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STATISTICAL BASES OF SOYBEAN FRACTIONATION

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Abstract

This article presents the data obtained in determining the fractional composition of soybean grains in slightly salty gray–meadow soils and studying their effect on germination. At the same time, the soybean grain had an average of 7.67 mm in height, 6.58 mm in width and 5.51 mm in thickness. Grain height and width remained relatively stable and had a weak degree of variation (7.07-8.11%). It is noted that the height of soybean grain depends more on the biological characteristics of the variety than its width and thickness on the external environment. It was found that there is a weak correlation between the height, width and thickness of the grain and a strong correlation between width and thickness. The effect of fractional composition on the germination of soybeans has also been established. In large fractions, germination was 79%, in medium - 81%, in small-84%, in ultra-small-66%. When dividing soy grain into a large fraction, it is advisable to use sieves with a diameter of more than 6.14 mm, for the medium fraction - 4.9 mm and for the small fraction - 3.65 mm.

Keywords: Soy, Variety “Nafis”, Grain, Fraction, Germination, Grain Height, Width, Thickness, Normal Distribution, χ^2–Xi Square, CV,% - Degree of Variation, Correlation Coefficient, Standard Deviation, HCP_{05}.

INTRODUCTION

Soy is considered one of the legumes that have biological, agronomic and social significance. This is due to the fact that it is used to meet the needs of the population for food, maintain soil fertility and as a profitable crop for farmers.

In subsequent years, attention to the shade plant has increased even more. In the natural climatic conditions of our republic, it is possible to use shade not only as the main one, but also as a re-culture. This, in turn, requires the selection of soybean varieties, the improvement of agricultural techniques for their cultivation, and the organization of seed production.

It is known that the quality of seeds is crucial for obtaining high yields. In turn, the relationship of seed quality with its size and weight has been confirmed in studies conducted with many agricultural crops. For example, when sowing coarse-grained seed grain from winter wheat, an additional 4-6 kg/ha of grain was obtained in conditions of moderately saline light gray soils [1]. Such studies were carried out with a soybean plant. Soy grains are divided into fractions on sieves with a diameter of 6-7 mm, 4-5 mm and 2-3 mm. As a result, the yield when propagating soybean grains with a diameter of 6-7 mm was 3.47 t/ha, fractions of 4-5 mm - 3.56 t / ha and 2-3 mm - 2.96 t/ha. From these data it can be seen that the difference between the variants is 0.54-0.66 t/ha [3].

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It is noted that the fractional composition of grain depends on natural climatic conditions. Soybean grain was divided into fractions of 4-5 and 5-6 mm and studied in the northern and southern regions. As a result, it was noted that the weight of 1000 grains depends on its fractional composition and climatic conditions of the area [3]. At the same time, it was found that the variability and determinism of the quantitative characteristics of legumes depends on the degree of salinity of the soil[1,2] [6, 7, 8, 9, 10].

It should be noted here that the fractional composition of grain is determined in many agricultural crops. The influence of coarse grain on yield and its quality has been proven by researchers. We also saw this from an analysis of some of the literature above. Nevertheless, the fractional composition of grain remains in the focus of researchers' attention. The amount of grain, in turn, is an important indicator of yield, genotype and environmental product. At the same time, the fractional composition of grain is formed in accordance with the natural and climatic conditions of each region. Based on this, the main purpose of this study was to identify the fractional composition of soy grains in the conditions of slightly salty light gray soils of the Syrdarya region and to study their effect on germination. Because such a study is being conducted for the first time on soybean varieties.

METHODS AND LOCATION OF THE RESEARCH

The research was conducted on an experimental field “Syrdarya Scientific experimental Station of the Scientific Research Institute of Grain and Leguminous Crops” in conditions of slightly saline glacial-meadow soil. The soybean variety ”elegant” was taken as the object of the study. SSPS-17 software was used to perform phenological observations and calculations [7]. With the help of this program, a statistical analysis of primary biometric indicators (arithmetic mean, correlation coefficient, standard deviation) was carried out. The grain composition for fractions was calculated using a caliper according to its height, width and thickness. Using the standard deviation (“S” or “σ” –Sigma), the grain was divided into fractions. When determining the correspondence of the normal distribution to practical and theoretical indicators, the *method* of χ^2–xi squares and the coefficient of variation *CV,%* were used. At the same time, the coefficient of variation was considered weak if it was up to 10%, average from 10% to 20% and highly variable if it was above 20% [2, 11].

