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STUDY OF THE EFFECT OF DROUGHT ON THE ECONOMIC PARAMETERS AND HEIGHT DYNAMICS OF FABA BEAN VARIETIES INTRODUCED FROM ICARDA

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Global climate change in today's world has caused environmental degradation on Earth. Stress factors such as drought can affect the growth, development and productivity of many valuable crops, causing them to die. As one of the priority crops of the modern era, pulses are an important part of the food basket of the population. They are considered one of the most important alternative foods for meeting the daily protein requirements. The minimal use of animal protein and the widespread use of legumes, which are rich in plant protein, to replace it, leads to a reduction in the need for animal husbandry and the replacement of pasture with arable land. This helps to increase the area sown to legumes and other crops in the country. The faba bean is the cheapest food crop in the agricultural sector. The Turgoromer-1 instrument was used to determine the water retention capacity of the leaves of the horsebean varieties, and an infrared thermometer was used to determine the temperature change at plant level due to leaf transpiration. According to the results of the researches, the most promising varieties for the Absheron district are Rebeya 40; FLIP17-010FB; FLIP17-008FB; FLIP17-032FB; FLIP16-202; FLIP17-055FB; FLIP17-033FB; FLIP16-200; Misir-3. Height to 1st bean and plant length (r=0.854*), number of seeds and beans per plant (r=0.982**), bean length and number of seeds per plant (r=0.986**), grain weight per plant and plant height (r=0. 939*), grain weight per plant and number of seeds per plant (r=0.886*), grain weight per plant and bean length (r=-0.885*), grain yield and plant height (r=0.950*), positive reliable relationships between grain yield and number of seeds per plant (r=0.947*) and seed weight (r=0.885*), hundred seed weight and number of beans (r=0.894*).

Keywords: faba bean, cultivar, introduction, drought, water retention capacity, correlation

In our country the area sown with legume crops is almost insignificant. In order to increase the production of these plants in our country the main task is to create new productive varieties, mechanization of their harvesting and introduction in farms. Considering the diversity of soil and climatic conditions, it is necessary to create varieties of intensive type by selecting high yielding, disease resistant, mechanized varieties for the regions. Therefore, it is necessary to conduct ecological experiments of the faba bean plant in different regions of our republic, determine the superior characteristics and create by breeding suitable varieties for each region [1; 2].

More recently, simpler devices have been used to study drought tolerance. For example, the water-holding capacity of the leaves can be determined with the «Turgorometer-1», and the change in temperature at planting level due to transpiration in the leaves with an infrared thermometer. The drought tolerance of wheat and ramson has been evaluated using these devices [3]. Other methods are used to determine the weight of the root system of faba bean plants [4], grain yield, number of days to flowering, shortening of the growing season, etc. [5]. to nozzle permeability, product index [6]. The effects of drought on plant height and development, 100 seed weight, yield, chlorophyll content [7], root system and dry biomass of 40 faba bean samples cultivated under different conditions of water supply were studied [6].

Drought adversely affects plant growth and productivity. The resilience of plants to drought stress depends on their species and the degree of water loss. Some varieties can withstand drought stress because they use water more efficiently.

As a result of drought stress, oil, starch and carbohydrates, various oils, esters and synthesis of specific substances are impaired. Conversely, the amount of protein starts to increase. Literature reviews show that varieties grown in arid regions have higher protein and starch content than varieties grown in humid and irrigated areas. A high protein content increases the energy of the plant and reduces water loss, preventing plant mortality.

Materials and methods of research

Research work was carried out at Absheron experimental base of RICH in 2017-2018, 2018-2019, 2019-2020 and 2020-2021. The Apsheron Peninsula is located on the western coast of the Caspian Sea near the 40th parallel, N400 31.957' north latitude and E49052.525' east longitude, at 6 m above sea level. The area has hot and dry summers and mild winters. Average annual temperature in the area is 10-140C, the average temperature in January is -10C to 50C, and the average temperature in June is 21-270C. The average annual wind speed, typical

for the region, is 4-8 m/s. Mostly northern winds dry out the soil, which increases the water demand of plants. The average annual precipitation on Apsheron Peninsula is 311 mm and is distributed unevenly. Most precipitation falls in autumn and winter and 10% falls in spring.

