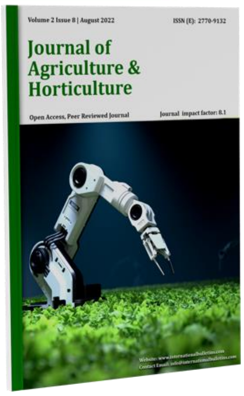

MICROMETRIC ANALYSIS OF PARAMETERS OF MIRZACHUL MELONS (USING THE EXAMPLE OF AK-URUG MELON)

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Abstract. The article presents the results of statistical studies of melons grown in the Mirzachul oasis of the Syrdarya region. Since determining the total volume (quantity) of melons in the Mirzachul oasis is a rather complex task, the “sampling technique” was used to determine the number of objects under study. Basically, the mass, length and diameter of the melon in 15 sections were subjected to static research. The results of micrometric studies are presented in the form of graphs of size distributions that obey the normal law (Gauss). The distribution law was checked according to the Kolmogorov criterion and the compatibility of empirical and theoretical distribution curves was established. During the micrometric analysis of the mass-geometric dimensions of the melon, the probability of the percentage of suitable and unsuitable melons according to their parameters was calculated. In conclusion, it is noted that the obtained data can be used in the development of installations for mechanized processing of melons, in particular, to determine the values of the diameters of the disk knives of the installation for ring slicing them before drying..

Key words: methodology, general population, small sample, micrometerage, diameter, ring lobule, size distribution, melon, mathematical expectation, standard deviation, parameter, measurement, variation coefficient, permissible error, probability.

Introduction. Importance of the topic. As is known, “32-35 million tons of melon are grown annually in the world and only 5-6% of them are dried” [1,2], then one of the most important tasks is the development of energy- and resource-saving technical means and devices with high quality of work and productivity for the production of dried melon.

Canning factories of Uzbekistan, which are part of the company "Uzplodoovoshchvinpromholding" for a number of years have tried to introduce the technology of mass processing of melon into jam, marmalade, preserves, melon honey and dried melon [3]. They have developed technical specifications for a number of food products from melon and recommendations for their production based on standard technological equipment intended for processing other vegetables and fruits. However, not all machines and devices are suitable for processing melon fruits. Taking into account the physical and mechanical properties and geometric shapes of melons, it is necessary to develop the foundations of a mechanized technology and a set of technical means for its processing [4-12].

The main issues that arise when cleaning melons, in particular Central Asian melons, are ensuring the separation of the peel from the pulp, as well as the removal of the internal contents from the seed cavity [5,8,9].

To implement the cleaning method and other technological operations by mechanical means, it is necessary to study the physical and mechanical properties of the melon, the mass - dimensional characteristics of the fruits subjected to processing, the processes of cutting fruits in different modes, as well as the kinetic - dynamic and design parameters of the cutting working bodies.

Purpose of the study: To determine the mass and dimensional characteristics of melon fruits before studying the issue of mechanization of the technological process of cutting melon fruits into ring-shaped slices to ensure their drying in a chamber drying unit. The solution to this issue is possible with the creation of a new machine design that takes into account the physical, mechanical and technological properties of Uzbek melons [9,12]. In this regard, we will have to study the physical, mechanical and technological properties of Uzbek melons, in particular melons grown in the Mirzachul oasis.

Materials and methods of research. In many scientific research works, the sampling method is used to control the quality of product parameters [13,14].

The essence of the sampling method is that from a general or general sample (batch), i.e. instead of a large volume of some product with common properties, only a certain part of this product is studied for the quantitative characteristics of the product.

In other words, for the study from the general set (general population) an arbitrary, probabilistic-random one (small) sample is made. When planning a statistical study, it is always necessary to determine the size (volume) of this small sample.

This is due to the fact that it is necessary that the average value of the selected small sample (batch) gives the average characteristic of the general sample (population) with a certain degree of accuracy.

