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MORPHOLOGICAL CHARACTERISTICS OF SEED TRAITS IN SOYBEAN VARIETIES INTRODUCED FROM THE KRASNODAR REGION

Tangirova Gulchexra Nasridinovna
Doctor of Agricultural Sciences (DSc), Associate Professor
Department of "Genetics, Breeding and Seed Production of Agricultural Crops"
Tashkent State Agrarian University
tangirova1966@mail.ru

Xayridinova Ranoxon Qaxromon qizi
Researcher, Department of "Breeding and
Agrotechnologies of Grain Legumes" SHITI
ranokhonxayridinova@gmail.com

ABSTRACT

The introduced varietal samples from the Krasnodar region are characterized by the following seed morphological traits: in terms of seed length, the varieties Arleta (0.9–1.1 cm) and Sparta (1.1–1.3 cm) stand out; in terms of seed width — Arleta and Sparta (0.7–0.8 cm); in terms of hilum color — Arleta, Sparta, Selekta 201, and Selekta 302 have a light-yellow hue; in terms of hilum length, the variety Selekta 302 (4.0–4.5 mm) shows the highest values. In the varietal samples Arleta, Avanta, Sparta, Selekta 201, and Selekta 302, no spots were observed on the seed surface. Overall, considering the combination of these characteristics, these varieties are regarded as the most promising and their use in genetic and breeding research for the improvement of economically valuable traits is of significant importance.

Keywords: Soybean (Glycine max), selection and genetics, introduced varieties, seed morphology (color, shape, length, width), hilum (rubchik) color and length, leaf morphology and xeromorphic adaptation, vegetation period (75–165 days), protein and oil content (50–55%), Krasnodar breeding varieties (Arleta, Avanta, Sparta, Selekta 201, Selekta 302), Uzbekskaya 2 (standard variety), economic efficiency and suitability for mechanization.

KRASNODAR O'LKASIDAN KELTIRILGAN SOYA NAV NAMUNALARI URUG'LARINING MORFOLOGIK BELGILARI TAVSIFI

Tangirova Gulchexra Nasridinovna
Toshkent davlat agrar universiteti "Qishloq xo'jalik ekinlari genetikasi, seleksiyasi va urug'chiligi" kafedrasi dotsenti qishloq xo'jaligi fanlari doktori (DSc), dotsent
tangirova1966@mail.ru

Xayridinova Ra'noxon Qaxromon qizi
SHITI, "Don dukkakli ekinlar seleksiyasi va agrotexnologiyalari" bo'limi ilmiy xodimi
ranokhonxayridinova@gmail.com

Annotatsiya:
Krasnodar o'lkasining 5 ta introduksiya qilingan nav-namunalari orasidan urug'ning morfologik belgilariga ko'ra, urug' uzunligi bo'yicha Arleta (0,9-1,1 sm), Sparta (1,1-1,3 sm) nav namunalar; urug' eni bo'yicha Arleta, Sparta (0,7-0,8 sm) nav namunalar; kertimining rangi bo'yicha Arleta, Sparta, Selekta 201, Selekta 302 nav namunalarda och sariq rangda, kertim (rubchik) uzunligi bo'yicha Selekta nav namunasida 302 (4,0-4,5 mm), Arleta, Avanta, Sparta, Selekta 201, Selekta 302 urug'lari qobig'ida dog'lar uchramasligi va boshqa nav namunalarga nisbatan keltirilgan belgilar bo'yicha afzal hisoblanib, ulardan belgini yaxshilashda genetik-seleksion izlanishlarda foydalanish muhim ahamiyat kasb etadi.
Kalit so'zlar: soya (Glycine max), seleksiya va genetika, introduksiya qilingan navlar, urug' morfologiyasi (rang, shakl, uzunlik, eni), rubchik (kertim) rangi va uzunligi, barg morfologiyasi va kseromorf moslashuv, vegetatsiya davri (75–165 kun), oqsil va moy miqdori (50–55%), Krasnodar seleksiya navlari (Arleta, Avanta, Sparta, Selekta 201, Selekta 302), Uzbekskaya 2 (andoza navi), iqtisodiy samaradorlik va mexanizatsiyaga yaroqlilik.

