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EVALUATION OF EGGPLANT COLLECTION SAMPLES BY PHYTOMETRIC INDICES, AMOUNT OF DRY MATTER AND NITRATES

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Abstract. In 2016-2017, 55 collection examples of eggplants were evaluated on phytometric indicators, quantities of dry matter and nitrates in vegetative organs and fruits. Differed samples were selected and recommended as a donor for future breeding (productivity and quality). As a result of the research, the distribution of dry matter on the surface of the eggplant seedlings was carried out in the following scheme: leaves –stems and sprouts – fruits. The highest amount of dry matter is observed in leaves, and the smallest amount is found in fruits. According to the number of nitrates which is the most important quality indicators, the collection samples were distinguished by the Ministry of Health of the Republic of Azerbaijan (300 mg/kg) for the fruits of these plants (29.0-151.3 mg/kg) to use them as a valuable donor to qualify for quality.

Keywords: *eggplant, collection samples, donor, selection, leaf surface, chlorophyll, absolute surface density of leaves (ASDL), dry matter, nitrates.*

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1. Introduction

Despite the fact that vegetarianism has an ancient history in Azerbaijan, the level of production of vegetable products has not yet reached the level of population coverage throughout the year. The increase in production should be at the expense of increased productivity rather than at the expense of expansion of sown areas, as in most developed countries.

The researches show that climate and soil condition of vegetable growing regions of the republic are very good for obtaining abundant and high-quality products.

Aubergine always occupies and holds the leading place among the vegetable crops in our country due to its sown area and production volume. So, the eggplant plant is grown in about 6000 hectares and produces about 100,000 tons of eggplant. Eggplant is one of the most commonly used vegetable product of Azerbaijani people, and many national dishes are prepared in our country (eggplant dolma, stuffing ingredient, caviar, roasted aubergine, etc.), which are characterized by high taste and nutritional quality.

According to the Food Institute of the Russian Academy of Medical Sciences, for normal living activities, people are required to eat 2-5 kg of eggplant every year. According to our calculations, this amount must be at least 5-8 kg. If we add canned eggplant products (salted, caviar forms), then this figure should be at least 8-11 kg. If we take into account that the population of the republic in 2021 is expected to reach 11 million, then it is necessary to produce 88-121 thousand tons of eggplant to meet the

needs of the population. Today, only 90-96 thousand tons of eggplant is produced in Azerbaijan.

Thus, the creation of new productive eggplant varieties to meet the increasing demand of the population of eggplants, as well as the selection of perspective species and samples suitable for local conditions within existing collection samples should be priorities.

Aubergine contain 6.0-12.5% of dry matter, 2.5-5.0% sugars, 0.8-3.7% starch, 0.1-0.4% protein. In addition, eggplant has solanol alkohydrate (1.2-2.5 mg/100 g) capable of keeping the amount of cholesterol in 1-2% required for the human body. Aubergine also contains minerals such as potassium, calcium, phosphorus, iron, 5-15 mg / 100k ascorbic acid (vitamin C), 0.6 mg / 100g nicotine acid, a small amount of thiamine (vitamin B1), riboflavin (vitamin B2), 1-1.5 mg/100 g phenolcarbonic acid, 0.27-0.64% pectins, etc.

2. Material and methods

As an object of the research, domestic and overseas originals and hybrids have been used. These samples are placed in the collection area with 70 x 35 cm planting scheme. The following agrotechnical care for plants is provided: regularly loosening of soil, destruction of weeds, once a week irrigation, fight against diseases and fertilizers, soil softening after each irrigation and filling of plants.

3 sorting works were carried out on the crops: For the first time in the planting circulation of seedlings, for the 2^{nd} time in the mass flowering phase, and finally for the third time in the mass adult phase of fruits.

In addition to the botanical characteristics of plants, the amount of chlorophyll in the leaves, the absolute density of the leaves, the amount of dry matter and nitrates in the vegetative organs and fruits have been studied during the fruit formation phase.

