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DETERMINATION OF LINEAR DIMENSIONS OF BOXES AND THIRDS OF INDIVIDUAL CASTOR VARIETIES

Summary. The article is devoted to the study of geometric characteristics of heap of castor. The varieties of castor seeds studied were the following: Donska, Aphrodite, Olesya, Khortychanka, VNIIMK-165, Hybrid early, Khortytska 1, Khortytska 3, Khortytska 7. The aim of the article is to establish the linear sizes of bolls and thirds for individual varieties of castor bean in the context of their percentage. The length and thickness of castor bolls and the length, width and thickness of thirds of the corresponding castor bean varieties were determined as experimental data. After statistical data processing, the interval series of each geometric size of the components of the heap of castor were determined. The distribution characteristics of a randomly determined individual size were evaluated using characteristics of variation series, such as: sample arithmetic mean, variance, standard deviation, coefficient of variation, range of variation, asymmetry and excess. The significance of the obtained results lies, firstly, in establishing the law of normal distribution, which is suitable for calculating the percentage of the heap with a fixed geometric size, and secondly - in obtaining some estimates of practical interest.

Keywords: castor seeds, heap of castor, geometric characteristics, castor bolls, thirds.

Introduction. It is possible to increase the efficiency of the process of post-harvest processing of castor in each technological operation by using special machines in this technology with the mandatory consideration of the physical and mechanical properties of castor components. One of the important ones is the geometric dimensions of the castor seed pile components: pods and thirds. Such characteristics are required when determining the design parameters and technological modes of machines for separating castor seed heaps from impurities and in peeling machines that separate castor seeds from their heaps. Accordingly, establishing the geometric dimensions of the pods and thirds of the heap of castor seeds is an urgent problem today [1-3].

Recent research and publications analysis. The most important and complex stage in the system of measures for the processing of castor seeds is its post-harvest processing operations, namely cleaning, drying and sorting of the bunch. Carrying out post-harvest processing of the pile determines the yield and quality of the products that go to further processing [4].

During the cleaning operation, the heap is separated according to physical and mechanical properties (size, density, speed of drift, etc.). The heap includes castor pods, both whole and broken, a significant mass of plant parts: stems and leaves, as well as extraneous impurities, which is due to the condition of the agro background before harvesting the castor crop.

Accordingly, the task of the cleaning process is to separate impurities and thresh castor seed pods first into thirds, and then thresh the thirds with further separation of clean seeds.

However, compared to other technical and grain crops, castor has a complex of specific features: multi-component composition, uneven moisture content, high oiliness of the kernel, fragility of the shells, high clogging, the need to peel the elements of its bunch, etc. The consequence of such specific features of castor oil is the impossibility of effective application of the existing technology for its post-harvest processing [5].

Special equipment for cleaning operations is extremely limited. Accordingly, when using the existing technology, the specific features of castor oil are not taken into account. So, for example, during the operation of peeling castor beans, the high-oil core can be injured. The consequence of this is the oiling of the working elements of the cleaning machines (machines for peeling and separating) of the castor pile and directly oiling the pile itself. As a result of this, firstly, the entire process of post-harvest processing is disrupted, both the castor itself and the castor seeds cannot be completely separated on the existing cleaning machines, and secondly, the yield and quality of the valuable product – castor oil – subsequently decreases. oil in the technological process of castor seed processing.

As a rule, the existing studies of castor geometric characteristics in the world refer to regional features, which are difficult to apply to castor varieties grown in Ukraine. So, for example, in work [6] the geometric characteristics of castor seeds, which were grown in Nigeria, were studied. In work [7-10], the research concerned local castor varieties grown in Pakistan and castor variety DS-30 Variety. In works [11-13], the research concerned local seeds grown in Iran and bought on the market in Tehran. In addition, local climatic conditions, soil and seasonal features of cultivation will further influence the geometric dimensions of the castor pile [10-13]. Castor oil is a high-oil technical crop, the main product of its processing is castor oil, which is used in the chemical, electrical, medical, aviation, other industries and in the production of biofuel [14-24]. In some industries, castor oil is often an irreplaceable or difficult to replace product [25-30].

Purpose statement. Justification of the methodology and equipment for determining the linear dimensions of boxes and thirds of individual castor varieties.

Results and discussion. The parameters of the geometric characteristics of the components of the castor bean seed heap, which must be determined, are the following: the length and thickness of the castor bean bolls (Fig. 1) and the length, width and thickness of the castor bean trebles (Fig. 2).

When determining biometric characteristics, the following castor bean varieties were studied: Donskaya, Afrodita, Olesya, Khortichanka, VNIIMK-165, Early Hybrid, Khortitskaya 1, Khortitskaya 3, Khortitskaya 7.

For measurements, an electronic vernier caliper MIOL 15-241 with a scale length of 150 mm and a measurement accuracy of 0.01 mm was used (Fig. 3).

The research methodology was as follows:

1. From the total amount of castor bean of one variety, a castor bean boll was selected. Its length and thickness were measured with a caliper. The value was recorded. Then, they took another boll and repeated the same measurements. The total number was 100 measurements. Measurements were carried out for each castor bean variety.

