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Study of mechanical and technological properties of seed fruits of vegetable and melon crops

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Abstract. The analysis of literature sources shows that the production of seed material for vegetable and melon crops is one of the most important problems that exists in the field of agricultural processing. The production of cucumber and melon seeds is an urgent issue in view of the volume of their cultivation in Ukraine. To study the processes of fruit grinding and seed production in agriculture, the key parameters are the dynamic friction coefficient, the volume deformation coefficient and the static load coefficient, but existing methods and equipment are limited to determining the limit values of the indicators, not allowing a full study of the dynamics of changes in properties at different stages of the technological process. To solve this, it is proposed to develop new methods, in particular, the use of computer modelling, which will allow a more detailed study and optimisation of physical and mechanical properties and their changes. The aim of the article was to study the physical and mechanical

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properties of vegetable fruits, which have the greatest impact on the quality of the technological process of fruit seed grinding and preliminary seed extraction. The study was conducted in the problematic research laboratory of the Faculty of Engineering and Energy of Mykolaiv National Agrarian University. Experimental setups were used to determine the dynamic coefficient of friction of melon and cucumber seeds, a device for determining the initial density of seed fruits, and a device for determining the dependence of seed deformation on compressive load. Experimental data show that the most optimal values of the static coefficient of friction, depending on the type of surface, for cucumber and melon seeds are perforated sieves, the values of which are 0.75 and 0.85, respectively. Optimal values of dynamic friction coefficients for cucumber have a surface made of perforated sieve – 0.69 and for melon made of aluminium – 0.88. The dependence of the linear deformation of seed fruits on the specific pressure increases from 0.9 to 3.6. The values of fruit deformation from compressive load vary from 4.1 to 24.6. The research presented in the article is of practical importance and can be used in the field of agricultural production and in the development of new engineering solutions

Keywords: seed; experimental studies; surface; dependence

INTRODUCTION

The global agricultural technology market is constantly evolving. Countries with developed agriculture are actively using mechanised and automated processes for seed preparation, which leads to increased productivity and reduced costs. In Ukraine, given its agricultural potential and role in the global agricultural sector, it is important to improve the technology for selecting and preparing vegetable and melon seeds. This will improve the quality and efficiency of production, ensuring stability in the agricultural sector and contributing to the competitiveness of Ukrainian products on the global market.

The production of seed material for vegetable and melon crops is one of the most important problems in the field of agricultural processing. The issue of obtaining cucumber and melon seeds is quite acute, given the volume of their cultivation in Ukraine (Havrysh *et al.,* 2022). An integral part of the development of technology and technological equipment for seed production is the study of the physical, mechanical and dimensional and mass characteristics of seed fruits and seeds of vegetable and melon crops (Fang *et al.,* 2020). The combination of qualities of seed fruits and seeds of vegetable and melon crops is an important basis for the design of working bodies and the machine as a whole. Technological equipment that provides a mechanised process of producing melon and cucumber seeds involves not only its theoretical substantiation in order to choose the right forms, machine designs and working bodies, but also experimental studies to confirm the theoretical premises (Pathania *et al.,* 2022).

V. Shebanin *et al.* (2019) note that to study the processes of fruit crushing and seed production, it is important to know such indicators as the dynamic friction coefficient, the coefficient of volumetric deformation of the seed fruit and the coefficient of static load (crushing force). Y. Yang *et al.* (2021), when studying the physical and mechanical properties of materials for the research and optimisation of technological processes, found that most existing methods and laboratory equipment are aimed at determining the critical values of the relevant parameters. However, these research tools do not always provide opportunities for in-depth analysis of patterns and establishing links between the deformation force and the deformation itself, especially in the context of different stages of the technological process, such as the grinding of seed fruits of vegetables and melons.

In light of the need to increase the efficiency of vegetable and melon seed production, modernisation and improvement of the seed fruit chopper and other processing equipment is becoming an important task. Modern requirements for seed quality and technological standards require that the production process be in line with them. In order to reduce seed losses and improve seed quality, Z. Stropek & K. Gołacki (2020) focused on the research and implementation of the latest solutions in the technological field, which will optimise production processes and ensure market competitiveness. In addition, J. Hou *et al.* (2021) emphasise that current trends in agriculture determine the increased demand for high-quality seeds to achieve optimal yields.

