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EVALUATION OF THE 1000-KERNEL WEIGHT OF FIELD PEA (PISUM ARVENSE) ACCESSIONS

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Abstract: *Based on the research results presented in this article, the primary objective is to evaluate the 1000-kernel weight of field pea (Pisum arvense) accessions intended for cultivation on irrigated lands, and to select the high-performing genotypes displaying superior metrics.*

Keywords: *Field pea, yield, productivity, ton, centner, kilogram, gram, 1000-kernel weight, evaluation, grain, pod, variety, research, forage accessions.*

INTRODUCTION

The requirements for the seed quality of forage-type field pea varieties are relatively flexible. The seeds of such varieties can vary in size, while seed color, shape, and culinary characteristics hold minor importance for forage purposes. However, rigorous requirements are imposed on these varieties regarding their protein content and amino acid composition [1,2].

In leguminous crops, particularly in the field pea, the 1000-kernel weight serves as a primary yield component. A higher 1000-kernel weight indicates larger seed size, greater seed density, and consequently, enhanced nutritional value [3].

Research Objectives and Tasks. The objective of this research is to develop new high-yielding field pea varieties adapted to irrigated conditions, characterized by superior forage value and other economically valuable traits.

To achieve this objective, the following tasks were defined: evaluating the 1000-kernel weight, forage suitability, and other essential agronomic traits of field pea accessions, followed by selecting high-yielding, ecologically adapted, and economically valuable genotypes suitable for irrigated land cultivation.

Research Methodology and Methods. Field experiments were conducted during 2021–2023 at the "Farboma Select" scientific seed production farm, located in the Jomboy district of the Samarkand region.

Experimental layouts and field management were carried out in accordance with the manual "Methods of Conducting Field Experiments" [4].

In the laboratory evaluations, the 1000-kernel weight of the field pea accessions was determined by taking two duplicate samples of 500 seeds each. The samples were weighed on an electronic balance with an accuracy of 0.1 g. If the variance between the two weights did not exceed 3%, the 1000-kernel weight was recorded as the arithmetic mean of the two samples, calculated to the nearest 0.1 g. If the variance exceeded 3%, a third sample was taken, and the 1000-kernel weight was determined using the two closest values [5].

Results and Discussion. During the research years, 56 field pea accessions were dynamically evaluated across different breeding stages: 31 accessions were studied in the

preliminary field trial plot (2021), 26 accessions in the breeding nursery (2022), and 25 accessions in the control plot (2023). Concurrently, 25 accessions were evaluated in the competitive variety trial plot over the entire 2021–2023 period. Throughout the evaluation period, the 1000-kernel weight of the field pea accessions was compared against the standard variety "Vostok-84".

In 2021, the evaluation of 31 field pea accessions in the preliminary field trial plot revealed that the 1000-kernel weight ranged from 144.4 g to 267.0 g, with an overall mean weight of 174.8 g. In the breeding nursery (2022), the 1000-kernel weight of the 26 accessions ranged from 142.2 g to 271.5 g, with an average weight of 180.0 g. In the control trial plot (2023), the 1000-kernel weight among the 25 accessions varied between 168.1 g and 269.1 g, averaging 180.9 g.

Analysis of the accessions evaluated across these three stages (31 in 2021, 26 in 2022, and 25 in 2023) showed that the lowest values for 1000-kernel weight were recorded in genotypes KK 45/08, Koll-754, XK 841, Qizildon, Sputnik, and KP-2020/13. Conversely, the highest 1000-kernel weight performance was exhibited by accessions K 95/13, KP-2018/09, P-6754, Usatiy-90, KP-2018/04, K-11148, KP-2159, K-1016/08, and Bio 116/03 (see Table 1).

