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FACTORS AFFECTING MAIZE (*ZEA MAYS* L.) KERNEL QUALITY AND EVALUATION BASED ON GERMINATION RATE

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SUMMARY

The evaluation of crucial factors affecting the maize (*Zea mays* L.) seed quality at macro- and micro-levels during threshing was the aim of this study. In maize cobs' threshing machines, the kernel separation occurs through the moving elements under-drum structures, with the protrusion of the concave acting as the main factor attempting to separate the kernels from cobs. Within the disk and vertical cylindrical threshing chambers, the element separating the kernel from the cob core is both the teeth of the moving disk and the teeth located on the inner surface of the cylinder. It impacts the moving cob in the threshing chamber. In obtaining quality grains, the postharvest processing of corn cobs plays a decisive role. This essentially determines how well the said process can take place to get quality maize grains. The proper management of postharvest processing of seed corn and the correct selection, adjustment, and operating conditions of machines reduce losses. This ensures getting the quality seed material for sowing, improving selection, as well as enabling a considerable increase in the economic efficiency of production.

Keywords: Maize (*Z. mays* L.), cobs, maize kernels, threshing machines, quality seed, moisture, mass and size, correlation, seed germination, production

Key findings: Technological measures can reduce the damage to maize (*Z. mays* L.) kernels and preserve the quality of seed material. The reduction of internal cracks in the maize kernels succeeded in its determination by evaluating their germination rate. As a result, the highest germination rate (98%–100%) emerged for the seed material compared with the required level (92%–96%).

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INTRODUCTION

According to global food security, meeting the domestic demand with high-yielding and better-quality seeds of strategic crops has reached recognition as one of the primary priorities for ensuring the population's access to more sustainable and quality food. This is particularly with maize (*Zea mays* L.) since it is a widely used crop for food, animal feed, and industrial raw material, and its seed quality directly influences the overall efficiency of production (Pathak *et al.,* 2024).

In the postharvest processing technology of maize, some of the most critical stages are the cleaning, sorting, and separation of kernels from the cob, which plays a significant role in overall grain production and quality. The statement formulation was intentionally in a general manner to emphasize the integrated importance of cleaning, sorting, and separation processes within the overall postharvest system. However, the study did not specify the individual contribution of each stage here, as their combined effect is widely popular as crucial for maintaining grain quality. These stages are of particular importance in preventing mechanical damage to the seed material, preserving germination capacity, and enhancing the quality indicators of obtained grains (Gumbatov *et al.,* 2024; Asadullayev *et al.,* 2024; Huseynov *et al.,* 2026a). Although, if carrying out these postharvest processes without using the correct and optimal technology, then cracks, fractures, and other types of damages could occur in the kernels, eventually affecting seed quality and overall productivity (Huseynov and Aghayev, 2024; Huseynov *et al.,* 2025).

At present, numerous pieces of technical equipment are available in this field, but some are either outdated or do not fully meet the modern threshing requirements. This subsequently leads to inefficient use of energy and resources, consequently increasing losses in the production. Especially in seed production, where the highest precision and delicate processing are vital, the lack of properly adapted machines and mechanisms develops serious problems (Villagra-Mendoza *et al.,* 2024).

Insufficient development of complex machine systems adapted to productivity and technological requirements in maize seed production is one of the main reasons. Another important issue is the lack of well-organized and specialized production facilities for cob cleaning and processing. This disrupts the continuity of technological processes and makes quality control significantly more difficult (Mamedov, 2015; Mammadov *et al.,* 2025; Kassa *et al.,* 2025). Maize is one of the most essential cereal crops worldwide, serving as a staple food, animal feed, and raw material for various industries. Therefore, the quality of maize kernels is a critical factor influencing their market value, storage stability, and suitability for planting and processing. Properties primarily determining maize kernel quality comprised physical, mechanical, and biochemical properties, often affected by harvesting, threshing, drying, and storage conditions. In particular, mechanical damage during threshing, such as macro- and micro-cracks, can significantly reduce germination rates, leading to lower seed viability and increased postharvest losses (Erenstein *et al.,* 2022; Huseynov *et al.,* 2026b).

