too. In order to satisfy the population's demand for vegetable products, the production volume of these plants should be increased.

Although the vegetable growing has an ancient history in Azerbaijan, the production level of the vegetable products has not reached the level that will provide the population all year-round. And the increase of the production should not be due to the expansion of the planting areas, but should be due to the increasing of the productivity.

The conducted researches show that the climate and soil conditions of the vegetable growing regions of our republic are very favorable for obtaining the abundant and quality products.

The object and subject of the research. The potato and eggplant sort samples have been the object of the research, and the selection of the primary donors by evaluating physiological, biochemical and biomorphological indicators among the local and introduced sort samples in order to create high-yielding, quality and resistant sorts against the adverse factors of the external environment, to obtain a preintended amount of the potato harvest from the potatoes based on the optimal values of the various photosynthetic parameters and the recommending the cultivar models of the eggplant plant according to the various parameters (physiological, biomorphological, biochemical) have been the subject of the research.

The goals and objectives of the research. The comparative evaluation of the biomorphological, physiological, biochemical properties, the resistance of the potato and eggplant genotypes of various origins to the abiotic and biotic factors in the field conditions, the selection of the high-yielding, quality, resistance donor samples in the creation of the new sorts and their application to the manufacturing in future selection work, the studying of their physical and chemical properties were the main goal of the research.

In order to achieve this goal, the following tasks are set:

On the potato plant:

- comparative research of the local and introduced genotypes according to the biomorphological, physiological and biochemical indicators under irrigation condition in the field;

- grouping and selection of the tubers of the sort samples according to the results of the biochemical analyses;

- studying the change dynamics of the biomorphological, photosynthetic and biochemical indicators depending on the planting schemes and the density of the plants in the row;

- determination of the optimal indicators of the net productivity of the leaf surface, photosynthetic potential and photosynthesis to obtain a preintented amount of the high harvest from the potato plant depending on the planting schemes;

- determination of the correlation between various morphological and biochemical indicators and their analysis;

- proposing of the optimal model of the new sort for increasing the harvest of the potato based on the results of the researched signs and characteristics.

- On the eggplant plant:

- evaluation of the eggplant sort samples of the different origins according to the biomorphological, physiological and biochemical indicators;

- placing of the selected samples according to the various signs to the control seed-plot, conducting phenological observations on them, studying valuable-farm characteristics;

- creation of the productive and adaptive sorts against the external environmental factors, carrying out hybridizations and obtaining new hybrid generations;

- research and selection of the productivity and resistance to the biotic stresses of the hybrids and perspective sorts in the different generations;

- studying of the sort samples according to the biological, farm maturity and productivity;

- continuous selection of the selected primary donors according to the biomorphological, physiological and biochemical indicators;

- grouping and selection of the sort samples fruits according to the results of the comparative biochemical analyzes;

- determination of the correlation between researched photosynthesis indicators and their analysis;

- proposing new sort models according to the different indicators (physiological, biomorphological, biochemical).

Research methods. The field experiments, phenological observations, the research of biomorphological, physiological, biochemical characteristics, evaluation, hybridization, selection, harvesting, statistical analysis of results, determination of correlations between various physiological and biochemical indicators were carried out according to the relevant methods during the implementation of the dissertation work. The selection materials of different origins of the “Scientific Research Institute of Vegetable Growing” public legal entity were used for the research.

The main provisions taken to the defence:

1. Depending on the planting scheme and the density of the plants in the row, the regularities of the photosynthetic indicators of regionalized potato genotypes - the leaf surface, photosynthetic potential, specific surface density of the leaves, plastid pigments, and the change dynamics of the total wet and dry biomass were studied and proposed to the selection and manufacturing.

2. Depending on the planting schemes and the density of the plants in the row, the change dynamics of the biochemical indicators of the potato sort samples - the dry matter, starch, nitrates, and biomorphological indicators were studied and selected by grouping.

3. Based on the researched potato genotypes, depending on the planting scheme, the optimal models were created to obtain a preintended amount of the harvest.

4. In order to create an optimal potato sort model on the biomorphological, physiological and biochemical bases, the selection

work was carried out by the clone selection method and the suggestions were given for obtaining valuable forms.

5. The parental forms selected from the eggplant collection samples were involved in the selection process through the hybridization and the sort models were proposed for the creation of the valuable forms according to the various indicators (physiological, biomorphological, biochemical).

6. The sort samples of the potato and eggplant were evaluated according to the physiological, biochemical and biomorphological indicators, the primary donors distinguished both according to the individual indicators and complex important farm indicators were selected among them and proposed for the selection according to the productivity, quality and adaptability.

7. The high correlations were determined between the physiological and biochemical parameters of the potato and eggplant sort samples.

Scientific innovation of the research. For the first time in Azerbaijan, for the creation of the new sorts of the potato and eggplant, in contrast to the traditional selection methods, the selection work was carried out complexly, using physiological and biochemical indicators.

20 sort samples of the potato and 59 of the eggplant were evaluated according to the physiological, biochemical and biomorphological indicators, the primary donors (the Farida, Bellarosa and Elfe sort samples for the potato plant, 144, 160, 161, 164, 167, 173, 174, 179, 180, 180/A, 183, 187, 200, 206, 225, 226, 229, 236, 242, 256 sort samples for the eggplant plant) which distinguished both according to the individual indicators and complex important farm indicators were selected among them and recommended for the selection work to be conducted according to the productivity and adaptability (the resistance to the lighting, drought and heat).

In two sorts of the potato the change dynamics of the photosynthetic, biochemical and biomorphological indicators were researched depending on the planting scheme and the density of the plants in the row, and the change of the leaf surface area, photosynthetic potential, the net productivity of the photosynthesis, the amount of the chlorophyll in the leaves, wet and dry biomasses, the sugar in the tubers and fruits, dry substance, nitrates, as well as the amount of the starch in the tubers were detected in different ways depending on the planting density in the ontogenesis of the studied plants, and the possibility of the managingof the physiological and biochemical processes taking place in the plants was clarified based on the character of this change. Besides of this, the optimal model was determined for the first time, based on the average prices of the assimilation surface of the leaf (Sevinj-30.2, Amiri-600 – 23.8 thousand m^2/ha), photosynthetic potential (Sevinj – 1778, Amiri-600 – 1992 thousand $m^2 \cdot$day/ha) and the net productivity of the photosynthesis (8 g/$m^2 \cdot$day for the Sevinj and Amiri-600 sorts) which ensured a preintended high harvest from the potato sorts depending on the planting scheme.

As a result of the researches, the sort models were determined according to the different indicators (biomorphological, physiological, biochemical) in the eggplant plant.

The correlation relations were determined between the different physiological, biochemical and biomorphological indicators of the potato and eggplant plant sorts.

Theoretical and practical significance of the research: The correlation relations between the physiological, biochemical, biomorphological indicators depending on the planting scheme and the density of the plants in the row for the regionalized sorts of the potato plant were determined and it was recognized that they have important theoretical significance in the management of the various metabolic processes occurring in the plant life.

For the first time in Absheron, 20 potato and 59 eggplant sort samples were evaluated according to physiological, biochemical and biomorphological indicators, and they have important practical significance in selecting valuable donors for future selection works based on productivity, quality and resistance to abiotic factors.

The biochemical composition and usability of the fruits and tubers of the selected primary donors were appointed.

The approbation and application of the research: The main results of the dissertation work were discussed and made reported at the Scientific Councils of the “Scientific Research Institute of Vegetable Growing” public legal entity (2015-2019), 8th International Scientific-practical conference (Ganja, 03-04.11.2016), Republic scientific-practical conference held on "The increase ways of the soil fertility in Azerbaijan" (07.08.2016, Ganja), International Scientific-practical conference (June 26, 2018, Kharkiv) held on "The current state and development perspectives of the vegetable growing" (for the 70th anniversary of the establishment of the institute and the memory of the outstanding scientist P.F. Sokol), IV and V international scientific-practical conferences held on "The Science Week in Krutakh-2018, 2019" (Kruty, Chernihiv region, Ukraine, March 12-13, 2018, 2019), XV and XVI international scientific-practical conferences held on "Food. Ecology. Quality” (Novosibirsk-30.06.2018, Barnaul-24-26.06.2019),International scientific-practical conference held on "Vegetable, melon and potato growing: state, problems and development perspectives" (01.06.2018, Tashkent).

Based on the research materials, 16 articles (eight of them in the journals included in international index databases), 4 books, 11 theses and 8 information bulletins reflecting the main content of the dissertation were published in the republic and abroad.

Name of the organization where the dissertation work was carried out: The research work was carried out in the “Scientific Research Institute on Vegetable Growing” public legal entity of the Ministry of Agriculture of the Azerbaijan Republic.

The structure and size of the dissertation work: The dissertation work was 348486 characters long and consists of introduction (19250 marks), 6 chapters (319231 marks), results (8199 marks), practical proposals (1806 marks), a list of 363 references which are in Azerbaijani, Russian and other languages and annexes. 58 tables and 46 pictures were given in the dissertation work.

CHAPTER I.
LITERATURE SUMMARY

This chapter provides a summary of literature sources on the research topic. References to the works of the local and world scientists mainly in the field of the potato and eggplant plant selection are explained in detail. It should be noted that the literature sources on the selection of the potatoes and eggplants are contradictory, and the selection of the starting material with the modern scientific approaches and the research works on the creation of a new sort based on the optimal model have not been mostly met.

CHAPTER II.
CONDITION IN WHICH THE RESEARCH WAS CONDUCTED, MATERIALS AND METHODS

Condition in which the research was conducted. The research work was carried out in 2015-2019 in the Absheron AEF, Selection, Potato growing and Seedage departments and Functional Analysis Laboratory of the "Scientific Research Institute on Vegetable Growing" public legal entity.

The soils of the Absheron AEF are mainly gray-brown soils with poor humus. The amount of the mire (<0.001 mm) and physical clay (<0.01 mm) in these soils varies between 10-42% and 21-78%. The amount of the humus in the upper layer of the soil is 1.2-1.5%.[2] Besides of this, the saline and salinized soils and sandy areas are also met here in the form of the glade. The soils of the Absheron AEF of the "Scientific Research Institute on Vegetable Growing" public legal entity are alkaline in nature (pH ranges from 7.3 to 9.0). According to the results of the multi-year researches, the amount of the sunny hours is 2200-2400 hours/year in Absheron. In the research years, the temperatures above 12°C are observed starting from the April month. The monthly maximum temperature was observed in 2016 and 2017 in August (28.8°C and 28°C, respectively), in 2018 in July (29.6°C), and in 2019 in June (27°C).

In May, June and July months, the amount of the precipitation was 0-8.9 mm per year during which irrigation water was used several times to ensure the normal development of the potato precisely.

The duration of the sunshine was 243.0 and 299.7 hours in May, and 311.7 and 300.0 hours in July and August in 2016 and 2018,

[2] Tərəvəzçinin sorğu kitabı. Müasir elmin və son ilin nəticələri əsasında işlənmiş üçüncü nəşri. / F.H. Məmmədovun redaktorluğu ilə. – Bakı: Qanun, – 2006, – 296 s.

respectively. In 2017 and 2019, the maximum level of the sunshine was observed in July (347.0 and 349.5 hours, respectively).

So in the research years, the temperature of the air, the amount of the precipitations and the duration of the sunshine differed by years, and the most favorable condition for the vegetation of the potato and eggplant were in 2017.

From the experiments carried out at the "Scientific Research Institute on Vegetable Growing" public legal entity, it was known that in order to get 250-450 cwt/ha of potato tuber harvest, 30-60 t of manure, N_{90-160} P_{95-145} $K_{140-190}$ kg (with the affective substance account) should be given to the soil. There are 13.5 kg of NPK, including 5 kg of nitrogen, 2.5 kg of phosphorus and 6.0 kg of potassium in 1 t of manure. If 30-60 t of manure is given to 1 ha of plough, then 150-300 kg of nitrogen, 75-150 kg of phosphorus and 180-360 kg of potassium or 405-810 kg of NPK enter to the soil, which are used by plants for several years. If we take into account that the potato plant absorbs 30% of nitrogen, 40% of phosphorus and 60% of potassium in the year of production, then 45-90 kg of nitrogen, 30-60 kg of phosphorus and 108-216 kg of potassium can be extracted from 30-60 t of manure.[3]

The material of the research. As research material, the sort samples differ from each other according to the vegetation period and ripeness of the potatoes and eggplants taken from the gene pool of the "Scientific Research Institute on Vegetable Growing" public legal entity and introduced, as well as, the collection samples of different origins obtained from ARPBI, AUSRPGSS, GRI, World Vegetable Center in 2016-2017 were used.

In the collection area the characteristics of 117 sort samples of the eggplant were researched in comparison with the Zahra and Ganja sorts without repetition and the brief biomorphological character of 114 of them was given.

Research methods. The selection of the site for setting up the field experiments, the preparation of the soil for planting and care of the plants were carried out in accordance with the generally accepted

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[3] Tərəvəzçinin sorğu kitabı. Müasir elmin və son ilin nəticələri əsasında işlənmiş üçüncü nəşri. / F.H. Məmmədovun redaktorluğu ilə. – Bakı: Qanun, – 2006, – 296 s.

relevant recommendations.

2.1. The methods of the selection

The clone selection methods were mainly used in the researches. The following selection methods were used in the potato selection: the individual selection in the 1st year of the seedlings; the selection of the important farm signs complexly individual in the period from the 2nd year of the hybrids to the competitive testing; the clone individual selection according to the plant and tuber by the generation.