Table 1: 1000-Kernel Weight of Field Pea Accessions and Lines during the Breeding Process

№	Accession / Line Name	1000-Kernel Weight (g) - Preliminary Trial (2021)	1000-Kernel Weight (g) - Breeding Nursery (2022)	1000-Kernel Weight (g) - Control Trial (2023)	Average	Variance from Standard
1	Vostok-84 (St)	168.2	171.9	169.7	169.9	0
2	KP-2022/88	176.1	174.1	175.6	175.3	5.4
3	K 33/16	171.1	170.8	170.6	170.8	0.9
4	K 95/13	187.9	187.9	187.0	187.6	17.7
5	Koll-5	174.2	174.3	173.2	173.9	4.0
6	KP-2019/01	179.1	179.6	179.9	179.5	9.6
7	KP-2018/09	179.9	180.9	179.9	180.2	10.3
8	Nikola	172.4	172.3	171.8	172.2	2.3
9	Flora-2	170.9	171.3	170.9	171.0	1.1
10	P-6754	194.1	194.4	193.6	194.0	24.1
11	K 54133	171.1	171.4	170.6	171.0	1.1
12	Usatiy-90	267.0	271.5	269.1	269.2	99.3
13	KP 847	169.0	168.0	168.5	168.5	-1.4
14	Nomsiz-4	171.1	170.1	170.6	170.6	0.7
15	KP-12127	172.1	172.3	171.4	171.9	2.0
16	KP-2018/04	181.1	181.1	180.8	181.0	11.1
17	K-1748	173.0	172.4	172.3	172.6	2.7
18	Nomsiz-1	169.3	168.8	168.1	168.8	-1.1
19	K-11148	188.8	188.5	188.1	188.5	18.6
20	K-145	171.1	171.3	170.5	171.0	1.1
21	Violanta	173.8	173.1	193.4	180.1	10.2
22	KP-2159	193.4	193.8	191.5	192.9	23.0
23	K-1016/08	192.4	191.7	195.7	193.3	23.4

24	Bio 116/03	195.4	197.0	169.7	187.4	17.5
25	K 219/17	170.8	168.9	169.7	169.8	-0.1
26	KK 45/08	139.9	142.2	-	141.0	-28.9
27	Koll-754	120.2	-	-	120.2	-49.7
28	XK 841	153.2	-	-	153.2	-16.7
29	Qizildon	121.3	-	-	121.3	-48.6
30	Sputnik	205.6	-	-	205.6	35.7
31	KP-2020/13	144.4	-	-	144.4	-25.5
	Total	5417.9	4679.7	4522.2	4439.2	
	Maximum Value	267.0	271.5	269.1		
	Minimum Value	144.4	142.2	168.1		
	Mean Value	174.8	180.0	180.9		

In the 2021 competitive variety trial, 25 field pea accessions were analyzed for their 1000-kernel weight. The data indicated that the 1000-kernel weight ranged from 112.6 g to 208.4 g, with a trial mean of 159.1 g. For comparison, the standard variety "Vostok-84" registered an average value of 168.3 g (Table 2).

Among the evaluated accessions, the lowest 1000-kernel weights were recorded in XX-2222-01, K-1909, K-1904, KP-2016-88, Bio-4455-16, and K-4754. Conversely, the highest values were observed in accessions S 2019-55, SL 2020-77, SL 2020-100, РК-2020/44, and KP-2014/88 (see Table 2).

Table 2: 1000-Kernel Weight of Field Pea Accessions in the Competitive Variety Trial (Jomboy, 2021)

№	Accession / Line Name	Rep I (g)	Rep II (g)	Rep III (g)	Rep IV (g)	Average	Variance from Standard
1	Vostok-84 (St)	168.9	166.7	169.7	167.8	168.3	±
2	XX-2222-01	149.8	149.7	149.3	149.8	149.6	-18.7
3	XL-2018-120	179.1	178.9	179.2	179.0	179.0	10.7
4	L 2018-38	177.7	177.6	177.7	178.1	177.8	9.5
5	L 2018-99	173.9	172.1	173.1	172.3	172.8	4.5
6	XL-2022-100	169.0	167.4	168.4	168.7	168.4	0.1
7	S 2019-55	189.8	189.4	190.7	190.0	190.0	21.7
8	S 2021-44	159.1	158.9	158.7	154.7	157.9	-10.4
9	SL 2018-111	177.7	177.3	177.9	177.8	177.7	9.4
10	KP 2014-444	175.0	176.4	179.0	178.6	177.2	8.9
11	Bio 2016-520	167.8	165.3	167.7	168.8	167.4	-0.9
12	L-4444	168.6	170.8	170.7	169.0	169.8	1.5
13	Bio 5420xL170	156.8	149.4	154.0	158.9	154.8	-13.5
14	SL2020-44	175.0	172.1	171.1	174.2	173.1	4.8
15	SL 2020-77	199.7	197.1	197.2	197.2	197.8	29.5
16	SL 2020-100	180.1	179.1	178.1	181.1	179.6	11.3
17	K 2011	146.9	149.7	149.6	149.7	149.0	-19.3
18	K-1909	116.1	117.8	117.7	114.5	116.5	-51.8
19	РК-2020/44	195.8	192.0	190.0	192.5	192.6	24.3
20	K-1904	119.1	112.3	118.4	118.3	117.0	-51.3
21	KP-2014/88	189.8	191.9	187.5	189.7	189.7	21.4

