Improving the cleaning efficiency of pile drums

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Abstract. The condition of cleaning machine-picked cotton in technological processes and the possibility of increasing the efficiency of cleaning pile drums due to changing different surface sizes have been analyzed in the given article. A part from it, the quality of the fiber produced at cotton gins, the impurities of natural and technological defects in its composition were analyzed. It has been shown that insufficient efficiency of cleaning technological equipment, an increase in the proportion of impurities in the fiber has decreased in the amount of obtaining "higher" and "middle" classes of cotton. It has been established that the cleaning efficiency can be increased due to the size of the mesh surface holes of pile drums, the cleaning return of pile and sawn cotton, the impact on the cleaning efficiency of cotton work productivity has been determined. The regression equation, which characterizes their interconnections, was obtained due to cleaning relapses. When cleaning cotton, it has been shown that increasing the width of the mesh surface Holes by 8mm will cause the cotton to get dirty and cause the holes to be in a state of cotton congestion. The character of a decrease in cleaning efficiency was determined in the sequence of cleaning cotton in pile and saw cleaners. The impact of work productivity on cotton was shown in the sharp decline in the efficiency of cleaning pile drums in Sections 3 and 4. Based on the analysis of the results obtained and the size of the holes of the mesh surface of the pile drums be 8x50 mm wer recommended.

1 Introduction

On the basis of modernization of cotton-cleaning technological machines for the development of cotton-textile production in the Republic, large-scale measures are carried out to increase the profitability of processing cotton raw materials and the competitiveness of manufactured products, and certain results are achieved [1-5].

Bringing cotton products to the world market as a finished product, ensuring that it is competitive, first of all, the efficiency of cleaning cotton cleaners depends on the quality of cotton fiber, including the amount of defects and dirty impurities in its composition [4-7].

In the current period, a complex of directional UXK-type cleaners at cotton-gins is considered a convenient and modern technology in which sections for cleaning cotton from small and large impurities are installed, auxiliary means do not need to use cotton

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transportation, transmission and harvesting transportation [1-4]. While these cleaners are cleaning hand-picked cotton at the level of technological regulation requirements, it has been found that the efficiency of cleaning machine-picked cotton is low. As a result, obtaining fiber of the “higher” and “better” class from machine-picked cotton became a complex task [7-10].

Numerous scientific studies have been carried out to reduce the amount of impurities and defects in cotton fiber [2, 3]. In particular, an increase in the efficiency of cleaning cotton from fine impurities by improving the working parts of the equipment has been achieved and appropriate recommendations have been made. As a result, a complex has been created consisting of 1XK cleaning of existing cotton from fine impurities and UXK cleaning sectors consisting of large impurities [10-12].

As you know, the price of fiber “high” and “good” classes is the highest, they will be 5 and 4% higher than the price of fiber of the “ middle” class, respectively. Since the price of the first and second varieties of cotton is higher with szilar compared to the rest of the varieties and can vary between 12.5% and 14%, respectively, depending on the class of fiber, and their amount is 80-90% of the total fiber produced, the quality of the fibers of Grade I-and II determines the economy of the cotton [5-9].

In order for the fiber of Grade I to be of the “higher” and “better” classes, their total impurities (defects and impurities) should be less than 2.0% and 2.5%, respectively, and the fiber of Grade II should not be more than 2.5% and 3.5%, respectively. Alternatively, it is desirable that the share of the” higher " class be as much as possible [5-8].

The main purpose of the article is to analyze the possibilities of increasing the efficiency of cleaning machine-picked cotton due to the state of cleaning and the change in the dimensions of the mesh surfaces of pile drums [8-12].

2 Materials and methods

The results of the primary operation of machine-picked cotton were studied at a number of cotton gins. For this purpose, samples were taken from cotton wool in gin top and fiber in condenser top, and their moisture, impurities, fiber class were determined [1-5].