2. Castor bean boll, divided into treble. For each third, the length, width and thickness were measured with a caliper. The total number of measurements was 100 for each castor bean variety.

3. To construct an interval series, the size of the interval was determined, the full scale of intervals was set, and the results of observations were grouped in accordance with it. To determine the optimal value of the interval h, at which the series would not be too cumbersome and, at the same time, would allow identifying the characteristic features of the random variable x, the Ster-Jess formula was used [9]*:*

$$h = \frac{x_{max} - x_{min}}{1 + 3{,}322 \lg n}, \quad (1)$$

x_{max}, x_{min} – maximum and minimum options, respectively;
n - number of experiments.

At the beginning of the first interval, it is recommended to take a value equal to [9]:

$$a_1 = x_{min} - \frac{h}{2}, \quad (2)$$

then [9]:

$$a_i = a_{i-1} + h, \quad (3)$$

$$i = 2, 3, 4\dots .$$

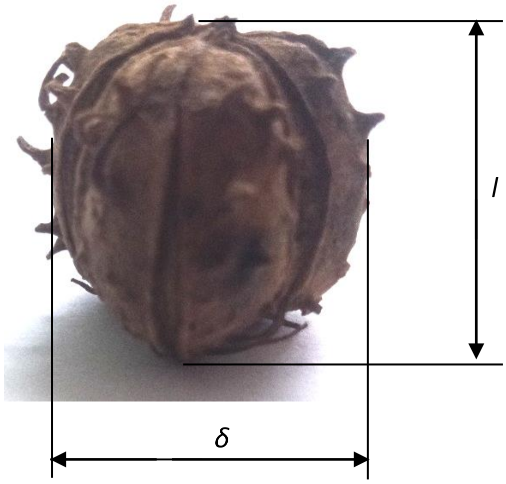
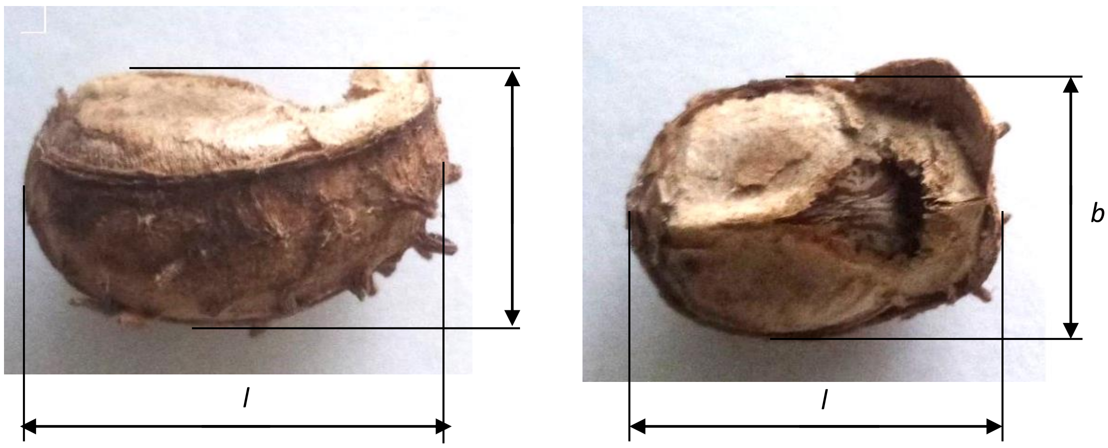


Fig1. General view of a boll of castor:
l – is the length of the boll, *δ* - is the thickness of the boll



a b

Fig 2. General view of a the third part of the castor bean boll:
a – top view; b – side view; *l* – length of the third; *b* – width of the third;
δ is the thickness of the third

Fig 3. General view of the electronic support MIOL 15-241 when measuring the geometric parameters of the castor bean boll

The construction of the intervals was continued until the beginning of the next interval is equal to or greater than $x_{\max}$.

The distribution characteristics of the random variable *x* were estimated using the characteristics of the sample (characteristics of variation series), which at increasing *n* converge in probability to the corresponding characteristics *x*, and at a sufficiently large *n* can be approximately equal to them [10].

The main characteristics of variation series include: sample arithmetic mean - $\bar{x}$, corrected variance - S*2, standard deviation - S*, coefficient of variation - V, range of variation - R, asymmetry - A_s, excess - Ex.