Therefore, improving the technical characteristics and functionality of seed treatment equipment is of strategic importance for producers. Furthermore, in the context of sustainability, reducing losses in the process can also contribute to reducing resource consumption and increasing the environmental efficiency of production. Such improvements can contribute not only to increased production efficiency, but also to sustainability and competitiveness in the vegetable and melon industry. Irrational operating modes of vegetable and melon seed crushing machines lead to a decrease in the quality of seed and irreversible seed losses, requiring the identification and resolution of design flaws and improvement of the technological process. The purpose of the study was to investigate the physical and mechanical characteristics of vegetable fruits, focusing on the parameters that most affect the quality of the technological process of seed grinding and preliminary seed extraction. To achieve this goal, the following tasks were performed: analysis of the influence of physical and mechanical parameters of seeds; development of an experimental approach; determination of optimal parameters for the technological process.

MATERIALS AND METHODS

The study complies with ethical standards and adheres to the Convention on Biological Diversity (Secretariat of the..., 2011). The determination of the size and weight characteristics of the seeds and seeds was carried out during the final period of harvesting cucumber and melon fruits, when the seeds reached their maturity. It is during this period – their biological ripeness – that it is advisable to conduct research. Fruit length and fruit diameter were determined using a caliper SHC-1 with a division price of 0.05 mm. Fruit weight was determined on a balance with an accuracy of 1 g (Fig. 1, 2) (DSTU 8439:2015, 2017). Seeds of such crops as cucumber and melon are similar in size and weight characteristics (Ternavskyi *et al.*, 2022). This is evidenced by the results of his study, the main generalised statistical indicators of which are given in Tables 1 and 2. All experimental data were statistically processed, with the accuracy of the experiment being 5% and the confidence interval being 0.95 (Devi & Mani, 2017).

Figure 1. *Determination of the size and weight characteristics of seedpods and seeds of melon fruit*
Source: *authors' photo*

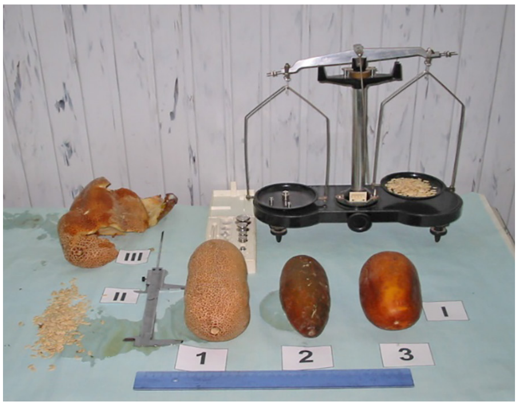

Figure 2. *Determination of the size and weight characteristics of seedpods and cucumber seeds*
Source: *authors' photo*

Table 1. *Summary size and weight characteristics of melon and cucumber seeds*

Culture, variety	Length, cm			Width, cm			Thickness, cm			Weight, g		
	min	max	aver.	max	min	aver	max	min	aver.	max	min	aver.
Cucumber												
Nizhynskyi 12	10.75	8.85	9.78	4.3	2.5	3.4	1.8	1.3	1.55	4.9	3.3	4.17
Koncurent	10.85	8.65	9.75	4.15	2.65	3.4	1.85	1.2	1.52	5	3.5	4.25
Melon												
Kolgospnytsa	12.4	10.4	11.35	6.46	4.56	5.51	2.05	1.10	1.56	6.8	4.2	5.47
Ukrainka	12.7	10.2	11.45	6.25	4.25	5.25	1.95	1.15	1.55	6.6	4.1	5.35

Source: *developed by the authors*

Table 2. *Size and weight characteristics of melon and cucumber seeds*

Culture, variety	Length, mm			Diameter, mm			Weight, kg		
	min	max	aver.	min	max	aver.	min	max	aver.
Cucumber									
Koncurent	116	141	128.5	48.0	73.0	58.4	0.210	0.255	0.232
Nizhynskyi 12	114	144	129	45.0	75.0	60.0	0.215	0.265	0.240
Melon									
Kolgospnytsa	150	260	205	180	215	197.5	0.45	1.45	0.95
Ukrainka	165	255	210	186	226	206	0.52	1.72	1.12