With diverse climatic conditions, maize production further faces challenges like high humidity during harvest, inadequate threshing equipment, and suboptimal drying practices, resulting in kernel damage rates of 5%–20%, even more in Azerbaijan and other regions. The indicated damage range (5%–20% and above) was a generalized estimate based on commonly reported values in the literature and practical observations under varying conditions. The intention was to highlight the potential scale of the problem rather than provide region-specific quantified data. These aforementioned factors not only affect the seed quality for sowing but also modify the grain yield and economic efficiency of farming operations. Previous studies reported that factors, viz., impact velocity, moisture content, and threshing equipment design, play a pivotal role in the kernel's integrity (Kotu *et al.,* 2022; Padhan *et al.,* 2024). For instance, excessive impact force during threshing can cause internal cracks in kernels, which may not be visible yet severely alter the germination ratio.

This research aimed to investigate the factors affecting maize kernel quality during threshing, focusing on mechanical impacts, moisture levels, and various parameters of the different threshing equipment. Specifically, the kernel damage levels and germination rates sustained evaluation to provide recommendations for optimizing the use of threshing machines. The study compares an experimental threshing device with a baseline machine (DTZ MKP-0.3), using empirical models to correlate impact angle, velocity, and moisture with damage and incomplete threshing. By addressing these issues, the research could contribute to reducing postharvest losses and improving the seed quality in maize production.

MATERIALS AND METHODS

Experimental procedure

The study commenced using an experimental threshing machine designed to minimize the maize (*Z. mays* L.) kernel damage while ensuring efficient separation. The baseline machine was the DTZ MKP-0.3 corn thresher (Ukraine), commonly used in small-scale farms. Maize cobs with kernel moisture levels ranging from 14% to 32% were options selected from local maize cultivars grown in Azerbaijan. The grouping of cob samples was according to moisture content, while performing threshing had varying rotor speeds (2–10 m/s) and impact angles. The grouping of cob samples based on moisture content sought to ensure controlled experimental conditions and analyze the effect of moisture as a key factor. Although some variability within each group may exist, efforts ensued to minimize it by carefully selecting and preparing the samples. Therefore, any potential inconsistencies could be minor and do not affect the overall validity of results. The experimental machine featured a disk rotor with adjustable clearances (z = 18–20 mm) between the disk and cylindrical chamber wall and a disk diameter (d = 438–443 mm). The baseline machine used a traditional drum-and-deck system.

Measurement of key parameters

Kernel damage assessment had kernel damage classified as macro (visible cracks and endosperm breakage) and micro (internal cracks). The use of a diaphanoscope served to detect the hidden cracks in seeds. Damaged kernels' quantification was a percentage of the total sample. The classification into macro- and micro-damage relied on established criteria and had the support of a diaphanoscope to improve the detection of internal cracks. Although the complete elimination of some degree of subjectivity in borderline cases cannot succeed, applying consistent evaluation procedures throughout the study sought to minimize this effect. Therefore, maintaining the overall accuracy and reliability of the damage assessment remained.

Incomplete threshing measurement was the percentage of unthreshed kernels remaining on the cob after processing. Impact force and velocity calculations used empirical formulas derived from experiments: $P = f(\gamma) = 10.19 - 0.99\gamma + 0.03\gamma^2$ (for baseline); $\chi = f(\upsilon) = 1.9 - 0.265\upsilon + 0.021\upsilon^2$ (for experimental, where χ is the damage level, and υ is velocity in m/s). Tests conducted continued at moisture levels of 15%–27% and velocities of 2–8 m/s. The germination rate of the seed samples from both threshing machines incurred testing in laboratory conditions (Table 1). The 100 kernels per sample, placed in petri dishes, had a temperature of 25 °C and 70% humidity for seven days to test the germination rate.

$$\text{Germination rate (\%)} = \text{Germinated seeds} / \text{Total seeds} \times 100.$$

Optimization of parameters

The parameters' optimization, as performed, used a Box-Behnken experimental design (BBD) with three factors: rotor speed (υ), disk diameter (d), and clearance (z). Regression models developed comprised formulas: $\eta = f(\upsilon, d, z)$ = optimized for maximum threshing efficiency (η). The selection of three factors

Table 1. Germination rates of corn seed samples.