On the collection, leaf surface determined by LI-3000C, the amount of chlorophyll in the leaves is determined by the SPAD-502 Plus Chlorophyll Meter device and the nitrate content in the fruits is determined using the Nitrotometer (SOE) device. The amount of dry matter in vegetative sections and fruits is determined according to A. Yermakova (Yermakova,1987). ASDL determined as dry weight of the single leaf surface, expressed in mg/cm^2.

The main objective of the collection of plants in the field of plantation is to select the best samples of the species adapted to local climatic conditions as the starting material, to study all their valuables and important biological characteristics, and to choose parenting pairs to be used in subsequent cross-breeding.

2. Results and discussion

2.1. Evaluation of eggplant varieties by phytometric indicators

Phytometric indicators are usually associated with the symptoms in contact with the process of photosynthesis, which plays an important role in plant life. All the growth and development processes in the plant and the important chemicals collected in them are related to the photosynthesis of the plant (Aliyev *et al*., 1988; Pivovarova, 2015).

Since photosynthesis mainly goes on the leaves, or rather in their chloroplasts, chlorophyll molecules, their absolute density and the study of the amount of chlorophyll in the leaves is important for the evaluation of eggplants.

The amount of chlorophyll in the leaves is important from the point of view of selection. As a result of photosynthesis in chlorophyll molecules, organic substances that are essential for the life of plants are forming.

Since the amount of chlorophyll in the leaves has a sort order (i.e, a genotypic mark), selective marking on this specimen creates favorable conditions for the production of high-durable, abiotic factors (especially lightning, drought, cold, heat, etc.) (Pivovarova, 2015; Starykh & Samsonov, 2002; Stepanova, 2000).

Table 1 illustrates the results of the eggplant plant samples for phytometric indicators and productivity.

As a result of the research it was found that according to the indicators which are learned, sort samples can be divided into 3 groups. The first group was characterized by an lowest level of these indicators (leaf surface -3634-5353m^2/ha, chlorophyll -55,7-157,2 mg/plant, ASDL-4,5-6.8 mg/cm^2 and productivity-0,4-0,8 kg/plant). The second group was characterized by an average level of these indicators (5724-10665 m^2/ha respectively, 161.4-227.5 mg/kg, 7.0-8.5 mg/cm^2 and 0.9-1.4 kg/plant). The third group was characterized by the highest level of indicators (11414-17262 m^2/hectare, 236.5-324.2 mg/hectare, 9.0-16.9 mg/cm^2 and 1.5-2, 7 kg/plant).

Table 1. Evaluation of eggplant collection samples for some phytometric indicators and productivity (at the fruit-forming phase)

No	Catalog number	Names and origin of samples	Leaf surface, m2 / ha	Chlorophyll, mg / plant	ASDL mg/sm^2	Productivity per plant, per kg
1	40	Ganja-standard (Azerbaijan)	8986	153,9	8,5	0,6
2	42	Zahra-standard (Azerbaijan)	10359	225,8	5,9	0,7
3	69/B	Selected line number 69	10157	198,3	5,9	0,9
4	149	K-584 SGR-584 Dlin.fiolet.-239 (Russia)	12706	240,5	6,1	0,5
5	164	K-2839 SGR—2839 Mestnıy (Russia)	9410	173,7	7,5	0,4
6	137	Pantera (Azerbaijan)	10665	227,5	8,5	0,4
7	202	XIAO CHVM (Russia)	5178	111,7	8,1	0,6
8	169	K-2670 SGR-2670 Violette tongue	4226	96,4	8,3	0,7
9	140/B	F1 Terong selected line (Indonesia)	12926	271,4	6,3	0,9
10	141	F1 Terong jellyte selected line (Indonesia)	12039	223,6	8,2	0,8
11	176	AG-1692 Some-136 Absheron-3 (Azerbaijan)	8993	189,3	6,3	0,8
12	140/A	F1 Terong selected line (Indonesia)	9697	161,9	16,9	0,8
13	174	AG-1691 Some-135 Shahbuz (Azerbaijan)	10201	192,7	6,3	0,4
14	188	CA PHAO TRAWG (Vyetnam)	4481	100,0	7,8	0,9
15	173	AG-1690 Some-134 Lenkoran-3 (Azerbaijan)	7640	161,4	7,7	0,5