Аннотатция:
Интродуцированные сортовые образцы Краснодарского края по морфологическим признакам семян характеризуются следующими показателями: по длине семени выделяются сорта Арлета (0,9–1,1 см) и Спарта (1,1–1,3 см); по ширине семени — Арлета и Спарта (0,7–0,8 см); по окраске рубчика — Арлета, Спарта, Селекта 201 и Селекта 302 имеют светло-жёлтый цвет; по длине рубчика сорт Селекта 302 (4,0–4,5 мм) отличается наибольшими значениями. У сортовых образцов Арлета, Аванта, Спарта, Селекта 201 и Селекта 302 на поверхности семян пятна отсутствуют. В целом, по совокупности приведённых признаков данные сорта считаются наиболее перспективными, и их использование в генетико-селекционных исследованиях для улучшения хозяйственно-ценных признаков представляет значительный интерес.

Ключевые слова: соя (Glycine max), селекция и генетика, интродуцированные сорта, морфология семян (цвет, форма, длина, ширина), рубчик (гилум) — цвет и длина, морфология листьев и ксероморфная адаптация, вегетационный период (75–165 дней), содержание белка и масла (50–55%), сорта краснодарской селекции (Arleta, Avanta, Sparta, Selekta 201, Selekta 302), Uzbekskaya 2 (стандартный сорт), экономическая эффективность и пригодность к механизации.

INTRODUCTION

In recent years, greater attention has been paid to the soybean plant worldwide, and its cultivation areas are expanding year by year. This crop is not only considered an oil-producing plant, but its seeds also accumulate the highest amount of protein, up to 50–55%. Currently, various types of products are being obtained from soybeans, and the demand for them is steadily increasing. Due to such beneficial characteristics, this crop has increasingly attracted the attention of soybean researchers and is encouraging them to conduct research in new directions. Enhancing the economic efficiency of soybeans is of great importance for providing livestock, poultry, and aquaculture with nutritious feed, as well as supplying humans with

protein and oil. In the creation of new varieties adapted to specific soil and climatic conditions, effective use of modern methods of genetics and breeding is a requirement of the time. In the development of plastic (highly adaptive) varieties by breeders, it is of great importance to selectively involve naturally existing forms with unique traits and properties into the breeding process.

Based on the introduced forms of soybean in our republic, it is important to develop breeding materials that possess a positive combination of economic traits — high productivity, high protein and oil content, non-shattering pods, and suitability for mechanization — and to implement them into production. In the Decree of the President of the Republic of Uzbekistan No. PF-5853 dated October 23, 2019, "On approval of the Strategy for the development of agriculture of the Republic of Uzbekistan for 2020–2030," the following task is defined: "...to create new breeding varieties of agricultural crops adapted to local soil-climatic and ecological conditions." Based on these tasks, research aimed at selecting the most suitable genotypes among the introduced soybean accessions and using them as initial material to create varieties adapted to specific soil and climatic conditions using breeding methods is considered relevant [9; p. 42, 10; pp. 111–114, 13; p. 377, 14; p. 563, 15; p. 381].

Depending on the varietal characteristics and soil-climatic conditions, the vegetation period ranges from 75 to 165 days, and the leaf color varies from light green to dark green-grayish. Additionally, leaf length is 5–16.2 cm, width 3–10.8 cm, and petiole length 9–34 cm; typically, leaves naturally fall off when the pods begin to ripen. A single plant may have 7 to 140 or more leaves. The leaves are compound, usually trifoliate, but sometimes pentafoliate or heptafoliate, arranged alternately on the stem. Leaf shape may be cordate, lanceolate, ovate, or round, and the leaf surface is covered with fine hairs. Leaves may be ovate or lanceolate (elongated), with pointed or rounded tips. It has been determined that varieties with lanceolate (elongated) leaves contain a higher number of seeds per pod compared to varieties with round-shaped leaves. The leaf surface is usually smooth, but in some varieties it is wavy; leaf color varies from green to dark green, light green, or even grayish [1; p. 110, 7; p. 248, 11; p. 47, 8; p. 188, 12; p. 96].