The size of a small sample from the general (general) population can be determined in two ways:

If, according to the conditions, the size of the observed general population is obvious, then the size of the small sample is determined by the following formula

$$n = \frac{t^2 \cdot V \cdot N}{(\varepsilon\%)^2 \cdot N + t^2 \cdot V^2}.$$

If the size of the observed total sample is not clear from the conditions, then the size of the small sample is determined by the following formula [12]

$$n = \frac{t^2 \cdot V^2}{(\varepsilon\%)^2},$$

here, *n – sample size, pieces; t – standardized deviation (Student's criterion);*
V - variation coefficient, %; N – general sample size; - permissible error of the average sample;

t- is determined by the experimenter himself. It depends on the degree of probability of reliability. For example, for the probability of reliability $P = 68\%$ $t = 1$, for degree $P = 95\%$ $t = 2$ and with the degree of probability of reliability $P = 99\%$ $t = 3$.

For field experiments the value is $\varepsilon\%$ is selected as follows. Under excellent conditions, $\varepsilon\% = 1...2\%$, under good conditions, $\varepsilon\% = 3$, under full satisfactory condition up to

$\varepsilon\% = 3...5$, under satisfactory conditions up to $\varepsilon\% = 5...7$. In agricultural work, in conditions when the operator of the machines observes their work, it is accepted $\varepsilon\% = 5...10$.

Since determining the total volume (quantity) of melons in the Mirzachul oasis is a rather complex task (the size of the total sample is unknown), the size of the small sample is determined (with different values of the components) using the formula given above.

$$n = \frac{t^2 \cdot V^2}{(\varepsilon\%)^2} = \frac{2^2 \cdot 25^2}{5^2} = 100 \text{ things}, \quad n = \frac{t^2 \cdot V^2}{(\varepsilon\%)^2} = \frac{2^2 \cdot 30^2}{5^2} = 144 \text{ things},$$

$$n = \frac{t^2 \cdot V^2}{(\varepsilon\%)^2} = \frac{2^2 \cdot 35^2}{5^2} = 196 \text{ things}. \quad n = \frac{t^2 \cdot V^2}{(\varepsilon\%)^2} = \frac{2^2 \cdot 40^2}{5^2} = 256 \text{ things}.$$

For micrometric studies, we take the average value $n \approx 170$ things. The measured parameters of the melon are shown in Fig. 1. The accuracy of linear measurements was 1 mm, the accuracy of weight measurements was 2 grams.

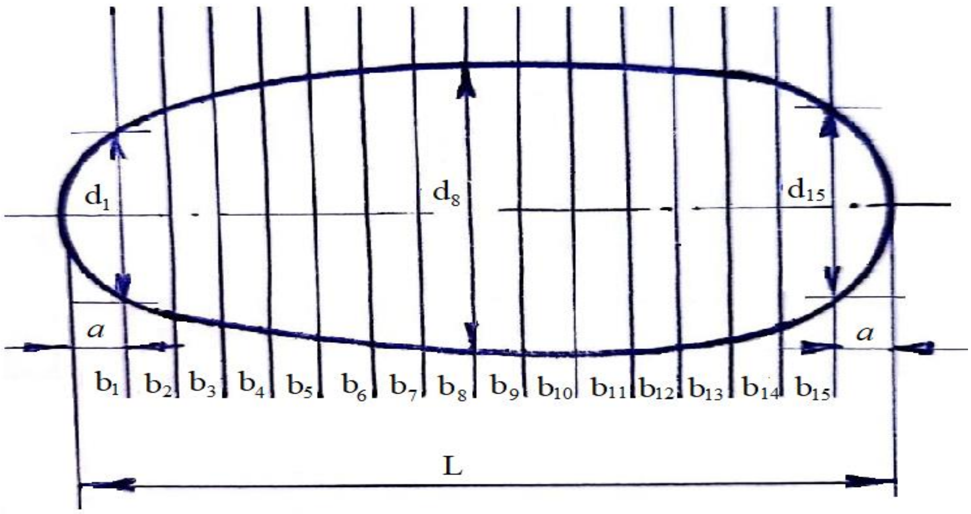

Fig. 1. Micrometric parameters of melon.