RESULTS AND DISCUSSION

The results obtained (Table.1) showed that the height of the soybean grain averaged 7.67 mm. The fact that this indicator has a variational character can be judged by its minimum (5.71 mm) and maximum (9.04 mm) indicators. Based on these data, the coefficient of variation characterizing the variability in grain length was 7.07%. This indicates a weak variability of this indicator. Recall that the coefficient of variation up to 10% is considered weak, up to 10-20% - average and more than 20% - highly variable [8]. Thus, it was noted that the grain height from weakly variable, relatively stable indicators.

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Soybean grain had an average of 6.58 mm in width and 5.51 mm in thickness. These indicators have also acquired the character of variability. This can also be seen by the maximum and minimum, as well as by the coefficient of variation. It was found that the width of the grain varied greatly, just like the height of the grain, while the thickness was moderately varied.

Table 1: Results of Statistical Analysis

Statistical indicators	Indicators of soybean		
	height, mm	width, mm	thickness, mm
Average indicator	7.67 ±0.04	6.58 ±0.03	5.51 ±0.04
Minimum	5.71	5.05	3.65
Maximum	9.04	7.85	7.76
Degree of variation, CV, %	7.07	8.11	11.39

In general, according to the primary data, the height, width and thickness of the grain inherent in quantitative indicators have acquired a variational character. It was found that the height of the grain and its width vary greatly, and the thickness is moderate. From this it can be concluded that the height and width of the grain are relatively stable indicators.

As we have already noted above, the variability of the fractional composition of grain means that these signs are reduced to quantitative indicators. This is clearly seen both by minimum and maximum (Table 1). This situation served as the basis for determining compliance with the requirements of normal distribution, widely used in cognitive statistics. This information is presented in Figures 1, 2 and 3 below. From the data in the figure (Fig.1) it can be seen that the grain height fully meets the requirements of the normal distribution. The results of the calculations showed that while the theoretical index of the χ2 - xi square (χ^2- *xi square method determines whether a practical distribution is suitable for theoretical testing. If the practical imitation is less than the theoretical one, it will depend on the genotype, and if it is large, then on the external environment)* is 11.07, its practical indicator is 8.89. These data (χ^2 *theoretical* > χ^2 *practical)* indicate that the theoretical indicator is greater than the practical one.

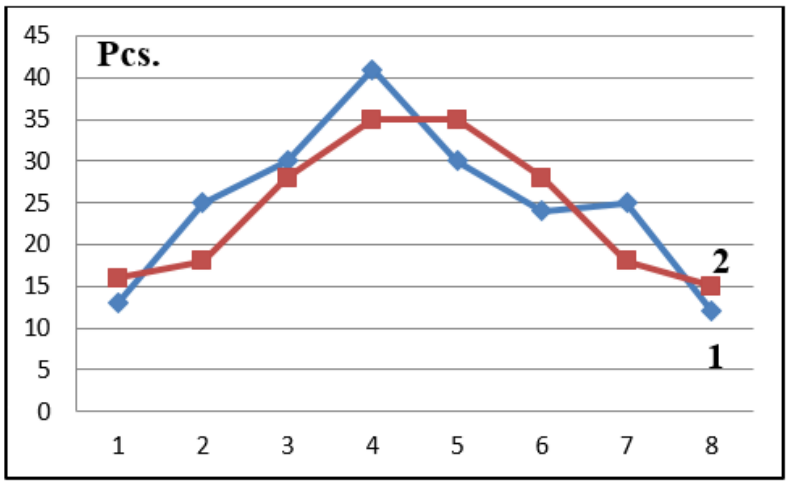

Figure 1: Results of Theoretical and Practical Distribution of Soybeans

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Note- 1-Practical Distribution; 2- Theoretical Distribution:

Theoretical Indicator of χ^2 –xi square is 11.07 and Practical Indicator is 8.89.

This situation suggests that the height of soy beans depends more on the nature of the variety. This is the result noted along the length of the pod. The authors believe that the length of the pod is more to the characteristic of the variety, while its weight depends on the external environment [4].

The results of the normal distribution of the width and height of soybeans are shown in Figures 2 and 3. Based on the data in the figure (Fig.2), the theoretical index of χ^2 –xi square in width and height of soybean grain was 11.1, and the practical indicator was 22.17.