16	151	K-632 SGR-632 B / H Kirgizsk (Kyrgyzstan)	3652	60,2	6,6	0,5
17	203	AS Ante seed (Russia)	6461	119,9	6,4	1,0
18	162	K-989 SGR-989 M.M-212	7447	107,8	5,6	0,3
19	182	ÜETTBSTİ–Agat F_1 (Russia)	4553	57,9	4,8	2,0
20	208	Yokohama, (Japan)	4066	80,1	7,5	0,9
21	210	Black Beauty (US)	6442	123,7	5,8	1,8
22	155	K-819 SGR-819 Puza Purple	7447	89,1	9,4	0,6
23	211	Preplone F1 (France)	6663	126,9	5,2	0,3
24	212	Mission Bell (Netherlands)	5724	99,9	7,2	1,4
25	214	Solora F_1 (Netherlands)	6709	125,1	6,1	1,2
26	158	K-886 SGR-881	6395	108,4	7,5	0,6
27	180	UETTBSTI-13-12 F_1(Russia)	17262	324,2	5,4	1,3
28	159	K-907 SGR-907 Burpec Hybrid	3365	70,8	5,4	0,7
29	226	VI 04 2481(Iran)	13750	284,6	5,3	1,8
30	156	K-835 SGR-835 Kairyota natanagu (Israel)	9437	174,8	5,5	1,2
31	207	Pekinskiye çornıye (Russia)	10628	208,6	8,2	1,6
32	168	K-1004 SGR-1004 Mestnıy (Russia)	9679	209,3	7,0	1,5
33	215	Onstramsa de Nev Jc (Spain)	12615	249,2	5,5	0,9
34	213	Falina F_1 (Netherlands)	11414	236,5	5,4	0,9
35	179	ÜETTBSTİ -13-17 F_1(Russia)	3634	55,7	4,8	2,7
36	143	Aydın siyahi (Turkey)	9928	169,3	5,3	0,8
37	228	VI 047327 (US)	12914	162,4	9,0	1,5
38	225	VI 042317 (Iran)	16217	217,5	6,5	1,5
39	189	Ca BAT TRAHG (Russia)	8766	147,1	5,3	0,9
40	196	Vostoçnıy ekspres (Russia)	5353	103,1	5,9	0,9
41	170	K-3099 SGR-3099 E_1 Hybrid, N29	14951	252,3	6,0	1,5
42	206	Solyaris (Russia)	13721	305,6	6,0	2,1
43	154	K-791 SGR-791	15627	267,6	5,2	0,6
44	167	K-923 SGR-954 Black beonity	11442	249,6	6,2	1,3
45	144	Ordubad, (Azerbaijan)	13297	214,4	5,6	0,8
46	187	Early Beauty (Russia)	4076	91,8	6,8	0,7
47	160	K-923 SGR-923 local	11732	201,8	9,1	0,9
48	185	HIGH Resistant todiseast and AİGH YİİLD (İtaly)	9773	211,5	5,3	1,1
49	223	Vİ 042687 (India)	11890	255,9	8,2	1,3
50	195	Nijnevoljskiy (Russia)	4591	76,0	5,0	0,8
51	199	Banan (Russia)	8129	157,2	5,9	1,0
52	205	Snejnıy (Russia)	6275	120,5	5,7	1,4

53	150	K-627 SGR-627 Baklajan C-64 (Russia)	10208	151,1	4,5	1,1
54	181	UETTBSTI -13-22 F_1(Russia)	15401	320,7	5,0	1,8
55	194	Freqat (Russia)	4135	90,0	9,5	0,8
Changing interval of phytometric statics		I	3634-5353	55,7-157,2	4,5-6,8	0,4-0,8
		II	5724-10665	161,4-227,5	7,0-8,5	0,9-1,4
		III	11414-17262	236,5-324,2	9,0-16,9	1,5-2,7