Source: *developed by the authors*

Absolute weight refers to the weight of 1,000 seeds in grams at standard moisture content. In the process of seed production, it is very important to have data on the absolute weight of the newly separated seeds at the stage of separation. This indicator is used to make a control assessment of the grown seeds before mechanical extraction. It is known that the sowing qualities of seeds and their productive properties are directly dependent on the absolute weight of seeds (Neamtallah *et al.,* 2017). To study such physical and mechanical properties of fruits as the dynamic friction coefficient, volume deformation coefficient and static load coefficient, appropriate installations were made in the problematic research laboratory of the Faculty of Engineering and Energy of Mykolaiv National Agrarian University.

The technological process of the installation for determining the dynamic coefficient of friction (Fig. 3) is as follows: the product under study is placed in front of the cut-off plate 2 in the initial position; the approximate time (to the hundredth of a second) of the product passing from the cut-off plate to the laser beam 7 is set using the timer; when the "Start" button of the timer 6 is pressed, the cut-off plate 2 is raised by an electromagnet and, at the same time, the timer 6 starts counting down; when the product passes through the laser beam 7, the electrical circuit is opened and the time countdown stops; using further mathematical transformations, the friction-slip coefficient is calculated.

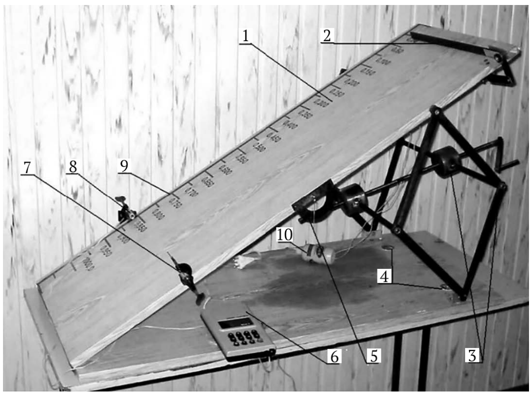

Figure 3. *Dynamic friction coefficient determination unit*
Notes: *1 – inclined surface, 2 – cut-off plate, 3 – device for changing the angle of inclination of the surface, 4 – balance sensor, 5 – angle meter, 6 – timer, 7 – laser, 8 – phototransistor, 9 – path measurement scale, 10 – electronics*
Source: *authors' photo*

To increase the versatility of the installation, the following adjustment is provided for the purpose of realising the possibility of studying various types of products. By means of the lifting device 3, the angle of inclination of the surface 1 is changed and, by changing the position of the laser 7 and phototransistor 8, the path of the product from the cut-off plate 2 to the laser beam is changed, which in turn leads to a change in time, and, accordingly, leads to a change in the friction-sliding coefficient. On the inclined surface, it is possible to install any type of material whose friction coefficient is to be investigated.

The following formula is used to obtain the dynamic friction coefficient:

$$f = \frac{1}{cos\alpha}\left(sin\alpha - \frac{2s}{gt^2}\right) = tg\alpha - \frac{2s}{gt^2 \cdot cos\alpha}, \qquad (1)$$

where f – the dynamic coefficient of friction; s – the distance travelled by the product under study, m; t – the time for the product to travel the distance s, sec; α – the angle of inclination of the surface to the horizon, deg.

The coefficient of volumetric compression (deformation) of seed fruits is defined as:

$$K_v = \frac{P_{cm}}{\Delta V}, \qquad (2)$$

where P_{cm} – the compressive load, H; ΔV – the reduction of the volume of the seed fruit under study when a load is applied P_{cm}, m^3.