2.2. Scheme of the selection process

In the selection process, the collection, parent, seedling (1st year), 2nd and 3rd year of the hybrids (based on the 2nd year tuber generation), preliminary test, main and competitive seed-plots were used. In addition to these seed-plots, the work was carried out in parallel in the next reproduction test, agroecological test and increasing seed-plots.

Clone selection. At the initial stage, the sorts adapted to the local soil and climate conditions were selected from among the collection samples, and the tubers (clones) obtained from the plants which differed with the positive farm characteristics were planted in separate lines the next year. Inside those lines, one or several lines differing from the parent form with the positive farm characteristics were selected, and each of the selected lines was studied separately and multiplied in the next year. When the amount of the healthy seeds tubers in each line was 120-130 pieces, that line was included in the initial test seed-plot.

2.3. The growing of the elite potato seeds

The elite seed was grown with 2 methods: method I - with the clone selection method; method II - by growing mini-tubers in vitro condition through a meristem cleared of viruses. In method I, the elite seed harvest of the potato can be collected in 4-6 years. Method II is considered more reliable in the growing of the virus-free elite seed. For this, at first, a meristem cleared from the viruses, is prepared (the plants are obtained in a test glass). These plants are divided into several parts, multiplied and planted to the greenhouse. As a result, the mini tubers without viruses, which are 5-10 grams in weight, are obtained that these are called super-superelite. In such mini tubers, the absence of viruses was checked by using an electron microscope. Later, the mini tubers were planted in a clean field and superelite was obtained, and in the 2nd year (by planting superelite) elite was obtained.

2.4. Obtaining elite seeds by clone selection method

2.4.1. Plant selection technology (1st year). The selection of the clones is considered the main method in the elite seed of the potato. The seed material is cleaned from sort mixtures, diseased and crabed tubers with this method.

At the first stage, the plants of any sort are selected in budding and flowering phases. The selected plants must meet the following conditions:

- the bushes should be identical with the characteristics of the sort according to their morphological characteristics;
- the trunks must be healthy and have the same shape;
- the number of the trunks should be average or more specific to the sort.

The selected plants should be marked with either wooden stakes or ribbon tied to the trunk.

The final selection is carried out at the collection time.

The marked bushes are dug, put to the place where they were dug, and then evaluated visually. The healthy tubers in a shape specific to the sort are selected.

In the keeping room, the distance between the horizontal plank should be 40-50 cm for good ventilation. The packages are made of thick paper or polyethylene coating. The holes are punched on the polyethylene-coated packages for good ventilation.

2.4.2. The 1st year test seed-plot of the clones (2nd year). The clones selected and saved in the previous year were planted in these seed-plots. For each sort, the harvest of each plant more in number of the commodity tubers belonging to the sort was collected and stored separately, the clones infected with the diseases were spoilaged.

2.4.2.1. Superelite seed-plot (1st year). The healthy tubers from all the pots belonging to the same sort were combined and planted. During the vegetation period, the approbation work was carried out and an act was compiled. The harvesting was done by hand, the disease tubers, sort mixtures were removed. The obtained seed material is called superelite.

2.4.2.2. Elite seed-plot (2nd year). The superelite obtained in the previous year was planted in the 4th year elite seed-plot and the elite was obtained in gathering. The rule stated above is called the elite obtaining scheme for 4 years.

2.5. The determination of the viruses by the serological method

ELISA method was used for determining the viruses by the serological method. In this method, a few drops of juice are pressed from the researched plant leaf, tuber, or tuber sprouts with a hand press and poured on the glass. Each of the diagnostic and control sera is mixed to the juice pressed separately with a roller tube. The solution obtained from the mixture of the drops is stored in a humid chamber at a temperature of 22°C for 15-20 minutes. Then the solution is taken out of the thermostat and viewed with a 25x magnifying binocular loupe on a dark background. When there is a virus in the juice, it takes the shape of a round in the mixed solution, when the plate is moved a little, the image looks better, but nothing is observed in the control.

2.6. Approbation

The sort cleaning and approbation work are carried out definitely in all the seed areas. The diseased plants and the mixtures of other sorts accidentally dropped on the field are collected and removed. This work was carried out twice a year - the first time when the height of the plants reached 10-15 cm, and the second time during the mass flowering phase.

The main purpose of the approbation is to heighten the quality of the potato plantings, make them healthy and improve the sort cleaning.

In order to determine accurately the potato sorts, their morphological signs were evaluated and this operation was carried out on both plants and tubers.

In the approbation work, the most used morphological signs are the shape and color of the tubers, the shape of the leaf and the bush, the presence of anthocyanin color in the trunk, the color of the flowers and whether they open more or less, whether the flowering is long or short-term. The color of the tuber and flower stays stable relatively regardless of the external environmental factors. The sort signs such as the shape of the tuber and bush are exposed to the phenotypic variability depending on the conditions.

According to the methodology, the approbation was carried out 3 times in the experimental area, the tags were closed to the healthy, sorta-appropriate plants, and the superelite seeds were extracted manually under the laboratory conditions from the fruits selected from the gathering carried out in the biological maturity period.

During the approbation, at first, the height, color of the leaves and flowers, the amount of the trunks of the healthy plants of the zoned or perspective sort, the presence or absence of anthocyanin color in them, etc. are determined precisely. At this time, the disease plants and the plants deviated from the signs specific to the sort, are removed from the super-superelite and superelite seediness areas. And in the elite area, the healthy plants are marked.

On the tubers, this work is carried out during the harvesting and sorting. Here, the attention is paid to the shape of the tubers, the color of their shell and flesh, the depth and location of the peepholes on them.

This work was carried out with the participation of two people and the approbation act was compiled.

2.7. Preparing eggplant seed to sowing

The eggplant seeds were prepared to the sowing in accordance with the methodology adopted in the "Scientific Research Institute on Vegetable Growing" public legal entity and the sowing was carried out in March-April, depending on the climatic condition.

Before sowing, the seed was soaked in a 5% table salt solution and then selected. The germless seeds were removed, the rest of them were washed in clean water and dried. Then it was kept in 1% potassium permanganate solution during thirty minutes, washed, dried and sorted. In polyethylene-covered greenhouses, the pre-prepared seeds were sown on the soil mixed with the manure, and the soil with a thickness of 1-1.5 cm was poured over it and sprinkled with warm water.

In order to increase the germination percentage of the eggplant seeds, to accelerate the growth of the seedlings, to prevent them from being infected with the diseases and pests, the special preparations were carried out before sowing, that is, the seeds were selected for their bigness, healthy, high germination capacity, and processed with a 1% potassium permanganate ($KMnO_4$) solution. The seeds were sown on the soil in polyethylene-covered greenhouses, and the feeding fertilizer was given 3 times for the normal development and growing of the seedlings. For this, 5-8 g of ammonium salt (NH_4NO_3), 20-30 g of superphosphate and 10 g of potassium sulfate (K_2SO_4) and a microelement mixture were dissolved in 10 l of water and sprayed on an area of 3 m^2, and the seedlings were washed several times with clean water.

2.8. Cultivation of seedlings

The preparation procedure of the eggplant seedling was described in this section.

The seedlings are cultivated during 30-40 days to get a good harvest. From sowing the seeds to obtaining the seedlings, in the seedling greenhouse, the optimum temperature was maintained at 25-28°C, and the seedlings were obtained during 5-6 days. The seedlings were watered with warm water of 20-25°C. The soil was kept moist and soft for to grow healthy and quality seedlings.

The feed fertilizer was given 2-3 times for the normal development and growth of the seedlings. For this, 5-8 g of ammonium salt, 20-30 g of superphosphate and 10 g of potassium sulfate and with a mixture of microelements were dissolved in 10 l of water and sprayed on an area of 2-3 m^2, the seedlings were washed several times with clean water for to prevent burns.

The seedling greenhouse was often ventilated on sunny days, and the seedlings were watered with plenty of water 2-3 weeks before planting. It is useful to keep open the ventilation of the greenhouse day and night 1-2 days before planting. The root system of a seedling ready for transplanting to the field should be strong, the trunk thick, with 6-7 main leaves and a height of 10-15 cm, and the seedlings should be watered well one day before planting.

The eggplant seedlings were transplanted to the collection seedplot with 70×30 cm scheme in 2016-2019 at Absheron AEF. In the experimental area (7 sot-0.07 ha), the agrotechnical maintenance work was carried out on time, the nitrogen fertilizer (NH_4NO_3) was given to the common area 1 time, the soil softening and bottom filling were carried out 4 times and irrigation work 12-15 times.

The optimal planting time of the eggplant is considered the first ten days of May in Absheron conditions. The planting scheme of the plant is 70x30 cm.

The main agrotechnical maintenance work to the eggplant plant are as follows: the systematic soil softening, destruction of the weeds, irrigation, fight against the disease and pest, softening of the soil after each irrigation. During the vegetation period, the mineral fertilizers were given in the form of feeding 2-3 times. 2 sen/ha of ammonium sulfate and 1.5 sen/ha of superphosphate were given as first feeding 15 days after planting the seedling. The second feeding was given 20-25 days after the mass ripening of the fruits in the first and second bushes. The fertilizers are given depending on the growth and development conditions of the plants.

In the seed plantings of the eggplant, sort cleaning work varietal purification was carried out 3 times on the plant: the 1st was carried out in the planting cycle of the seedling, the 2nd in the mass flowering phase of the plants, and the 3rd in the phase of mass ripening of the fruits, the disease plants were removed.

The selection work of the eggplant was placed on the following seed-plots and fields in accordance with the approved selection program and scheme, method and stage:

1. The collection seed-plot where the starting material is located;
2. Control seed-plot;
3. Competitive sort-test seed-plot;
4. Seed field.

In 2018, the selection research work of the eggplant plant was carried out with the following program:

1. The studying and selection of the collection samples of different geographical origins for increasing the gene pool;
2. In appropriate seed-plots, the studying, selection and evaluation of the sort samples according to the valuable-farm important signs during the vegetation period;
3. The studying, selection and evaluation of the collection sort samples and perspective sorts according to the biomorphological and quality indicators;
4. The studying, selection and evaluation of the sort samples according to some physiological and biochemical indicators;
5. The selection of the resistant sorts against the diseases and pests;

6. The production of the superelite seeds of the sort samples;

7. The application of the regionalized sorts in the republic by regions.

In addition to the botanical characteristics of the plants, in the phases of the mass flowering and the formation of the first fruits, the leaf surface, the amount of the chlorophyll in the leaves, the amount of chlorophyll in the leaves, SSDL, FECP, PP, the amount of dry matter and nitrates in the fruits, the number of the leaf layers in the plant, the height measurements of the plants, the distribution of the biomass (in wet and dry forms) in separate organs (roots, trunks and stems, leaves, fruits) were studied.

In addition, the morphological characteristics of the collection samples - the shape of the bush, the height of the plant, the branching of the bush, the leafing, the type of the leaf, the size of the leaf surface, the color of the leaf, the hairiness of the leaves, the type of the flower, the location of the flower and flower group, the location of the fruit, the shape of the fruit, the size of the fruit, the color of the fruit in the state of the technical ripeness, the color of the pulp, the hardness of the pulp, the color of the fruit when the seeds are ripe, the color of the pulp, the hardness of the pulp, the number of the seed nests; the biological farm characteristics - the number of the days from mass release to the beginning of fruit ripening, the length of the interphase period, the productivity were studied.

The main purpose of the organizing the collection area was to select the best sort samples adapted to the local soil and climate conditions as starting material, to study in detail all their valuable farm signs and important biological characteristics, and to select the parent pairs which will be used in the next crossbreeding.

Initially, 105 sort samples participated in the experiment, 63 samples were selected from them in 2018 and they were tested according to their early maturity, productivity, quality indicators, some physiological and biochemical indicators (59 samples in 2016-2017, 30 samples in 2018) and in the direction of resistance to the abiotic factors.

2.9. The method of the physiological and biochemical researches

In the potato the starch was appointed by two methods.

The first method: An average sample of the potato tubers (at least 5 pieces) was taken, chopped finely, and 50 g of each sample (with an accuracy of 0.01 g) was weighed and poured into a 150 ml glass. Then the distilled water was poured on it until reaching the mark, the mouth of the glass was closed with the filter paper and was kept 20 hours at the room temperature. At this time, the starch and proteins contained in the potato absorb the water. After this period, the water was filtered from the mixture in the glass, and the potato residues were dried with the filter paper and weighed. According to the obtained difference, the water absorption capacity (WAC) of the tuber was appointed.

The second method: The selected medium potato tubers (at least 5 pieces) were washed, dried and weighed on a laboratory scale (with an accuracy of 0.01 g). A measuring 1 liter cylinder was filled up to half with the water and a weighed potato tuber was dropped into the cylinder. The volume (level) of the pressed water is noted. The density was appointed using Archimedes' law. The amount of the starch was calculated according to the table. The measurements were carried out three times with each tuber. According to the Archimedes' law, the density of the potato was calculated according to the mass and volume.

