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# To study the main factors influencing fiber quality in the process of sawdust separation and their interdependence

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***Abstract:*** ***The article develops the main factors affecting the quality of fibers and seeds and their interrelationships, as well as mathematical regression equations. It has been shown that the separation of fiber from seed in the process of sawdust fiber separation depends on many factors and their interaction and can be studied using modern mathematical methods of experimental planning that allow to find a solution to the problem. Acceleration of the speed of the raw material roller by means of a seed extractor and a new optimal profile of the working chamber were found. Through the planned experiment, the most important factors influencing the quality indicators of fibers and seeds and their interrelated effects were studied. The main factors and their levels of variability were determined by the output parameters during the selected experiment. The randomly ordered planning matrix of the experiment and the inequality of variation are presented. The adequacy of the obtained equations is shown by the closeness of the experimental results with the mathematical calculation models. Thus, a system of equations was created that allows to find the optimal parameters of the auxiliary seed extractor in the working chamber of the saw fiber separator.***

***Keywords: sawmill fiber separator, sawmill, sawmill cylinder, auxiliary seed extractor, working chamber, apron, brush, shaft, seed comb, air chamber.***

## 1. INTRODUCTION

The formation of the raw material roller in the process of separating the cotton fiber from the seed in the gin machine and its rotation in the working chamber depends on several factors; The most important of these are the fiber content, density of the raw material roller, the amount of seeds separated from the fiber, and so on. In addition, it is necessary to take into account the frictional force created by the walls of the working chamber under the pressure generated in the raw material roller. These factors affect the performance of the gin machine and the quality of the fiber obtained. It has been proven that the increase in the productivity of the gin machine necessarily occurs with the increase in the density of the raw

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material roller [1]. However, as the density increases, the increase in productivity reaches a certain limit, and then the productivity begins to decline. This is due to the fact that the rotational speed of the raw material shaft decreases under the influence of frictional forces in the lateral direction; It has been proved that the process stops completely when the density is 550-600 kg / m3. The density of the raw material shaft affects the productivity of the machine, the quality of seeds and fibers, as well as the consumption of electricity for the rotation of the working bodies. It has long been known in cotton ginning practice that there is a close correlation between productivity, raw material roller density and fiber quality in sawing ginning, which is the most basic technological process in cotton ginning.I.G. Boldinsky [2] proved in his research that an increase in gin productivity would inevitably occur with an increase in the density of the raw material. However, as the density increases, the productivity increases to a certain limit and then the productivity starts to decrease. A.D. Grober conducted theoretical and experimental studies on mathematical expression to study the characteristics of the process of insanity. He identified the statistical regularities of the insanity process. In particular, the author showed that reducing the unevenness of the transmission of seed cotton to the gin working chamber and stabilizing the ginning process improves the quality of cotton fiber[3]. The developmental analysis of the basic studies of sawing gin allows us to identify ways to optimize it. It is necessary to stabilize the ginning process to increase gin productivity and improve fiber quality. In the practice of cotton mills, the density of the raw material roller in ginning is subjectively studied and adjusted. To do this, the supply of gin is set at a speed determined by the work experience, depending on the seed cotton navigator, and then proceed to adjust the density of the raw material roller and the degree of fluffiness of the seeds. B.I. Bekmirzaev [4] obtained experimental data on the effect of density of raw material roller on fiber and seed quality. In the scientific article of S.Fazildinov, R.M.Kattakhodjaev [5] the reasons for the increase in the amount of defects in the fiber after sawing cotton, the role of the density of the raw material roller. Studies conducted at the Pakhtasanoat Scientific Center IIChM and TTESI have shown that the main reason for the formation of defects in fiber is the excess and variable density of the raw material roller. When the density of the raw material roller increases, the weaving process is complicated by the formation of tangles, combined tangles and knots. To minimize ginning defects, the ginning process should be carried out at a relatively bush and constant density of the raw material roller. The authors studied the quality of the fiber obtained in gin when the density was reduced using a raw material roller. [6]

## 2. EXPERIENCE

Saw fiber separators consist of a working chamber, a grate with a grate, a roof beam, an air chamber, a dead conveyor, a cotton entrance to the chamber, and a front apron bounded by a seed comb. These elements of the working chamber, their structure, size and position relative to the saw affect the sawdust separation process. Also, the process of separating the sawdust is based on cutting the fiber from the seed while dragging the fiber to the saw teeth and passing it through the border of the grate. As a result of this process, a raw material roller is formed in the working chamber. In addition to this function, the grate grateforms part of the working chamber in the formation of dense cotton or seed rollers and helps the cleaned seed

