GALAXY INTERNATIONAL INTERDISCIPLINARY RESEARCH JOURNAL (GIIRJ)
ISSN (E): 2347-6915
Vol. 9, Issue 12, Dec. (2021)

ANALYSIS OF FULL-FACTOR EXPERIMENTAL STUDIES OF A COTTON CLEANER

Abdialim Tukhliev
Assistant, Tashkent Institute of Textile and Light Industry

Alisher Abdusamatov
Doctorate, Tashkent Institute of Textile and Light Industry,

Shakhnoza Khaytbaeva
Student, Tashkent Institute of Textile and Light Industry

ABSTRACT

The article presents the results of full-factor experimental researches of a cleaning machine with a new design of the feeder. The dependences of cotton cleaning efficiency on the relative speed of the feed rollers, on the productivity of the machines and the effect of changes in the gap between the feed rollers are given. The optimal parameters of input factors are recommended.

Keywords: cleaner, feeder, feed roll, related speeds of feed roll, productivity, multifaceted pin, drum, loosening, mathematical model, uniformity, cleaning effect.

INTRODUCTION

The process of cleaning raw cotton is characterized by such an indicator as the cleaning effect of the machine. When conducting experimental studies, the influence of parameters such as machine performance, the gap between the feed rollers, the relative velocity of the feed rollers, etc. was studied [1-9]. The cleaning indicators listed above directly or indirectly affect the technological parameters of the cleaner and the efficiency of cleaning raw cotton from fine litter. In the cleaning process, the gap between the feeding rollers has an important role, by changing which the efficiency of the raw cotton cleaning process can be regulated, since, as a result of the interaction of the pegs with the raw cotton and the mesh surface, the process of cleaning raw cotton from weed impurities is carried out [10-23].

METHOD

As a result of the analysis of the experimental laboratory work and theoretical studies, the following main variable factors were identified: productivity (t/ h); the gap between the feed rollers (mm), the ratio of the velocity of the feed rollers.

When conducting research, a complete factorial experiment (hereinafter PFE) was selected 2^3. All the identified main factors vary at two levels (+1 and -1), and the number of experiments is $2^3 = 8$ [24, 25].

After selecting the main factors and their levels of variation, it was determined by which the main output parameters can be judged and evaluated, as well as optimize the technological and design parameters of the cleaner with multi-faceted feeder pegs [26].

ANALYSIS OF RESEARCH RESULTS

The accuracy and reliability of the experimental results largely depends on the accuracy of control of all input and output parameters and their constancy. Therefore, each experiment was preceded by preparation with repeated control of the input and output parameters of the cotton cleaner from fine litter.

$y_1=76,94+1,04x_1 – 2,11x_2 – 2,54x_3 +0,9\ x_1x_2 – 1,62x_1x_3+0,4x_2x_3 – 0,59x_1x_2x_3$

Only significant coefficients are included in the mathematical model of the process. Thus, the regression equation has the following form:

$y_1=76,94+1,04x_1 – 2,11x_2 – 2,54x_3 +0,9\ x_1x_2 – 1,62x_1x_3+0,4x_2x_3 – 0,59x_1x_2x_3$

Table 1 shows the levels of variation of experimental factors.

Table 1

Levels of variation of experimental factors

№	Name of the factor	Units of measurement	Marking	The importance of factors			Levels of variation
				-1	0	+1	
1	Velocity ratio of feed roller	-	X_1	1,08	1,18	1,28	0,1
2	Efficiency	т/ч	X_2	6	6,5	7	0,5
3	Gap between the feed rollers	мм	X_3	80	100	120	20

The working matrix of PFE $2^3 = 8$ is shown in Table 2.

Table 2.