The leaf surface in the potato and eggplant plants was appointed by L1-3000C portable apparatus, the amount of the chlorophyll in the leaves by SPAD-502 Plus Chlorophyle meter device (by comparing the obtained numbers with the table attached to the device), the amount of the nitrates in the tubers and fruits by Nitratometer (SOEKS) device. The amount of the dry substance and dry biomass in the leaves, stems, flowers, and tubers was appointed according to A.I.Yermakov.[4]

The photosynthetic potential is calculated with the summing of the assimilation surface of the leaf during each day of the vegetation or with the multiplying the average assimilation surface area of the leaf (Lav) to the length of the vegetation period (Tv) by the following formula:

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[4] Методы биохимического исследования растений / под ред. А.И.Ермаков. – Ленинград: Агропромиздат, Ленинградское отделение, – 1987. – 430 с.

$$PP = L_{av} \cdot T_v \quad (1)$$

PP is related with the the preintended harvest by the following formula:

$$PP = 10^5 \cdot U_{ph}/M_{pp} \quad (2)$$

$$U_{ph} = PP \cdot M_{pp}/10^5 \quad (3)$$

Here: U_{ph} - preintended harvest, cwt/ha, Mpp - the mass of the tuber or other main harvest per thousand PP units, with kg.[5,6]

The specific surface density of the leaves is characterized with the amount of the dry leaf mass per unit leaf surface and expressed with mg/cm^2, and is calculated like this:[7,8]

$$SSDL = \frac{M_l}{L} \quad (4)$$

The farm efficiency coefficient of the photosynthesis expresses the ratio of the dry biomass of the farm important part of the plant (tuber, fruit) to the dry biomass of its vegetative parts (including flowers from the generative organs) and is calculated by the following formula:[9,10]

$$FECP = \frac{M_d}{m_v} \quad (5)$$

The results of the research were processed statistically and the correlation relations were determined among the various

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[5] Eyvazov, Ə.Q., Ağayev, F.N., Abbasov, R.Ə. Kartofun fiziologiyası, intensiv texnologiya ilə becərilməsi və proqramlaşdırılmış məhsulun alınması yolları. Bakı: "Tərəqqi" MMC, 2017, 212 s.

[6] Котиков, М.В. Оценка современных сортов картофеля по комплексу ценных признаков / Мат-лы XVI Междун. научно-практ. конф. «Агроэкологические аспекты устойчивого развития АПК». Брянск, 2019, с. 1031-1036.

[7] Yusifov, M.A. Qarpızın fiziologiyası. Bakı: Nur-A, 2004, 216 s.

[8] Тооминг, Х.Г. Солнечная радиация и формирование урожая / Х.Г.Тооминг. – Л.: Гидрометеоиздат, – 1977, – 200 с.

[9] Вечер, А.С., Гончарик, М.Н. Физиология и биохимия картофеля / А.С.Вечер. – Минск: Наука и техника, – 1973. – 264 с.

[10] Физиология картофеля / под ред. член корра. Б.А.Васхнил Рубина. –Москва: Колос, –1979, –272 с.

indicators.[11,12,13]

CHAPTER III.
BOTANICAL CHARACTERISTICS OF POTATO *(SOLANUM TUBEROSUM)* SORT SAMPLES

3.1. The biomorphological description of the potato sorts of different origins

The brief botanical description of the studied potato sort samples was given according to the research results, and it was determined that the Bermina (51.1%), Bellarosa (55.3%), Silvana (58.7%), Red-scarlet (57.6%), Colomba (52.3%), Jelli (56.4%), Captiva (52.4%), Julinka (53.1%), Concordia (61.9%), Elfe (51.9%) and Irina (67.3%) sort samples differed according to the amount of the commodity harvest. Concordia (61.9%) and Irina (67.3%) are distinguished particularly due to the amount of the commodity harvest among these samples. And the local sorts (Amiri-600, Sevinj and Telman) were excelled from the sorts of foreign origin (53.5, 53.8 and 72.9%) according to the amount of the seed harvest. The seed harvest is 24.9-41.2% of the total harvest in the sorts of foreign origin. Concordia (36.1%), Irina (38.5%), Mozart (39.8%) and Sifra (41.2%) sorts are distinguished among them.

It was determined that the amount of the commodity and seed harvest varies depending on the cultivation condition. It is possible to increase the amount of the commodity harvest in planting by creating the optimal cultivation condition.

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[11] Доспехов, Б.А. Методика полевого опыта / Б.А.Доспехов. – Москва: Альянс, – 2014. – 351 с.

[12] Литвинов, С.С. Методика полевого опыта в овощеводстве / С.С.Литвинов. – Москва: Россельхозакадемия, – 2011. – 648 с.

[13] Рязанова, Л.Г., Проворченко, А.В., Горбунов, И.В. Основы статистического анализа в садоводстве. Учебно-методическое пособие: [Электрон ресурс] – Краснодар, 2013. https://www.studmed.ru/ryazanova-l-g-provorchenko-a-v-gorbunov-i-v-osnovy-statisticheskogo-analiza-rezultatov-issledovaniy-v-sadovodstve_40aa1a04e30.html

3.2. Evaluation of the collection samples of the potato plant according to some physiological and biochemical indicators

The physiological and biochemical indicators of the collection samples of the potato plant were researched and evaluated. Their statistical data are reflected in Tables 1 and 2.

As can be seen from the statistical data in Table 1, the highest variation coefficient is noted in the assimilation system of the leaf (55.08), in the price of FECP (55.05), in the price of PP (54.71), in the chlorophyll information of the leaves (46,66%), in the collecting of the tubers (45.9%), and in the price of SSDL (44.94%).

Table 1

Statistical data of the photosynthetic and productivity indicators in the sort samples of the potato plant

Statistical indicators	Leaf surface, thousand m^2/ha	Chlorophyll, mg/100 g in the wet mass	PP, housand $m^2 \cdot$day/ha	SSDL, mg/cm^2	FECP	Total wet biomass, cwt/ha	Total dry biomass, cwt/ha	The biomass of the above-ground part, g	The mass of the tubers, g	Productivity, cwt/ha
n - the number of the samples	20	20	20	20	20	20	20	20	20	20
$\bar{X}$ - arithmetic average	22.37	190.94	1780.12	4.40	2.30	186.95	25.91	207.53	130.77	348.10
δ - square deviation	12.32	89.10	973.89	1.95	4.27	53.81	7.76	81.56	60.02	158.64
C_V, % - coefficient of variation	55.08	46.66	54.71	44.94	55.05	28.78	29.95	39.30	45.90	34.08
$S_{\bar{X}}$ - arithmetic average error	7.83	20.44	223.43	0.45	0.29	12.37	1.78	18.71	13.77	27.22
S_d- specified dispersion	3.90	28.18	307.97	0.62	0.40	17.01	2.45	25.79	18.98	37.51
$SID_{0.5}$ - the smallest important difference	8.15	58.90	643.66	4.30	0.84	35.56	5.72	53.90	39.67	78.39
$SID_{0.5}$, %	36.43	30.85	36.16	29.55	36.52	19.02	19.77	25.97	30.34	22.52

The coefficient of variation was 28.7-35.3% in the mass of the above-ground part, in the amount and productivity indicator of the total wet and dry biomass.

The data given in Table 2 show that the smallest coefficient of variation (7.74%) was noted in the amount of the dry substance in the composition of the tubers, and the highest in the mass of the stems and stalks (46.98%).

Table 2

Statistical data of the biochemical and some mass indicators in the sort samples of the potato plant

Statistical indicators	Dry substance, %				Nitrates, mg/kg	Starch, %	Mass indicators, g		
	Leaves	Stem and stalks	Root part	Tubers			Root	Leaves	Stem and stalks
n - the number of the samples	20	20	20	20	20	20	20	20	20
$\bar{X}$ - arithmetic average	16.42	8.46	12.49	17.10	105.08	13.92	182.53	102.38	104.41
δ - square deviation	2.65	2.56	2.49	1.32	16.34	2.12	64.97	33.14	48.98
C_V, % - coefficient of variation	16.12	30.24	19.92	7.74	15.55	15.23	35.67	32.37	46.91
$S_{\bar{X}}$ - arithmetic average error	0.66	0.59	0.57	0.30	3.75	0.49	14.90	7.60	11.24
S_d- specified dispersion	0.84	0.81	0.79	0.42	5.17	0.67	20.55	10.48	15.49
$SID_{0.5}$ - the smallest important difference	1.76	1.08	0.84	0.87	10.81	1.40	9.30	21.80	32.22
$SID_{0.5}$ %	10.72	12.77	13.13	5.03	10.29	10.06	23.47	21.29	30.86

The coefficient of variation was 30.24-35.67% in the amount of the dry substance in the composition of the stem and stalks, in the mass of the roots and leaves, the coefficient of variation was 15.55% and 15.23%, respectively, according to the amount of the nitrates and starch, and the coefficient of variation was equal to 19.92% according to the amount of the dry substance in the composition of the root part.

Based on the variation interval of both photosynthetic and biochemical indicators of the collection samples, the sorts and hybrids were selected according to the biologically and farm important signs among the potato sort samples, and it was recommended to use them in the selection in different directions. Jelli, Mozart, Panomera, Concordia sort samples were selected for their productivity and it was recommended to increase them in the wide fields. Farida, Bellarosa and Elfe sort samples are characterized with the assimilation surface of the leaves and the high amount of the chlorophyll in them among the collection samples of the potato cultivated in the Absheron condition, so they can be used as successful donors in the future selection. Among the studied sort samples Mozart (19.1%) and Amiri-600 (19.7%) sort samples differ according to the highest amount of the dry substance, and Bermina (18.0%), Irina (16.9%), Amiri-600 (16.7%) and Elfe (16.0%) sort samples differ due to the water absorption capacity and the amount of the starch, so it is possible to use them as a parent form conducted selection due to the quality in the future. In the researched collection samples the amount of the nitrates did not exceed the permissible norm (250 mg/kg) determined for potato by the Ministry of Health of the Republic of Azerbaijan, but was much lower than this limit (82.4-145.4 mg/kg). The highest level of the amount of the nitrate was noted in 2017 in the Sevinj sort (200.1 mg/kg), and the lowest limit was noted in the same year in the Mozart sort sample (57.0 mg/kg).

In the studied collection samples, the amount of the total dry biomass varied between 11.2-39.8 cwt/ha, the specific surface density of the leaves 2.80-8.65 mg/cm^2, the photosynthetic potential 443.4-4003 thousand m2xday/ha, the total wet biomass 92,4-377.6 cwt/ha, as a result, Colomba (327.6 cwt/ha), Elfe (260.4 cwt/ha) and Concordia (232.2 cwt/ha) sort samples were excelled from other samples according to the amount of the total wet biomass, Viviana (8.65 mg/cm^2), Julinka (8.12 mg/cm^2) and Red-scarlet (6.87 mg/cm^2) according to the specific surface density of the leaves, Farida (4003), Elfe (2776), Panomera (2407), Telman (2969 thousand m2xday/ha) according to the price of the photosynthetic potential, and Amiri-600 (39.8 cwt/ha), Colomba (38.4 cwt/ha) and Elfe (38.0 cwt/ha) according to the amount of the total dry biomass.

In the vegetative organs and root tubers of the collection samples of the potato the distribution of the dry substance mainly occurs according to the root tubers-leaves-stem and stems scheme (65,0%), and some part according to the leaves-tubers-stem and stalks scheme (25,0%). The amount of the dry substance accumulated in the leaves and tubers was equal only in 2 samples - Julinka and Bermina. In all the researched samples, it was determined that the least amount of the dry substance was collected in stems and stalks. As a research result on the distribution in the vegetative and generative (root part) organs of the wet biological mass, it was determined that the distribution of the wet biological mass mainly occurs root-leaf-stem-leaf (50,0%) or root-stem and stalk-leaf (45,0%) scheme. In contrast to the wet biological mass, the distribution of the dry biomass occurs according to the tuber-leaf-stem and stalk-root part (45,0%), leaf-tuber-stem and stalk-root part (35,0%), tuber-leaf-root part-stem and stalk (15%,0), leaf-stem and stalk-tuber-root (5,0%) schemes.

So the research results of the physiological, biochemical and biomorphological indicators (height of the plant, number of the leaf layers, number of the stems, number of the tubers, distribution of the biological mass in the vegetative and generative organs in wet and dry conditions) of the potato sort samples can be used for both in the cultivation and creation the models of the new high-yielding sorts in the irrigated and moisture-provided foothills.

In addition, Telman and Elfe sorts differ from other samples due to the amount of the total dry biomass collected in the vegetative and generative organs of the plant, more efficient distribution of assimilates, and that's why it is appropriate to use them as very valuable donors for the selection work will be conducted in future according to their productivity and quality.

3.3. The optimum photosynthesis indicators ensuring formation of the potential productivity in different sorts of the potato plant

It was determined that during the vegetation of the Sevinj and Amiri-600 sorts of the potato, the course of the change dynamics of the assimilation surface of the leaf does not differ sharply from each other depending on the planting schemes. So, the difference is only in the prices of the assimilation surface of the leaf. In both varieties, the maximum assimilation surface of the leaf is noted in the mass flowering phase of the planting scheme of 70x20 cm and at the beginning of flowering of the planting scheme of 70x25 cm, but in the planting scheme of 70x30 cm, the sorts differ from each other according to the course of the change dynamics of this indicator (Figure 1).

The accumulation dynamics of the chlorophyll differ depending on the planting schemes, the biological characteristics of the sorts and soil and the climate conditions in the leaves of different sorts of the potato plant. So the accumulation dynamics of the chlorophyll is characterized by a two-maximum curve in the planting schemes of 70x20 and 70x30 cm in both sorts. And in the 70x25 cm planting scheme, the highest amount of the chlorophyll coincides with the budding phase, and the amount of the indicator decreases starting from this phase until the end of the vegetation. A characteristic feature of both sorts and all the planting schemes is that the amount of the chlorophyll in the leaves decreases sharply due to the yellowing and drying of the leaves at the end of the vegetation (Figure 1).