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to slide across itself and out of the machine. The front apron of the chamber is a guide surface to form a raw material shaft in a shape larger than the diameter of the saw. The front rack of the case is fitted with two hanging columns, which are attached to the working chamber by means of a hinge. The cotton is transferred from the distribution auger to the PD supplier, where it is titrated and cleaned of fine contaminants. The efficiency of the sawdust separator is adjusted by changing the speed of rotation of its supply rollers.From the suppliers, the cotton is lowered into the working chamber through the gins, where it is exposed to the saw cylinder and forms the raw material roller.

The teeth of the saw cylinder hang the cotton fibers in the raw material roller, bring them between the columns, and pull them out of the seed surface. The fibers in the saw teeth are separated from the nozzle by a stream of air coming out at a speed of 55-65 m / s and passed through a common fiber pipe to the fiber cleaning machine. Since the width of the holes in the working part of the columns is not greater than 3.2 mm, the seed cannot pass through, the rotating seed is attached to the cotton roller and continues to rotate until all the fibers are separated.

Seeds separated from total fibers lose their ability to function. The seeds are separated from the fiber roller and fall to the surface of the column and through it. The degree of hairiness of the seeds coming out of the sawdust fiber separator is changed by the seed comb.

In view of the above, various options have been created to accelerate the rotation of the raw roller of the working chamber through the seed extractor and to select the optimal profile of the sawing fiber separator working chamber.

When choosing a working chamber, the distance between the seeder and the saw is 40 mm, the distance between the axis of the saw cylinder and the seeder is 107 mm horizontally, the distance between the axis of the sawmill cylinder 252.5 mm vertically and the axis of the seed drill is 242 mm. the distance between the axis of the seed extractor was 208 mm and the distance between the tip of the seed comb and the column was 30 mm [7]. Thus, on the basis of the above measurements, an auxiliary seed extractor was installed in the working chamber, and in the process of fiber separation, the productivity was 14.2 kg / hr and the fiber quality was improved. The optimal cylindrical tubular structure size was selected as follows: the outer diameter of the tube was 165 mm, the inner diameter was 154 mm, the relative fixed auger diameter inside the tube was 154 mm, and the hole size was 1.77 cm2 [8]. Figure-1.

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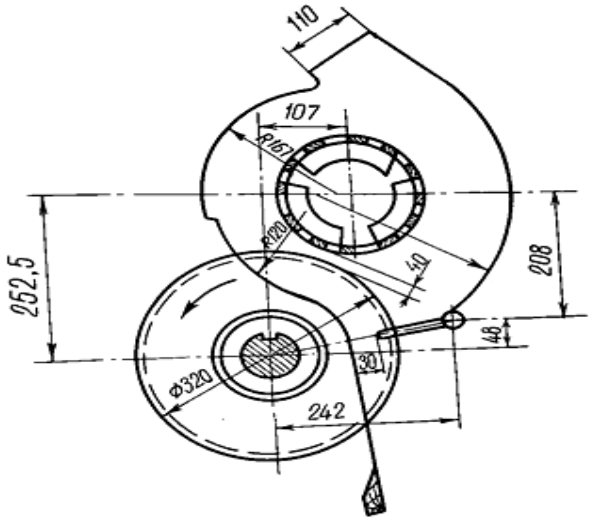


Figure-1. Saw fiber separator with auxiliary seed extractor

Further research is to increase the speed of the raw material roller in the fiber separation process through the seed extractor and select a new working chamber profile and determine the rotation speeds of the seed extractor.

The experimental results were processed by experimental planning mathematical methods that allowed to find an optimal solution to the problem at minimal cost.

The quality of production of ginneries largely depends on the design structure of the equipment and the mode of technological operation. The separation of fiber from seed in the sawdust fiber separation process depends on many factors and their interaction and can only be studied using modern mathematical methods of experimental planning that allow to find a solution to the problem that is close to an acceptable level with minimal cost.

In order to use the experimental planning method, it is necessary to study the independent factors influencing the quality indicators of the fiber separation process. As a result of the analysis of the work and production experience, the following key variables were identified:

- Intermediate fiber separator productivity (kg / saw-hour);

- Rotation speed of auxiliary seed extractor (rpm);

- Output of hairless seeds from the auxiliary seed extractor (kg).