The sample arithmetic mean $\bar{x}$ was determined by the formula:

$$\bar{x} = \frac{\sum_{1}^{n} x_i}{n}. \quad (3)$$

The dispersion S^{*2} was determined by the formula [9, 10]:

$$S^{*2} = \frac{\sum_{1}^{n} (x_i - \bar{x})^2}{n-1}. \quad (4)$$

The standard deviation of S^* (empirical standard) was determined by the formula [9, 10]:

$$S^* = \sqrt{S^{*2}} = \sqrt{\frac{\sum_{1}^{n} (x_i - \bar{x})^2}{n-1}}. \quad (5)$$

The coefficient of variation of standard deviation V was determined by the formula [9, 10]:

$$V = \frac{S^*}{\bar{x}} \cdot 100\%. \quad (6)$$

The range of variation *R*, was calculated by the formula [9, 10]:

$$R = \max x_i - \min x_i. \quad (7)$$

Asymmetry A_s was determined by the formula [9, 10]:

$$A_s = \frac{\sum_{1}^{n} (x_i - \bar{x})^3}{n \cdot S^{*3}}. \quad (8)$$

Excess E_x was determined by the formula [9, 10]:

$$E_x = \frac{\sum_{1}^{n} (x_i - \bar{x})^4}{n \cdot S^{*4}} - 3. \quad (9)$$

The average values are generalized quantitative characteristics of a set of similar phenomena on a variable basis. The arithmetic mean characterizes the average value, close to which the possible values of a random variable are grouped. The variance is a measure of the scatter of these values relative to the mean. The standard deviation is a measure of oscillation, but in contrast to the variance is an absolute value expressed in the same units as the variants. The coefficient of variation is a relative indicator of fluctuations.

The variational range (or width of the distribution) is unstable, an extremely random variable that serves to estimate the variation. Asymmetry and excess are indicators of the deviation of the distribution function *f(x)* for *x* from the normal distribution law. If A_s = 0, then the curve for *f(x)* is symmetric, for $A_s \neq 0$ - asymmetric. At $A_s > 0$ the right part of the distribution is longer than the left, $A_s < 0$ - vice versa. Excess characterizes the steepness of the distribution curve. If $E_x \neq 0$, then the vertex of the curve for *f(x)* is either above (at $E_x > 0$) or below (at $E_x < 0$) the vertex of the normal distribution curve [11].

The linear dimensions of oilseeds are always subject to the law of normal distribution, which is determined taking into account the characteristics of variation series and based on the typical relationship [11]:

$$\Phi = \frac{1}{S^* \sqrt{2\pi}} \cdot e^{\left(-\frac{x-\bar{x}}{2 \cdot S^{*2}}\right)}. \quad (10)$$

When measuring the geometric characteristics of the boxes and thirds of castor seeds, it was found that the sizes of individual varieties have almost the same values. According to the above, in the process of research, the varieties of castor studied were divided into three groups: small, which corresponded to the varieties: Olesya, Khortychanka, Khortytska 7; medium - for varieties: VNIIMK-165, Hybrid early, Khortytska 1; large - for varieties Donska, Aphrodite, Khortytska 3.

As a result of the conducted researches variational series of distribution of castor bolls by: length (fig. 4), thickness (fig. 5), variational series of distribution of thirds by: length (fig. 6), width (fig. 7) and thickness are established (fig. 8).

Taking into account the experimental dependences (Figs. 1...5) and formulas (3… 9), the characteristics of variation series of bolls and thirds of castor varieties are determined (Table 1… 3). The calculated values of the parameters of the sample arithmetic mean of each variation series (Table 1… 3) must be taken into account in the technological processes and designs of machines when separating the castor bolls and peeling its thirds.

Centering of variation series obtained in the course of research (Fig. 1… 5) was carried out by determining the law of normal distribution of the series according to formula (10). To do this, it is necessary to take into account the results of the characteristics of the variation series of the geometric parameters of the components of the castor heap (Table 1… 3).