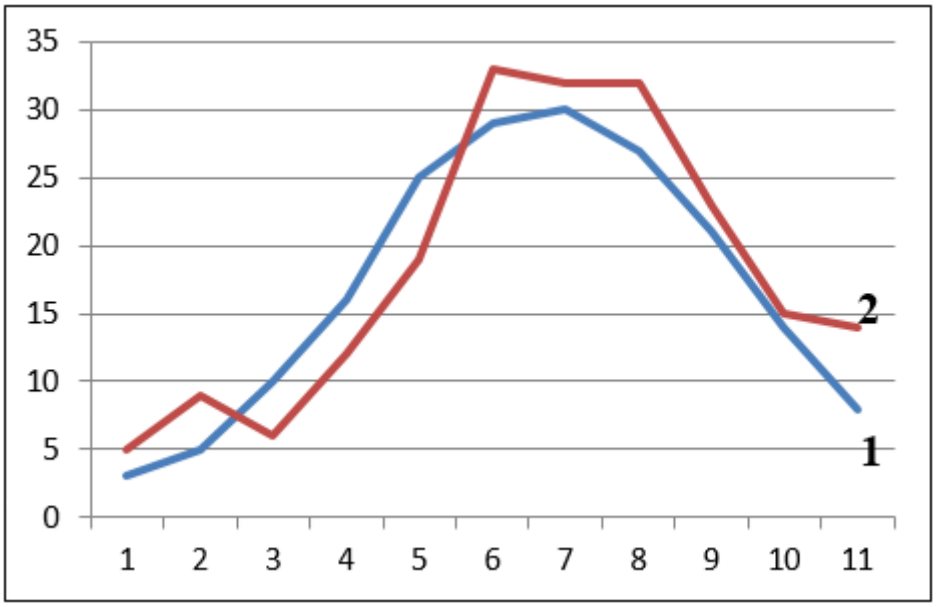

Figure 2: Theoretical and Practical Indicators of Grain Width Distribution

Note- 1-Practical Distribution; 2- Theoretical Distribution:

Theoretical Indicator of χ^2 –xi square is 11.1 and Practical Indicator is 22.17.

At the same time, the practical productivity of the χ^2 square turned out to be greater than its theoretical productivity. This can also be seen by the location of the lines in the image. This suggests that the width of the grain depends more on the external environment.

The results of the grain thickness distribution are shown in Figure 3. From these data it can be seen that the theoretical distribution and the practical distribution differ.

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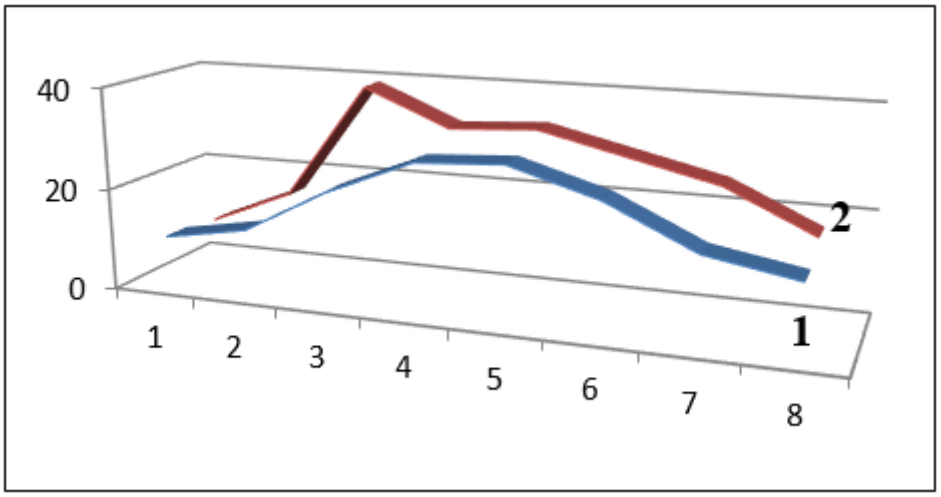


Figure 3: Theoretical and Practical Indicators of Grain Thickness Distribution

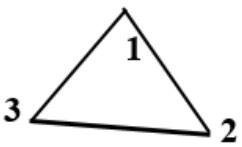
Note- 1-Practical Distribution; 2- Theoretical Distribution:

Theoretical Indicator of χ^2 –xi Square is 11.0 and Practical Indicator is 22.17.

The results of calculations showed that the theoretical χ^2 *–xi square* index is 11.0, and the practical one is 22.17. This suggests that the practical performance of χ^2 *–xi square* is greater than the theoretical one. This situation suggests that the grain thickness depends more on the external environment. It was here that the result was recorded, fixed by the width of the grains.

The relationship of features related to the grain fraction is also clearly visible from the results of correlation analysis. From the data in the figure it can be seen that the correlation coefficient between the height of the soybean grain (1) and its width (2) is equal to r = 0.672.