We substantiate these factors and select their degree of variability.

Saw fiber separator performance X1

The efficiency of sawdust fiber separator can be increased as follows:

1. By increasing the amount of cotton falling into the working chamber (by changing the profile of the working chamber);

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2. By increasing the speed of the raw material roller through the auxiliary seed extractor;

3. By increasing the amount of cotton falling into the working chamber and increasing the fiber content of the raw material by reducing the time of stay of hairless seeds in the chamber;

4. By increasing the ability of the saw teeth to bind the fiber.

The purpose of the experimental study was to increase the speed of the raw material roller by means of an auxiliary seed extractor and to study its effect on machine productivity, as well as to find the rotational speeds of the optimum structured seed extractor.

A decrease in the density of the raw material roller was achieved with an increase in the productivity of the sawdust fiber separator, an increase in the rotation speed of the seed-extracting device. This has led to an increase in the fiber content of the raw material and an acceleration of seed separation.

The reason for the decrease in fiber quality is that as a result of increased mechanical damage to the seeds, the amount of broken seeds and seed husks is added to the fiber content. Therefore, sawdust fiber separator productivity was included as a key factor in the experimental plan, with a range of productivity changes ranging from 7.4 to 14.2 kg / hr. The efficiency of the saw fiber separator is adjusted by changing the rotation speed of its supply rollers.

Auxiliary seed extractor rotation speed X2.

The rotation speed of the auxiliary seed extractor significantly affects the technological parameters of the fiber separation process, ie the density of the raw material roller, the time of the seeds in the working chamber and the operation of the sawdust separator.

During the experiment, it is necessary to determine the optimal speed values of the auxiliary seed extractor, which vary from 150 to 350 rpm.

Hairless seeds coming out of the seed extractor X3

It is known that in the process of processing medium-fiber cotton, hairless seeds remain in the working chamber for a long time. This has a significant impact on machine productivity and fiber separation process. Removing the hairless seeds from the working chamber by means of an auxiliary seed extractor device reduces the standing time of the hairless seeds in the chamber and increases the ability to attach the fiber to the saw tooth. This leads to a decrease in the mass and density of the raw material roller and therefore an improvement in the quality of the fibers and seeds. Finding the amount of hairless seeds coming out of the seed extractor is one of the main tasks of our research. In this regard, the amount of hairless seeds coming out of the seed extractor was taken as a factor ranging from 140 to 420 kg per hour of output.III. Experimental results

The following factors were selected to optimize the parameters affecting the fiber separation process with the seed extractor and to conduct experimental research:

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-Arlali fiber separator productivity;

- Rotation speed of the auxiliary seed extractor;

- Output of hairless seeds from the auxiliary seed extractor.

Therefore, three factors influence research. Experiments were conducted to plan complete factorial experiments.

The essence of PFE includes the following

1. Construction of experimental planning matrices.

2. Experiment in the matrix.

3. Process the experimental results to obtain a regression model.

4. Analysis of the regression model.

All identified key factors differ in two levels (+1), (-1) and the number of experiments - 8. The experiment was conducted on the first variety of industrial variety Nam-77, a selection variety of medium-fiber cotton, the most widely grown in the country.IV. Conclusion

Experimental studies to determine the optimal value of the selected key factors that affect the process of sawdust separation allow us to draw the following conclusions:

1. Experimental studies show that in the form of a cylindrical tube with an outer diameter of 165 mm and an inner diameter of 154 mm of an optimally structured auxiliary seed extractor, the relatively fixed screws on the inside move in the left and right directions. Screw diameter 154 mm ,. the surface of a single hole in the pipe is 1.77 cm2 holes are made of elliptical-device steel-3 material, thickness 5.0-0.1 mm, screw thickness 2.00-0.1 mm, screw pitch 125 mm. The distance between the seed drill and the saw is 38-40 mm;

2. Acceleration of the raw material roller, acceleration through the seed extractor and a new optimal profile of the working chamber was found;

3. The study of the most important factors affecting the quality of fibers and seeds and their interrelationships, as well as the results of processing the regression equation were identified through a systematic experiment;

4. The effect of the quality of the fiber and seeds produced in the process of sawing fiber, machine productivity, rotation speed of the seeder and the amount of hairless seeds coming out of the seeder was studied.

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