Experimental research. A statistical study of the sizes of melons was carried out in the farm "Garasha Forish ifori" of the Ak-Altyn tuman of the Sirdarinsky viloyat. The study was carried out at ambient temperature $t=20^0\pm5^0$. To avoid damage, the melon's dimensions were measured using a tape measure and scales. The weight was mainly measured (*G*), melon length: total (*L*), and circles (C) in 15 sections (see Fig. 1).

To determine the distance between the melon sections $b_1; b_2;...;b_{15}$ Let's use the results of scientific research by F. Rakhmatov [16] and accept b_i = 18±2 mm. In this case, we leave a free distance "a" in the head and tail parts of the melon. The value of this quantity varies depending on the thickness of the melon rind [16]. To determine the diameter of each slice (section) of the melon, we use the well-known formula *C=2πR.*

The results of micrometric studies are presented in the table and in figures 2-17. As can be seen from the table and figures, the dimensions (circumference length) of the Ak Urug melon sections along the length (from the head to the tail) are respectively 14,83; 15,36; 15,94; 16,76; 17.30; 18.03; 18,45; 19.02; 18,34; 17,95; 17.21; 16,63; 15,96; 15,38; 14,17 sm, and the standard deviations varied from σ=±2,26 to 2,84 sm. The coefficient of variation changed from 12,3% up to 18.5%, and for the length and weight of the melon these parameters were 6.15 and 1.7; 13.8% and 25.3%, respectively.

Results of the study and their discussion. From the type of graphs, we note that the distribution (scatter) of the mass - overall dimensions obeys the normal law (Gauss), since when checking the law according to the Kolmogorov criterion, the value *P(λ)* varies within the range 0,001...0,997. As is known, when $0 \le P(\lambda) \le 1$ a conclusion is made about the compatibility of empirical and theoretical distribution curves[15,17,18

Table

Results of micrometry of parameters of melon Ak Urug

	Control dimensions and units of measurement	esignation	Mathematical expectation $\overline{M}$, sm	Standard deviation σ, sm	Coefficient of variation, *V*, %	Absolute error, $\delta_м$, см	Indirect error $\overline{M}$, $\delta_н$, %	Mathem. expect - nie $\overline{M}_{min}$, sm	Матем. ожидание $\overline{M}_{max}$, см	Критерия Колмогорова *P(λ)*
	Length, sm		44,70	6,15	13,8	0,47	1,05	43,8	45,0	0,270
	Weight, kg		6,71	1,70	25,3	0,13	1,94	6,5	7,0	0,178
	Diameter melons by cross-section,sm	*1*	14,83	2,74	18,4	0,21	1,41	14,4	15,2	0,112
		2	15,36	2,70	17,6	0,21	1,35	14,9	15,8	0,178
		3	15,94	2,78	17,4	0,17	1,09	15,0	16,3	0,068
		4	16,76	2,37	14,1	0,18	1,08	16,4	17,1	0,178
		5	17,30	2,50	14,4	0,19	1,11	16,9	17,7	0,112
		6	18,03	2,50	13,9	0,19	1,06	17,7	18,4	0,465
		7	18,45	2,31	12,5	0,18	0,95	18,1	18,8	0,997
0		*8*	19,02	2,39	12,6	0,18	0,96	18,6	19,4	0,544
1		*9*	18,34	2,26	12,3	0,17	0,94	18,0	18,7	0,270
2		*10*	17,95	2,47	13,8	0,19	1,05	17,6	18,3	0,001
3		*11*	17,21	2,39	13,9	0,18	1,06	16,8	17,6	0,112
4		*12*	16,63	2,38	14,3	0,18	1,09	16,3	17,0	0,023
5		*13*	15,96	2,47	15,5	0,19	1,19	15,6	16,3	0,001
6		*14*	15,38	2,84	18,5	0,22	1,42	14,9	15,8	0,003
7		*15*	14,17	2,58	18,2	0,20	1,39	13,8	14,8	0,005