Among the examples which is studied, the following examples are important for future selection:149 (leaf surface 12706 m^2/ha, chlorophyll 240.5 mg / plant, ASDL-6.1 mg/cm^2), 140 / B (12926 m^2/ha 271.4 mg/plant 6.3 mg/cm^2), 141 (12039 m^2/ha, 223.6 mg/plant 8.2 mg/cm^2), 180 (17262 m^2/ha 324.2 mg/plant 5.4 mg/cm^2), 215 (12615 228 (12914 m2 / ha; 162.4 mg / plant; 9.0 mg / cm2), 225 (16217 m2 / ha, 217, m2 / ha; 249.2 mg / plant 5.5 mg / cm2) 5 mg / plant, 6.5 mg / cm 2), 170 (14951 m^2/ha 252.3 mg/plant 6.0 mg/cm^2) 206 (13721 m^2/ha 305.6 mg/plant , 154 (15627 m^2/ha, 267.6 mg/plant, 5.2 mg/cm^2), 144 (13297 m^2/ha, 214.4 mg/plant 5.6 mg/cm^2). Apparently, some of these examples are selected by high productivity(1,3-2,1 kg/plant), (225, 228, 226, 180, 206). We believe that these samples can be drawn into the production process, as well as varieties that are well adapted to local conditions by performing certain sorting activities and seeding. Among the examples studied, the most recent selection of yields for the productivity of the 180, 225, 154, 181, 170 large-size leaf surface (14951-17262 m^2 / ha) and high chlorophyll (252.3-324.2 mg/plant) can be used as good donors. It should be noted that, with regard to small exceptions (eg 205, 168, 210 specimens, the amount of chlorophyll on the leaves is moderate), high productivity plants have a higher leaf surface and higher levels of chlorophyll. Also, it should be noted that the large area of the leaf surface still does not mean that the species has a high economic value, the active leaf area, the amount of chlorophyll and the absolute density of the leaves provide more information for the growth and development of the plant. Among the studied variables, the highest value of ASDL was recorded at 140 / A (16.9 mg/cm^2). However, this sample does not have a dominant position among the other varieties on the surface of the leaf and chlorophyll and is not selected with productivity (0.8 kg/plant). This sample can be a good donor to get a drought-resistant sort. According to some researchers, there is a positive correlation between the ASDL and the intensity of photosynthesis. This means that when the density of the leaves increases, the thickness of the basic structural elements increases. This, in turn, plays a role in assisting the transmission of carbon dioxide (CO_2) in leaves, in particular increasing mesophilin permeability (Aliev & Kazibekova, 1988; Rasulov & Asrorov, 1982). By studying ASDL in watermelon plant, Prof. M. Yusifov showed that this indicator has positive correlation relations with biological mass, chlorophyll value in leaves, coefficient of use of reduced photosynthetic active beam, photosynthesis intensity, photosynthetic phosphorylation and productivity (Yusifov & Aghazadeh, 2003).

According to the ASDL, 228 (9.0 mg/cm^2), 160 (9.1 mg/cm^2), 155 (9.4 mg/cm^2) and 194 (9.5 mg / cm2) are also selected. However, only 228 are different from those of both the size of the leaf surface and the amount of chlorophyll, as well as for the productivity. In our study, it is worth noting that in most of the learned varieties (the

number of such samples is 38), the cost of ASDL is between 4.5-7.0 mg/cm^2. The lowest quantity of ASDL is 150 (4,5 mg/cm^2), 179 (4,8 mg/cm^2) and 182 (4,8 mg/cm^2). However, 182 is characterized by high productivity, 150 is characterized by big leaf surface, chlorophyll levels, and moderate levels of productivity.

Thus, the research showed that the learned phytometric indicators have a sort order and they vary widely in varieties. It is possible to select valuable donor specimens for future selection with different varieties (productivity, quality, abiotic stability, etc.) using this variation.

2.2. Estimation of dry matter, nitrate content in vegetable portions and fruits of eggplant plant samples

Sort samples varies widely because of the amount of dry matter and nitrates. It is possible to choose samples that differ in the amount of dry matter and nitrates among the varieties learned using this factor.

Accumulation of high nitrates in plant products, including eggplants, can be dangerous to the human body, this danger can lead to death. Some of the nitrates that are infused into the human body are converted to nitrites and nitrosamines by the influence of some microorganisms and enzymes in the gastrointestinal tract, which is 10 to 20 times stronger than nitrates due to their toxic effects. Nitrate nitrogen, even in small quantities that regularly enters the body causes chronic poisoning of the person. At this time, some adverse changes occur in the liver, kidneys, heart, and lungs (Agayev *et al.*, 1988).