No.	Moisture (%)	Seed samples (%)	
		Prepared	Experimentally obtained from the sedge
1	14.5	92	98
2	15.3	93	98
3	18.0	96	100
4	21.0	96	99
5	24.0	92	98
6	26.0	92	99

(rotor speed, disk diameter, and clearance) was according to their primary influence on threshing performance and their practical relevance in machine design and operation. As we acknowledge that other operational or material variables may also have an effect, the chosen factors represent the most significant parameters for the scope of this study.

$$\chi = f(\upsilon, d, z) = \text{optimized for minimum damage } (\chi)$$

Data analysis

Statistical analysis used the analysis of variance (ANOVA) and regression in SPSS software. Figures of the kernels' damage vs. velocity and efficiency vs. moisture entailed plotting using Origin software. Empirical equations reached validation with $R^2 > 0.85$. Comparisons proceeded at a 95% confidence level. This methodology ensures a comprehensive evaluation of threshing impacts on kernel quality and germination, providing practical insights for equipment design.

RESULTS AND DISCUSSION

Considering the germination test, maize (*Z. mays* L.) kernel samples obtained from the experimental cob-threshing device were samples provided by the seed supply company. Their evaluation through a germination test had six different variants based on the seed moisture percentage (ranging from 14.5% to 26.0%) under laboratory conditions. The germination test conducted under controlled laboratory conditions ensured repeatability and minimized the influence of external variables, allowing for a more accurate comparison between samples. Given that field conditions involve additional ecological factors, laboratory testing is a widely accepted initial approach for assessing seed viability. The results provide a reliable baseline, and further field-based evaluations can take place in future studies to complement these findings. The results revealed the germination rate of the seed material obtained from the experimental cob-threshing device was the highest in all variants compared with maize seed samples obtained from the seed supply company (Table 1).

In both variants, the impact force applied to the maize cobs ensures the kernels' separation and plays a vital role in the micro- and macro-damage in grains. Considering the dependence of the magnitude of impact force on the angle of its application to the kernels, a minimum value requires selection in separating the kernels while eliminating harmful effects. Based on experimental values, determining the dependence of the force (P) exerted by the working element on the kernels on the application angle (γ) has succeeded (Figure 1). Villagra-Mendoza *et al.* (2024) reported that the impact force required for kernels' separation reaches its minimum value when applied at a 90° angle to the kernels' surface. These findings confirmed the theoretical assumption that optimizing the contact angle between the working element and the maize cobs significantly reduces both macro- and micro-damage of grains while ensuring efficient threshing.

Based on Figure 1, empirical formulas reflecting the dependence of the force's magnitude on its application angle have been successful, as follows:

$$P = \exp(-25{,}48 \cdot 10^{-3}\gamma + 3{,}5384),$$

Where P is the force separating the kernel (N), and γ is the application angle of the force (degrees).

The minimum value of the impact force on the kernels corresponds to the condition where its application angle was 90° (Figure 1). Based on that, the correctness of the theoretical considerations regarding the need for an organ that ensures the contact of cobs with the straightening device and the teeth of the concave approaching a rectangle gained confirmation. The kernels' protection from destructive impact also depends on the speed of the impact and the moisture level of the kernels. Mengfei experimentally demonstrated that the impact force applied to the kernels reached its minimum value precisely when the application angle was 90°. These findings confirmed the theoretical assumption that an organ ensuring near-rectangular contact between the straightening device and the concave teeth was crucial for efficient kernel separation while simultaneously protecting the kernel from macro- and micro-damages. The authors further emphasized that kernel protection also robustly depends on the impact velocity and kernel moisture content (Mammadov *et al.,* 2026; Huseynov *et al.,* 2026c).

The macro- and micro-damage levels depend on the impact speed applied to the cob kernels. For the experiment, in the selected cobs, the kernel moisture was 14%. The intentionally conducted experiment on kernels with a constant moisture content of 14% sought to isolate and clearly observe the effect of impact speed on macro- and micro-damage levels. As authors acknowledged that variations in moisture could slightly influence damage, controlling moisture allowed for a more precise analysis of the primary factor. This experiment determined the impact speed corresponding to the separation of the kernels from the cob core without damage as a result of the cob hitting the concave tooth. This speed was 2 m/s. Xue *et al.* (2025) reported that in maize kernels, the levels of macro- and micro-damages were considerably dependent on the impact velocity during threshing. Through experiments conducted at 14% kernel moisture, their findings established that an impact speed of 2 m/s enables complete separation of kernels from the cob core without causing any measurable mechanical damage.