The change dynamics of PP have certain similar and different aspects depending on the characteristics of the sorts, food area and soil-climate conditions during the vegetation. Thus, in all the planting schemes of both sorts, PP 6-7 increases continuously from the leaf formation phase to the mass flowering phase and reaches its maximum level in this phase. The sharp decrease occurs in the price of this indicator at the end of the vegetation. The price of PP is getting more higher in all the planting schemes of the Amiri-600 sort compared to the Sevinj sort. The lowest price of PP is noted at the beginning of the vegetation, i.e. in the phase of 6-7 leaf formation.

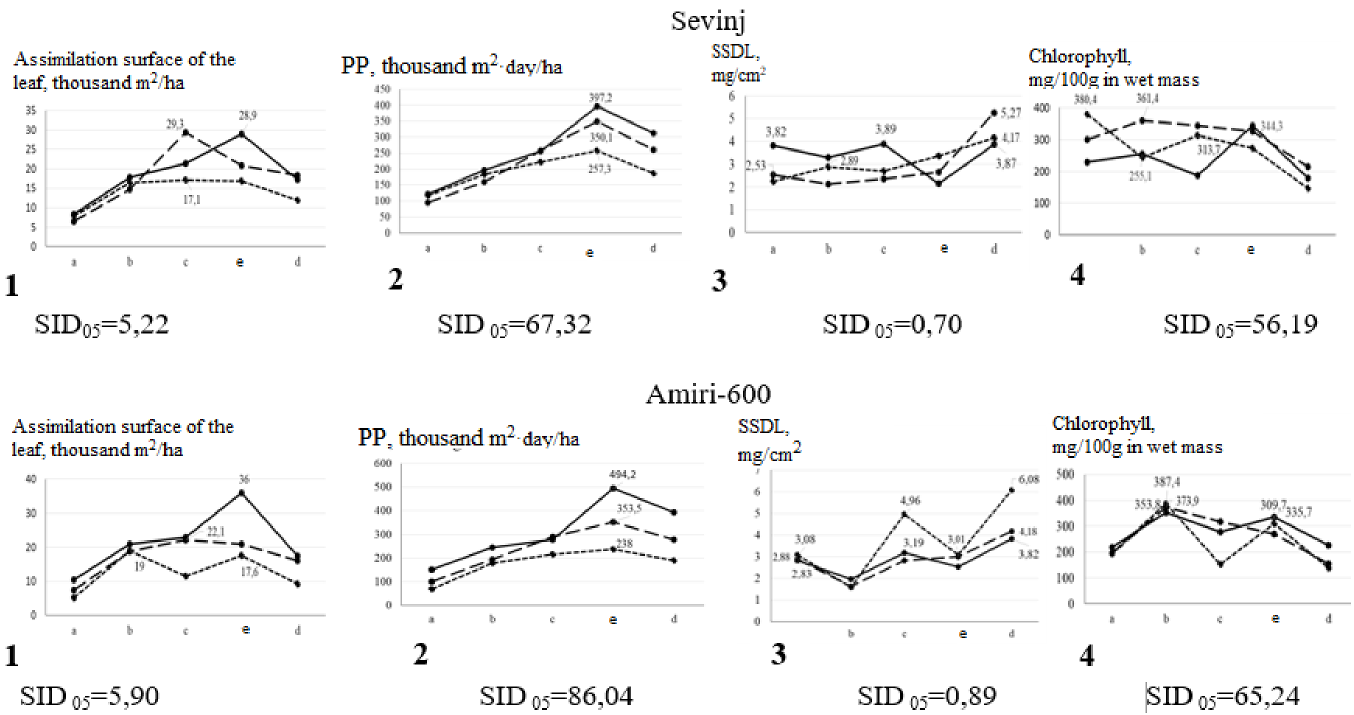


Figure 1. In different sorts of the potato plant: in the ontogenesis of the plant, the change dynamics (average for the years 2016-2019) of 1-the assimilation surface of the leaf; 2-PP; 3-SSDL; 4-the amount of the chlorophyll in the leaves

Note: a-6-7 leaf formation; b-budding; c-the beginning of the flowering (≤25,0%); e-mass flowering (≥75,0%); d-the technical ripeness of the tubers.

A———70x20 cm; B----70x25 cm; C····70x30 cm planting schemes

SSDL and FECP vary in different range depending on the biological characteristics of the sorts, planting schemes and the climatic conditions in the research years during the vegetation. A characteristic feature of all the planting schemes for both sorts is that these indicators have high prices at the end of the vegetation. In 70x20 and 70x25 cm planting schemes of the Sevinj sort, and in all the planting schemes of the Amiri-600 sort, the regular alternation of maxima and minima is observed in the dynamics of SSDL. The 1st maximum is detected in the budding phase, and the second maximum at the end of the vegetation in the planting scheme of 70x30 cm of the Sevinj sort. The price of FECP is the smallest (0.52-1.21) at the beginning of the vegetation. Because at this time, the farm important part of the potato-the tubers-is just beginning to form (Figures 1 and 2).

Thus, the optimal parameters of the new sorts ensuring the obtaining intended high harvest have been determined by improving the effects of the planting schemes on the development regularities of the plants and the activity of the photosynthesis.

The change dynamics of the assimilation surface of the leaves stipulates the accumulation of the total biomass, that's why, its study is of great importance in terms of the evaluating the photosynthetic ability of the plant, potato genotypes and selecting them in the selection.

In all the options from the beginning of the vegetation to the mass flowering phase, the total wet biomass was continued to increase and was reached the maximum level in the mass flowering phase, and the sharp decrease of the total wet biomass was occured at the end of the vegetation. In the Amiri-600 sort, the amount of the total wet biomass (275.7-352.8 cwt/ha) was getting more higher compared to the Sevinj sort (252.7-311.8 cwt/ha) (Figure 2).

In potato, during the vegetation, the change dynamics of the total wet and dry biomasses show that the timely harvesting of the selected samples is significant importance for the obtaining high harvest.

So the delay of the harvesting can cause to the decrease of the productivity and quality of the selected selection samples.

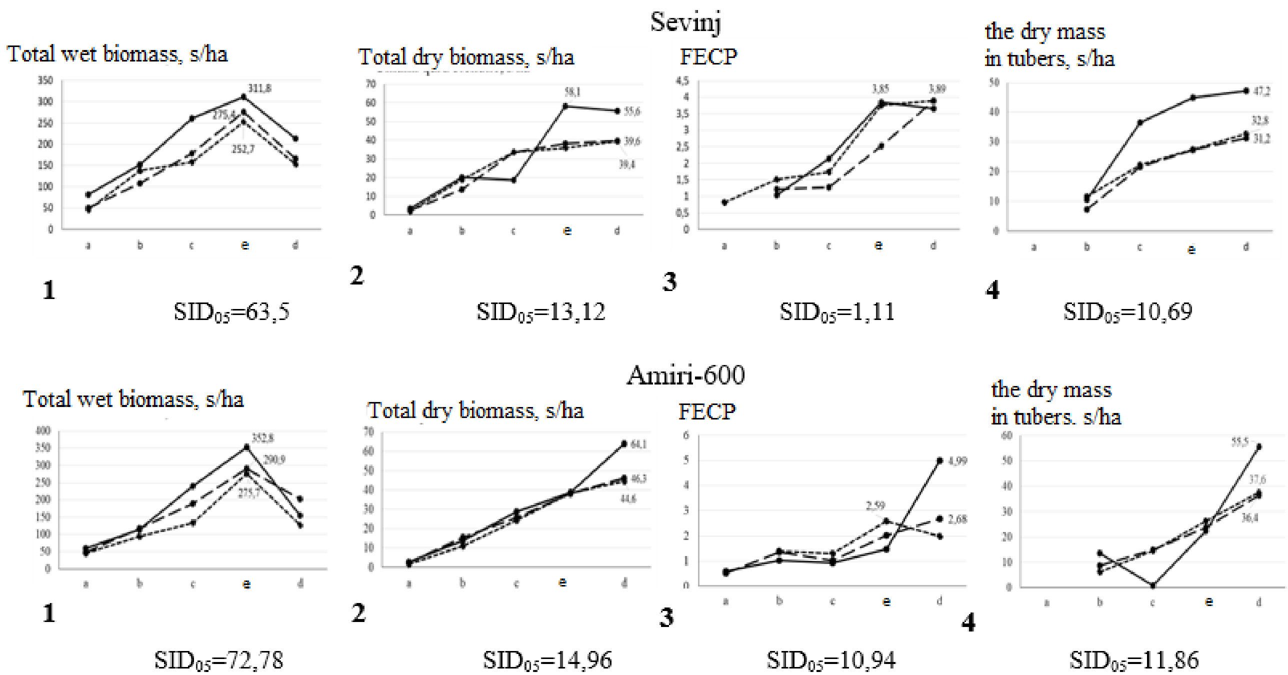


Figure 2. In different sorts of the potato plant: in the ontogenesis of the plant, the change dynamics (average for the years 2016-2019) of 1-the total wet biomass; 2-the total dry biomass; 3-FECP; 4-the dry mass in the tubers

Note: a-6-7 leaf formation; b-budding; c-the beginning of the flowering (≤25,0%); e-mass flowering (≥75,0%); d-the technical ripeness of the tubers.

A———70x20 cm; B----70x25 sm; C····70x30 cm planting schemes

In the vegetative organs (leaves, stems and stalks) of different sorts of the potato plant, during the vegetation, depending on the planting scheme and the soil-climatic conditions in the research years, the change dynamics of the amount of the dry substance increases continuously beginning from the 6-7 leaf formation phase until the end of the vegetation, and reaches the maximum level in the technical ripeness phase of the tubers (this indicator varies between 23.8-29% in the Sevinj sort and 27.2-29.3% in the Amiri-600 sort). In contrast to the vegetative part, in the tubers, in the change dynamics of the dry substance, the sort differences manifests more distinctly only in the 70x30 cm planting scheme. So in the Sevinj sort, the amount of the dry substance increases continuously until the mass flowering phase, and when the tubers reach the technical ripeness, the amount of the dry substance decreases, albeit slightly. And in the Amiri-600 sort, the change dynamics of the dry substance is characterized by a two-peaked curve in the tubers (the maximums are detected at the beginning of the flowering and in the technical ripeness of the tubers) (Figure 3).

In the leaves of the researched potato sorts the accumulation dynamics of the dry biomass stipulates the change dynamics of the dry biomass of the above-ground part as a whole, that's why, on years, during the vegetation, the change curve of the first determines the character of the change of the second depending on the planting scheme. In the leaves of the Sevinj sort, the highest increase of the dry biomass is noted at the beginning of the flowering, and in the Amiri-600 sort during the mass flowering phase. A decrease in the dry biomass occurs in the leaves beginning from these phases until the end of the vegetation. This decrease is sharper in the Amiri-600 sort (1.48-1.91 times), and in the Sevinj sort at a slightly slower pace (1.27-1.56 times). In the stems and stalks of both sorts, in the accumulation dynamics of the dry biomass, the sort differences are only observed in the 70x30 cm planting scheme, in the noted scheme, the highest amount of the dry biomass coincides to the beginning of flowering. In both sorts and other planting schemes, in the stems and stalks, the highest amount of the dry biomass is noted during the mass flowering phase, as in the leaves. During the vegetation, in the change dynamics of the dry biomass of the tubers, the occuring differences depending on the characteristics of the sorts, planting schemes and soil-climate conditions, are manifested only in the price of this indicator. So in both sorts and all the planting schemes, the dry biomass of the tubers increases continuously due to the growth and development of the plant, and reaches the maximum level during the period of the technical ripeness of the tubers (respectively, 32.8-47.2 in the Sevinj sort; and 36.4-55.5 cwt/ha in the Amiri-600 sort). The change dynamics of the total wet biomass is absolutely similar to the change dynamics of the total dry biomass in the above-ground part of different sorts of the potato plant during the vegetation. The lowest amount of the total dry biomass is observed at the beginning of the vegetation (5.7-10.5 cwt/ha), and the highest amount in the mass flowering phase (32.9-57.9 cwt/ha) (Figures 3 and 4).

So in the selection conducted on the quality, it should be paid serious attention to the change dynamics of the dry substance and dry biomass in the plants, the selection of the samples should be carried out exactly during the technical and mass ripeness period of the potato, the conducting early diagnostics may lead to the wrong results.

3.4. Accumulation dynamics of the nitrates, starch in the potato tubers and the water absorption capacity of the tubers

It was determined that the change dynamics of the nitrates differs sharply depending on the planting schemes, the characteristics of the sorts and the soil-climate conditions in the potato during the vegetation. In the 70x20 and 70x25 cm planting schemes of the Sevinj sort, in the tubers, the amount of the nitrates increases continuously due to the growth and development of the tubers, reaches the maximum level at the end of the vegetation. The highest amount of the nitrates coincides with the mass flowering phase in the 70x30 cm planting scheme of the Sevinj sort, and in all the planting schemes of the Amiri-600 sort. The transition to the technical ripeness of the tubers is accompanied with a decrease in the amount of this substance. The amount of the nitrates is the lowest in the newly formed tubers (72.6-92.9 mg/kg) in all the planting schemes of both sorts (Figure 4).