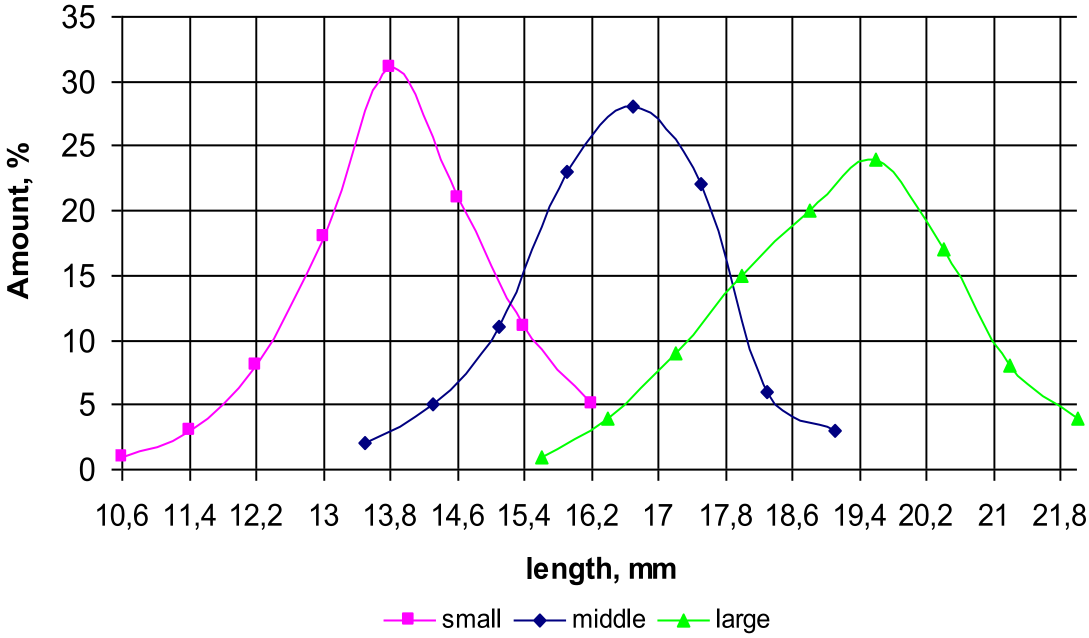


Fig 4. Variation series of distribution of castor bolls by length

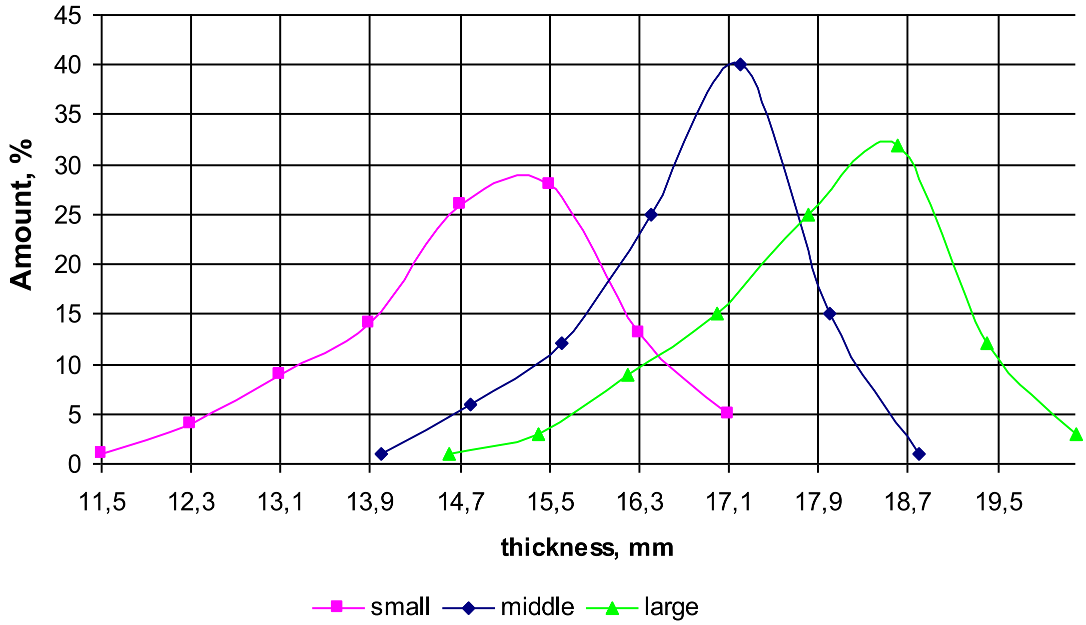


Fig 5. Variation series of distribution of castor bolls by thickness

Results of calculations of laws of normal distribution of variational series of distribution of bolls on length and width; and thirds of bolls in length, width and thickness for different varieties of castor are given in table. 4.