Through this relevant experimental research, it has been apparent that when the tooth's impact speed on the kernel was 2 m/s or higher, the kernels underwent complete separation from the cob core by the concave tooth at that contact point. The macro- and micro-damages of the kernel (1%) begin after the impact speed of 4 m/s. Therefore, the disk's rotation speed should be in the option that it serves only to separate kernels from the maize cobs. Villagra-Mendoza *et al.* (2024) established that an impact speed of 2 m/s or higher enables the concave tooth to completely separate kernels from the cob core. Their findings further demonstrated that macro- and micro-damages to the kernel (reaching 1%) only start once the impact speed exceeds 4 m/s, highlighting the importance of selecting the disk's rotation speed exclusively to achieve a clean separation without causing mechanical seed injuries.

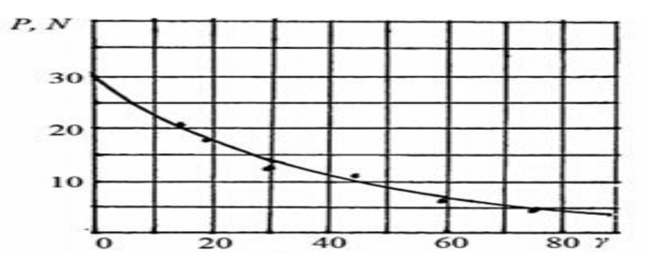

Figure 1. Dependence of the force acting on the kernel during threshing on the angle of its application.

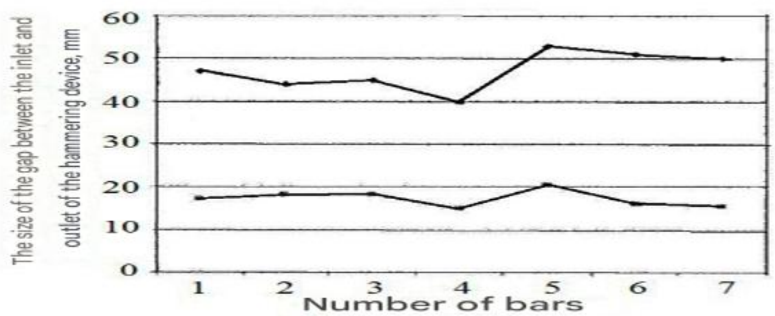

Figure 2. Kernel breakage level during threshing as a function of moisture content (W).

The results revealed that during threshing, the highest moisture content of the kernels caused an increase in damaged kernels. Based on these observations, an empirical dependence has emerged between the kernel's moisture and the damage level (χ) during the threshing process (Figure 2). Kassa *et al.* (2025) reported that the higher kernel moisture content during the threshing process leads to a considerable enhancement in the proportion of damaged kernels (Salimov and Huseynov, 2025; Musayeva *et al.,* 2026). Their findings established an empirical relationship between the kernels' moisture level and damage index (χ), confirming that elevated moisture levels significantly heighten the risk of mechanical injury to kernels.

$$\chi = \exp\left[\left(\frac{57022}{\exp(W)}\right) + 21{,}464 \cdot \ln(W) - 21{,}27\right].$$

According to Figure 2, for the maize cobs submitted for threshing, the permissible moisture of the kernels can be substantially acceptable only up to 30%. The statement regarding the permissible kernel moisture of up to 30% resulted directly from the data presented in Figure 2 to provide a clear reference point. Based on the postharvest technology, one suggested removing the husks from maize cobs in their fresh state, while the cobs intended for threshing should be in a dried condition (Kassa *et al.,* 2025).

For a comparative evaluation of the performance of the experimental device and to determine the amount of damaged kernels and incompletely threshed cobs, the conducted studies continued in comparison with a baseline machine. The selected baseline device was the DTZ MKP-0.3 maize cleaning machine manufactured for farm use in Ukraine (Zhang *et al.,* 2024). As noted earlier, the moisture content of maize kernels significantly affects the threshing quality of cobs. Therefore, to determine the moisture level that ensures maximum productivity of the device and minimum kernel damage, establishing a relationship was according to the values obtained from experiments conducted under farm conditions (Figures 3 and 4) (Li *et al.,* 2024).

From Figure 3, one can state that as the kernel moisture content in the cob increases, the productivity of both devices decreases. When the kernel moisture content increases from 15% to 27%, productivity decreases by 20% in the baseline machine and by 28% in the experimental machine. The sharp decline in productivity occurred up to a moisture level of about 19%, which played an important role in considering the design and operation of the maize threshing devices (Kumar *et al.,* 2024). Based on the results, one can conclude that as the moisture content of the kernels in the cob increases, the productivity of both devices decreases (Salimov *et al.,* 2025).