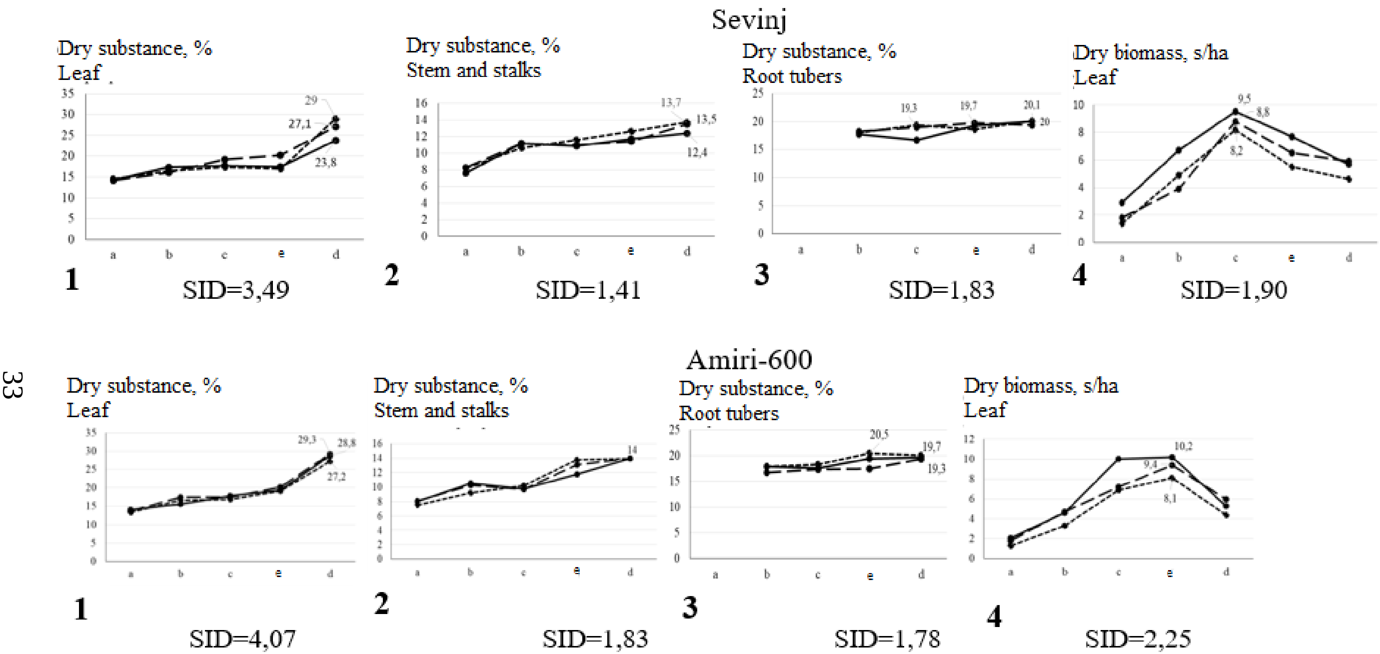


Figure 3. In different sorts of the potato plant: in the ontogenesis of the plant, the change dynamics (average for the years 2016-2019) of 1-the dry substance in the leaves ; 2-the dry substance in the stem and stalks; 3-the dry substance in the root tubers; 4-the dry biomass in the leaves

Note: a-6-7 leaf formation; b-budding; c-the beginning of the flowering (≤25,0%); e-mass flowering (≥75,0%); d-the technical ripeness of the tubers.

A———70x20 cm; B----70x25 sm; C····70x30 cm planting schemes

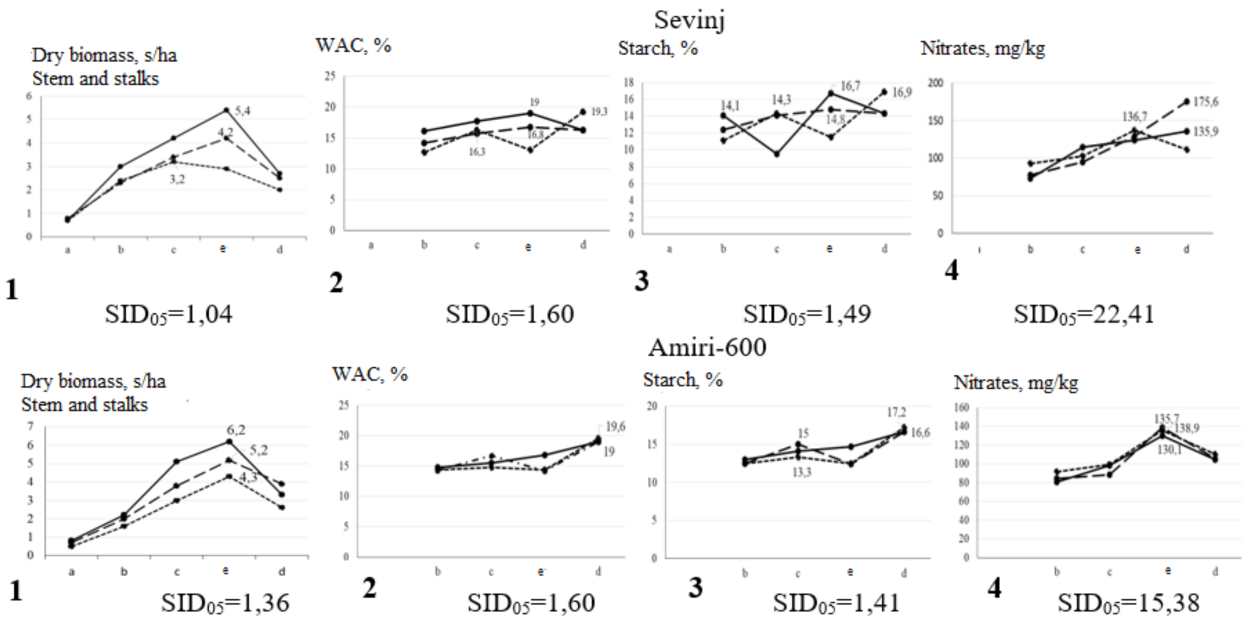


Figure 4. In different sorts of the potato plant: in the ontogenesis of the plant, the change dynamics (average for the years 2016-2019) of 1-the dry biomass in the stems and stalks; 2-WAC in the tubers; 3-the starch; 4-the nitrates

Note: a-6-7 leaf formation; b-budding; c-the beginning of the flowering (≤25,0%); e-mass flowering (≥75,0%); d-the technical ripeness of the tubers.

A———70x20 cm; B----70x25 sm; C····70x30 cm planting schemes

In the potato tubers, the accumulation dynamics of the starch and the water absorption capacity (WAC) of the tubers differ according to the characteristics of the sorts depending on the planting schemes and soil-climatic conditions, during the vegetation. So the amount of the starch and WAC of the tubers reach the maximum level in the mass flowering phase, the transition to the technical ripeness of the tubers is accompanied with a relative decrease of these indicators in the 70x20 and 70x25 cm planting schemes of the Sevinj sort. In the 70x30 cm planting scheme of the Sevinj sort, and in the 70x25 and 70x30 cm planting schemes of the Amiri-600 sort, the maximums are detected in the phases of the budding and technical ripeness of the tubers in the accumulation dynamics of the starch and the change dynamics of WAC of the tubers. In the Amiri-600 sort, in the planting scheme of 70x20 cm, in contrast to the other variants, the increasing of the studied indicators continue throughout the vegetation, and reach the maximum level at the end of the vegetation (Figure 4).

So it is recommended to use widely the starch accumulation accompanied with the reduction of the nitrates in the period when the potential harvest is realized towards the technical ripeness in the potatoes and the genotypes increasing to the maximum level of WAC in the creation of the new sorts in the selection practice.

3.5. Biomorphological changes in the potato sorts during the vegetation

In 2016-2019, in the researches conducted due to the formation of the potential in the potato genotypes, their biomorphological changes were also studied. For this, the observations and measurements were carried out on 8 parameters - the height of the plant, the number of the leaf layers, the mass of the above-ground part, the mass of the root part, the number of the tubers, the mass of the tubers, the mass of the leaves, the mass of the stems and stalks in the phases of 6-7 leaf formation, the budding, the beginning of the flowering, the mass flowering (the intensive growth of the tubers) and the technical maturity of the tubers in different years, it was determined that in the relatively fast-growing Sevinj sort (although the sort authors belong it to the medium-fast-growing sort category), these parameters had a quantitatively low price compared to the medium-growing Amiri-600 sort (in this sort, the tubers reach to the technical ripeness 7-10 days later compared to the Sevinj sort). For example, in the Sevinj sort, for 4 years, on average while the number of the layers reach 11.8-12.8, the height of plants 45.2-48.3 cm, the above-ground mass 147.6-171.8 grams, the mass of the tubers 326.1- 519.5 grams, the mass of the leaves 53.8-90.4 grams, the mass of the stems and stalks 62.4-70.5 grams, in the Amiri-600 sort, these indicators are 12.8-13.3; 47.4-50.1 cm; 176.3-190.3 g; 370.8-499.5 g; 78.5-100.3 g; 80.3-93.5 g, respectively. The same view can be observed also comparing the other parameters.

So as a result of the conducted researches, it was determined that in different sorts of the potato plants, the optimal biomorphological indicators forming the genotypes that produce the high harvest, can be used to create the new sorts in the selection although the biomorphological changes are manifested in different aspect depending on the planting schemes and soil-climatic conditions. That's why, it should be achieved the optimal size of the biomorphological indicators in the selecting samples which will be conducted the selection according to the productivity, quality and adaptability.

CHAPTER IV. CREATION OF AN OPTIMAL MORPHOPHYSIOLOGICAL MODEL ENSURING HIGH HARVEST FROM POTATO

4.1. Assimilation area of the leaf and the photosynthetic potential depending on the planting scheme of the potato sorts

It was determined that the daily increase of the dry biomass of the potato varies between 80-150 kg/ha in the intensive growth phase of the plant (budding - the mass flowering period), starting from zero at the beginning and at the end of the vegetation, the maximum leaf area is 51.5-52.2 thousand m^2/ha in the Sevinj sort, 300-500 kg/ha when it is 46.6-53.3 thousand m^2/ha in the Amiri-600 sort.

In order to obtain a high harvest from the medium-fast-growing Sevinj and medium-growing Amiri-600 sorts, first of all, it is necessary to achieve the formation of the favorable structured planting, to increase the leaf area and their photosynthetic potential to the optimal level. The productivity of the tubers is high in the plantings developing strong assimilation surface (up to a certain limit - until 50-55 thousand

m^2 leaf area). During the vegetation, if the average assimilation surface of the leaf is at least 25-30 thousand m^2/ha, the photosynthetic potential should be 2650-3180 thousand m^2/ha.day. In such case, if on average the tuber output is 8 kg according to per thousand PP units, the average productivity will be 212.0-254.40 cwt/ha. If the average assimilation surface of the leaf is 30-45 thousand m^2/ha, and the photosynthetic potential is 3180-4770 m^2/ha×day, respectively, then the productivity of the tubers will be 254.40-381.6 cwt/ha.

4.2. A model for obtaining the intended high harvest from potato

In order to obtain the intended high harvest from potato sorts, it is necessary to reach CP from PAR to 2-3%, the assimilation surface of the leaf during the intensive growth of the plant to 30-45 thousand m^2/ha, and the photosynthetic potential to 3180-4770 thousand m^2/ha×day.

Based on the research results, the following formulas were used to model the intended high harvest from the Sevinj and Amiri-600 sorts:

$$PP=105 \cdot Uph./M_{pp} \qquad (6)$$

Here, Uph - preintended harvest, cwt/ha; Mpp - the mass of the tuber or potato tuber per thousand PP units, kg.

Since the productivity also consists of the sum of the daily increase of the dry biomass during the vegetation, by expressing the multiply of NPP (the net productivity of the photosynthesis) and PP, the daily increase of the dry biomass which has high indicators ensures the formation of the optimal productivity.

The maximum harvest corresponds to the optimal prices of NPP and PP:

$$U_m = NPP \bullet PP \qquad (7)$$

So in order to model according to the formula (6), we will have to refer here to some information noted in subsection 4.1. During the period of the intensive growth of the tubers (budding-the mass flowering period), while the leaf area is 40 thousand m^2/ha, the average leaf area is 33 thousand m^2/ha, and the photosynthetic potential is 3630 thousand m^2/ha-day (33•110 =3630) is in the Amiri 600 sort (110 days) during the vegetation. It is possible to harvest 292.8 cwt of the tubers from 1 ha when buying 8 kg of the tubers according to per thousand PP. As the average leaf area is 33 thousand m2/ha day for Sevinj sort (102 days), the productivity will be 269.3 cwt with the same tuber output. It can be seen from this calculation, that it is very important to ensure the planned density of the planting, the optimal increase of the leaf area and their high photosynthetic indicator.