The experiment of the dimensions of the mesh surface was carried out at a laboratory stand, consisting of 4 pegs of drums and 1 saw of drums, the supplier of which is presented in Figure 1. For experiments, mesh surfaces with hole sizes 6x50, 8x50 and 10x50 mm were prepared for 4 pile drums. The experiments were carried out on the S-6524 selection variety with hand and machine-picked dirt at a humidity of Cgen=7.04% and Cgen=13.93% at a working productivity of 6t/hour and 4.5 t/hour on 8% cotton. The dirt from each cleaning sector myth was pulled separately and separated from cotton by the soiling of C and the cleaning efficiency was determined using the following formulas [5-9].

$$C = M_{im}/M_h \, x \, 100 \qquad \text{and} \qquad K = C/Z_{tot} \, x \, 100$$

In this case, M impurities -the weight of the transferred cotton, kg; 3 total impurities of cotton fibers, %.

3 Results and discussion

Table 1 lists the quality of the fiber produced from machine-picked cotton in a number of cotton cleaning bellows.

Table 1. Results of preliminary work of cotton at gins

#	Cotton grade and class	Cotton humidity, %	Impurities of cotton, %	Drying temperature, ^{0}C	Cotton at gin		Cleaning efficiency, %	Impurities and defective impurities in the fiber, %			Fibre sort
					Humidity, %	Impurity, %		Impurities	Defective mixtures, %	Total, %	
1.	C-6524, 1/2	9.07	4.66	80	8.0	0.9	80.7	1.2	1.4	2.6	Middle
2.	An-35, 2/1	12,3	4.87	165	9.8	1.2	75.9	1.42	1.45	2.87	Good
3.	C-6524, 1/2	9.2	4.4	70	8.4	2.0	68.6	1.7	1.55	3.25	Simple
4.	C-6524, 4/1	15.0	3.8	170	8.4	2.7	58.9	2.4	3.4	5.8	Good
5.	An-35, 4/1	16.6	5.7	185	9.5	2.3	59.6	2.1	3.0	5.1	Good
6.	An-35, 5/3	21.4	6.8	200	10.7	3.0	55.4	2.9	5.7	8.6	Middle

Cotton cleaning efficiency ranges from 55.4% to 80.7%. from machine-picked cotton, mainly "ordinary", "medium" and "good" class fibers are obtained.

According to the requirement of the coordinated technology of preliminary processing of cotton (PDI70-2017), the cotton variety, class, the procedure for cleaning depending on the initial dirt, and the amount of impurities of cotton in the Gin lotog are determined.

As can be seen from the table, the efficiency of cleaning equipment is at different levels, and due to the insufficient use of their capabilities, cotton pollution in almost all cotton processing options is higher than the standard of demand, as a result of which "high" class fiber was not obtained, mainly "medium" and "normal" class fibers were obtained.

This circumstance requires an increase in cleaning efficiency in order to obtain a high-class fiber.

In studies [4] it was found that the amount of fiber single seeds in cotton being given to cleaning is 20-24%, and the effective diameter is 15.5-18mm, and the mesh surfaces of cleaners showed that there is an opportunity to expand the size of the holes. Figures 1 and 2 show the effect of mesh surface hole size on cleaning efficiency. Cleaning efficiency: 1.general; 2.1-transfer; 3. 2-transfer; 4. 3-transfer; 5. 4-transfer.

 https://doi.org/10.1051/e3sconf/202337101019

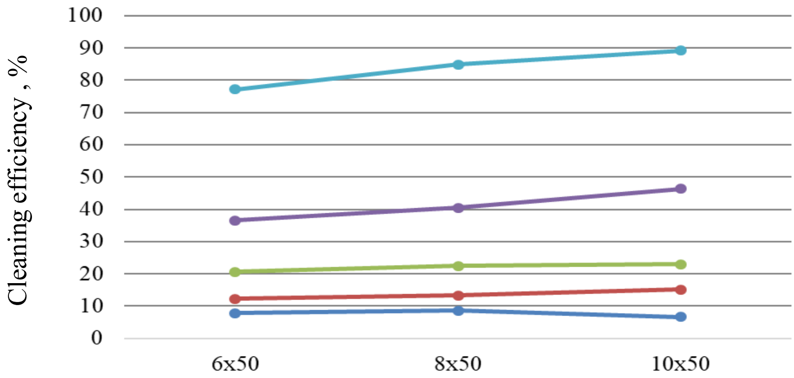

Fig. 1. Cleaning efficiency on different mesh surfaces (hand picking Q = 6 tons/hour).