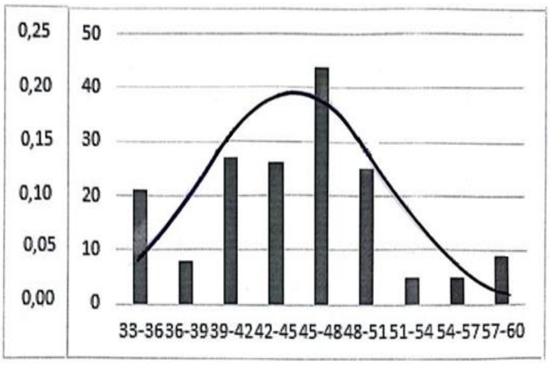

Fig. 1. Melon length L (sm)

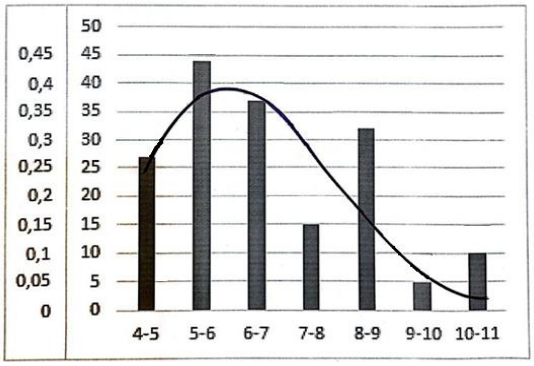

Fig. 2. Melon weight (kg))