Thus, using formula (7), the following models can be proposed for the Amiri-600 and Sevinj sorts, in the 70x25 planting schemes:

Table 3

The photosynthesis indicators of the potato plantings with different productivity (Amiri-600, 70x25 cm planting scheme)

Parameters	The harvest of the tubers, cwt/ha							
	187.0	219.0	253.4	292.8	329.9	371.9	416.3	463.1
The output of the tubers per thousand PP units, kg	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10,0
Photosynthetic potential, thousand m^2/ha×day	2878	3128	3379	3630	3881	4132	4382	4631
The assimilation surface of the leaf , thousand m^2/ha, average	26.16	28.44	30.72	33.0	35.28	37.56	39.84	42.10
Maximum	28.0	30,0	35.0	40.0	45.0	50.0	55.0	60.0

According to the formula (7), it is possible to calculate the accumulation of the dry biomass in the interphase period and during the vegetation of the plant as a whole during each day of the vegetation. In the sprout phase until the full technical ripeness of the tubers, the increase graphics of the dry biomass and the assimilation surface of the leaf of the plantings with different productivity are compile in the determination of the preintended productivity according to the formula (7) that, it also allows to control the formation process of the planned leaf area and photosynthetic potential and and manage it.

Table 4

The photosynthesis indicators of the potato plantings with different productivity (Sevinj, 70x25 cm planting scheme)

Parameters	The harvest of the tubers, cwt/ha							
	173.4	203.1	235.0	269.3	305.9	344.8	386.1	429.1
The output of the tubers per thousand PP units, kg	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
Photosynthetic potential, thousand m^2/ha×day	2668	2901	3133	3366	3599	3831	4064	4294
The assimilation surface of the leaf , thousand m^2/ha, average	26.16	28.44	30.72	33.0	35.28	37.56	39.84	42.10
Maximum	28.0	30.0	35.0	40.0	45.0	50.0	55.0	60.0

Table 5

The model photosynthesis indicators of the potato plantings with different productivity (Amiri-600, 70x25 cm planting scheme)

Parameters	The harvest of the tubers, cwt/ha							
	158.3	187.7	219,6	256.2	291.1	330.6	372.5	416.8
NPP g/m^2×day	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0
Photosynthetic potential, thousand m^2/ha×day	2878	3128	3379	3660	3881	4132	4382	4631
The assimilation surface of the leaf , thousand m^2/ha, average	26.16	28.44	30.72	33.0	35.29	37.56	39.84	42.10
Maximum	28.0	30,0	35.0	40.0	45.0	50.0	55.0	60.0

Table 6

The model photosynthesis indicators of the potato plantings with different productivity
(Sevinj, 70x25 cm planting scheme)

Parameters	The harvest of the tubers, cwt/ha							
	146.7	174.1	203.7	235.6	269.9	306.5	345.4	386.5
NPP $g/m^2 \times day$	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0
Photosynthetic potential, thousand $m^2/ha \times day$	2668	2901	3133	3366	3599	3831	4064	4294
The assimilation surface of the leaf , thousand m^2/ha, average	26.16	28.44	30.72	33.0	35.28	37.56	39.84	42.10
Maximum	28.0	30.0	35.0	40.0	45.0	50.0	55.0	60.0

So it can be determined a model for buying a preintended amount of the harvest for different potato sorts by knowing the price of ASL, NPP and PP, or more exactly by controlling the price of these indicators in the plantings.

It is possible to determine a model for buying a preintended amount of the harvest by using photosynthetic indicators, following the necessary agrotechnical conditions (soil-climatic conditions, giving the mineral and organic fertilizers, observing the planting density, softening the soil, irrigation, etc.).

The following results can be concluded by summarizing the information obtained and discussed according to the chapter:

1. The outout of the tubers per thousand PP units, between 6.5-10 kg, the photosynthetic potential is 2878-4631 thousand $m^2/ha \times day$, the assimilation surface of the leaf maximum 28.0-60.0, on average 26.16-42.10 thousand m^2/ha 187-463.1 cwt/ha of the Amiri-600 sort in the 70x25 cm planting scheme, corresponding indicators 6.5-10 kg, 2668-4294 thousand m^2/ha. day, when it varies between 28.0-60.0, 26.16-42.10 thousand m^2/ha, it is possible to obtain the potato tubers in the preintended amount of 173.4-429.4 cwt/ha from Sevinj sort according to the same scheme.

2. It can be obtained the potato tuber harvest of 158.3-416.8

cwt/ha from Amiri-600 sort, and 146.7-386.5 cwt/ha from Sevinj sort by controlling the price of NPP in the planting fields at the same prices of the leaf assimilation surface and photosynthetic potential.

3 In order to achieve the optimal price of the photosynthetic indicators, the agrotechnical requirements (soil-climatic conditions, giving the mineral and organic fertilizers, observing the planting density, softening the soil, irrigation, etc.) must be observed strictly in the potato planting areas.

CHAPTER V.
BOTANICAL CHARACTERISTICS OF THE EGGPLANT *(SOLANUM MELONGENA)* VARIETIES

5.1. Biomorphological characteristics of the eggplant sort samples and hybrids

As a result of the research, the studied sort samples of the eggplant were divided into medium-ripening (87-100 days), medium-late-ripening (101-120 days) and late-ripening (121-148 days) groupsd ue to the ripeness. The same sort samples were divided into 3 groups according to the time from flowering to the ripeness: the early bloomers (8-18 days), mid bloomers (19-29 days) and late bloomers (30-46 days) (37.1% of the collection samples).

The studied variety samples were divided into 3 groups according to the height of the bush: short (43.2-65 cm), medium (66-87 cm) and tall (88-121 cm), and were divided into 3 groups according to the weight of the fruits: light weight (21-71 g), medium weight (72-150 g) and heavyweights (above 151 g).

Since some of the sort samples of different geographical origin introduced from foreign countries have adapted to the local conditions and gained advantages in terms of both biomorphological and valuable farm signs, it was recommended to study and evaluate them in the appropriate seed-plots (control, competitive sort test) in the next years.

It should be noted that it is also possible to classify the collection samples according to the period from flowering until the ripeness: early bloomers (8-18 days), medium bloomers (19-29 days) and late bloomers (30-46 days). 141 (8 days), 69/B (11 days), 153 (11 days), 154 (11 days), 179/A (11 days), 196 (12 days), 142 (12 days), 205 (14 days), 208 (15 days), 174 (15 days), 149/A (15 days), 157 (15 days), 149 (16 days), 155 (16 days), 143 (16 days), 218 (16 days), 140/A (17 days), 144 (17 days), 156 (17 days), 166 (18 days), 40- Ganja (18 days) (a total of 21 samples, i.e. 20,0% of the studied collection samples) belong to the first group, 214 (19 days), 214/A (19 days), 151 (19 days), 154/A (19 days), 140/B (20 days), 149/B (20 days), 158 (20 days), 162 (20 days), 168 (20 days), 176 (20 days), 187 (20 days), 194 (20 days), 200 (20 days), 212 (20 days), 152 (21 days), 155/A (21 days), 159 (21 days), 137/A (22 days), 173/A (22 days), 179/B (22 days), 183 (22 days), 202 (22 days), 204 (23 days), 42-Zahra (23 days), 137/B (24 days), 179 (24 days), 180 (24 days), 189 (24 days), 198 (24 days), 232 (25 days), 182 (25 days), 173 (25 days), 161 (25 days), 137 (26 days), 164 (26 days), 191 (26 days), 227 (26 days), 170/A (27 days), 190 (27 days), 150 (28 days), 197 (28 days), 236 (28 days), 254 (28 days), 186 (29 days), 181/A (29 days) (a total of 45 samples, i.e. 42.9% of the studied collection samples) to the second group, and 181 (30 days), 185 (30 days), 195 (31 days), 169 (32 days), 170 (32 days), 228 (32 days), 233 (33 days), 210 (33 days), 209 (33 days), 206 (33 days), 200/A (33 days), 177 (33 days), 160 (33 days), 188 (34 days), 192 (34 days), 222 (35 days), 193 (36 days), 203 (36 days), 223 (36 days), 240 (37 days), 238 (37 days), 213 (37 days), 255 (39 days), 243 (39 days), 242 (39 days), 234 (39 days), 229 (39 days), 220 (39 days), 215 (39 days), 207 (39 days), 225 (40 days), 199 (43 days), 226 (43 days), 211 (45 days), 216 (45 days), 237 (46 days), 239 (46 days) (a total of 39 samples, i.e. 37.1% of the studied collection samples) to the third group.

So 42.9% of the studied collection samples belong to the medium-bloomers, 37.1% to the late-bloomers, and 20,0% to the early-bloomers groups. The samples of 141, 69/B, 153, 154, 179 (8-11 days) differ according to the ripening period of the first fruits. And 211, 216, 237 and 239 (45-46 days) sort samples differ according to their late ripeness. And the ripening period of the first fruits varies between 12-44 days in the remaining samples.

The definite differences were appeared according to the farm indicators (the harvest, total productivity, bush height, fruit mass obtaining from one plant) in the variety samples, and some of them had different characteristics according to these indicators. According to the average results of the 2-year and 3-year research, in the studied collection samples, the harvest obtained of one plant varied between 0.5-2.2 kg, and in the control sorts was 0.8 kg. The lowest harvest is noted in 190 (0.5 kg), 193 (0.5 kg), 149 (0.6 kg), 218 (0.6 kg), 232 (0.6 kg) sort samples, and the highest harvest in 254 (2.2 kg) and 179/A (1.7 kg) sort samples. These samples differed from other studied samples according to the total productivity per hectare, too.

In the control seed-plot, a comparative study of 4 samples (24, 69, 77 and 97) with the Zahra and Maharram sorts showed that in these samples, the vegetation period from output to the ripeness is less relatively than the control sorts (it is 102-105 days, while this period is 112- 115 days in the control varieties). The samples of 24 and 93 were higher relatively than other samples and control sorts (479.4 and 487.7 cwt/ha, respectively, and 386.2-428.7 cwt/ha in the control sorts) according to their productivity. The sort samples differed from the control sorts according to the mass of the fruits, too. The sort sample with the largest fruit was 69 (327.0 g), and the smallest was 77 (127.1 g). The sort samples of 69 (7.0-7.2%), 77 and 93 were excelled relatively than the control sorts (6.0-6.1%) according to the amount of the dry substance.

As a result of the comparative study of 7 perspective sort samples (43, 50, 51, 52, 94, 95 and 122) with the Zahra and Ganja control sorts in the competitive sort test seed-plot, it was determined that the vegetation period (94- 107 days) from output to the ripeness was shorter than the control sorts. All the samples exceeded the control variants according to their productivity (respectively, 427.5-467.0 cwt/ha, and 422.4-425.4 cwt/ha in the control sorts). The mass of the fruits varied from 127.5 to 182.9 g in the perspective sorts, and from 170.0 to 213.0 g in the control sorts, the sample of 95 (127.5 g) was differed with the least weight of the fruit and the sample of 94 (182.9 g) with the most weight. The samples of 122 (6.3%) and 51 (6.5%) were differed with the highest amount of the dry substance. 2017 was excelled compared to 2018 for all the studied valuable farm signs, that is, the meteorological conditions in the research years were influenced variously to the height and development of the plant.

5.2. The physiological and biochemical characteristics of the eggplant sort samples

In the eggplant collection samples (59 samples), the physiological and biochemical indicators - the assimilation surface of the leaf (ASL - thousand m^2/ha), the amount of the chlorophyll in the leaves (according to the wet mass of mg/100g), the specific surface density of the leaves (mg/cm^2), photosynthetic potential (PP) - thousand m^2xday/ha), the amount of the dry substance (%) and nitrates in the fruits (mg/kg according to the wet mass) were studied and the samples differed on these characteristics were selected.

Table 7

The statistical data of the eggplant plant collection samples on the biological and physiological indicators

Statistical indicators	Photosynthetic indicators				The distribution of the wet biomass to the organs						
	ASL, thousand m^2/ha	The amount of the chlorophyll in the leaf, mg/100 g in the wet mass	PP, thousand m^2/ha.day	The specific surface density of the leaves, mg/cm^2	Total, cwt/ha	The mass of the flowers and buds, g	Leaves, g	The mass of the fruits, g	The mass of the stems and stalks, g		The mass of the root, g
n - the number of the samples		59	59	59	59	59	59	59	59	59	59
$\bar{x}$ - arithmetic average		4.48	249.77	1013.59	6.53	119.64	0.55	69.18	60.99	82.01	14.37
δ - square deviation		3.71	53.57	426.58	1.66	44.37	0.38	24.83	26.02	33.41	12.39
C_V, % - coefficient of variation		76.10	21.45	42.09	25.49	37.09	70.49	35.90	42.66	40.74	86.25

Table 7 continuation

$S_{\bar{X}}$ - arithmetic average error	0.48	6.97	55.54	0.22	5.08	0.05	3.26	3.42	4.39	4.63
$SID_{0.5}$ - the smallest important difference	1.31	19.99	159.01	0.31	16.88	0.14	9.35	20.50	12.58	1.51
$SID_{0.5}$, %	26.84	8.0	15.69	4.75	14.11	24.45	13.52	33.61	15.34	10.51

The sort samples of 225, 150, 213, 164, 189, 140/B, 167 and 222 (8 samples in total) were excelled from other samples according to the assimilation surface of the leaf and the amount of the chlorophyll in the leaves, the sort samples of 164, 140/B, 189, 167 and 222 (5 samples in total) according to PP, the sort samples of 167, 140/B, 140/A, 207 (4 samples in total) according to the amount of the total dry biomass, the sort samples of 207, 223, 155, 169, 194 and 140/A (6 samples in total) according to the price of SSDL. It was recommended that these samples be used as donors in future selection.

The physiological indicators studied in the eggplant collection samples (59 samples) changed significantly depending on the meteorological conditions during the research years. As a rule, the studied indicators were higher in 2017 than in 2018.