The increase in the height of the grain has led to the fact that it has become wide. Or maybe the breadth of the grain also affected its growth. The correlation coefficient between the grain height (1) and its thickness (3) became equal to R= 0.504. This situation suggests that the thickness of the grain depends on its height. There was a strong (**r=0.734**) correlation between the grain width (2) and its thickness (3). This shows that the wider the grain, the thicker it will be.



Note: numbers represent the symbols. *Here: 1- height of grain, mm; 2- width of grain, mm; 3- thickness of grain, mm*

Figure 4: The Degree of Correlation between the Height, Width and Thickness of Soy Grains

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This means that the width of the grain under the influence of the external environment primarily guarantees that it will be thick. For this reason, the width and thickness of the donnig have become more dependent on the external environment.

The variability of the grain composition served as the basis for their fractionation. The indicator "**S**" of the standard deviation, widely used in statistics, was used. It is known that one standard deviation **X±1s**-68.3%, two standard deviations **X±2S** - 95.5% and three standard deviations **X±3S**-99.7% cover the data [6]. These indicators formed the basis for dividing the grain composition into fractions (Table 2).

Table 2: Results of Grain Composition Separation into Fractions

Features	Composition of fraction				
	Very small	Small	medium	Large	Very large
	X-3S	X-2S	X± S	X+2S	X+3S
Height, mm	6.59>	6.59- 7.12	7.13- 8.21	8.22 -8.75	8.75<
in %	3.5	12.5	66.0	16.0	2.0
Width,mm	5.52>	6.04-5.52	6.05- 7.11	7.12-7.64	7.64<
in %	4	10.5	70.5	14.0	1.0
Thickness, mm	3.64>	3.65- 4.88	4.89 -6.13	6.14-7.37	7.37<
in %	0.5	13.0	69.5	16.5	0.5

From the table data it can be seen that for a large fraction the grain height is 8.22 - 8.75 mm, for an average-7.13-8.21 mm, for a small-6.59-7.12 mm, and for an very small - 6.59 mm. The share of these fractions was: very small 2.0%, large fractions -16.0%, medium 66%, small 12.5% and very small 3.5%. From these data it can be seen that the average grain fraction is larger than the rest. Exactly this result was noted in grain width (70.5%) and thickness (69.5%).

The average grain fraction in grain width was 6.05-7.11 mm, and in thickness - 4.89 - 6.13 mm.

As you know, seed germination is considered one of the important factors affecting yield. Scientific sources note that the soybean plant was found to have a grain located in the lower tiers of the harvest branch of good quality [3]. Registration of such a condition guarantees its quality due to the fact that the grain formed in conditions of low yield is large and full-fledged.

Data on the effect of grain fractions on soybean germination are presented in Table 3. It follows from the table data that the germination of large fractions averaged 79.0%, while in the medium fraction it was 81.0%, in the small fraction-84.0%, and in the very small fraction-66.0%.

Table 3: Germination of soybeans (%) by fractions

Variants	Returns				Average	Difference, ±
	1	2	3	4		
Large fraction	76	76	84	80	79	+1.5
Medium fraction	80	79	82	80	81	+3.5
small fraction	85	84	83	85	84	+6.5
Very small fraction	61	65	64	66	66	-11.5
Average					77.5	
HCP_{05}						1.80 %

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Grain germination in all variants was 77.5%. Of this indicator, the difference in variants was +1.5% in the large fraction and -11.5% in the very small fraction. From these data, the results of the dispersion analysis showed that the germination of grain in small and medium fractions was higher than in very small. The table notes that the small real difference (HCP_{05}) between the options is 1.80%. From these data it can be seen that not only large, but also medium fractions can be used as seed grain. However, it should be taken into account that the yield in the small fraction was lower than in the medium and large fractions [3].

According to the results of the separation of soybean grains into fractions in the conditions of slightly saline soils of the Syrdarya region , the following conclusions can be drawn:

1. The average size of soybeans was 7.67 mm in height, 6.58 mm in width and 5.51 mm in thickness. The grain was relatively stable in height and width and had little variability (7.07-8.11%).
2. It it was noted that the height of the soybean grain depends more on the biological characteristics of the variety than its width and thickness on the external environment.
3. It was found that the grain varies slightly in height, width and thickness and has a strong correlation between width and thickness.
4. The effect of fractional composition on the tensile strength of soybeans was found. In large fractions, uniformity was 79%, in the medium fraction -81%, in the small fraction - 84%, in the very small fraction - 66%.
5. When dividing soybeans into fractions, it was considered appropriate to use sieves with a diameter for the large fraction - 6.14 mm, for the medium fraction - 4.9 mm, and for the small fraction - 3.65 mm.

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