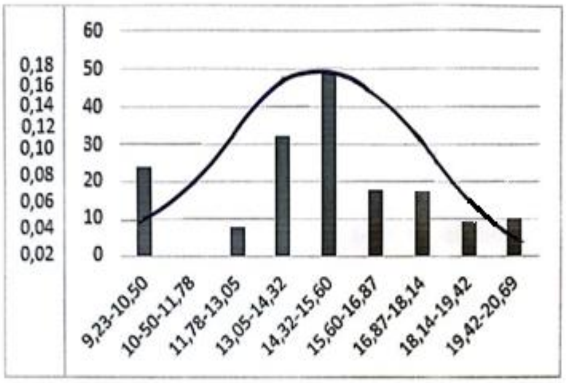

Fig.3. Melon diameter d1 sm

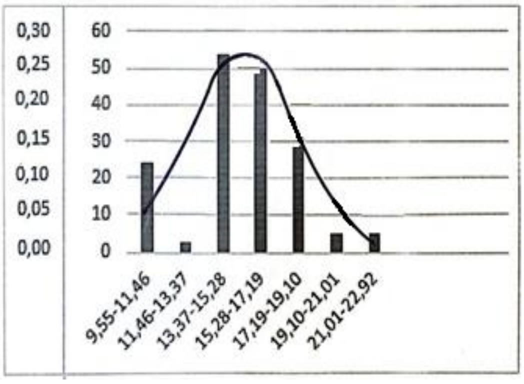

Fig.4. Melon diameter d2 sm

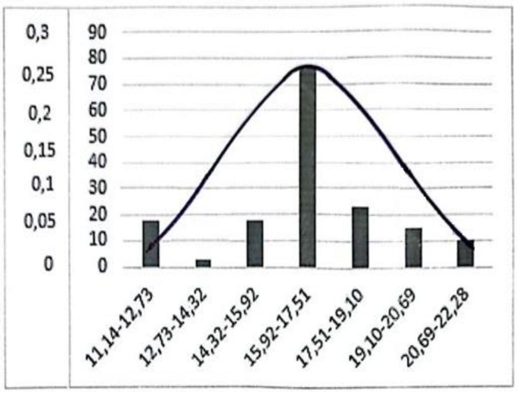

Fig. 5. Melon diameter d3 sm

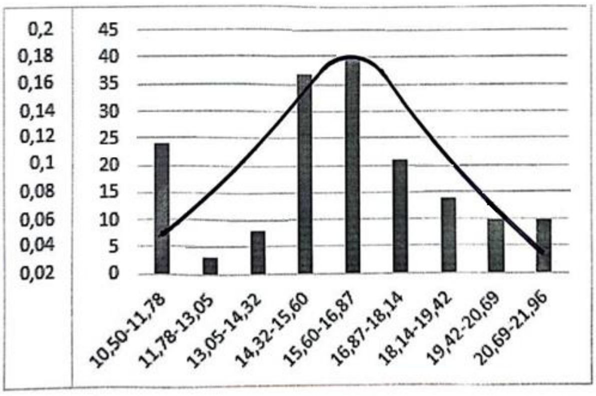

Fig.6. Melon diameter d4 sm

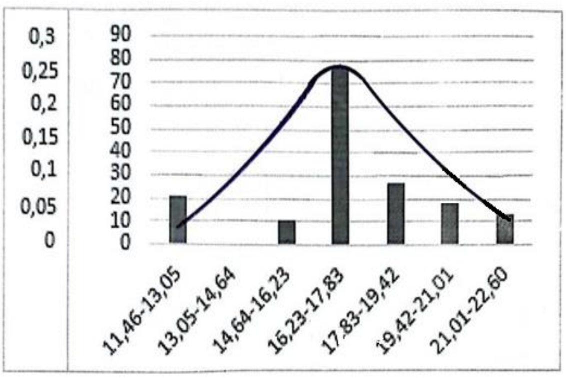

Fig. 7. Melon diameter d5 sm

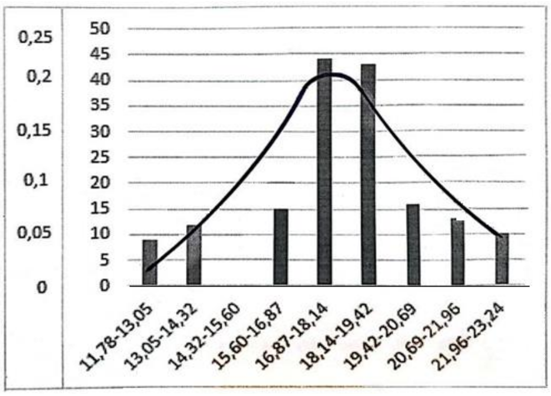

Fig. 8. Melon diameter d6 sm

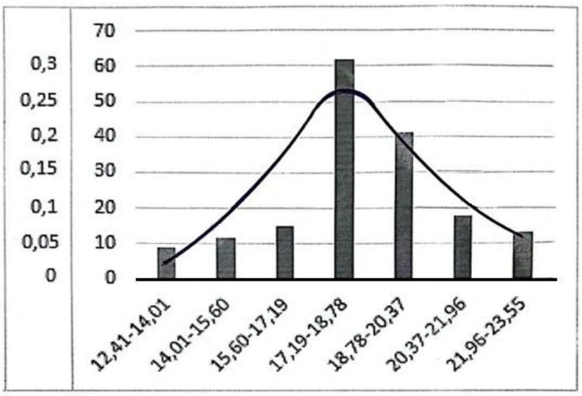

Fig.9. Melon diameter d7 sm

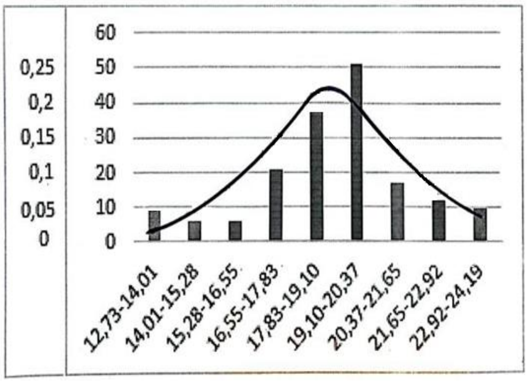

Fig.10. Melon diameter d8 sm

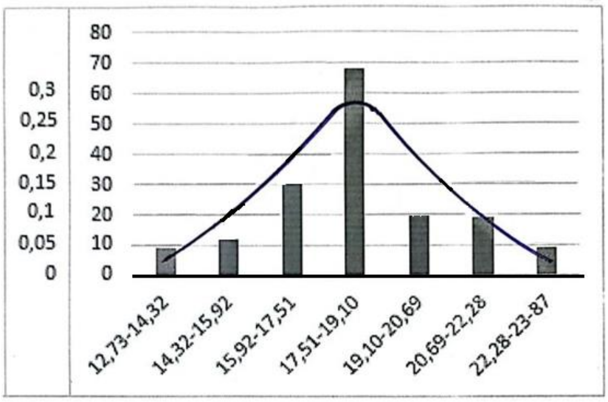

Fig.11. Melon diameter d9 sm

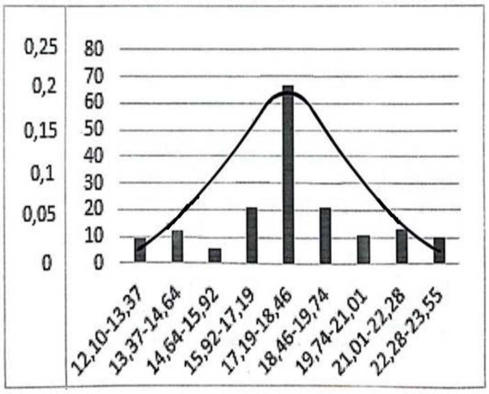

Fig.12. Melon diameter 10 sm

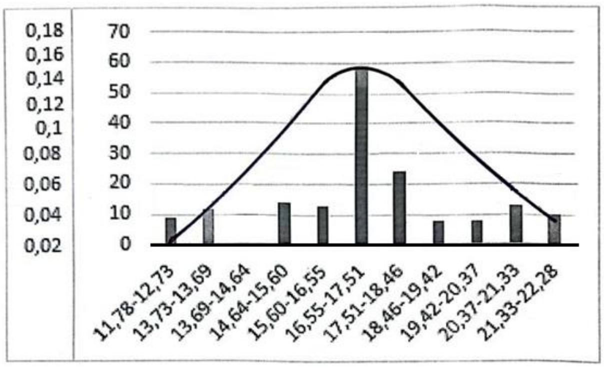

Fig.13. Melon diameter d11 sm

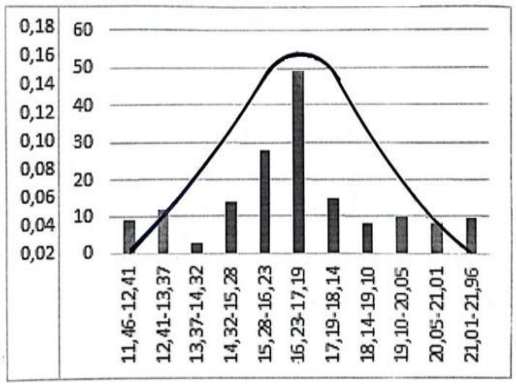

Fig.14. Melon diameter d12 sm

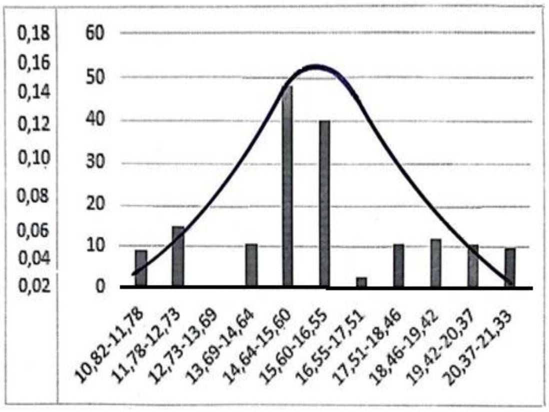

Fig.15. Melon diameter d13 sm

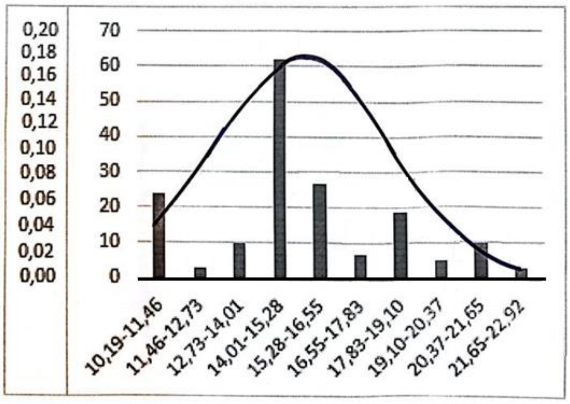

Fig. 16. Melon diameter d14 sm

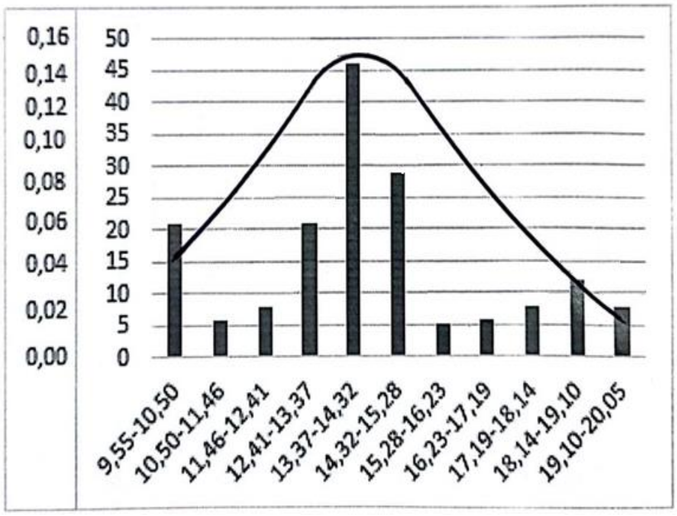

Fig.17. Melon diameter d15 sm