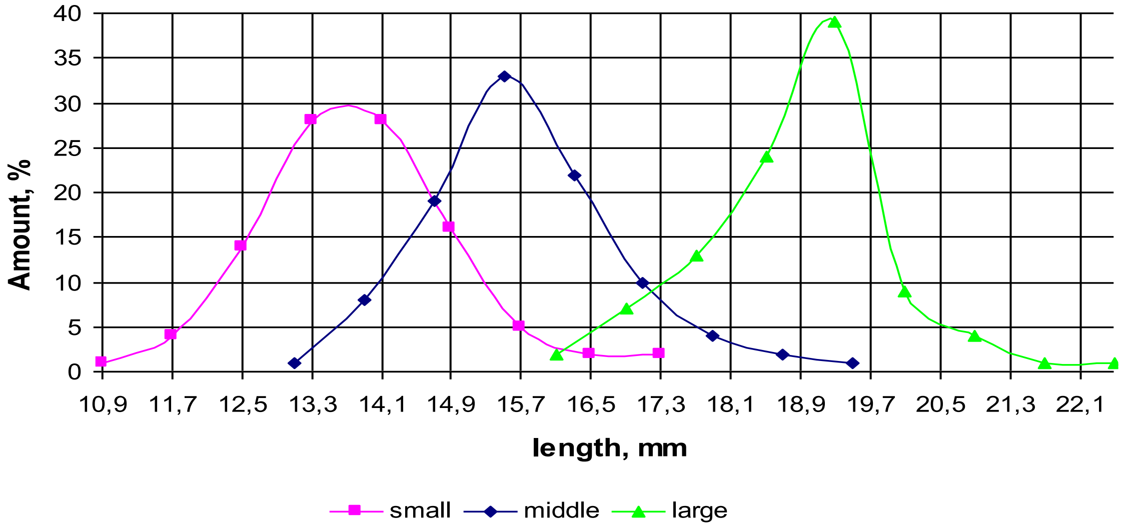


Fig 6. Variation series of distribution of castor thirds by length

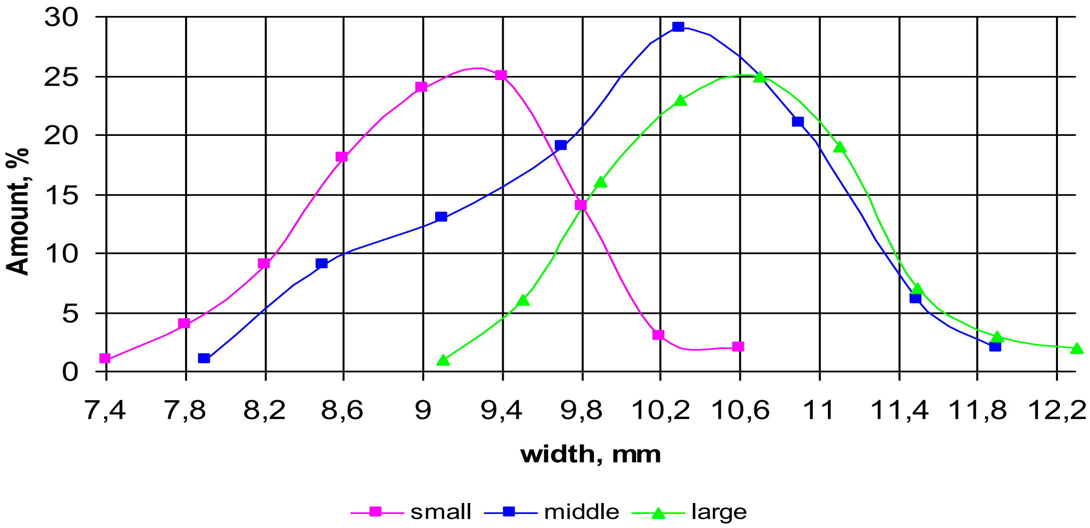


Fig 7. Variation series of distribution of castor thirds by width

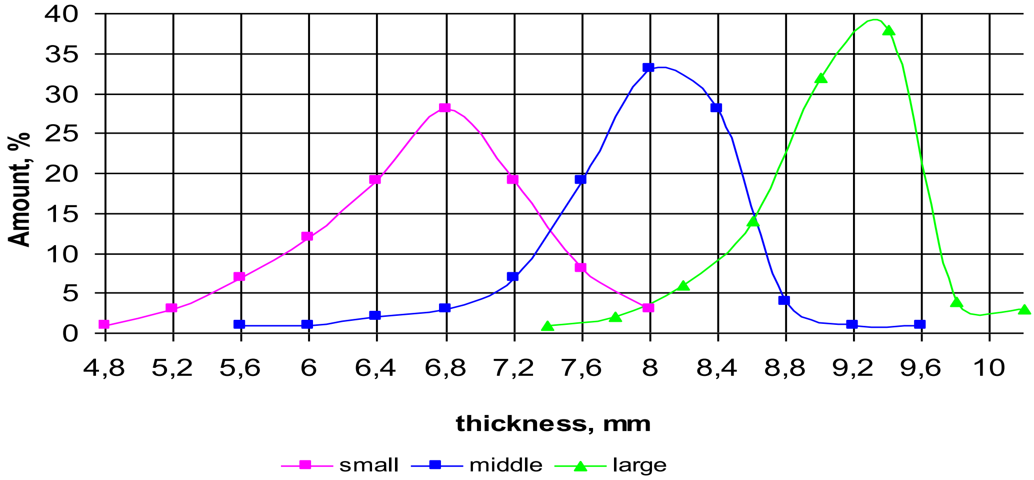


Fig 8. Variation series of distribution of castor thirds by thickness

Table 1

Characteristics of variation series for a group of small varieties of castor

Mathematical characteristics	Castor bolls		Thirds		
	By length	By width	By length	By width	By hickness
Selective arithmetic mean, $\bar{x}$	13,65	14,48	13,3	8,83	6,45
Dispersion, S^{*2}	1,56	1,54	1,38	0,39	0,44
The standard deviation, S^{*}	1,25	1,24	1,18	0,62	0,66
Coefficient of variation, V	9,15	8,58	8,83	7,03	10,27
Range of variation, R,	5,67	5,35	6,31	3,24	3,71
Asymmetry, A_s	-0,07	-0,55	0,56	0,18	-0,45
Excess, E_x	-0,41	-0,16	1,39	-0,03	0,85

Table 2

Characteristics of the variation series for the group of medium varieties of castor