The results of the study of the amount of dry matter as well as the amount of nitrates in vegetative portions and fruits of the eggplant plant collection samples are presented in Table 2. As can be seen from Table 2, the amount of dry matter and nitrates in the leaves varies widely (17.3-29.4% in the leaves, 8.7-12.4 in the hull and stem) %, 7.2-12.2% in fruits). It should be noted that, as in most plants, dry matter is the most commonly collected in the leaves, then the trunk and stems, and finally fruits.176 (29.4%), 223 (27.3%), 168 (26.2%) and 202 (26.1%) specimens were found to be the most dry matter in the leaves, 202 (12.4%) in hull and stem, 188 (12.3%), 189 (12.2%), 187 (12.1%) and 210 (12.0%), fruits - 208 (12.2% , 155 (12.2%), 226 (11.7%) and 159 (11.4%).

Table 2. Estimation of the amount of dry matter and nitrates in vegetable portions and fruits of the eggplant plant collection samples

No	Catalog Number	Names and origin of samples	Quantity of dry matter in leaves,%	Quantity of dry matter in hull and stem,%	Amount of dry matter in fruits,%	The amount of nitrates in fruits, mg/kg
1	40	Ganja-standard (Azerbaijan)	22,5	10,1	8,5	67,5
2	42	Zahra-standart(Azerbaijan)	21,4	9,7	7,2	74,7
3	69/B	Selected line number 69	19,3	9,8	7,6	52,0
4	149	K-584 SGR-584 Dlin.fiolet.-239 (Russia)	21,7	10,3	9,3	151,3

5	164	K-2839 SGR—2839 Mestnıy (Russia)	22,1	10,7	7,4	106,3
6	137	Pantera (Azerbaijan)	23,3	11,2	7,2	114,0
7	202	XIAO CHVM (Russia)	26,1	12,4	7,3	59,3
8	169	K-2670 SGR-2670 Violette tongue	25,1	12,2	8,5	94,0
9	140/B	F1 Terong selected line (Indonesia)	22,5	11,4	8,2	89,0
10	141	F1 Terong jellyte selected line (Indonesia)	22,3	11,1	10,0	53,7
11	176	AG-1692 Some-136 Absheron-3 (Azerbaijan)	29,4	11,3	8,1	73,0
12	140/A	F1 Terong selected line (Indonesia)	24,0	11,2	8,2	65,0
13	174	AG-1691 Some-135 Shahbuz (Azerbaijan)	21,4	10,3	8,1	78,0
14	188	CA PHAO TRAWG (Vietnam)	24,9	12,3	8,8	98,0
15	173	AG-1690 Some-134 Lenkoran-3 (Azerbaijan)	22,6	11,7	7,2	69,7
16	151	K-632 SGR-632 B / H Kirgizsk (Kyrgyzstan)	20,2	10,7	10,2	108,7
17	203	AS Ante seed (Russia)	20,8	10,9	8,0	47,5
18	162	K-989 SGR-989 M.M-212	17,3	8,7	8,8	53,5
19	182	UETTBSTI–Aqat F_1 (Russia)	18,3	8,9	8,9	49,0
20	208	Yokohama (Japan)	25,4	12,2	12,2	119,7
21	210	Black Beauty (US)	23,3	12,0	11,7	82,7
22	155	K-819 SGR-819 Puza Purple	20,2	10,8	12,2	63,0
23	211	Preplone F_1(France)	21,6	10,3	9,0	32,6
24	212	Mission Bell (Netherlands)	20,5	10,2	8,8	79,0
25	214	Solora F_1 (Netherlands)	20,4	10,2	7,9	79,3
26	158	K-886 SGR-881	21,7	10,8	8,8	46,3
27	180	ÜETTBSTİ-13-12 F_1(Russia)	20,3	10,1	10,9	55,4
28	159	K-907 SGR-907 Burpec Hybrid	22,9	11,7	11,4	44,8
29	226	VI 04 2481(Iran)	20,4	10,3	11,7	45,8
30	156	K-835 SGR-835 Kairyota natanagu (Israel)	18,6	9,7	10,3	40,3
31	207	Pekinskiye çornıye (Russia)	22,8	11,1	8,9	39,3
32	168	K-1004 SGR-1004 Mestnıy (Russia)	26,2	12,3	8,9	61,5
33	215	Onstramsa de Nev Jc (Spain)	19,4	10,1	8,3	61,8
34	213	Falina F_1 (Netherlands)	20,5	10,5	7,8	53,8
35	179	ÜETTBSTİ -13-17 F_1(Russia)	17,6	8,8	7,8	43,5
36	143	Aydın siyahi (Turkey)	18,9	8,9	9,8	46,0
37	228	VI 047327 (US)	22,0	11,1	9,8	35,2
38	225	VI 042317 (Iran)	22,4	11,5	10,4	37,0