The working matrix of PFE $2^3 = 8$

№	Procedure for implementing the experience			Input parameters							Output parameter
				x_1	x_2	x_3	$x_1 x_2$	$x_1 x_3$	$x_2 x_3$	$x_1 x_2 x_3$	У
1	17	2	19	-	-	-	+	+	+	-	80,83
2	13	14	11	+	-	-	-	-	+	+	83,13
3	16	22	23	-	+	-	-	+	-	+	72,8
4	8	21	12	+	+	-	+	-	-	-	81,13
5	6	15	10	-	-	+	+	-	-	+	77,03
6	18	4	1	+	-	+	-	+	-	-	75,20
7	5	7	24	-	+	+	-	-	+	-	72,9
8	20	3	9	+	+	+	+	+	+	+	72,4

The output parameter of the experiment was taken as the value characterizing the cleaning efficiency, which is given in Table 3.

Table 3.

The output parameter of the experiment

Marking	Name	Dimension
У	Cleaning effect	%

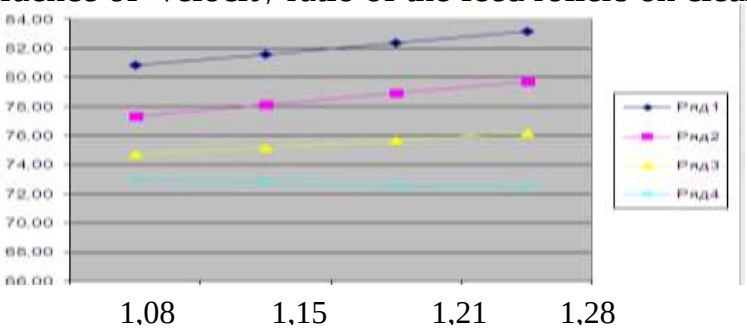
Mathematical calculation of the adequacy of the obtained equations showed good convergence of models and experimental results.

In the models, the value of the regression coefficients characterizes the contribution of the corresponding factor to the value of the output parameter when the factor moves from the main level to the upper or lower one. The contribution of the factor in the transition from the lower to the upper level to the value of the output parameter is called the factor effect. If the regression coefficient was larger, the effect of this factor would be higher, i.e. the influence of the factor on the output parameter would be stronger. Thus, according to the magnitude of the regression coefficients in the models, factors are sorted by the strength of their influence on y, the sign before the regression coefficient determines the nature of the influence of the factor on y. Factors whose coefficients have a plus sign (+) increase the value of the output parameter, and those with a minus sign (-) reduce it.

Let's consider the influence of input factors on the studied factor, that is, on the cleansing effect. Analysis of the regression equation shows that the main influence on the efficiency of cleaning -y, has a relative velocity of the feed rollers (x_1), performance (x_2), the gap between the feed rollers (X_3) and interaction factors (x_1x_3, x_2x_3, x_1x_2 X_3).

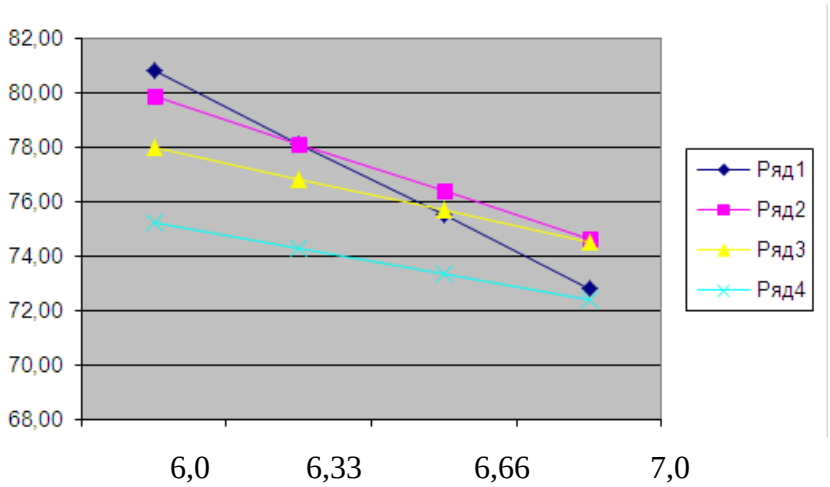
To study these dependencies are numerically calculated curves, the regression equation for different values of the main factors.