The results disclosed that as the kernel moisture content increases, the amount of damaged kernels in both devices tends to increase. This increase in damaged grains becomes more pronounced after the moisture level reaches 19%–21%. However, when the cob kernel moisture increases from 15% to 27%, the proportion of damaged kernels rises

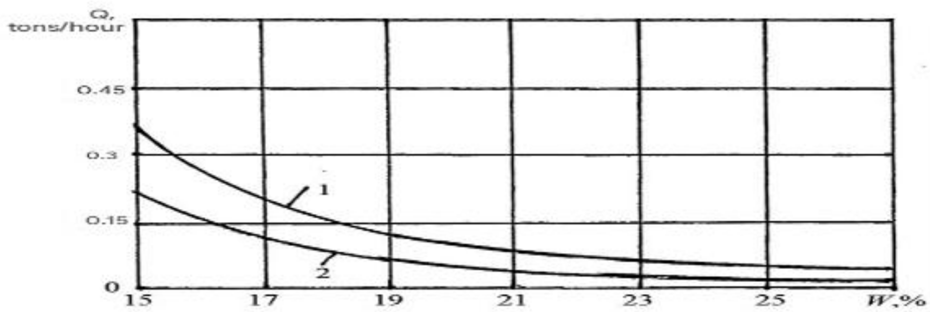

Figure 3. Dependence of the productivity (Q) of maize threshing devices on kernel moisture content (W):1 – for the experimental device ($Q = 40.23 - 2.36W + 0.049W^2$); 2 – for the baseline device ($Q = 30.8 - 1.66W + 0.035W^2$).

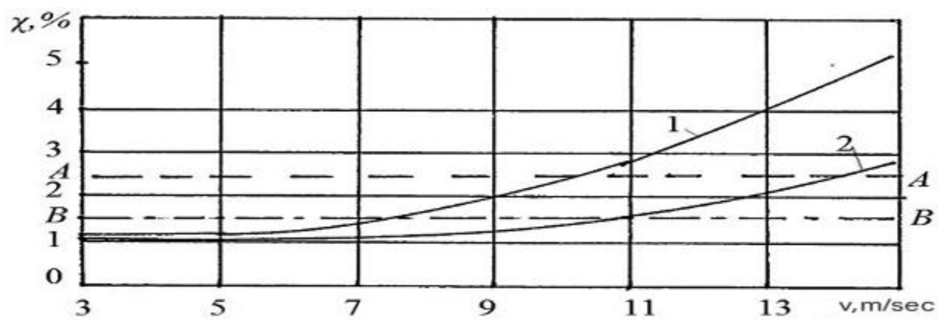

Figure 4. Variation of kernel damage level (χ) depending on disk rotation speed (υ): 1 – for the baseline device ($\chi = 1.62 - 0.246\upsilon + 0.033\upsilon^2$); 2 – for the experimental device ($\chi = 1.9 - 0.265\upsilon + 0.021\upsilon^2$); A–A: allowable limit for kernels intended for food purposes, B–B: allowable limit for kernels intended for seed purposes.

from 4% to 8% in the baseline device, whereas in the experimental device, this increase ranged between 1% and 4% (Gonzalez *et al.,* 2025; Shukurova *et al.,* 2026).

The rotational speed of the working element is one of the factors affecting the quality of the working process and the device's productivity. Past conducted experiments had a kernel moisture content of 19% (Gonzalez *et al.,* 2025). The results showed that as the disk rotation speed increases, the productivity of the device also increases, following a parabolic relationship. The curve reaches its extremum at a speed of 8 m/s. Based on the obtained relationship, a conclusion could be that the productivity of the device can be regulated within the range of 100 to 400 kg/h by adjusting the disk rotation speed. However, the acceptable nominal productivity was at 350 kg/h (Patel *et al.,* 2024).

One should also note that the disk rotation speed affects the level of complete and incomplete threshing of maize cobs. Experimentally, the effects of moisture content and the working element on incomplete threshing of cobs entailed studies with both the baseline and experimental threshing devices. The effect of disk rotation speed on the level of kernel damage appears in Figure 4. The results demonstrated the several advantages of the experimental cob-threshing device compared with the baseline machine and also provided insights into ways to further improve process efficiency. The study determined that increasing disk rotation speed from 2 to 8 m/s raises the productivity of the experimental cob-threshing device from 0.1 to 0.4 tons per hour. However, one should note that beyond a certain rotation speed, the level of kernel damage may begin to increase (Quliyev and Huseynov, 2019).