The determination of the coefficient of volumetric deformation of the fetus was carried out on a specially manufactured device (Fig. 4), which is similar in principle to the Znamensky device. It consists of a compression chamber and a piston with a plate on the rod for placing weights. The Znamensky apparatus is a measuring device used to determine the coefficient of volumetric deformation of materials, in particular, in this case, fruits. This device uses the principle of compressing a material with a piston and measuring the change in its volume. The description of the Znamensky device includes a compression chamber and a piston that performs the compression. Usually, a plate is placed on the piston to add weights, which are used to create standard compression conditions. This device measures the degree of compression of a material and records the change in its volume under the force. The Znamensky apparatus is an important tool for studying the mechanical properties of materials, and its use in experimental studies provides data on the volumetric deformation of fruits and their resistance to compression. The amount of linear deformation Δ_l is controlled by an indicator mounted on a plate arm, the stem of which interacts with a stop on the compression chamber. Before the start of each experiment, the fruits were weighed, and after placing them in the chamber and pre-compressing them with a piston, the volume V_0 at zero load was determined. The obtained values were used to determine the initial density of seed fruits.

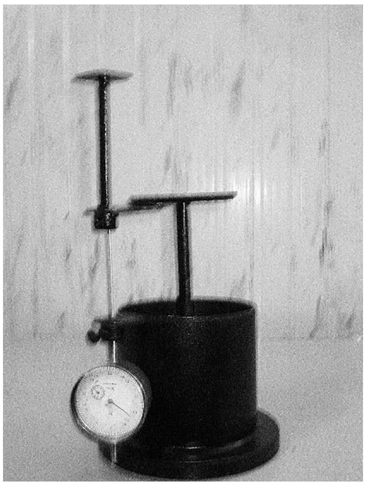

Figure 4. *Device for determining the volume strain coefficient*
Source: *authors' photo*

The dependence of linear strain on specific pressure was determined by the expression:

$$\Delta_l = \delta q = 4.5 \cdot 10^{-7} \cdot q, \quad (3)$$

where δ – the inverse of the volume strain coefficient (obtained using the least squares method); q – the specific pressure.

To determine the dependence of the deformation of the seed on the compressive load, a special device was developed and manufactured (Fig. 5), which consists of posts fixed to the base, on which a rocker arm suspended on pins is installed. The rocker arm has a compression plate and a load plate. The test object is mounted on a height-adjustable platform. The amount of deformation is determined by the indicator.

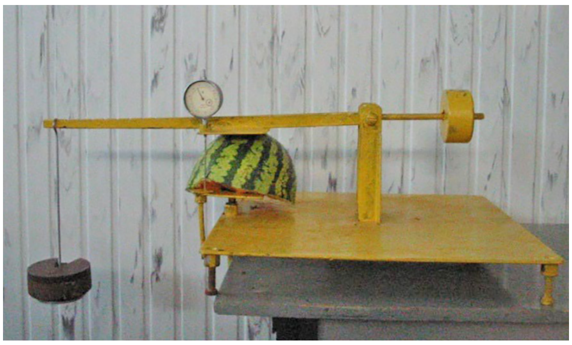

Figure 5. *Setup for determining the effect of a compressive static load on the seed*
Source: *authors' photo*

Changing the load acting on the seeders is done by increasing the number of weights mounted on the plate or moving it along the length of the rocker arm. Balancers are used to balance the rocker arm when the compressive force is set to zero at the beginning of the load (Zhang, 2022).

In fact, the load acting on the seed fruit is calculated by the expression:

$$P_{cm} = \frac{g m_6 l_1}{l_2}, \quad (4)$$

where $m_в$ – the weight of the loads mounted on the plate; l_1 – the distance from the load plate to the rocker arm rolling axis; l_2 – the distance from the seeder mounted on the platform to the rolling axis of the rocker arm.

In the process of loading the seeder, the indicat or measures the amount of its deformation Δст, which corresponds to the applied force. Accordingly, the static load factor will be determined by the following equation:

$$\Delta_{cm} = XP_{cm} = 0.41P_{cm}, \quad (5)$$

where X – the coefficient of fruit yield obtained by the least squares method, mm/H.

The experimentally obtained data are approximated by a first-order equation using the least squares method, followed by checking the mathematical description of the experimentally obtained data for adequacy using the Fisher criterion.