Influence of velocity ratio of the feed rollers on cleaning effect



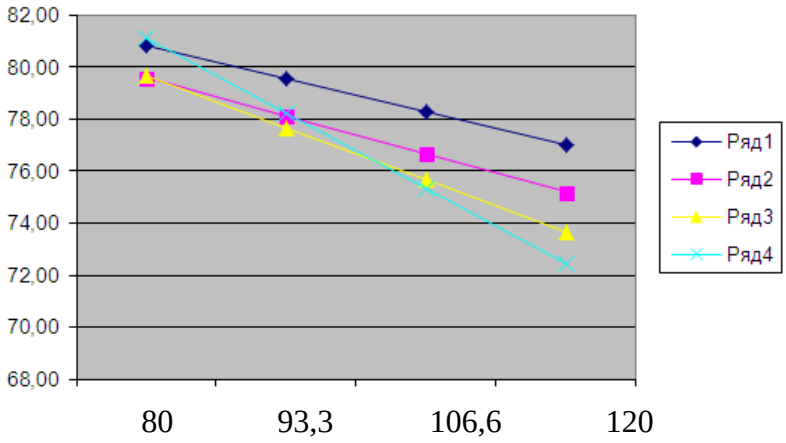
a)

Influence of performance on cleaning effect



b)

Influence of changing the gap between the feed rollers on cleaning effect



c)

Fig. 1. Graph of the dependence of the purification effect on the incoming factors of a full-factor experiment

The results of calculations after processing are presented in the form of graphs (Fig. 1.). In Fig. 1a shows the dependences of the cotton cleaning efficiency on the ratio velocity of the feed rollers, where four curves y =y(x) are given. The first curve corresponds to the minimum, the second and third to the daily, the fourth to the maximum values of factors x2 and x3. It can be seen from the curves that with an increase in the ratio velocity from 1.08 to 1.28, the cleaning efficiency on the first curve, i.e. at minimum values of the main factors x2 = 6 t/s, x3 = 80 mm, increases from 80.8% to 83.2%, and at maximum values, i.e. x2=7 t/s , x3=120 mm, decreases 72.9% to 72.4%. At the second and third curves, 77.3% increases by 79.7%, 74.7% by 76.1%, respectively. Figure 1b shows the dependence of the cleaning efficiency on the performance of machines.

The presented curves show that with an increase in productivity from 6 t/h to 7 t/h, depending on the specified x2 and x3, the cleaning efficiency is characterized by descending. On the first curve at x1= 1.08; x3=80 mm from 80.8% to 72.8% on the second curve at x1= 1.15, x3=93.3 mm from 79.8% to 74.6% on the third curve at x1=1.215, x3=106.6 mm from 78.1% to 74.5% on the fourth curve at x1=1.28, x3=120 mm from 75.2% to 72.4%. Fig. 1c shows the effect of changing the gap between the feed rollers on the cleaning effect. The presented curves show that with an increase in the gap between the feeding rollers from 80 mm to 120 mm, depending on the given x1 and x2, the cleaning efficiency is characterized by descending curves, on the first curve at x1=1.08; x2=6.0 t/h from 80.8% to 77.1%, on the second curve at x1=1.15; x2=6.33 t/h from 79.6% to 75.1%, the third curve at x1=1.215; x2=6.66 t/h from 79.6% to 73.6 %, the fourth curve at x1 = 1.28; x2= 7 t/h from 81.1% to 72.4% [27].

DISCUSSION

The gap between the feed rollers affects the cleaning process in a straight line. By changing the gap, the cleaning effect can be adjusted. When analyzing the effect of the gap between the feed rollers, it was revealed that there is a tendency to deterioration in the quality characteristics of raw cotton with a decrease in the gap. This is due to the friction force that occurs when the feeding rollers meet with lumps of raw cotton. Note that the increase in the gap affects the

friction force negatively, that is, the friction force actually decreases if the interaction of the feed rollers with cotton decreases.