According to the data of A.V. Grigoryeva [2; p. 154], the anatomical structure of plant leaves naturally changes depending on their tiered arrangement. Leaves located in the upper tier grow under slightly limited water supply conditions; the higher the leaf is positioned in the plant canopy, the greater the rate of transpiration and the intensity of photosynthesis. Under arid conditions, the leaf size becomes smaller, and in such circumstances, they form a xeromorphic leaf structure that is anatomically adapted to water deficiency.

According to the findings of Sun, Sin-Dun [7; p. 248], V.V. Tolokonnikov [11; p. 47], A.N. Sozonova [8; p. 188], G.R. Kholmurodova and others [12; p. 96], the spear-shaped leaves of soybean indicate its xeromorphic nature. According to R.S. Yerzhebayeva, S.V. Didorenko, M.S. Kudaybergenov, A.K. Daniyarova, and A.A. Amangeldiyeva [4; pp. 63–73], soybean is an annual plant, and depending on the varietal traits and soil-climatic conditions, its vegetation period ranges from 75 to 165 days, and its leaf color varies from green, dark green, light green to grayish. Additionally, leaf length ranges from 5 to 16.2 cm, width 3–10.8 cm, petiole length 9–34 cm; typically, leaves fall off naturally when the pods begin to ripen. A single plant may have 7 to 140 or more leaves. The leaves are compound, usually trifoliate, but sometimes

pentafoliate or heptafoliate, arranged alternately on the stem. Leaf shape may be cordate, lanceolate, ovate, oval, or round, and the leaf surface is smooth, though in some varieties it is wavy.

From a morphological and physiological perspective, the adaptation of leaves to drought ensures a reduction in water consumption.

According to S.V. Didorenko, M.S. Kudaybergenov, S.I. Abugaliyeva, and Ye.K. Turuspekov [3; pp. 122–124], when water is scarce, leaf area decreases and the rate of transpiration is reduced. M.I. Ikromov, Kh.N. Normurodov, and A.S. Yuldashev [6; p. 333] emphasize that petioles allow the leaves to be positioned in a way that efficiently receives green light, while providing stability, conductivity, and facilitating intercalary growth.

RESEARCH METHODS

Statistical analyses were carried out according to the "Methods for conducting field experiments" (2007), based on the methodology of B.A. Dospekhov (1985) and using the MS Excel software.

RESEARCH RESULTS

In our experiment, observations were conducted on the seed morphology of 5 soybean collection varieties from the Krasnodar region, as well as on the standard variety Uzbekskaya 2.

The medium-maturing Uzbekskaya 2 standard variety was studied separately; in this variety, seed length was 0.8–0.9 cm, width 0.7–0.8 cm, shape oval, color light yellow, hilum (rubchik) length 0.4–0.5 cm, hilum color black, and some seeds had black spots on the testa.

The seeds of the collection varieties were predominantly oval or spherical in shape, light yellow in color, with some seeds showing black, green, or brown spots, and the hilum located in the center was black, brown, or light yellow.

According to the data obtained from the experiment, the early-maturing Arleta, Avanta, Sparta, Selekta 201, and medium-maturing Selekta 302 collection varieties from the Krasnodar breeding program had light-yellow seed color and oval seed shape, and the results were found to be close to the seed color and shape of the standard Uzbekskaya 2 variety (see Table 1).

The analysis of seed length across the collection varieties showed that the seed length of the Avanta variety was shorter than that of the other varieties, measuring 0.6–0.7 cm. In comparison, the Arleta variety studied in the experiment had a seed length of 0.9–1.1 cm, demonstrating an indicator close to that of the standard Uzbekskaya 2. The seed lengths of the Selekta 201 and Selekta 302 varieties were measured at 0.7–0.8 cm.

The Sparta variety exhibited the greatest seed length among all samples, with measurements ranging from 1.1 to 1.3 cm.