RESULTS

In the context of a growing population and climate change, the importance of improving agricultural techniques and varieties of vegetables and melons is becoming increasingly important. The study of the mechanical and technological properties of seed fruits is an important component for the development and implementation of new methods of cultivation and processing aimed at improving agricultural efficiency and product quality. Vegetables and melons are of great importance as a source of food rich in vitamins, minerals and other nutrients. Ensuring high quality and quantity of seeds is becoming a key aspect for ensuring food security and responding to global market challenges (Gorzelany *et al.*, 2022).

The study of mechanical and technological properties includes a comprehensive approach focused on the study of physical, chemical and biological aspects of seed fruits. This allows not only to determine the optimal conditions for their cultivation, but also to develop technologies for harvesting, storage and processing aimed at maintaining high quality and commercial value. Mechanical and technological properties include physical, chemical and biological characteristics of seed fruits. Physical parameters, such as size, weight and hardness of the seed coat, affect the efficiency of harvesting, processing and transportation. The chemical composition of the seed determines its nutritional and economic value, as well as its resistance to disease. Biological characteristics, such as the seed fruit's tightness and germination ability, are important to ensure normal plant development. Technological aspects, such as storage, transport and handling methods, also have a significant impact on seed quality and value (Xia *et al.,* 2021).

One of the main challenges is to address disease resistance, optimise growth and yield, and develop varieties suitable for different agroclimatic conditions. High-precision studies of the mechanical and technological properties of seed fruits are a key tool for achieving these goals and creating sustainable and productive crops (Serhiienko *et al.,* 2023). The results of the studies of the static friction coefficients of melon and cucumber seeds made on different surfaces (perforated sieve, galvanised iron, aluminium plate) are presented in Table 3. Taking into account the choice of friction surfaces and the use of spokes to avoid seed rolling, the study allowed to determine the optimal conditions for the interaction of seeds of both crops.

Table 3. *Static friction coefficients of melon and cucumber seeds*

Culture, variety	Types of surfaces								
	Perforated sieve			Galvanised iron			Aluminium		
	min	max	aver.	min	max	aver.	min	max	aver.
Cucumbers:									
Nizhynskyi 12	0.6	0.9	0.75	0.52	0.72	0,62	0.5	0.84	0.67
Koncurent	0.58	0.88	0.73	0.48	0.68	0.58	0.48	0.82	0.65
Melons:									
Kolgospnytsa	0.79	0.95	0.87	0.71	0.81	0.76	0.73	0.85	0.79
Ukrainka	0.77	0.93	0.85	0.55	0.65	0.60	0.73	0.83	0.78

Source: *developed by the authors*

Experimental data show that the most optimal indicators of the static coefficient of friction depending on the type of surface for cucumber and melon seeders are perforated sieves, the values of which are 0.75 and 0.85, respectively. Analysis of this table can reveal certain trends and differences between crops and types of surfaces. In particular, both cucumber varieties (Nizhynskyi 12 and Koncurent) have similar average values of static friction coefficients on different surfaces. The lowest values are observed for galvanised iron, which may indicate less friction in contact with this surface. The melon varieties (Kolgospnytsa and Ukrainka) also show similar average static friction coefficients. The highest values are observed on the aluminium surface, which may be important for the production process where friction can affect the movement and handling of the seedpods.

Thus, according to the results of static studies, it was found that perforated sieves are the most optimal surfaces for cucumber and melon seeders, having static friction coefficients of 0.75 and 0.85, respectively. Analysis of the table shows certain trends and differences between crops and types of surfaces. Cucumber varieties show similar values of static friction coefficients on different surfaces, with the lowest values for galvanised iron. Melon varieties also show similar values of static friction coefficients, with higher values on the aluminium surface. In general, the analysis of static friction coefficients allows to draw conclusions about the interaction of seed drills with different surfaces, which is important for optimising the technological processes of seed grinding and processing. Table 4 shows the results of dynamic indicators of the friction coefficients of melon and cucumber seeds.