CONCLUSION

According to the results of full-factor experimental studies, the following parameter values are recommended; productivity, t /h - 6.0; the ratio of the velocity of the feeding rollers, 1.28; the gap between the feed rollers - 80.0 mm, at which the cleaning effect of cotton using the recommended feeder is above 83%.

REFERENCES

1. Roy V. Baker Performance characteristics of saw-type lint cleaners. American Society of Agricultural and Biological Engineers, St. Joseph, Michigan www.asabe.org . 2021 y.
2. Yongliang Liu, Gary R. Gamble, and Devron Thibodeaux, "Assessment of Recovered Cotton Fibre and Trash Contents in Lint Cotton Waste by Ultraviolet/Visible/Near Infrared Reflectance Spectroscopy," J. Near Infrared Spectrosc. 18, 239-246 (2010)
3. Mavlyanov Aybek Palvanbaevich, Rajabov Ozod Isroilovich and Yakubova Aziza Vakil qizi, Study of the influence of the parameters of the plastic grate on elastic supports with nonlinear stiffness on the oscillation frequency, International scientific and practical conference “Innovative ideas of modern youth in science”, (2019), USA. P. 152-154.
4. Mavlyanov Aybek Palvanbaevich, Djuraev Anvar Pin drum with the polyhedral splits of raw cotton cleaner// European science review, Scientific journal № 7–8 2017 (July–August), Vienna • Prague 2017, 104-106 p.
5. Djuraev Anvar, Mavlyanov Aybek Palvanbaevich Analysis of new scheme of feeder with the effective working bodies// European science review, Scientific journal № 7–8 2017 (July–August), Vienna • Prague 2017. 106-109p.
6. Nuutinen, Yrjö; Väätäinen, Kari; Asikainen, Antti; Prinz, Robert; Heinonen, Jaakko (2010) Operational efficiency and damage to sawlogs by feed rollers of the harvester head // http://urn.fi/URN:NBN:fi-fe2016101225050, doi:10.14214/sf.165
7. RH Yang, Y Xue, WD Gao Structure and performance of color blended rotor spun yarn produced by a novel frame with asynchronous feed rollers // Textile Research Journal, 2019 - journals.sagepub.com
8. H.S.Sidhu, ManpreetSingh, YadvinderSingh, J.Blackwell, ShivKumarLohan, E.Humphreys, M.L.Jat, VickySingh, SarbjeetSingh. Development and evaluation of the Turbo Happy Seeder for sowing wheat into heavy rice residues in NW India// Field Crops Research Volume 184, December 2015, Pages 201-212 https://doi.org/10.1016/j.fcr.2015.07.025
9. Juraev Anvar and Rajabov Ozod, Analysis of the interaction of Fibrous Material with a Multifaceted Grid of the cleaner, International Journal of Recent Technology and Engineering, vol. 8, No 1, (2019), pp. 2661-2666.
10. O. I. Rajabov, A. S. Abrorov, N. I. Mirzaqulova, G. B. Zaripov, Kh. S. Ziyodullaev, An experimental study of the location of the grid bars cells installed under spiked cylinders in

a cotton cleaner from small waste, IOP Conference Series: Materials Science and Engineering, (2020), 734(1) 012073.