With micrometric analysis of the mass-geometric dimensions of a melon, it is possible to calculate the probability of the percentage ratio of suitable and unsuitable ones based on their parameters. The probability of the percentage of suitable melons should be determined based on the size of the mathematical expectation, for larger or smaller sizes. If one of the most important dimensions of a melon is, for example, its length, then it is necessary to determine the probability of the percentage of suitable melons for sizes greater than the mathematical expectation and less than the mathematical expectation. As is known, the largest and smallest sizes of a melon L_{max} = 60 sm; L_{min} =33 sm, and the standard deviation is equal to б=6,15.

Результаты исследований по измерению многих технических и технологических продукций показывают, что вероятность того, что искомая величина окажется в пределах нормы $\bar{M} \pm 3\sigma$, равна 0,9973.

Therefore, in technical and technological calculations it is usually determined at the limit of the greatest scatter of sizes. Then the actual area of scatter of sizes will be equal to $V = 6\sigma = 6 \times 6{,}15 = 36{,}9$ sm. So when picking melons there is a chance that some of them will be unsuitable. Let's calculate the risk coefficients [15,17]:

$$Z_1 = \frac{M_1}{\sigma} = \frac{60 - 44{,}7}{6{,}15} = 2{,}48,$$

$$Z_2 = \frac{M_2}{\sigma} = \frac{33 - 44{,}7}{6{,}15} = 1{,}90.$$

From the table (see Appendix 1 [12]) we find the Laplace function

$$\Phi(Z_1) = 0{,}4934 \qquad \Phi(Z_2) = 0{,}4713$$

The total probability of producing suitable melons is:

$$P_г = [\Phi(Z_1) + \Phi(Z_2)] \times 100\% = (0{,}4934 + 0{,}4713) \times 100 = 96{,}47\%$$

From here we find the probability of the percentage of unsuitability among all melons.

$$P_{н} = 100 - P_{г} = 100 - 96{,}475 = 3{,}53\%$$

Conclusions. The conducted research allows us to draw the following conclusions:

1. Determine the average statistical weight and dimensions of melons grown in the Mirzachul oasis and evaluate them by comparative comparison.
2. Establish the laws of probabilistic-random mass distribution of melon sizes by variety.
3. Conduct a quantitative assessment of the impact of various agricultural technologies for growing melons on their physical and mechanical characteristics.

Based on the identified physical and mechanical characteristics of melons, it is possible to develop installations for their processing, in particular, to determine the values of the diameters of the disk knives of the installation for ring-cutting melons before drying

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