Table 4. *Dynamic friction coefficients of melon and cucumber seeds*

Culture, variety	Types of surfaces								
	Perforated sieve			Galvanised iron			Aluminium		
	min	max	aver.	min	max	aver.	min	max	aver.
Cucumbers:									
Nizhynskyi 12	0.62	0.76	0.69	0.41	0.57	0.49	0.35	0.69	0.52
Koncurent	0.58	0.72	0.65	0.34	0.50	0.42	0.29	0.63	0.46
Melons:									
Kolgospnytsa	0.75	0.91	0.83	0.63	0.75	0.69	0.63	0.81	0.72
Ukrainka	0.69	0.85	0.77	0.47	0.59	0.63	0.79	0.97	0.88

Source: *developed by the authors*

The analysis of the data in the table can indicate the nature of the interaction between seeds and different materials and help to optimise technological processes. Cucumber varieties have average dynamic friction coefficients that range from 0.35 to 0.76. The lowest friction coefficient is observed on aluminium surfaces and the highest on galvanised iron. Melon varieties also have average dynamic friction coefficients that range from 0.47 to 0.97. The minimum coefficient of friction is recorded on an aluminium surface, and the maximum – on galvanised iron. The optimum values of dynamic friction coefficients for cucumber are 0.69 on a perforated sieve surface and 0.88 on an aluminium melon surface. These data make an important contribution to understanding the dynamic friction properties of cucumber and melon seeds on different surfaces. Equation (3) describes the dependence of the linear strain on the specific pressure, which is shown in Figure 6. The dependence of linear deformation of seed fruits on specific pressure increases from 0.9 to 3.6. The values of fruit deformation from compressive load vary from 4.1 to 24.6. Figure 7 shows a graphical interpretation of the dependence $\Delta_{cm} = f(P_{cm})$.

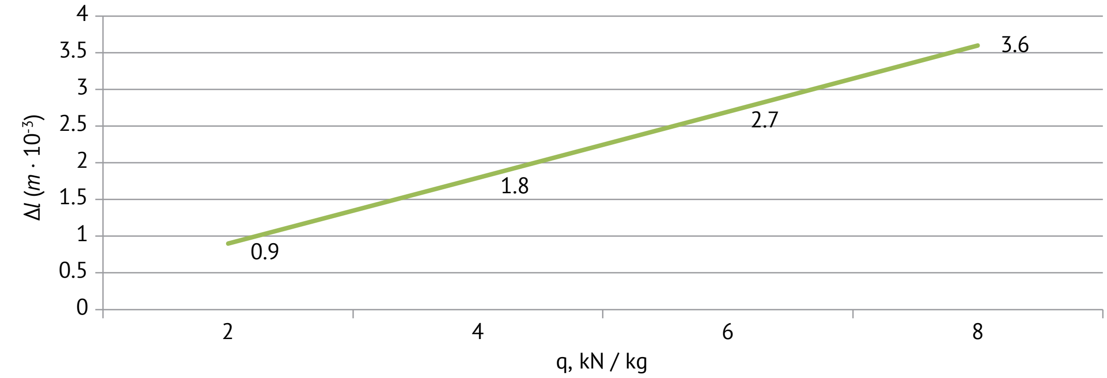

Figure 6. *Dependence of linear deformation of seed fruits on specific pressure*

Notes: $\Delta_l = 4.5 \cdot 10^{-7} \cdot q$

Source: *developed by the authors*

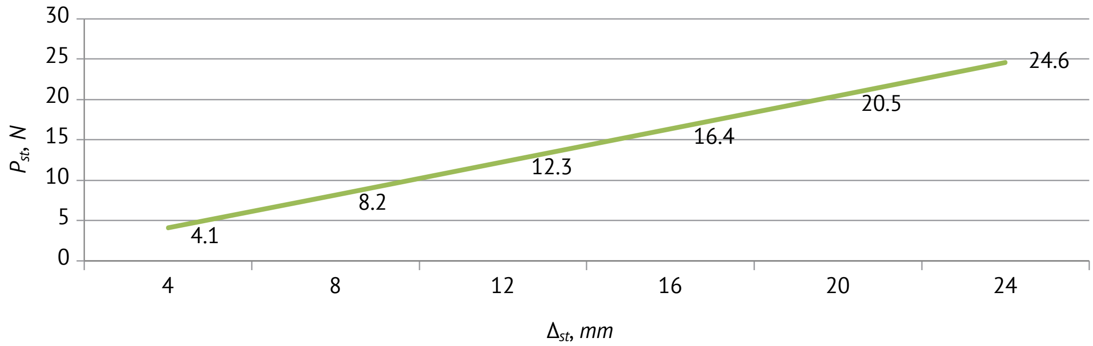

Figure 7. *Dependence of fetal deformation on compressive load*

Source: *developed by the authors*

The values of fruit deformation under compressive load vary from 4.1 to 24.6. These ranges of fruit deformation under compressive load indicate a large variability in the physical and mechanical properties of plant material. Low strain values, such as 4.1, may indicate high resistance of certain fruits to compressive stress, while high values, such as 24.6, may indicate less resistance and a pronounced ability of the material to change shape under load.

