QISHLOQ XO‘JALIGINI MEXANIZATSIYALASH ILMIY-TADQIQOT INSTITUTI (QXMITI)

SCIENTIFIC-RESEARCH INSTITUTE OF AGRICULTURAL MECHANIZATION (SRIAM)

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INNOVATIVE SOLUTIONS FOR CREATING HIGHLY EFFICIENT AGRICULTURAL MACHINERY AND INCREASING THE EFFICIENCY OF USE OF TECHNICAL MEANS

GULBAHOR – 2024

O‘ZBEKISTON RESPUBLIKASI
QISHLOQ XO‘JALIGI VAZIRLIGI

MINISTRY OF AGRICULTURE OF THE
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QISHLOQ XO‘JALIGIDA BILIM VA
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NATIONAL CENTER FOR KNOWLEDGE AND
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THEORETICAL RESEARCH OF THE PROCESS OF CUTTING KNIFE IN THE GRINDING CHAMBER OF THE NEW INNOVATIVE CORN-SEED GRADER DEVICE

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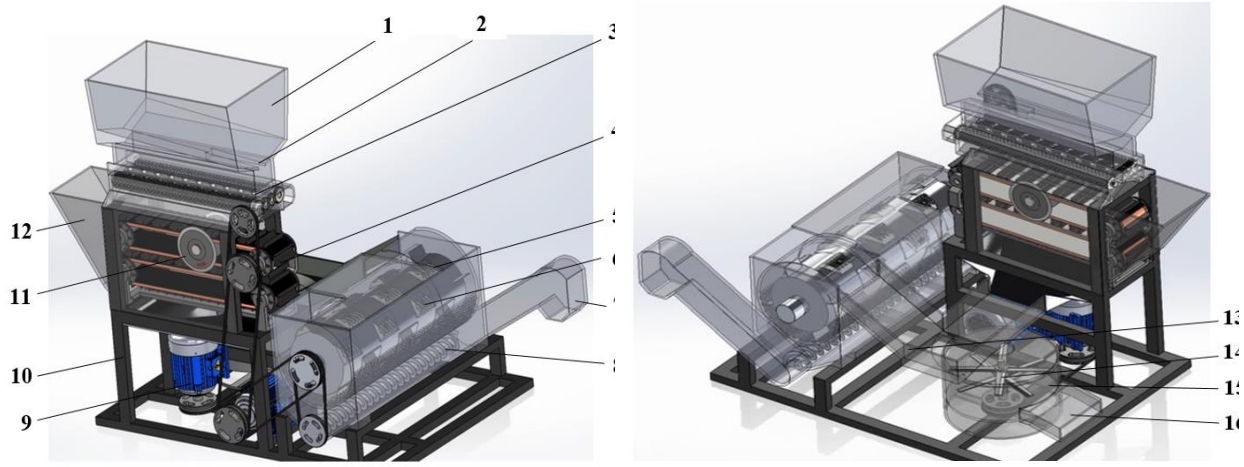
We decided to compare the results of experiment with properties of seed-corn. According to some agronomic researchers’ observation, there is special determination method to harvest corn-crop for producing seed-corn. Finally, according to above mentioned observations and analysis, it is an actual theme to do research on creating new innovative corn-seed preparing technologies and grader machines based on smart technological methods. Otherwise, it is difficult to grade precise properties of corn-seed [1].

According to performed research and observations, we invented new innovative corn-seed grader that peels the husks, threshes the grain and separates precise sized corn-seed during one technological process. The 3D technological schema of the new innovative corn-seed grader device was developed [2] fig. 1.

The corn-seed grader consists of a bunker-1, pod-corn feeder hole-2, husk-peeling rollers-3, ear-corn transporter-4, threshing drum-5, rasp bar-6, elevator-7, auger-8, electric motor 9, frame-10, disk for cutting precise part of ear-corn-11, ear-corn feeding gutter-12, outlet gutter for pith and husk-13, grinding knife-14, grinding chamber-15, outlet gutter for ground forage production-16.

The technological process of the devise is performed as following: pod corn is fed into bunker 1, where the pod-corn falls through feeder hole 2 and arrives on husk-peeling rollers 3. Then, rollers peel husk of the pod-corn. Next stage, ear-corn falls in feeding gutter 12 where transporter 4 holds and carries ear-corn toward cutting disk 11 where top and bottom unavailable parts of the ear-corn are cut off. Subsequently, precise middle part of the ear-corn is threshed by drum 5. During the next step, threshed grain is separated according to its precise sizes. Backtrack parts of the corn like peeled husk, top and bottom parts of ear-corn are fed into grinding chamber 15 through outlet gutter 13 where they are ground as a forage production. The device is moved by electro motor 9.



right side vision left side vision

Figure 1. New innovative smart corn-seed grader device

The methods of research, the development of a device for threshing husked ear-corn and separating grain were carried out taking into account the experience of our domestic industry and foreign engineering. Theoretical studies on the justification of the technological process of the device, dimensions and modes of working bodies were carried out based on the laws of applied mechanics and the rules of mathematical analysis.

According to the grinder operation process, the husks coming out of the hopper must first be grinded to a certain size by the shredder knifes. For this, it is important to consider the interaction between the sawdust coming down from the hopper and the grinder knife and determine the correlation between their movements.

In the grinding chamber, we make the following assumptions about the interaction between the cob and the grinding knife:

1. The rod falls towards the knife from a certain height at the same speed.

2. The first knife cuts through the stubble and then the stubble moves downward without changing its position until the second knife comes to cut the stubble. we look at it.