22	KP-2015-99	163.1	165.9	167.1	166.2	165.6	-2.7
23	KP-2016-88	118.0	118.9	117.2	115.2	117.3	-51.0
24	Bio-4455-16	115.9	116.7	114.3	110.2	114.3	-54.0
25	K-4754	119.0	118.0	117.2	118.2	118.1	-50.2
	Total	4051.7	4031.4	4041.5	4040.5	4041.3	
	Maximum Value	199.7	197.1	197.2	197.2		
	Minimum Value	115.9	116.7	114.3	110.2		
	Mean Value	162.7	161.2	161.7	161.6		

In the 2022 competitive variety trial, 25 accessions were evaluated. The 1000-kernel weight of the standard variety "Vostok-84" was 171.3 g. The weight of the evaluated field pea accessions ranged from 116.4 g to 201.5 g, with an overall trial mean of 163.7 g.

Based on the performance analysis, lower 1000-kernel weights were recorded in accessions XX-2222-01, S 2021-44, Bio 5420xL170, K 2011, K-1909, K-1904, KP-2016-88, Bio-4455-16, and K-4754. In contrast, superior weight performance was identified in accessions S 2019-55, SL 2020-77, РК-2020/44, and KP-2014/88 (see Table 3).

Table 3: 1000-Kernel Weight of Field Pea Accessions in the Competitive Variety Trial (Jomboy, 2022)

№	Accession / Line Name	Rep I (g)	Rep II (g)	Rep III (g)	Rep IV (g)	Average	Variance from Standard
1	Vostok-84 (St)	170.9	171.7	170.7	171.8	171.3	±
2	XX-2222-01	150.8	151.7	152.3	151.8	151.6	-19.7
3	XL-2018-120	181.1	183.9	183.2	180.0	182.0	10.7
4	L 2018-38	179.7	180.6	180.7	181.1	180.5	9.2
5	L 2018-99	176.9	174.1	175.1	174.3	175.1	3.8
6	XL-2022-100	171.0	170.4	170.4	171.7	170.9	-0.4
7	S 2019-55	194.8	190.4	191.2	191.0	191.8	20.5
8	S 2021-44	160.1	160.9	159.7	159.7	160.1	-11.2
9	SL 2018-111	179.7	179.3	179.9	179.8	179.7	8.4
10	KP 2014-444	177.0	178.4	180.0	181.6	179.2	7.9
11	Bio 2016-520	169.3	167.5	169.5	169.3	168.9	-2.4
12	L-4444	170.6	172.8	172.7	171.2	171.8	0.5
13	Bio 5420xL170	157.8	152.4	154.0	159.9	156.0	-15.3
14	SL2020-44	177.1	174.1	173.1	176.2	175.1	3.8
15	SL 2020-77	203.4	203.1	200.2	199.3	201.5	30.2
16	SL 2020-100	180.1	179.1	178.1	181.1	179.6	8.3
17	K 2011	149.3	152.4	150.2	150.5	150.6	-20.7
18	K-1909	118.1	119.8	118.7	117.5	118.5	-52.8
19	РК-2020/44	196.8	192.6	193.1	195.5	194.5	23.2
20	K-1904	119.1	117.3	119.4	120.2	119.0	-52.3
21	KP-2014/88	191.8	193.9	190.5	191.4	191.9	20.6
22	KP-2015-99	165.1	166.8	169.3	168.4	167.4	-3.9
23	KP-2016-88	120.0	119.9	118.2	119.2	119.3	-52.0
24	Bio-4455-16	117.9	118.7	117.3	113.2	116.8	-54.5
25	K-4754	121.2	120.0	119.4	119.7	120.1	-51.2
	Total	4099.6	4091.8	4086.9	4095.4	4093.2	
	Maximum Value	203.4	203.1	200.2	299.3		
	Minimum Value	117.9	118.2	117.3	113.2		