11. O.I. Rajabov, F.A.Fazliddin, M. H. Gapparova and J. Shakhrillo, The influence of the location of the cells on the allocation of weed impurities for cleaning raw cotton from fine waste, IOP Conference Series: Materials Science and Engineering, (2020), 734(1) 012073.
12. Rajabov O, Fazliddin K, and Salimov Sh., Substantiation of Parameters of the Fibrous Material Cleaning Zone, International Journal of Engineering and Advanced Technology, vol. 9, No 3, (2020), pp. 1052-1057.
13. Jurayev A., and Rajabov O., Experimental study of the interactional of multifaceted and cylindrical spiky cylinder in cotton cleaner from small waste, International Journal of Advanced Research in Science, Engineering and Technology. Vol. 6, Issue 3, (2019), pp. 8376-8381.
14. Rajabov Ozod Isroilovich, The influence of the mode of movement of the pieces cotton when interacting with a cotton grid, International Journal of Advanced Research in Science, Engineering and Technology (India). Vol. 6, Issue 3, (2019), pp. 8455-8381.
15. Ozod Rajabov and Ziyodullo Shodiyev, Analysis of Small Fluctuations of a Multifaceted Mesh under the Influence of Technological Load from the Cleaned Cotton - Raw, International Journal of Advanced Research in Science, Engineering and Technology, Vol. 6, Issue 10, (2019), pp. 11396-11399.
16. Anvar Djuraev and Ozod Isroilovich Rajabov, Substantiation of the main parameters of the cylinder with multifaceted spiked of the cotton cleaner from small waste, International scientific and practical conference Innovative ideas of modern youth in science, (2019), USA. P. 149-151.
17. Z. Shodiyev, A. Shomurodov and O. Rajabov. The results of the experimental nature of the vibrations of the grid cotton cleaner, IOP Conference Series: Materials Science and Engineering, 2020, 883 012169 https://doi.org/10.1088/1757- 899X/883/1/012169
18. Ozod Rajabov, Ziyodullo Shodiyev, Ikrom Inoyatov, Mastura Gapparova. Analysis of the Technological Process of Cleaning Raw Cotton from Small Trash, International Journal of Emerging Trends in Engineering Research, Volume 8. No. 9, September 2020, pp. 6022-6029.
19. A.D. Djuraev, S.L. Daliev, O.I. Rajabov Validation Of The Parameters Of The Composite Cock Drum With The Elastic Element Of The Cotton Cleaner. - Acta of Turin Polytechnic University in Tashkent, 2018.
20. R.H. Kodirovich, R.O. Isroilovich, J.D. Qahramonovna Investigation of methods of preparation of cotton and its components for storage. European science review, 2017.
21. O. Rajabov, S. Aminova. Classification of grain cleaners of cotton cleaners-raw from large lit. SCOPE ACADEMIC HOUSE B&M PUBLISHING, 2019.
22. A. Djuraev, O.I. Rajabov. Analysis Of The Movement Of Cotton Particles On A Flat Face Of A Cylinder With Multifaceted Spikes. Scientific-technical journal
23. A. Djurayev, A. Mavlyanov, S. Daliyev, O. Rajabov Development and determination of parameters for composite pin cylinder of a seed-cotton cleaner Digest of scientific and technical achievements in the realm of cotton industry of the Republic of Uzbekistan, 2017

24. A. Djuraev, O.I. Rajabov. The influence of the mode of movement of volatiles when interacting with a cotton net. Journal Turin Polytechnic University in Tashkent 1, 30-5
25. Dyakonov V.P. Ot teorii k praktike. Moskva. Solon-Press. 2010. s. 13-14.
26. Sevostyanov A.G. Metodi i sredstva issledovaniya mexaniko-texnologicheskix protsessov. M.: MGTU. 2007.-648 s.
27. Mavlyanov A.P., Djurayev A. Analiz novoy sxemi pitatelya s effektivnimi rabochimi organami // «Metalloobrabativayushiye kompleksi i robototexnicheskiye sistemi-perspektivniye napravleniya nauchno-issledovatelskoy deyatelnosti molodix uchenix i spetsialistov». 2-aya Mejdunarodnaya nauchno-texnicheskaya konferensiY. Rossiya, g. Kursk. YUZGU, 17-18 iyunya 2016 goda. S. 292-295.
28. Mavlyanov A.P. Sovershenstvovaniye konstruksiy rabochix organov pitateley xlopka i metodi rascheta osnovnix parametrov. Dissertatsiya doktora filosofii. Tashkent-2018. 120 s.