Soil in Apsheron peninsula is heterogeneous, mainly greyish-brown, poorly nutrient-depleted, alkaline and carbonatised. In terms of mechanical composition, soils are mainly clayey, sandy and poorly structured. The amount of total humus in arable layer is small and amounts to 1.27-1.32%. There are very few readily available forms of nutrients in the soil. In this soil type, the faba bean plant has a high demand for nutrients. Three nurseries containing 234 varieties of faba bean from the ICARDA International Centre were taken as research material. These include the International Ascochytosis Immunity Nursery (FBIABN), the International Brown Spots Immunity Nursery (FBICSN) and the International Mechanical Harvest Nursery (FBIMHN).

The International Classification of cultivated Vicia faba species, URBI of the All-Russian Institute of Botany, State Variety Testing of Agricultural Plants (1989), International Biodiversity Institute Methodology for determining a key set of characteristic and evaluation descriptors of faba bean (Vicia faba) – methodology were used to examine samples [7].

During the study, phenological observations of plants were made, and the resistance of samples to diseases and the dormancy period, the duration of the growing season of plants, height, position in the field, height of lowest pod –bearing node were evaluated. Height, number of grains in the pod, width, length of the pod, weight of 100 grains and yield were determined on a Turgonometer-1 device (Fig. 1,2).

As can be seen from the Table, drought stress had a negative effect on plant growth and productivity. The response of the varieties we studied to the drought was different. In this regard, the effect of drought on the design elements was different (Table 1). The drought-tolerant varieties had growing season of 210-217 days, height of 1 pod 10-40 cm, plant height 35.6-76.0 cm, number of seeds in pod 3, pod width 1.0-1.4 cm, length 6, 8-9.3 cm, yield varied from 60-471 g/m 2. The growing season for moderately drought resistant varieties was 211-217 days, the height of 1 pod 15-38 cm, plant height 31.3-76.3 cm, the number of seeds in a pod 3-4 pcs, pod size – width 1.0-1.3 cm, length 6.7-9.8 cm , the yield varied between 139-513 g/m 2 . In less drought-resistant varieties growing season 211-217 days, height of 1 pod 10-40 cm, height of the plant 31,3-86,3 cm, the number of seeds in a pod 3, pod width 1,0-1,3 cm, length 6,7-9,4 cm, the yield varied in the range 100-509 g/m2.

Fig. 1. Faba bean – Vicia faba.L (inflorescence)

Fig. 2. Faba bean – Vicia Faba.L (height measuring)

St. VIFA2-93 was moderately drought-tolerant according to the turgor index measured by the Turgorometer-1 in a local variety sample of 0.6. In the variety samples presented in Table 2, the drought tolerance was in the range (0.8-0.9). As a result of the research we can say that these varieties are suitable for the Absheron zone as drought tolerant and promising varieties (Table 2).

During the growing season, the height of the faba bean plant was measured during germination and emergence, vegetative, reproductive, pod senescence and stem senescence stages.

Table 1

Turgor and morphobiological indices of varieties of faba bean belonging to different nurseries