Based on the obtained results, the optimal disk rotation speed for the experimental device is acceptable as 7 m/s with a kernel moisture content of up to 19%. It should be noteworthy that in drum-type devices, at this rotation speed of the working element, the level of kernel damage reaches 4% or even more. Conversely, in the experimental device, the damage level was below the standard set for seed-purpose kernels (1.5%) (Aliyev *et al.,* 2017).

The optimal disk rotation speed and the proper kernel moisture content were also greatly crucial in preventing incomplete threshing. With an increased cob moisture (> 19%), a low disk rotation speed (3–5 m/s) results in an incomplete threshing rate of 2%–3%. In the experimental device, incomplete threshing at a disk speed of 7 m/s occurs only after the kernel moisture exceeds 25%. The increase in incomplete threshing with higher moisture can be because of the swelling of moist kernels, which become more tightly packed in the cob core (Quliyev and Huseynov, 2019).

The straightener added to the design does not significantly change the speed during operation. The maize cobs move freely in the threshing chamber, and after the first impact, they acquire a speed equal to that of the rotor, allowing the threshing process to continue efficiently. In determining the speed where the impact force solely centered on separating the kernels from the cob, the study developed the following empirical formula.

$$\upsilon = \sqrt[5]{\left[\frac{2{,}28\,\delta^{1/2}\left(1-1{,}6\frac{E_2^{2/3}R_2^{1/3}}{E_1^{2/3}R_1^{1/3}}\right)\left(\frac{4\sqrt{R_1}}{3\pi(k_1+k_2)}\right)^{1/5}}{m_1\left[4\cdot\left(\frac{m_1+m_2}{m_1 m_2}\right)\right]^{3/10}}\right]^2},$$

Where υ = the speed of the driving protrusion on the rotor acting on the cob (m/s), δ is the deformation of the cob (this deformation causes the kernel to separate from the cob) (m), E_1 and E_2 are the elastic moduli of the kernel and the cob, respectively (Pa), R_1 and R_2 are the radii of curvature of the kernel at the contact point (m), m_1 is the mass of the cob (kg), and m_2 is the mass of the tooth (kg).

$$k_1 = \frac{1-\nu_1^2}{\pi E_1},$$

$$k_2 = \frac{1-\nu_2^2}{\pi E_0},$$

Where E_1 and E_0 are the Young's moduli of the grain and tooth material, respectively (Pa), and V_1 and V_2 are the Poisson's ratios of the grain and tooth material, respectively.

The above equation allows determining the rational speed range of the rotor, which was between 1.5 and 3.3 m/s. Thus, the theoretical rotor speed is set, with the force of the cob striking the threshing tooth spent solely on separating the kernels from the cobs (Zhang *et al.,* 2023). Macro- and micro-damages in the separated kernels succeeded in their detection using a diaphanoscope. The results revealed that kernel separation without damage occurs at an impact speed of 2 m/s. Experiments continued using cobs with 14% moisture content. The impact speed varied from 0 to 10 m/s. However, when the impact speed exceeded 3 m/s, the kernels' damage level sharply increased from 1% to 53%.

Therefore, the results confirmed the theoretical considerations and justified the speed at which the impact force was sufficient only to separate the kernels from the maize cobs. The confirmation occurs at an impact speed of 2 m/s, which can separate the kernels from the cobs without damage. The maximum allowable speed should not exceed 3 m/s (Zhang *et al.,* 2023). One could eliminate incomplete threshing without increasing speed by extending the interaction path between the cobs and the working element. However, this may have both positive and negative consequences. Therefore, it would be necessary to increase the diameters of the threshing chamber cylinder and the disk. In