39	189	Ca BAT TRAHG (Russia)		18,0	9,5	9,1	120,3
40	196	Vostoçnıy ekspres (Russia)		22,4	11,8	9,0	41,3
41	170	K-3099 SGR-3099 E_1 Hybrid, N29		21,4	11,3	9,8	45,3
42	206	Solyaris (Russia)		20,7	10,9	7,6	38,7
43	154	K-791 SGR-791		20,2	10,1	9,5	49,3
44	167	K-923 SGR-954 Black beonity		22,0	11,2	9,3	36,3
45	144	Ordubad, (Azerbaijan)		20,8	11,1	9,4	42,3
46	187	Early Beauty (Russia)		23,1	12,1	11,0	48,8
47	160	K-923 SGR-923 local		22,2	11,4	8,0	55,1
48	185	HİGH Resistant todiseast and AİGH YİİLD (Italy)		20,0	11,9	8,3	29,0
49	223	Vİ 042687 (India)		27,3	11,9	9,7	46,4
50	195	Nijnevoljskiy (Russia)		19,1	10,3	8,3	56,8
51	199	Banan (Russia)		19,9	10,4	10,6	58,0
52	205	Snejnıy (Russia)		19,9	10,4	7,9	55,3
53	150	K-627 SGR-627 Baklajan C-64 (Russia)		21,0	10,7	8,3	57,6
54	181	UETTBSTI -13-22 F_1 (Russia)		20,2	10,1	9,7	62,7
55	194	Freqat (Russia)		21,7	11,2	8,0	79,1
Change interval of indicators			I	17,3-20,2	8,7-10,1	7,2-9,0	29,0-52,5
			II	20,3-24,0	10,3-11,3	9,1-11,0	53,5-74,7
			III	24,9-29,4	11,4-12,4	11,4-12,2	78,0-151,3

It should be noted that the amount of dry matter in the leaves (17.3-29.4%) is at least 2 times higher than that of the hull and stem (8.7-12.4%), which is why the physiological and biochemical processes in the leaves are so important. It is clear that 95% of the substances needed for the plant's life activity have been created here, and that they are transported to other organs through the body and stem.

Thus, as a result of this research, it can be concluded that, with small exceptions, the distribution of dry matter in vegetable portions and fruits occurs on the following scheme: leaves–stem and saplings – fruits. Only in the 226 and 156 varieties this scheme and takes the following form: leaves - fruits - bole and sprouts.

Eggplant can be divided into 3 groups for nitrate collection. The first group included at least nitrate-collecting samples (29.0-52.5 mg/kg, total 23 samples), the second group included mid level nitrate-collecting samples (53.5-74.7 mg/kg, total 19 samples) and the third group includes nitrous samples (78.0-151.3 mg/kg, total 13 samples). However, it should be noted that the amount of nitrates in any sample has not exceeded the allowed norm (300 mg/kg) established for the eggplant by the Ministry of Health of the Azerbaijan Republic. Even in the samples included in the third group, the amount of such nitrates is at least 1.98-3.85 times lower than the allowable limit. In spite of all this, the 23 samples included in Group I (69 / B, 203, 162, 182, 211, 158, 159, 226, 156, 207, 179, 143, 228, 225, 196, 170, 206, 154, 167 , 144, 187, 185, 223) may be used as the best donors in a future quality selection.

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