ECONOMIC EFFECTIVENESS OF THE NEW SAW DISC

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Annotation
The determination of annual economic efficiency is based on comparing the economic benefits and costs derived from the implementation of a high-efficiency saw cylinder design for the cotton fiber separation machine that separates cotton fiber from seeds.

Keywords: Saw disk, gin machine, economic benefit, efficiency, profile teeth, seed damage.

Main part. The installation of a high-efficiency saw cylinder design in the cotton fiber separation machine increases the productivity of the gin machine while reducing seed damage, preserving its natural properties, and allowing for a decrease in the amount of defective impurities in the fiber.

The total costs for re-equipping the existing saw gin machine in the proposed cotton industry enterprises with a saw cylinder that has new profile teeth instead of the current working cylinder amount to an average of 250,000 sums. This cost is incurred for the additional labor required to rotate the saw from the side.

The results of the production test are presented in Table 1.

Results of Tests

Table 1

№	Indicator name	Unit of measure	Options	
			Basic	New
1	Number of fiber splitters in the plant	Piece	2	2
2	Performance requirements for fiber splitters (average)	kg saw/hour	12	12
3	The planned production working hours of the cotton factory (3 shifts, 148 hours per week,)	Hour	2208	2208
4	Demand coefficient	-	0,15	0,15
5	Annual fiber output (forecast)	Tons	9300	9300
6	The price of 1 kW of electricity	Sums	900	900
7	Electrical energy consumed by a sawed toe separator:	kW/h	75	75
8	Preparation and installation costs	thousand sums		120
9	Labor productivity of a saw blade separator (average)	kg/saw-hour	11.7	12.7
10	Mechanical damage to the seed	%	4,5	3,1
11	Residual fiber in the seed	%	9.9	8.1
12	The aggregate of defects and impurity impurities in the fiber after sawing, of which Impurity defects	% % %	4,8 3.1 1.7	3.2 2.0 0.8

The economic efficiency derived from the implementation of new technical solutions arises due to these factors. We consider economic efficiency as the lowest level of positive results achieved.

The basic price for reconstructing equipment in the new variants of capital expenditures is set at 250,000 sums.

Additional capital expenditures for the transportation and installation of equipment (5% of the equipment price) are taken into account, which amounts to 12,500 sums.

Installing a new saw cylinder on the cotton fiber separation equipment allows for an improvement in the quality of seeds and fiber compared to the existing equipment.

We will calculate the economic efficiency derived from saving electricity.

As of 2023, the price of 1 kW of electricity for industrial enterprises is set at a single rate coefficient of N_{el} = 900 sums.

The cotton fiber separation machine consumes 75 kW of energy per hour. The new equipment has an operational efficiency of 12.7 kg of fiber per hour, which amounts to 1,651 kg or 1.651 tons for 130 machines, while the existing cylinder has an operational efficiency of 11.7 kg of fiber per hour, or 1,521 kg, or 1.521 tons for 130 machines. We assume the annual production of fiber to be 9,300 tons.

We will calculate the actual operating time of the technology:

$$T = M/Iu \quad , \qquad (1)$$

There: M gross amount of fiber, 9300 tons;

Iu – Uskuna ish unumi, tons/hour.

On existing equipment:

$$Tm = M/Iu = 9300/1.521 = 6144 \text{ hours},$$

On new equipment:

$$Ta = M/Iu = 9300/1.651 = 5632 \text{ hours}$$

Accordingly, the new equipment reduces the technology's operating time by the following amount:

T*= Tm – Ty = 6144 – 5632 = 512 hours.

The amount of electrical energy consumed during this time Ee is equal to the time of operation of the technology T* multiplied by the power consumption of the electric motor by N:

Ee = T* x N = 512 x 75 = 38400 kW/h

This indicator shows the amount of electricity saved when introducing new equipment. We will determine its monetary amount. It is equal to Ee multiplied by the cost of 1 kW/h electricity by Ne:

Is = Ee x Ne = 38400 x 900 = 34 560 000 sums.

Determining the benefits of improving the quality of processed fiber

In the basic and current options, the selling price of the fiber depends on the mass share of defects and impurities in it. According to O‘zDSt 604:2014, the fiber is divided into five classes based on the mass share of defects and impurities. The difference between the classes constitutes an amount ranging from 0.5% to 3.5%. Based on the obtained data, the mass share of defects and impurities in the fiber decreases by 0.9% after the cotton is processed. For the basis, we accept the “Standard” class as the first type of I-grade fiber. The mass share of defects and impurities in the fiber accepted by us decreases by 1.6%, and when the difference between the “Standard” and “Medium” class fiber impurities is 1.0%, in the current option, 20% of the fiber will raise its class, and when the average price of 1 ton of fiber is 17,537,500 sums, in the new option, the fiber volume will be 1.6% or 1.016 times more. The analyzed cotton cleaning plant produces 9,300 tons of fiber annually. Its income in the basic and current options is as follows:

$$S_{t1} = 9300x20\% \cdot 17537500 = 32\ 619\ 750\ 000 \text{ sums},$$
$$S_{t2} = (9300x20\% \cdot 1.016) \cdot 17537500 = 33\ 141\ 666\ 000 \text{ sums}.$$

We put the obtained calculation data into the economic efficiency calculation formula:

$$E = [(St_2 + E_n \cdot K_1) - (St_1 + E_n \cdot K_2)] \cdot A =$$

=[(33 141 666 000++0,15*0)-(32 833 836 000+0,15*262500)] *1+

= 307 790 625 sums

Total economic efficiency:

$$Eu = E + Иc = 214\ 046\ 625 + 34\ 560\ 000 = 342\ 350\ 625 \text{ so‘m}$$

According to this, the annual economic benefit from the introduction of a sawing gin machine with a saw cylinder with an updated tooth profile is 342 million sums, or 171 million sums per year for one gin, or 37 thousand sums per 1 ton of fiber produced.

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