DISCUSSION

In Ukraine, as in many other countries, the development of the agricultural sector is one of the key sectors for food security and economic growth. Vegetable and melon farming is an important part of the agricultural sector, providing a significant share of vegetable production for domestic consumption and export.

This study can be compared with the research of Y. Fang *et al.* (2020), who emphasise that in the context of growing vegetables and melons, the use of high-quality and viable seeds is of great importance. Optimal seed selection and preparation is a key step in growing high-quality products. The mechanical and technological aspects of seed handling, such as sorting, separation and preparation, can affect the yield and quality of the crops grown.

Comparing the study with the results of the authors, in particular Yu. Kononov & A. Lymar (2020), it is important to note that there are problems in obtaining high-quality seeds of vegetable and melon crops. The authors identify the need to expand the dialogue and take comprehensive measures to modernise seed production in Ukraine, which is also reflected in the study. The development of technological solutions and the introduction of the latest equipment should solve a number of problems that relate not only to the quality of the final product, but also to ensuring the efficiency of production in general. One of the main obstacles is the backwardness of the equipment used in the process of growing and processing seeds. With this in mind, the works of many authors, including G. Hu *et al.* (2021) and Y. Yi *et al.* (2021), confirm that it is important to improve seed selection and preparation technologies, as well as mechanised separation and sorting processes, to ensure maximum seed quality and purity. One of the key aspects is the study of the physical and mechanical properties of seed fruits. This includes analysing the strength of the shell, size, shape and weight of the seeds. The study of these parameters allows for the development of optimal mechanical processing methods, such as sorting and separation, to ensure efficient selection and preparation of seeds for high quality cultivation, which is also reflected in the study.

Z. Zheng *et al.* (2022) also note that mechanised seed separation and sorting processes are important for selecting the most viable and plantable specimens. Technologies that use optical sensors and other advanced methods can quickly and efficiently determine seed quality, as well as detect possible defects or diseases. The study of mechanical and technological properties also contributes to the development of new varieties and hybrids that meet the requirements of mechanised production. This may include the creation of hybrids with improved resistance to mechanical stress and increased yields, as revealed by the study.

A similar opinion is expressed by N. Kim *et al.* (2013), who note that in order to obtain high-quality seed material, the technological process should involve equipment that minimises its injury and loss and meets the requirements for the quality of the final product. The absence of such equipment requires a mandatory solution to this problem by developing new technological equipment. In addition, according to the data obtained, it is necessary to consider the possibility of using modern methods of seed processing and storage to increase its shelf life. An important aspect is to ensure a high level of energy saving and rational use of labour in seed production.

This study correlates with the work of V. Havrysh *et al.* (2022), according to which, for the successful implementation of improved technologies for the selection and preparation of vegetable and melon seeds, it is important to establish an effective mechanism for cooperation between all stakeholders. Authorities should ensure favourable regulation and create incentives for the introduction of new technologies in agriculture. Producers should be actively involved in the process of introducing new methods and techniques, and provide feedback on their effectiveness and practicality in the field. Scientists, in turn, play a key role in conducting experimental studies that allow for a deeper understanding of the mechanical and technological properties of seeds and establish optimal parameters for mechanised processes. It is important to take into account the best practices and experience of countries where a high level of mechanisation in seed production has been achieved, in particular in the European Union and the United States (Li *et al.,* 2022).

Stakeholders may also include representatives of agricultural businesses, farmers' associations, and other groups with an interest in improving seed production processes. This broad collaboration will facilitate the exchange of experience, resources and innovations, which in turn will contribute to the rapid adoption of advanced technologies. In summary, an integrated approach is key to the successful implementation and improvement of vegetable and melon seed production technologies in Ukraine.