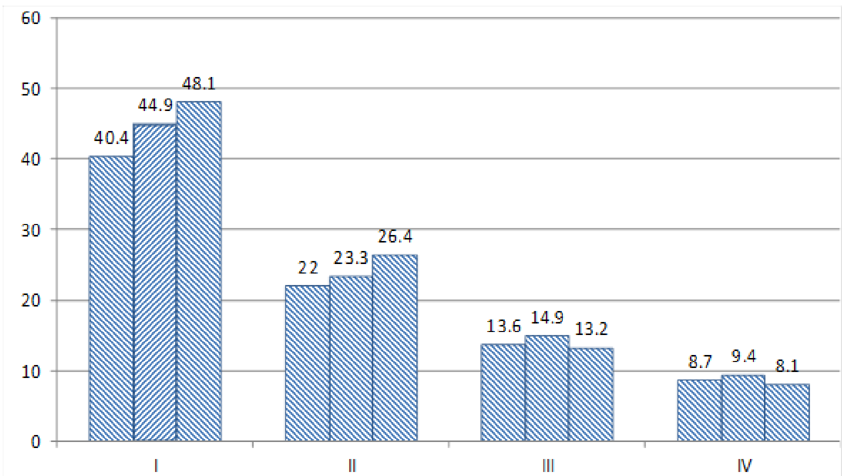

Fig. 2. Cleaning efficiency on different mesh surfaces (hand picking Q=4.5 tons/hour) : a), b), c), d)-the number of transfers, respectively. Mesh surface hole dimensions: 1-6x50 mm; 2-8x50 mm.

The equations of the resulting curves have acquired the following appearance. Overall cleaning efficiency in 16 pile drums and 4 Arrach drums

$$y1= - 0.42x2-9.8\,x+33.7$$

When cleaned for the first time in a drum with 4 pegs and a drum with 1 saw

$$y2=0.23x2-1.3\,x+35.9$$

When cleaned 2 times

$$y3= - 0.\ 42x2+6.9\,x-5.5$$

When cleaned 3 times

$$y4=0.1x2-0.9\,x-14.1$$

When cleaned 4 times

$$y5= - 0.\ 33x2+5.1\,x-10.8$$

in this x=6-8-10mm mesh surface hole width.

The cleaning efficiency is increasing as the size of the holes on the mesh surface increases. The hole sizes were 7.7% and 12.3% higher in 6T/H working productivity, respectively, compared to the 6x50 size surface on mesh surfaces with 8x50 and 10x50 mm. Work productivity increased by 4.5% and 7.8% in 11.1 t/hour, respectively.

The effect of mesh surfaces size on overall cleaning efficiency was high in the first transfer i.e. (4 pile drums and 1 Arrach drum) when held at 4qb+1AB on 8x50 and 10x50 mm perforated mesh surfaces, 6s/hour was 2.1% and 8.3% in work productivity, respectively, 4.5 t/hour was 4.2% and 7.7% higher in work productivity. But as the return on cotton transfer from 4qb+1AB sectors increased, the differences in cleaning efficiency decreased. This circumstance is explained by the fact that there are impurities left in the cotton, which are actively combined with fiber, and it is difficult for them to separate.

It should be noted that when transferring 3va 4 in 4KB+1AB on mesh surfaces with a hole size of 10x50 mm, a situation was observed in which cotton gets dirty and gets stuck in the holes.

4 Conclusions

It was found that there is an opportunity to increase the efficiency of cleaning cotton due to the expansion of pile drums with mesh surface hole sizes from 6x50 mm to 8x50 mm.

The cleaning efficiency was also increased when the hole dimensions were increased to 10x50 mm, but Cotton was observed to fall into the dirt. Production was given the recommendation to make pile drum mesh surfaces hole sizes 8x50 mm.

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