5.3. The assessment of the amount of the dry substance and dry biomass in the vegetative organs and fruits of the eggplant plant collection samples

In 2017-2018, the distribution of the dry substance in 31 collection samples and the dry biomass in 59 collection samples was studied in the vegetative and generative organs, as well as the amount of the nitrates and productivity in them were researched. The statistical data on these indicators are reflected in the table 8. As it can be seen, the average arithmetic price of the distribution of the dry substance in the leaves was 21.59±0.38, the coefficient of variation was 9.71%, SID0.5 was 1.80%. The statistical indicators were characterized respectively with the following prices in the stems and stalks, roots and fruits: the average arithmetic price and its arithmetic average error are given for the noted organs, 14.70±0.35; 18.30±0.27; 9.58±0.22, CV–13.15; 8.19 and 12.51 %, SID0.5 –1.02; 0.80; 0.61, respectively.

In general, the study of the dry substance, dry biomass, nitrates and productivity on the eggplant plant collection samples showed that the amount of dry substance in the vegetative parts and fruits varies depending on the biological characteristics of the sorts and the meteorological conditions during the research years. The samples selected with the amount of the dry substance in the leaves, stems and stalks, root part and fruits were differentiated and it was recommended to use them as donors in the selection will be conducted according to the in quality future.

The distribution of the dry substance in the vegetative parts and fruits occurs unambiguously according to the leaf-root-stem and stalk-fruit scheme, which is the visual evidence of how leaves and roots play an important role in the life of the plant.

The amount of the dry biomass in the vegetative parts and fruits varies in a wide range depending on the biological characteristics of the sorts and the soil-climatic conditions in the research years, which allows to select the sort samples characterized with the high amount of the dry biomass. The amount of the dry biomass varies between 2.7-15.3 in the leaves, 1.3-10.1 in the stalks and stems, 0.4-2.4 in the root part and 4.5-16.9 cwt/ha in the fruits. The distribution of the dry biomass in the vegetative parts and fruits mainly (76.3%) occurs according to the fruit-leaf-stem and stem-root scheme. The amount of the dry biomass in the root part is much less compared to the other organs and makes up 2.7-8.5% of the total dry biomass.

In the studied collection samples of the eggplant, the amount of the nitrates is much lower (29.0-128.3 mg/kg) than the permissible norm (300 mg/kg) determined by the Ministry of Health of the Republic of Azerbaijan for eggplant. The lowest amount of the nitrates (29.0-58.4 mg/kg) was noted in the sort samples of 185, 207, 164, 167, 140/B, 200, 195, 206, 202, 173, 137, 212, 150 and 228 (14 samples in total). In these samples, the amount of the nitrates is 5.14-10.35 times lower than the permissible norm, which allows them to be used as environmentally clear product.

Table 8

The statistical data on the biological and physiological indicators of the eggplant plant collection samples

Statistical indicators	The distribution of the dry substance to the organs, %				Total dry biomass, cwt/ha	The distribution of the dry biomass to the organs, cwt/ha				Nitrates, mg/kg	Productivity, cwt/ha
	Leaves	Stems and stalks	Root	fruit		Leaves	Stems and stalks	Root	fruit		
n - the number of the samples	31	31	31	31	59	59	59	59	59	59	59
$\bar{x}$ - arithmetic average	21.59	14.70	18.30	9.58	21.38	6.14	4.96	1.0	9.28	66.16	406.78
δ - square deviation	2.10	1.93	1.50	1.20	5.67	2.36	1.03	0.39	3.46	15.83	101.35
C_V, % - coefficient of variation	9.71	13.15	8.19	12.57	26.59	38.39	40.90	38.75	37.31	23.92	24.92
$S_{\bar{X}}$ - arithmetic average error	0.39	0.35	0.27	0.22	0.74	0.34	0.26	0.05	0.45	2.06	13.20
$SID_{0.5}$ - the smallest important difference	1.80	1.02	0.80	0.61	2.11	0.88	0.76	0.12	1.31	5.91	37.77
$SID_{0.5}$, %	8.34	9.94	4.35	6.37	9.90	14.39	15.32	12.0	14.12	8.93	9.29

As a result of the study of the productivity of the eggplant plant collection samples, the amount of the dry substance in the vegetative parts in the fruit formation phase, it was determined that the sort samples of 161, 166, 173/A, 174, 177, 179, 182, 205, 210, 286 (1.3 kg), 140/A, 168, 181/A, 206 (1.4 kg), 174 (1.5 kg), 179/A (1.7 kg) and 254 (2.2 kg) (17 samples in total) differed according to the productivity of one plant, the sort samples of 159 (22.2%), 187 (22.3%), 164, 225 (22.4%), 173 (22.5%), 174 (22.7%), 222 (22.8%), 150 (22.9%), 208 (23.3%), Ganja (23.6%), 137 (23.9%), Zahra (24%), 170 (24.2 %), 202 (24.9%) (14 samples in total) according to the amount of the dry substance in the leaves, the sort samples of 195 (15.5%), 213 (15.7%), 156 (15.8%), 158 (15 ,9%), 180, 159 (16.1%), 174 (16.2%), 222 (16.5%), 164 (16.6%), 173 (17.2%), 170 (17 .5%) and 202 (17.6%) (12 samples in total) according to the amount of the dry substance in the stems and stalks.

5.4. Distribution of total wet biological mass in the vegetative organs and fruits of the eggplant collection samples

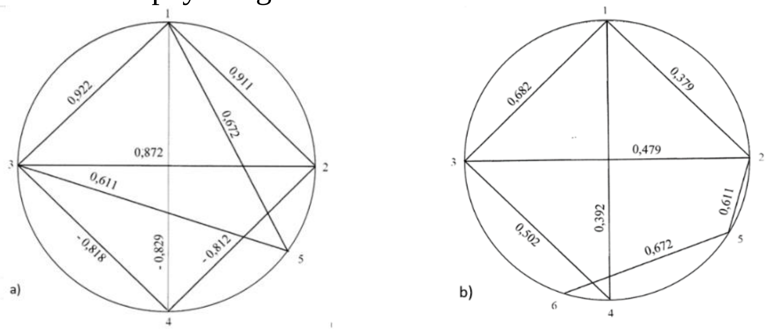
In the vegetative and generative organs of the eggplant plant collection samples, the amount of the wet biomass varies depending on the characteristics of the sorts and the meteorological conditions during the research years. The change limit of the amount of the wet biomass is between 31.5-135 g in the leaves, 30.0-150 g in the stems and stalks, 10.1-138.8 g in the fruits, 5.8-24.2 g in the root part, and 0.20-1.06 g in the flowers.

The distribution of the collection samples of the wet biomass in the vegetative and generative organs occurs mainly (in 58.6% of the studied samples) according to the stem and stalk-leaf-fruit-root part-flower scheme, according to the fruit-stem and stalk-leaf-root - flower scheme in 17.2%, according to the fruit-leaf-stem and stalk-root part-flower scheme in 10.4%, according to the stem and stalk-fruit-leaf-root part-flower scheme in 8.6% , according to the leaf-stem and stalk-fruit-root part-flower scheme in 5.2%. The most characteristic aspect of the distribution of the wet biomass on the plant organs is that the lowest amount of the wet biomass is observed in the root and flower portion, and the highest amount in most cases in the leaves (in some cases in the fruit, stem and stalk) depending on the characteristics of the sorts.

CHAPTER VI.
CORRELATION RELATIONS BETWEEN DIFFERENT IMPORTANT FARM INDICATORS IN THE POTATO AND EGGPLANT SORT SAMPLES

6.1. The correlation relations between different important farm indicators of the potato sort samples

The results of the correlation analysis conducted on 20 samples of the potato sorts showed that the correlation relations were of different levels between different physiological and biochemical indicators.



P≥0,05 P≥0,05

Figure 5. The correlation relations between different physiological indicators in the potato sort samples

Note: a) 1-ASL; 2- Chlorophyll; 3-PP; 4-SSDL; 5- Productivity. b) 1- Dry biomass; 2- PP; 3- Wet biomass; 4- Chlorophyll; 5- Productivity; 6- FECP.

The correlation relations were studied among 24 indicators – leaf surface-chlorophyll, leaf surface-productivity, chlorophyll-productivity, chlorophyll-photosynthetic potential, productivity- photosynthetic potential, wet biomass-chlorophyll, dry biomass-chlorophyll, dry biomass-photosynthetic potential, wet biomass-photosynthetic potential, starch -wet biomass, starch-dry biomass, the mass of the aboveground part-the mass of the tubers, SSDL-ASL, SSDL-PP, SSDL-total dry biomass, SSDL-total wet biomass, SSDL-FECP, dry substance-nitrates, dry substance-photosynthetic potential, dry substance - productivity, nitrates-starch, nitratesphotosynthetic potential, nitrates-productivity of the studied samples and it was determined that the relation between some of these indicators was exact at the level of $p \geq 0.05$ and was high, in some it was at an average level, in some it was very small and was not statistically significant.

Table 9

The correlation relations between different physiological and biochemical indicators in the potato sort samples (p≥0,05)

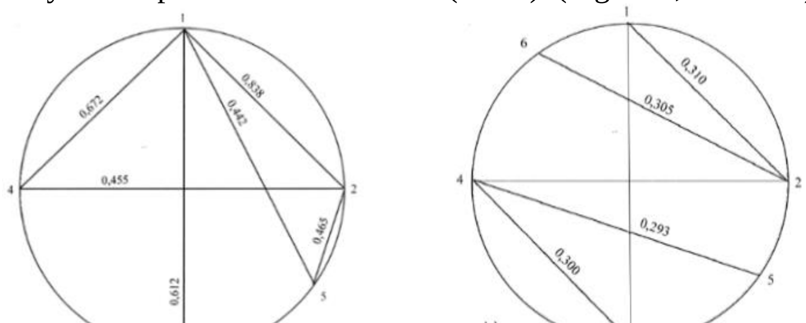
№	Physiological and biochemical indicators	Physiological and biochemical indicators											
		ASL	Chlorophyll	PP	Productivity	Dry biomass	Wet biomass	SSDL	Starch	Dry substance	Nitrates	The mass of the above-ground part	FECP
1	ASL, thousand m^2/ha	///////	0.911	0.922	0.672	0.412	0.479	-0.829	-	-	-	0.912	-0.572
2	The amount of the chlorophyll in the leaves, mg/100 g in the wet mass	0.911	///////	0.872	0.032	-	0.172	-0.812	-	-	-	0.372	-
3	PP, thousand m^2/ha.day	0.922	0.872	////////	0.611	0.379	0.479	-0.818	0.228	0.096	0.228	0.872	_
4	Productivity, cwt/ha	0.672	0.032	0.611	///////	-	-	-	-	-	-	0.712	0.672
5	Dry biomass, cwt/ha	0.412	0.192	0.379	-	////////	-	-	0.126	0.872	-	-	-
6	Wet biomass, cwt/ha	0.479	0.172	0.479	-	-	///////	-	0.291	-	-	-	-
7	SSDL, mg/cm^2	-0.829	-	-0.818	-	0.227	0.252	/////////	-	-	-	-	0.264
8	Starch, %	-	-	-	0.272	-	-	-	////////	0.212	0.209	-	-
9	Dry substance, %	-	-	0.096	0.057	0.872	-	-	0.212	///////	0.339	-	-
10	Nitrates, mg/kg	-	-	0.228	0.082	-	-	-	0.209	-	///////	-	-
11	The mass of the above-ground part, cwt/ha	0.912	0.372	0.872	0.712	-	-	-	-	-	-	///////	-
12	FECP	-0.572	-	-	0.672	-	-	0.264	-	-	-	-	///////

These correlation relations are reflected in figure 5 and table 9. As can be seen from the reflected data, the correlation coefficient is high and very high between leaf surface-chlorophyll, leaf surface-photosynthetic potential, leaf surface- productivity, chlorophyll - photosynthetic potential, photosynthetic potential-productivity and the relation between these signs is very dense directly according to the Cheddock scale, is 0.911; 0.922; 0.672; 0.872; 0.611, respectively.

6.2. The correlation relations between different important farm indicators of the eggplant sort samples

The correlation relations were studied between various physiological and biochemical indicators also in the eggplant sort samples and the results are reflected in table 10 and figure 6.

The data show that the highest correlation relations at the p≥0.05% level and direct according to the Cheddock scale were observed between leaf-surface-photosynthetic potential (0.878), leaf-surface-wet biomass (0.672), leaf-surface-dry biomass (0.612), photosynthetic potential-productivity (0.465), leaf surface-productivity (0.442), photosynthetic potential-wet biomass (0.455) (Figure 6, Table 10).



P≥0,05 P≥0,05

Figure 6. The correlation relations between some physiological and biochemical indicators in the eggplant sort samples (The correlation relations at the p≥0.05% level and direct according to the Cheddock scale)

Note: a) 1- Leaf surface; 2- PP; 3- Dry biomass; 4- Wet biomass; 5- Productivity.
b) 1- Leaf surface; 2- Chlorophyll; 3- Dry substance; 4- Productivity; 5- Wet biomass; 6- PP.

These relations can be used in the selection conducted according to the productivity.