CONCLUSIONS

Experimental studies of the working processes of obtaining cucumber and melon seed material are peculiar, since the mechanised technological process of seed separation largely depends on the parameters and operating modes of the pressure-separating machine. Scientific substantiation of this process becomes impossible without a detailed study of the mechanical and technological properties of the seed mass and the peculiarities of operations related to the destruction of the seedpods and separation of seed-plant material.

The study included separate stages aimed at a detailed study of the mechanical and technological properties of the seed mass, which is important for a proper understanding of the seed separation process. At the same time, the focus was on the study of operations related to the destruction of the seed pods and the separation of seed-plant material using a pressure-separating machine. Experimental studies of the working processes of obtaining cucumber and melon seed material revealed significant features of the interaction of seeds with different surfaces, which determines the efficiency of technological processes of seed processing and grinding. The static friction coefficients showed that the perforated sieve is the most optimal surface for cucumber (0.75) and melon (0.85) seeds. Dynamic friction coefficients confirmed these results, indicating average values in the range of 0.35-0.76 for cucumber and 0.47-0.97 for melon on different surfaces. The study of fruit deformation due to specific pressure and compressive load revealed a large variability in the physical and mechanical properties of plant material. Strain values from 4.1 to 24.6 indicate different levels of fruit resistance to mechanical stress.

The dependencies and data on the size and weight and physical and mechanical characteristics of seed fruits and seeds of vegetable and melon crops obtained in this article are important for further design of the grinding device and study of the quality of the technological process of seed separation. Prospects for future research may include a more detailed study of the interaction of different varieties and types of vegetables with pressure-separating machines and further improvement of technological parameters to optimise the process.

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CONFLICT OF INTEREST

None.

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Дослідження механіко-технологічних властивостей насіннєвих плодів овоче-баштанних культур

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Анотація. Аналіз літературних джерел свідчить, що виробництво насіннєвого матеріалу овоче-баштанних культур є однією з важливих проблем, яке існує в галузі переробки сільськогосподарської продукції. Актуальним питанням є отримання насіння огірка та дині з погляду на обсяги їх вирощування в Україні. Для дослідження процесів подрібнення плодів та отримання насіння у сільському господарстві ключовими параметрами є динамічний коефіцієнт тертя, коефіцієнт об'ємної деформації та коефіцієнт статичного навантаження, але існуючі методи та обладнання обмежуються визначенням граничних значень показників, не дозволяючи повноцінне вивчення динаміки змін властивостей на різних етапах технологічного процесу. Для вирішення цього, пропонується розробка нових методик, зокрема використання комп'ютерного моделювання, що дозволить детальніше вивчити та оптимізувати фізико-механічні властивості та їх зміни. Метою статті було провести дослідження фізико-механічних властивостей плодів овочевих культур, які мають найбільший вплив на якість технологічного процесу подрібнення насіння плодів та попереднього отримання насіння. Дослідження проводилося в проблемній науково-дослідній лабораторії інженерно-енергетичного факультету Миколаївського національного аграрного університету. Використовувалися експериментальні установки для визначення динамічного коефіцієнта тертя насіння дині та огірка, прилад для визначення початкової щільності насіннєвих плодів та прилад для визначення залежності деформації насіння від стискаючого навантаження. Експериментальні дані свідчать, що найоптимальніші показники статичного коефіцієнта тертя в залежності від виду поверхні для насінників огірка та дині є перфоровані решета, значення яких відповідно складають – 0,75 та 0,85. Оптимальні значення показників динамічних коефіцієнтів тертя для огірка має поверхня з перфорованого решета – 0,69 та для дині з алюмінію – 0,88. Залежність лінійної деформації насіннєвих плодів від питомого тиску збільшується з 0,9 до 3,6. Значення деформації плоду від стискаючого навантаження змінюються в межах від 4,1 до 24,6. Дослідження, що наведенні в статті мають практичне значення і можуть бути використані в галузі сільськогосподарського виробництва та при розробці нових інженерних рішень

Ключові слова: насінник; експериментальні дослідження; поверхня; залежність