Mathematical characteristics	Castor bolls		Thirds		
	By length	By width	By length	By width	By hickness
Selective arithmetic mean, $\bar{x}$	16,27	16,36	15,27	9,55	7,76
Dispersion, S^{*2}	1,66	0,78	1,17	0,92	0,44
The standard deviation, S^{*}	1,29	0,88	1,08	0,96	0,66
Coefficient of variation, V	7,92	5,4	7,09	10,03	0,49
Range of variation, R,	5,8	4,1	6	4,4	3,7
Asymmetry, A_s	-0,066	-0,82	0,69	0,09	-0,46
Excess, E_x	-0,45	0,52	1,93	-0,6	0,89

Table 3

Characteristics of the variation series for a group of large varieties of castor

Mathematical characteristics	Castor bolls		Thirds		
	By length	By width	By length	By width	By hickness
Selective arithmetic mean, $\bar{x}$	18,78	17,44	18,38	10,39	8,84
Dispersion, S^{*2}	1,82	1,3	1,14	0,5	0,26
The standard deviation, S^{*}	1,35	1,14	1,07	0,71	0,51
Range of variation, V	7,19	6,54	5,81	6,83	5,76
Range of variation, R,	6	5,0	6	3,5	3,1
Asymmetry, A_s	-0,067	-0,64	0,25	0,2	-0,56
Excess, E_x	-0,5	-0,009	1,71	-0,33	1,72

Table 4

Laws of normal distribution of variational series of distribution: bolls in length and width; thirds of bolls in length, width and thickness for different groups (varieties) of castor seeds

Biometric characteristics of castor bolls and thirds		
Castor bolls by length		
Small varieties of castor	Medium varieties of castor	Large varieties of castor
$\Phi = 0{,}32 \cdot e^{\left(-\frac{x-13{,}65}{3{,}12}\right)}$	$\Phi = 0{,}31 \cdot e^{\left(-\frac{x-16{,}27}{3{,}32}\right)}$	$\Phi = 0{,}296 \cdot e^{\left(-\frac{x-18{,}78}{3{,}64}\right)}$
Castor bolls by width		
Small varieties of castor	Medium varieties of castor	Large varieties of castor
$\Phi = 0{,}323 \cdot e^{\left(-\frac{x-14{,}48}{3{,}08}\right)}$	$\Phi = 0{,}454 \cdot e^{\left(-\frac{x-16{,}36}{1{,}56}\right)}$	$\Phi = 0{,}35 \cdot e^{\left(-\frac{x-17{,}44}{2{,}6}\right)}$
Thirds by length		
Small varieties of castor	Medium varieties of castor	Large varieties of castor
$\Phi = 0{,}338 \cdot e^{\left(-\frac{x-13{,}3}{2{,}76}\right)}$	$\Phi = 0{,}37 \cdot e^{\left(-\frac{x-15{,}27}{2{,}34}\right)}$	$\Phi = 0{,}373 \cdot e^{\left(-\frac{x-18{,}38}{2{,}28}\right)}$
Thirds by l width		
Small varieties of castor	Medium varieties of castor	Large varieties of castor

$\Phi = 0{,}644 \cdot e^{\left(-\frac{x-8{,}83}{0{,}78}\right)}$	$\Phi = 0{,}416 \cdot e^{\left(-\frac{x-9{,}55}{1{,}84}\right)}$	$\Phi = 0{,}562 \cdot e^{(10{,}39-x)}$
Thirds by thickness		
Small varieties of castor	Medium varieties of castor	Large varieties of castor
$\Phi = 0{,}605 \cdot e^{\left(-\frac{x-6{,}45}{0{,}88}\right)}$	$\Phi = 0{,}605 \cdot e^{\left(-\frac{x-7{,}76}{0{,}88}\right)}$	$\Phi = 0{,}783 \cdot e^{\left(-\frac{x-8{,}84}{0{,}52}\right)}$

Conclusions. As a result of the studies of the geometric characteristics of the components of the castor pile, it was established:

1. The geometrical dimensions of a bunch of castor beans depend on the type of castor and vary in a fairly wide range: according to the length of the pods: 10.55 - 22.5 mm, according to the width of the pods: 11.5 - 20.2 mm, according to the length of the thirds: 10.86 - 22.5 mm, width of thirds: 7.36 - 12.3 mm, thickness of thirds: 4.8 - 10.2 mm. The percentage ratio for the size of the castor pile is determined by its varietal characteristics.

2. To increase the efficiency of the separation of pods and peeling of its thirds, depending on the group of castor varieties, the following geometric dimensions are established: pod length: small - 13.65 mm, medium - 16.27 mm; large - 18.78 mm; box width: small - 14.48 mm, medium - 16.36 mm; large - 17.44 mm; length of the third: small - 13.3 mm, medium - 15.27 mm; large - 18.38 mm; width of third: small - 8.83 mm; medium - 9.55 mm; large - 10.39 mm; third thickness: small - 6.45 mm, medium - 7.76 mm; large - 8.84 mm. The specified parameters must be taken into account in the relevant technological processes of castor oil processing and machine designs.

3. For each variation series of the distribution of components of the castor pile, taking into account the corresponding group of castor varieties, centering is ensured by establishing the law of normal distribution of the corresponding variation series.