	Mean Value	164.0	163.7	163.5	163.8		

In 2023, the 25 field pea accessions in the competitive variety trial plot were evaluated for their 1000-kernel weight parameters. The results showed that the standard variety "Vostok-84" attained an average 1000-kernel weight of 169.3 g. Among the tested accessions, lower values were observed in genotypes XX-2222-01, S 2021-44, Bio 5420xL170, K 2011, K-1909, K-1904, KP-2016-88, Bio-4455-16, and K-4754. High performance metrics for 1000-kernel weight were sustainably recorded in accessions S 2019-55, SL 2020-77, РК-2020/44, and KP-2014/88 (see Table 4).

Table 4: 1000-Kernel Weight of Field Pea Accessions in the Competitive Variety Trial (Jomboy, 2023)

№	Accession / Line Name	Rep I (g)	Rep II (g)	Rep III (g)	Rep IV (g)	Average	Variance from Standard
1	Vostok-84 (St)	169.9	169.7	169.7	167.8	169.3	±
2	XX-2222-01	149.8	150.7	149.3	150.4	150.0	-19.3
3	XL-2018-120	179.1	180.9	179.2	180.0	179.8	10.5
4	L 2018-38	178.7	177.6	179.7	178.1	178.5	9.2
5	L 2018-99	173.6	172.1	173.1	173.3	173.0	3.7
6	XL-2022-100	169.8	168.4	168.8	169.5	169.1	-0.2
7	S 2019-55	190.2	189.9	191.7	190.2	190.5	21.2
8	S 2021-44	159.1	158.9	158.7	154.7	157.8	-11.5
9	SL 2018-111	177.8	178.5	178.2	178.2	178.2	8.9
10	KP 2014-444	176.2	176.8	179.2	179.3	177.9	8.6
11	Bio 2016-520	168.4	166.3	169.2	168.9	168.2	-1.1
12	L-4444	169.1	171.2	170.9	169.7	170.2	0.9
13	Bio 5420xL170	156.9	150.2	154.2	159.2	155.1	-14.2
14	SL2020-44	175.4	173.1	172.1	175.2	174.0	4.7
15	SL 2020-77	199.9	198.1	197.8	197.9	198.4	29.1
16	SL 2020-100	180.3	179.6	178.7	181.8	180.1	10.8
17	K 2011	147.2	150.1	149.6	149.9	149.2	-20.1
18	K-1909	116.7	117.9	117.5	116.0	117.0	-52.3
19	РК-2020/44	194.9	194.0	193.1	193.6	193.9	24.6
20	K-1904	119.8	116.9	118.7	118.8	118.5	-50.8
21	KP-2014/88	190.5	192.0	188.7	190.4	190.4	21.1
22	KP-2015-99	163.7	166.0	167.9	166.8	166.1	-3.2
23	KP-2016-88	118.5	119.0	118.0	116.0	117.9	-51.4
24	Bio-4455-16	116.2	116.9	115.3	115.2	115.9	-53.4
25	K-4754	119.5	119.8	187.2	118.9	136.3	-33.0
	Total	4061.2	4054.6	4126.5	4059.8	4075.5	
	Maximum Value	199.9	198.1	197.8	197.9		
	Minimum Value	116.2	116.9	115.3	115.2		
	Mean Value	162.4	162.2	165.1	162.4		

Conclusion.

Based on the field evaluations conducted during the 2021–2023 experimental years, the field pea accessions S 2019-55, SL 2020-77, SL 2020-100, РК-2020/44, and KP-2014/88 demonstrated stable, outstanding performance regarding their 1000-kernel weight.

Consequently, these genotypes have been selected as prominent source materials for future crop breeding programs.

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