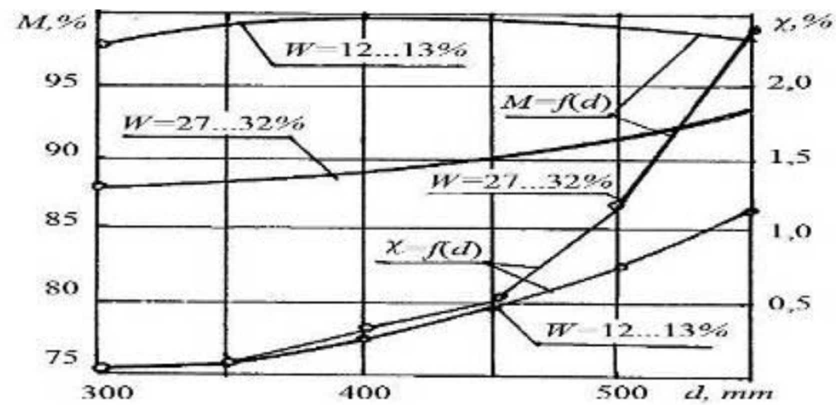

Figure 5. Interpretation of the variation in the cob threshing level (M) and kernel damage level (χ) depending on the disk diameter (d).

such a situation, optimization of these parameters would be essential (Garcia and Miller, 2021).

The optimization of the disk diameter (d) and the clearance (z) between the disk and the cylindrical chamber wall proceeded using an experimental planning method. The optimization was according to two quality indicators: the level of complete threshing (η) and the level of kernel damage (χ). In accordance with the selection requirements, experiments progressed in a one-factor series under conditions of more difficult threshing and the highest kernel moisture content (27%–32%) (Figure 5). Based on the results, the maximum allowable disk diameter determined was according to two-factor experimental conditions (Patel *et al.,* 2021; Sonawane *et al.,* 2022; Ji *et al.,* 2024).

Comparative testing of six variants demonstrated the superiority of the cob-threshing device with a disk equipped with a straightening element. It was also evident that the effectiveness of the straighteners can only be considerably real for a certain disk diameter; beyond a certain limit of diameter increase, the straightening element loses its significant effect on the maize cobs (Zhang *et al.,* 2023; Chen *et al.,* 2024). As a result of implementing the Box–Behnken second-order experimental design matrix, the obtained regression equations reflected the relationship between the structural parameters of the working elements, the speed regime, and the quality indicators of the device.

The mathematical model representing the threshing level of the cob (Y_1) is as follows:

$$Y_1 = -7{,}58X_1 + 1{,}84X_2 + 1{,}72X_3 + 1{,}21X_1^2 + 5{,}17X_2^2 + 3{,}64X_3^2 + 6{,}68.$$

The mathematical model representing the kernel damage level (χ) is as follows:

$$Y_2 = 0{,}116X_1 - 0{,}067X_2 - 0{,}099X_3 + 2{,}648,$$

Where, X_1 = the disk rotation speed (m/s); X_2 = the clearance between the disk and cylindrical chamber wall (mm); and X_3 = the disk diameter (mm).

By analyzing Equation No. 6 at its extremum, it determined the values of the input factors corresponding to the maximum of the output factor. In natural units, the factors were as follows: υ = 9.1 m/s; d = 438 mm; and z = 18 mm (Karimova and Aliyev, 2018).

By analyzing Equation No. 7 at its extremum, it provided the values of the input factors corresponding to the minimum of the output factor. In natural units, the factors were: υ = 7.8 m/s, d = 443 mm, and z = 20 mm.

These values allow increasing the productivity of the experimental device while also ensuring that the level of cob threshing rises and the level of kernel damage remains within the standard required for seed-purpose kernels. The research has also established allowable limits for the overall dimensions.

CONCLUSIONS

Typically, the types of damage that occur in maize (*Z. mays* L.) kernels during cob processing include internal and external cracks (endosperm and embryo), shell breakage, partial detachment of the endosperm, and complete detachment of the embryo. Internal cracks formed in the endosperm were also not visible. The seed cracks occurring during cob threshing could attain a boost during subsequent sieving, transport, and drying, which further reduces the quality of seed-purpose kernels. Special devices' use should be reliable to detect invisible cracks in kernels. The comparison with seed samples from the seed supply company focused on the performance of the experimental cob-threshing device under controlled conditions. We acknowledge that variations in initial seed quality or storage conditions could slightly influence germination results. However, the observed differences still provide a meaningful indication of the device's effectiveness. Although the most convenient method in postharvest processing was to test the kernel samples through germination. According to the germination test, the germination rate of the seed material obtained from the experimental cob-threshing device was the highest in all variants compared with seed samples taken from the seed supply company.

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