References

1. Malajowicz J., Kusmirek S. Characteristics and possibilities of industrial use of castor oil. *Przemysl Chemiczny*. 2016. Vol. 95(9). No 1756-1760.

2. Hadiyanto H., Yuliandaru I., Hapsari R. Production of Biodiesel from Mixed Waste Cooking and Castor Oil. *INMATEC*: Web of Conferences. 2018. Vol.156. P. 1-4.

3. Conejero M. A., César A. D. S., Batista A. P. The organizational arrangement of castor bean family farmers promoted by the Brazilian Biodiesel Program: a competitiveness analysis. *Energy Policy*. 2017. Vol.110. P.461-470.

4. Nikitchin D. I., Gridnev E. K, Cherepuhin V. D. Intensive technology of growing sunflower and castor oil plants. Kiev, 1990. 175 p.

5. Shaforostov V. D., Tyurin A. A. Advanced container technology for post-harvest treatment of castor bean. *Sci. those. bul.* 2007. Vol. 2 (137). P. 124-137.

6. Danbaba N., Dauda S. M. Anounye J. C. Some technological properties of castor seeds (Recinuscommunis) of importance in the design of its processing operations. *Academic Research International.* 2012. Vol. 2(3). P. 239-245.

7. Panhwar T., Mahesar S. A., Mahesar A. W. [et al.]. Characteristics and Composition of a High Oil Yielding Castor Variety from Pakistan. *Journal of Oleo Science*. 2016. Vol. 65(6). P. 471-476.

8. Gharibzahedi S., Mousavi S., Ghahderijani M. A survey on moisture-dependent physical properties of castor seed (Ricinus communis L.). *Australian journal of Croup science*. 2011. Vol. 5(1). P. 1-7.

9. Agisheva D. K., Zotova S. A., Matveev T. A., Svetlichnaya V. B. Mathematical Statistics: A Study Guide. Volgograd: VPI (branch) VolgSTU, 2010. 159 p.

10. Volkovets A. I. [et al.]. Probability theory and mathematical statistics. Workshop for students of all specialties of full-time education, Minsk: BSUIR, 2016. 72 p.

11. Barkovskiy V. V., Barkovska N. V., LopatIn O. K. Probability theory and Mathematical Statistics: Textbook 5th Ed. Kiev: Center for Educational Literature, 2010. 424 p.

12. Бондар А. М. Використання біологічної оливи для сільськогосподарської техніки. *Механізація та електрифікація сільського господарства*. 2019. Вип. № 10(109). С. 125-131.

13. Gritsaenko G., Gritsaenko I., Bondar A.. Mechanism for the Maintenance of Investment in Agriculture. *Modern Development Paths of Agricultural Production*. 2019. P. 29-40.

14. Samoichuk K., Viunyk O., Milko D., Bondar A. Research on milk homogenization in the stream homogenizer with separate cream feeding. *Potravinarstvo Slovak Journal of Food Sciences*. 2020. Vol. 14. P.142-148.

15. Milko D., Samoichuk K., Postol Yu. Revealing new patterns in resourcesaving processing of chromium-containing ore raw materials by solidphase reduction. *Eastern-European Journal of Enterprise Technologies*. 2020. № 1/12(103). P. 24-29.

16. Milko D., Sclyar O., Sclyar R., Pedchenко G. Results of the nutritional preservation research of the alfalfa laying on storage with two-phase compaction. *INMATEH - Agricultural Engineering.* 2020. Vol. 60(1). P. 269-274.

17. Samoichuk K., Palyanichka N., Oleksiienko V., Petrychenko S. Improving the quality of milk dispersion in a counter-jet homogenizer.

Potravinarstvo Slovak Journal of Food Sciences. 2020. Vol. 14. P. 633-640.

18. Бондар А. М. Покращення та оцінка якісних показників відпрацьованих автотракторних олив для сільськогосподарської техніки. *Науковий вісник ТДАТУ*. 2021. Вип. 11, т. 1. С. 15. https://doi.org/10.31388/2220-8674-2021-1-6.

19. Бондар А. М. Прогнозування ресурсу трибосистем при використанні сумішевих олив. *Науковий вісник ТДАТУ*. 2021. Вип. 11, т. 1. С. 19. https://doi.org/10.31388/2220-8674-2021-1-10.

20. Бондар А. М., Дашивець Г. І., Паніна В. В. Обґрунтування швидкісних параметрів роботи машино-тракторного агрегату. *Науковий вісник ТДАТУ*. 2021. Вип. 11, т. 2. С. 13. https://doi.org/10.31388/2220-8674-2021-2-16.

21. Zhuravel D. Research of lubricant properties of used tractor motor oils. *Науковий вісник ТДАТУ*. 2021. Вип. 11, т. 2. С. 18. https://doi.org/10.31388/2220-8674-2021-2-5.

22. Kuznetsov, M., Lysenko, O., Chebanov, A. Ensuring power balance in a hybrid power system with a backup generator. *Eastern-European Journal of Enterprise Technologies*. 2021. № 6(8 (114)). P. 6–15. https://doi.org/10.15587/1729-4061.2021.245557.