Sowing №	Accession name	Drought-resistance	Growing season, days	Crop height, cm	Height of lowest pod –bearing node, cm	Pod length		Number of Beans per pod, pc	100 seeds weight, gr	Yield, gr/m^2
						Width, mm	Length, cm			
FBİABN										
1	Rebeya 40	0,9	210	65	25	10	7,2	3	88	296
14	FLİP16-190	0,5	216	61	25	10	7,7	3	100	423
16	Rebeya 40	0,4	217	70	31	12	7,8	3	73	420
17	FLİP17-007FB	0,5	217	74	10	13	8,8	3	90	390
18	FLİP17-045FB	0,6	217	68	15	12	7,7	3	90	454
19	Rebeya 40	0,5	217	63	25	13	8,3	3	88	475
20	FLİP17-016FB	0,6	217	75	20	11	8,5	3	80	431
29	St.VİFA-2-93	0,4	216	73	40	15	9,0	3	90	460
30	FLİP16-199	0,4	215	86	35	11	8,2	3	93	493
31	Rebeya 40	0,6	214	77	25	13	9,0	3	74	513
32	FLİP17-022FB	0,4	213	82	38	13	9,0	3	90	425
33	FLİP17-039FB	0,4	216	74	35	12	8,0	3	95	359
34	Rebeya 40	0,6	216	72	38	12	9,8	3	85	455
35	FLİP17-010FB	0,8	217	66	35	13	9,4	4	94	471
37	Rebeya 40	0,4	217	74	38	11	7,8	3	74	509
38	FLİP17-018 FB	0,7	217	73	28	11	7,8	3	87	305
44	FLİP17-008FB	0,9	216	70	26	13	8,0	3	82	359
36	VİFA2-93(st)	0,5	217	75	35	10	9,4	3	118	466
FBİCSN										
2	FLİP17-038FB	0,5	211	53	27	13	9,1	3	94	100
12	FLİP17-032FB	0,9	211	52	20	13	7,7	3	83	384
14	FLİP16-202	0,9	214	65	25	12	7,8	3	94	263
15	FLİP17-041FB	0,5	213	59	15	10	7,0	3	67	313
17	FLİP16-215	0,6	217	63	23	15	12,0	4	90	364
23	FLİP17-055FB	0,8	212	58	19	10	6,8	3	93	326
24	FLİP17-033 FB	0,8	210	54	20	11	7,7	3	74	399
26	FLİP17-043FB	0,7	217	52	25	13	6,7	3	86	366
27	FLİP17-045FB	0,6	217	53	20	13	8,5	3	94	354
30	FLİP17-035FB	0,6	217	54	20	14	7,5	3	100	371
31	Rebeya 40	0,7	217	43	25	20	8,8	3	94	100
32	FLİP17-031FB	0,7	216	54	20	13	9,0	3	100	213
34	Rebeya 40	0,6	215	56	20	13	8,6	3	95	213
39	FLİP17-059FB165	0,5	217	49	27	15	7,3	2	95	304
42	FLİP16-200	0,9	213	56	25	14	8,1	3	78	286
29	VİFA2-93(st)	0,4	217	60	20	10	8,5	3	122	353

End of table 1

Sowing №	Accession name	Drought-resistance	Growing season, days	Crop height, cm	Height of lowest pod –bearing node, cm	Pod length		Number of Beans per pod, pc	100 seeds weight, gr	Yield, gr/m²
						Width, mm	Length, cm			
FBİMHN										
1	ELİZAR	0,9	217	53	10	13	9,3	3	110	219
2	FLİP16-205	0,5	216	63	17	14	8,8	3	86	260
7	FLİP16-217	0,7	210	41	30	10	8,6	3	78	330
8	FLİP16-214	0,6	216	47	15	13	8,8	3	100	375
10	FLİP16-012	0,6	211	47	19	12	6,8	3	64	287
11	FLİP17-055FB	0,6	212	59	17	12	8,1	3	87	263
13	FLİP16-206	0,5	213	43	15	13	7,8	2	82	286
14	FLİP16-213	0,6	216	31	12	12	8,8	3	81	209
15	Misir-3	0,8	215	36	10	12	8,6	3	80	60
21	FLİP16-211	0,5	213	31	10	10	6,7	3	80	188
22	FLİP16-014	0,5	214	37	20	12	8,0	3	70	126
25	FLİP16-011	0,6	217	45	15	12	7,8	3	90	139
18	St.VİFA-2-93	0,6	217	31	15	10	6,8	3	95	199