1-table

Morphological characteristics of seeds of Krasnodar collection variety samples

№	Soybean variety samples	Seed				Seed coat (rubchik)		Seed spots
		The color	shape	length, cm	width, sm	colored	length, mm	
1.	Arleta	pale yellow	oval	0,9-1,1	0,7-0,8	och sariq	3,0-4,0	-
2.	Sparta	pale yellow	oval	1,1-1,3	0,7-0,8	och sariq	2,5-3,0	-
3.	Avanta	yellow	oval	0,6-0,7	0,4-0,5	sariq	3,0-4,0	-
4.	Selekta 201	pale yellow	oval	0,7-0,8	0,5-0,6	och sariq	2,5-3,0	-
5.	Selekta 302	pale yellow	oval	0,7-0,8	0,5-0,6	och sariq	4,0-4,5	-
6.	Uzbekskaya 2 (st)	pale yellow	oval	0,8-0,9	0,7-0,8	qora	4,0-5,0	qora

According to the analysis, the varieties were divided into three groups based on seed length: the first group consisted of varieties with short seeds — Avanta (0.6–0.7 cm), Selekta 201, and Selekta 302 (0.7–0.8 cm); the second group included the Arleta variety with medium seed length (0.9–1.1 cm); and the third group consisted of the Sparta variety with long seeds (1.1–1.3 cm). Thus, differences in seed length were observed among the varieties.

Based on seed width in the studied collection varieties, Avanta measured 0.4–0.5 cm, while Selekta 201 and Selekta 302 measured 0.5–0.6 cm. The Arleta and Sparta varieties measured 0.7–0.8 cm, similar to the standard Uzbekskaya 2 (0.7–0.8 cm).

The seeds of the collection varieties were predominantly oval or spherical in shape, light yellow in color, with some seeds covered with black spots. Additionally, the hilum located in the center was observed in black or light yellow tones.

According to the experimental data, the varieties were divided into three groups based on seed width: the first group consisted of Avanta with a seed width of 0.4–0.5 cm; the second group included Selekta 201 and Selekta 302 with a seed width of 0.5–0.6 cm; and the third group consisted of Arleta and Sparta with a seed width of 0.7–0.8 cm. Thus, differences in seed width were confirmed.

According to the analysis, the collection varieties were divided into two groups based on hilum (rubchik) color: the first group consisted of Arleta, Sparta, Selekta 201, and Selekta 302, whose hilum was light yellow; the second group consisted of Avanta, whose hilum was yellow. It was determined that the hilum color of the studied collection varieties was either light yellow or yellow.

According to the research analysis, the collection varieties were divided into three groups based on hilum (rubchik) length. The first group consisted of Sparta and Selekta 201 with hilum lengths of 2.5–3.0 mm; the second group included Arleta and Avanta with hilum lengths of 3.0–4.0 mm; and the third group consisted of Selekta 302 with a hilum length of 4.0–4.5 mm, showing a value close to the standard Uzbekskaya 2 (4.0–5.0 mm). It was confirmed that the hilum length varied from short to medium to long, and that the seeds of the Krasnodar-bred varieties had no testa spots.

CONCLUSION

Based on the study of the morphological characteristics of the seeds of the introduced soybean collection varieties, the following conclusions can be drawn: Among the five introduced varieties from the Krasnodar region, varieties were distinguished according to seed morphological traits such as seed length and width, hilum (rubchik) color and length, and presence of testa spots. By seed length, Arleta (0.9–1.1 cm) and Sparta (1.1–1.3 cm) stood out; by seed width, Arleta and Sparta (0.7–0.8 cm) were distinguished; by hilum color, Arleta, Sparta, Selekta 201, and Selekta 302 had light yellow coloration; by hilum length, Selekta 302 (4.0–4.5 mm), as well as Arleta, Avanta, Sparta, and Selekta 201 stood out. The absence of testa spots in these varieties and their superiority over other varieties according to these traits indicate that they are valuable for use in genetic-breeding research aimed at improving traits.

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