23. Бондар А. М., Дашивець Г. І., Паніна В. В. Методика обробки емпіричних даних якісних показників роботи колісної машини. *Науковий вісник ТДАТУ*. 2022. Вип. 12, т. 2. С. 13. https://doi.org/10.31388/2220-8674-2022-2-2.

24. Samoichuk, K., Petrychenko, S., Bondar, A. et al. Modeling of Diesel Engine Fuel Systems Reliability When Operating on Biofuels. *Energies*. 2022. Vol. 15. P. 1795. https://doi.org/10.3390/en15051795.

25. Kapłan, M., Klimek, K., Maj,G., Bondar, A. et al. Method of Evaluation of Materials Wear of Cylinder-Piston Group of Diesel Engines in the Biodiesel Fuel Environment. *Energies*. 2022. Vol. 15. P. 3416. https://doi.org/10.3390/en15093416.

26. Верещага О. Л. Аналіз способів отримання олійних матеріалів із насіння рицини. *Технічне забезпечення інноваційних технологій в агропромисловому комплексі:* матеріали ІІ Міжнар. наук.-практ. Інтернет-конф. (м. Мелітополь, 2-27 листопада 2020 р.). Мелітополь, 2020. С. 77-82.

27. Nadikto V., Chebanov A., Verechaga O. Improving the efficiency of pressing the male of castor seeds in the screw press. *Norwegian Journal of development of the international Science*. 2021. Vol. 59(1). P. 48-53. https://doi.org/10.24412/3453-9875-2021-59-1-48-53.

28. Дідур В. В., Журавель Д. П., Шокарев О. М., В'юник О. В., Комар А. С. Аналіз технологій отримання олії з олійних культур. *Науковий вісник ТДАТУ*. 2022. Вип. 12, т. 3. С. 10. https://doi.org/10.31388/2220-8674-2022-3-18.

29. Журавель Д. П. Дослідження аеродинамічних властивостей компонентів насіння рицини. *Сучасна інженерія агропромислових і харчових виробництв:* Матеріали міжнар. наук.-практ. конф. Харків: ДБТУ, 2021. С. 411-413.

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ВСТАНОВЛЕННЯ ЛІНІЙНИХ РОЗМІРІВ КОРОБОЧОК І ТРЕТИНОК ОКРЕМИХ СОРТІВ РИЦИНИ

Анотація

Робота присвячена обгрунтуванню лінійних розмірів коробочок і третинок окремих сортів рицини у розрізі їх відсоткової кількості. В якості експериментальних даних було визначено довжину і товщину коробочок рицини та довжину, ширину і товщину третинок відповідних сортів рицини. Після статистичної обробки даних, визначено інтервальні ряди кожного геометричного розміру компонентів вороху рицини. Відповідно задачею процесу очищення є відділення домішок та обмолот коробочок насіння рицини спочатку на третинки, а потім обмолот третинок із подальшим відділенням чистого насіння. Однак, у порівнянні з іншими технічними і зерновими культурами, рицина має комплекс специфічних особливостей: багатокомпонентність її складу, нерівномірність по вологості, висока олійність ядра, крихкість оболонок, велика засміченість, необхідність лущення елементів її вороху тощо. Наслідком таких специфічних особливостей рицини є неможливість ефективного застосування існуючої техніки для її післязбиральної обробки. Спеціальної техніки при проведені операцій очищення вкрай обмежено. Відповідно, при використанні існуючої техніки не враховуються специфічні особливості рицини. Так, наприклад, під час операції лущення третинок рицини може травмуватися високоолійне ядро. Наслідком цього є заолівання робочих елементів очищувальних машин (машин для лущення і розділення) вороху рицини та безпосередньо заолівання самого вороху. В результаті цього, по перше, порушується весь процес післязбиральної обробки, як самої рицини так і насіння рицини не може бути повністю відділено на існуючих очищувальних машинах, а по-друге, в подальшому відбувається зниження виходу і якості цінного продукту – касторової олії в технологічному процесі переробки насіння рицини. Характеристики розподілу випадково визначеного окремого розміру оцінювали за допомогою характеристик варіаційних рядів, таких як: вибіркова середня арифметична, дисперсія, середнє квадратичне відхилення, коефіцієнт варіації, розмах варіації, асиметрія та ексцес. Значимість отриманих результатів полягає, по-перше, у встановленні закону нормального розподілення, що придатний для розрахунків відвідної відсоткової кількості вороху зі встановленим геометричним розміром, а по друге – в отриманні деяких оцінок, що мають практичний інтерес. Це стосується вибору з урахуванням отриманих геометричних характеристик вороху рицини, конструкцій робочих органів сільськогосподарських машин, що забезпечують виконання операцій розділення коробочок і лущення третинок вороху в технологічному процесі післязбиральної обробки рицини.

Ключові слова: лінійні розміри, геометричні характеристики, ворох рицини, фільтрація, касторова олія, варіаційний ряд, коробочки, третинки.