3. The second knife is located at 180^0 from the first knife, that is, on the opposite side.

In that case, the rotor of the grinder must be half-turned so that the second knife can come and cut the grain. We determine the time it takes for the second knife to reach to cut the stalk in a half rotation of the rotor as follows [3]

$$t_k = \frac{1}{2} \cdot \frac{60}{n_r} = \frac{30}{n_r}, \tag{1}$$

where t_k – cutting the stub of the second knife in half rotation of the rotor time to arrive for, s; n_r – number of rotor revolutions, rpm.

Now, considering the corncob falling from a certain height towards the grinder knife as a material body, we will consider its movement based on the well-known laws of theoretical mechanics.

In this case, the rod moves up and down under the influence of gravity, and its motion is according to the differential equation

$$m\ddot{h}_f = mg, \tag{2}$$

where m – the mass of the cob, kg; h_f – the height of the fall of the cob, m; g – free fall acceleration, m/s^2.

Integrating this equation, we find the speed of the cob falling towards the grinder knife

$$V_c = gt_f + C_1, \tag{3}$$

where V_c – the speed at which the cob is falling towards the grinder knife, m/s; t_f – the time when the cob falls towards the grinder knife, s; C_1 – integral constant.

(3) by integrating the equation, we determine the falling height of the cob

$$h_f = \frac{gt_f^2}{2} + C_1 t_f + C_2, \tag{4}$$

where C_2 – integral constant.

t_f=0 at h_f=0; V_c=0 because they are C_1=0 and C_2=0 .

In that case (4) the expression will look like this:

$$h_f = \frac{gt_f^2}{2}. \quad (5)$$

From this expression, we derive the expression that determines the time t_f of the cob falling towards the grinder knife

$$t_f = \sqrt{\frac{2h_f}{g}}. \quad (6)$$

If we transfer the value of tm from the expression (6) to the expression (3), then the expression of the speed of the cob falling towards the grinder knife will be as follows

$$V_c = \sqrt{2gh_f}. \quad (7)$$

Depending on the time tm of the cob falling from the top and the falling speed V_c, the length of cutting or grinding the cob is as follows

$$l_g = V_c t_g, \quad (8)$$

where l_g – the length of cutting or grinding the cob, m.

Taking into account the expression (7) from the expression (8) the time of falling of the cob can be written as follows

$$t_f = \frac{l_g}{V_c} = \frac{l_g}{\sqrt{2gh_f}}. \quad (9)$$

In order for the cuttings to be cut or grinding to the desired size in the grinding chamber, the time it takes for the second knife to reach the cuttings in half a rotation of the rotor, t_k is less than or equal to the time the cuttings fall from the top, t_f the following condition must be met

$$t_k \le t_f \quad (10)$$

According to expressions (1) and (9), condition (10) can be written as follows

$$\frac{30}{n_k} \le \frac{l_g}{\sqrt{2gh_f}} \quad (11)$$

The expression (11) is an formula of the interaction between the cob falling from the hopper and the grinder knife, and this expression determines the relationship between the drop height of the straw h_f, the number of revolutions of the rotor with the grinder knife n_k, and the grinding length l_g.

From this expression, we determine the number of rotor revolutions n_k, which provides the required grinding length l_g

$$n_k \ge \frac{30\sqrt{2gh_f}}{l_g} \quad (12)$$

According to above mentioned observations and research about determination the number of rotations of the rotor with a grinder knife, we achieved following results.

Conclusion

If $g=9.8\ m/s^2$, the falling height of logs is structurally h_f=0.15 m, according to calculations

according to the expression (2.12), the number of rotations of the rotor with a grinder knife turns out that must be greater than 2571.9 rpm.

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Fozilov G.G., Xudayberdiev Sh.Z. Yangi innovatsion makkajo‘xori urug‘ini ajratish smart qurilmasining yanchish kamerasida kesish pichog‘ining ish jarayonini nazariy tadqiq etish.

Maqolada makkajo‘xorini urug‘lik donlarini aniq o‘lchamlarda ajratib oladigan yangi innovatsion smart qurilmaning yanchish kamerasidagi kesish pichog‘ining ish jarayonini o’rganish bo’yicha olib borilgan nazariy tadqiqot natijalari keltirilgan.

Фозилов Г.Г., Худайбердиев Ш.З. Теоретическое исследование процесса работы режущего ножа в камере обмолота нового инновационно-интеллектуального устройства для разделения кукурузных зерен.

В статье представлены результаты теоретических исследований по изучению рабочего процесса режущего ножа в камере обмолота нового инновационно-интеллектуального устройства, разделяющего зерна кукурузы по точным размерам.

Fozilov G.G., Khudayberdiev Sh.Z. Theoretical research of the process of cutting knife in the grinding chamber of the new innovative smart corn-seed grader device.

This article presents the results of theoretical research on the study of the working process of the cutting knife in the threshing chamber of the new innovative smart device, which separates corn kernels in precise sizes.

УДК 631.352.

ВЛИЯНИЕ УГЛА ЗАТОЧКИ РЕЖУЩЕГО НОЖА НА СТЕПЕНЬ РАСЩЕПЛЕНИЯ СТЕБЛЕЙ ПУСТЫННЫХ КОРМОВЫХ РАСТЕНИЙ

Толибаев А.Е. (ЦИТТ), Хазиев С.А.(НИИМСХ), Горлова И.Г. (ТашГАУ)

В настоящее время из-за отсутствия специальных кормо-уборочных машин, уборка пустынных растений осуществляется вручную, методом кетменной рубки, что считается малопроизводительным и экологически вредным, провоцирующим болезнь и уничтожение растений, что приводит к деградации пастбищ [1]. Технология заготовки сена с естественных аридных пастбищ, отличающихся низкой урожайностью, должна предусматривать регулярное накопление кормовой массы в процессе скашивания [2]. Проведенный анализ технологий и уборочных машин, являющихся основой усовершенствованных технологических приемов и машин для заготовки сена с