Table 10

The correlation relations of the eggplant sort samples between different important farm indicators (n=59)

№	Physiological and biochemical indicators	Physiological and biochemical indicators							
		ASL	Chlorophyll	PP	Productivity	Dry biomass	Wet biomass	Dry substance	Nitrates
1	ASL, thousand m^2/ha	\\\\\\\\\\\\	0.310	0.838	0.442	0.612	0.672	-	-
2	The amount of the chlorophyll in the leaves, mg/100 g in the wet mass	0.310	\\\\\\\\\\\\	0.305	0.218	0.109	0.104	-	-
3	PP, thousand m^2/ha.day	0.838	-	\\\\\\\\\\\\	0.465	0.150	0.455	-0,147	0.272
4	Productivity, cwt/ha	0.442	0.218	0.465	\\\\\\\\\\\\	0.071	0.293	0.300	0.112
5	Dry biomass, cwt/ha	0.612	0.109	0.150	0.071	\\\\\\\\\\\\\\	0.175	0.443	_
6	Wet biomass, cwt/ha	0.672	0.104	0.455	0.293	0.175	\\\\\\\\\\\\\\	0.099	0.072
7	Dry substance, %	-	-	-0.147	0.300	0.443	0.099	\\\\\\\\\\\\\\\\	_
8	Nitrates, mg/kg	-	-	0.272	0.112	-	0.072	-	\\\\\\\\\\\\\\\\

So thanks to the most favorable agrotechnical measures, in the eggplant, it is possible to regulate the various valuable physiological and biological indicators with the raising the leaf surface to the optimal level. The correlation coefficients (0.293-0.310) at the level of $P \geq 0.05\%$ and relatively low level according to the Cheddock scale, but considered direct were noted between leaf surface-chlorophyll (0.310), chlorophyll-photosynthetic potential (0.305), productivity-dry substance (0.300), productivity-wet biomass (0.293). The other studied correlation relations were at the $p \geq 0.05\%$ level and weak according to the Cheddock scale, and were not statistical significant.

RESULTS

1. It was determined that in the Farida, Bellarosa and Elfe sort samples, in the mass flowering phase, the assimilation surface of the leaves and the amount of the chlorophyll in them reached the maximum limit, due to use the efficient of the sunlight energy, that is why, the photosynthesis activity of the plants is accelerated, and those samples can be used as successful donors in the future selection.

2. Although the amount of the total dry biomass in the studied collection samples of the potato varied between 11.2-39.8 cwt/ha, and the total wet biomass 92,4-377.6 cwt/ha, according to the compared relevant indicators, Colomba (327.6 cwt/ha), Elfe (260.4 cwt/ha) and Concordia (232.2 cwt/ha), Amiri-600 (39.8 cwt/ha), Colomba (38.4 cwt/ha) and Elfe (38.0 cwt/ha) sort samples were excelled from other samples.

At this time, it was determined that in the collection samples of the potato the distribution of the dry substance mainly occurs according to the root tubers-leaves-stem and stalks scheme (65,0%), and some part (25,0%) according to the leaves-root tubers-stem and stalks scheme, and the distribution of the wet biomass mainly occurs root-leaf-stem-stalk (50,0%) or root-stem and stalk-leaf (45,0%) scheme. So according to the 1st scheme, it is more appropriate to use the collection samples in which the assimilates are mostly distributed in the tubers in the selection process.

3. In the Sevinj and Amiri-600 sorts of the potato plant, PP 6-7 increases continuously from the leaf formation phase to the mass flowering phase and reaches its maximum level in this phase. The sharp decrease occurs in the price of this indicator at the end of the vegetation. The price of PP is getting more higher in all the planting schemes of the Amiri-600 sort compared to the Sevinj sort.

4. In the vegetative organs (leaves, stems and stalks) of different sorts of the potato plant, the dry substance increases beginning from the 6-7 leaf formation phase until the end of the vegetation, and reaches the maximum level in the technical ripeness phase of the tubers (this indicator is between 23.8-29% in the Sevinj sort, and 27.2-29.3% in the Amiri-600 sort). In contrast to the vegetative part, in the tubers, in the change dynamics of the dry substance, the sort differences

manifests more distinctly only in the 70x30 cm planting scheme.

5. It was detected that there are sharp differences in the change dynamics of the nitrates in the potato sorts during the vegetation. The highest amount of the nitrates was determined in the mass flowering phase, and its decrease during the transition period to the technical ripeness of the tubers in the 70x30 cm planting scheme of the Sevinj sort, and in all the planting schemes of the Amiri-600 sort. The amount of the nitrates was the lowest (72.6-92.9 mg/kg) in the newly formed tubers in all the planting schemes of both sorts. In the researched collection samples, the amount of the nitrates was 82.4-145.4 mg/kg. The highest level of the amount of the nitrates was noted in 2017 in the Sevinj sort (200.1 mg/kg), and the lowest limit was noted in the same year in the Mozart sort sample (57.0 mg/kg).

6. In the potato tubers, the accumulation dynamics of the starch and the water absorption capacity (WAC) of the tubers differ depending on the characteristics of the sorts, during the vegetation. So the amount of the starch and WAC of the tubers reach the maximum level in the mass flowering phase, the transition to the technical ripeness of the tubers is accompanied with a relative decrease of these indicators in the 70x20 and 70x25 cm planting schemes of the Sevinj sort. In the 70x30 cm planting scheme of the Sevinj sort, and in the 70x25 and 70x30 cm planting schemes of the Amiri-600 sort, the maximums are detected in the phases of the budding and technical ripeness of the tubers in the accumulation dynamics of the starch and the change dynamics of WAC of the tubers. In the Amiri-600 sort, in the planting scheme of 70x20 cm, in contrast to the other variants, the increasing of the studied indicators continue throughout the vegetation, and reach the maximum level at the end of the vegetation.

7. It was determined that the biomorphological characteristics of the potato plant are exposed to the various changes depending on the studied sort and planting scheme. So in the relatively late growing sort Amiri-600, the number of the layers, the height of the plant, the mass of the above-ground part, the masses of the leaves, stems and stalks, the number and mass of the tubers are higher than the medium-fast-growing Sevinj sort.

8. An optimal model was proposed for the first time according to

the photosynthetic indicators (the assimilation surface area of the leaf, the photosynthetic potential and the net productivity of the photosynthesis) that allow to the obtaining the preintended amount of the high potato harvest in the favorable cultivation conditions (70x25 cm planting scheme). According to the model, the outout of the tubers per thousand PP units, between 6.5-10 kg, the photosynthetic potential is 2668-4631 thousand m^2/ha×day, the assimilation surface of the leaf maximum 28.0-60.0, on average level 26.16-42.10 thousand m^2/ha 187-463.1 cwt/ha of the Amiri-600 sort in the 70x25 cm planting scheme, and the corresponding indicators from Sevinj sort 6.5-10 kg, 2668-4294 thousand m^2/ha. day, when it varies between 28.0-60.0, 26.16-42.10 thousand m^2/ha, it is possible to obtain the potato tubers in the preintended amount of 173.4-429.4 cwt/ha according to the 70x25 cm planting scheme. It is possible to obtain the potato tuber harvest of 158.3-416.8 cwt/ha from Amiri-600 sort, and 146.7-386.5 cwt/ha from Sevinj sort by controlling the price of NPP in the planting fields at the same prices of the leaf assimilation surface and photosynthetic potential.

9. The highest price of the correlation coefficient (0.611-0.922, dense according to the Cheddock scale at the level of $p \geq 0.05$) between different important farm indicators of the potato sort samples was noted between leaf surface-chlorophyll (0.911), leaf surface-PP (0.922), chlorophyll- PP (0.872), leaf surface-productivity (0.672), PP-productivity (0.611), chlorophyll-SSDL (-0.812), PP-SSDL (-0.818) and ASL-SSDL (-0.829). At the same time, the other correlation relations (0.379-0.682) were also detected at the level of $p \geq 0.05$ and considered direct according to the Cheddock scale. The correlation relations between dry biomass-wet biomass (0.682), productivity - FECP (0.672), PP - productivity (0.611), PP - wet biomass (0.479), dry biomass - chlorophyll (0.397) and dry biomass - PP (0.379) can be belonged to them.

10. The sort models were proposed according to different indicators (biomorphological, physiological, biochemical) in the eggplant plant. It was determined that 42.9% (117 samples) of the collection samples of the eggplant plant researched according to their valuable farm important signs belong to the medium-bloomers, 37.1% to the late-bloomers, and 20,0% to the early-bloomers groups. The samples of 141, 69/B, 153, 154, 179 (8-11 days) differed according to the ripening

period of the first fruits, and 211, 216, 237 and 239 (45-46 days) sort samples according to their late ripeness. And the ripening period of the first fruits varies between 12-44 days in the remaining samples. In the selection, it is recommended to use samples with the optimal vegetation period according to the ripeness period.

11. In the eggplant collection samples (59 samples), the physiological and biochemical indicators - the assimilation surface of the leaf (thousand m^2/ha), the amount of the chlorophyll in the leaves (according to the wet mass of mg/100g), the specific surface density of the leaves (SSDL-mg/cm^2), photosynthetic potential (PP - thousand m^2xday/ha), the amount of the dry substance (%) and nitrates (mg/kg according to the wet mass) in the fruits were studied and the samples differed on these signs were selected. So, the sort samples of 225, 150, 213, 164, 189, 140/B, 167 and 222 (8 samples in total) were excelled from other samples according to the assimilation surface of the leaf and the amount of the chlorophyll in the leaves, the sort samples of 164, 140/B, 189, 167 and 222 (5 samples in total) according to PP, the sort samples of 167, 140/B, 140/A, 207 (4 samples in total) according to the amount of the total dry biomass, the sort samples of 207, 223, 155, 169, 194 and 140/A (6 samples in total) according to the price of SSDL, that's why, it was recommended that these samples be used in selection.

12. The amount of the nitrates is 29.0-128.3 mg/kg in the eggplant collection samples. The lowest amount of the nitrates (29.0-58.4 mg/kg) was noted in the sort samples of 185, 207, 164, 167, 140/B, 200, 195, 206, 202, 173, 137, 212, 150 and 228 (14 samples in total). In these samples, the amount of the nitrates is 5.14-10.35 times lower than the permissible norm, which allows them to be used as environmentally clear product.

13. In the vegetative parts and fruits of the eggplant collection samples, the variation limit of the wet biomass was between 31.5-135 g in the leaves, 30.0-150 g in the stems and stalks, 10.1-138.8 g in the fruits, 5.8-24.2 g in the root part, and 0.20-1.06 g in the flowers.

14. As a result of the study of the productivity of the eggplant plant collection samples, the amount of the dry substance in the vegetative parts in the fruit formation phase, it was determined that the sort samples of 161, 166, 173/A, 174, 177, 179, 182, 205, 210, 286 (1.3 kg),

140/A, 168, 181/A, 206 (1.4 kg), 174 (1.5 kg), 179/A (1.7 kg) and 254 (2.2 kg) (17 samples in total) exceed according to the productivity of one plant, the sort samples of 159 (22.2%), 187 (22.3%), 164, 225 (22.4%), 173 (22.5%), 174 (22.7%), 222 (22.8%), 150 (22.9%), 208 (23.3%), Ganja (23.6%), 137 (23.9%), Zahra (24,0%), 170 (24.2 %), 202 (24.9%) (14 samples in total) according to the amount of the dry substance in the leaves, the sort samples of 195 (15.5%), 213 (15.7%), 156 (15.8%), 158 (15.9%), 180, 159 (16.1%), 174 (16.2%), 222 (16.5%), 164 (16.6%), 173 (17.2%), 170 (17 .5%) and 202 (17.6%) (12 samples in total) according to the amount of the dry substance in the stems and stalks, therefore, it is recommended to use these samples in the next stages of the selection process.

PRACTICAL RECOMMENDATIONS

As a result of the study of the potato and eggplant sort samples, it is appropriate to apply the following proposals in practice:

1. It is recommended to use Jelli, Mozart, Concordia and Panomera sort samples selected according to the biologically and farm important signs among the potato sort samples, to be also used as starting material for creating the disease-resistant sorts, as well as to be regionalized as high-yielding sorts in the republic.

2. Since the Farida, Bellarosa and Elfe sort samples of the potato plant are characterized with the high assimilation surface of the leaf, photosynthetic potential and the amount of chlorophyll in the leaves, it is appropriate to use them as parent forms in the future selection work conducted according to the productivity.

3. A model of the optimal indicators of the photosynthetic signs (the assimilation surface area of the leaf, the photosynthetic potential, and the net productivity of the photosynthesis) was proposed in order to obtain a high harvest from medium-growing (Amiri-600) and fast-growing (Sevinc) sorts in the 70x25 cm planting scheme in the potato for the Absheron condition of Azerbaijan.

4. It is considered appropriate to use the high correlation relations ($r=0.672-0.922$, $P\geq0.05$) detected in the potato collection samples conducted in the future selection due to the productivity and adaptability.

5. The collection samples of 144, 160, 161, 164, 167, 173, 174, 179, 180, 180/A, 183, 187, 200, 206, 225, 226, 229, 236, 242, 256 (a total of 20 samples) of the eggplant differed according to the biomorphological and farm important signs, as well as quality indicators, were recommended as sort models for use as valuable donors in future selection conducted due to the productivity, quality and adaptability.

6. It is recommended to use the correlation relations ($r=0.442$-0.838, $P\geq0.05$), especially between the assimilation surface area of the leaf, photosynthetic potential and productivity relations detected in the eggplant sort samples in the selection conducted according to the productivity.

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Address: AZ 1098, Baku, Pirshaghi settlement, Sovkhoz № 2.

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