Table 2

Drought tolerance of faba bean varieties

Accession name	T_1	T_2	T_2/T_1
FBİABN			
Rebeya 40	102	88	0,9
FLİP17-010FB	74	57	0,8
FLİP17-008FB	90	81	0,9
FBİCSN			
FLİP17-032FB	102	88	0,9
FLİP16-202	110	100	0,9
FLİP17-055FB	96	75	0,8
FLİP17-033 FB	102	78	0,8
FLİP16-200	80	73	0,9
FBİMHN			
Misir-3	106	91	0,8
St.VİFA 2-93	112	70	0,6

The observation shows that the resistance to Ashichytosis in the nursery (FBIABN-18) increased with plant height and varied between 65 and 104 cm. In St. VIFA-2-93, the plant height index was 87-88 cm. The lowest index was 65 cm in sample FLIP16-190 and the highest index was 104 cm in sample FLIP17-022FB.

The observation shows that resistance to brown spot disease in the nursery (FLIP18) gradually increased with plant height, the plant height varied between 47 and 76 cm. In VIFA2-93, plant height ranged from 62-71 cm. The minimum value was 47 cm for FLIP16-200 and the maximum value was 76 cm for FLIP17-038FB.

Table 3

Correlation between morphobiological parameters of faba bean varieties

	PH	HLPN	BPS	NSP	PL	100SW	SY
PH	1						
HLPN	0,854**	1					
BPS	0,071	-0,392	1				
NSP	0,923*	-0,534	0,982**	1			
PL	-0,713	0,755	-0,573	0,986**	1		
100SW	-0,251	0,245	0, 894*	-0,529	0,248	1	
SY	0,950*	-0,229	0,241	0,947*	-0,944*	-0,490	1

NOTE: PH – plant height, **HLPN –** height of lowest pod –bearing node, **NBP** – Number of Beans per pod, **NSP** –number of seeds per plant, **PL** –pod length, **100SW** – 100 seeds weight, **SY –** seed yield.

The height of the plants in the nursery suitable for mechanized harvesting (FLIP18) gradually increased, the height of the plants varying between 51 and 72 cm. The plant height of VIFA2-93 was 58 cm. The lowest value was 51 cm for FLIP16-211 and the highest was 72 cm for FLIP16-210 (Table 3).

A correlation between morphobiological indices in the studied faba bean cultivars was established.

Conclusion

1. 10 promising drought tolerant (0,8-0,9) variety samples were selected from the nurseries of the faba bean for various purposes, introduced from the International Breeding Center ICARDA, and used for creation of a source material for breeding.

2. During the growing season the height of the faba bean plants during the germination and emergence, vegetative, reproductive, pod senescence and stem senescence stages was measured in 12 varieties of resistance to ashichytosis disease in nursery (FBIABN), resistance to brown spot disease in nursery (FBIKSN) in 3 mechanized harvesting conditions in nursery (FBIIMHN) in 11 varieties was higher than in local varieties St.VIFA-2-93.

3. Rebeya 40; FLIP17-010FB; FLIP-008FB; FLIP-032FB; FLIP16-202; FLIP17-055FB; FLIP17-033FB; FLIP16-200; ELIZAR; It was determined that the samples of variety Egypt-3 are important as a donor form in future breeding work. The recommended optimum biometric dimensions of plants to create a model variety of horse bean with high grain yield under the irrigation conditions of Absheron : plant height 65-100 cm, height of lowest pod –bearing node 18-25 cm, number of beans per plant 25-35, number of beans in 1 plant 9-15 cm, length 8-10 cm, bean width15-19 mm, weight of 100 grains 80-130 grams..

4. The positive correlation was ovserved between height of lowest pod –bearing node (r=0,854*), number of grains per plant and number of beans per plant (r=0,982**), length of pod and number of grains per plant (r=0,986**), grain yield and height of plant (r=0,950*), grain yield and number of grains per plant (r=0,947*) and number of pods (r=0,894*).

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