Economic Efficiency of Using Electro technological Equipment During Revitalization and Care of Mulberry Silkworm Seed

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ABSTRACT

This article analyzes practical methods of revitalization and maintenance of mulberry silkworm seeds. Also, by using an electrotechnological method for the revitalization and maintenance of mulberry silkworm seeds by saturating the air of the incubator and worm house with negative ions using an aeroionization device during the cultivation of mulberry silkworm cocoons, the process of revitalizing the mulberry silkworm seeds was shortened, the percentage of revival increased and In the process of caring for mulberry silkworms, various diseases can be prevented and thus the possibilities of increasing cocoon productivity are presented. In addition, the calculation results of the economic efficiency achieved by using a new electrotechnological device for the process of incubation and care of silkworms are given.

Keywords: Ion, aeroionizer, silkworm, cocoon, silk, electric field, electron, corona discharge, aeroion, wormhole, climate, productivity, quality.

Introduction More than 60 countries around the world are engaged in silk cultivation, and the main share of the cultivated cocoon raw material belongs to the People's Republic of China. In the world silk market, the demand for cocoon products with a high metric number (thin) silk fiber is increasing every year. In the modern era of market relations, the production of export-oriented products competitively in the world market is of primary importance. In the silk industry, quality silk mainly depends on the quality and characteristics of the cocoon. Improving the quality of raw silk can be achieved by applying new innovative technologies to the production of silk products using various technologies (D.A. Ismatullaeva, 2021[1,2]).

It is known from the researches of U. Akhmedov (2014, 2018) that the mulberry silkworm consumes its main food in young adults and a large amount of moisture is released from its body. Carbon dioxide is also released during respiration of silkworms. As a result, the humidity in the worm house increases and the ambient air deteriorates. It has been proven that the silkworm cannot accumulate enough silk fluid if the humidity of the worm house is high and if the polluted air is not changed in time, that is, there is no fresh air. According to the author, the number and weight of cocoons wrapped in a worm house without fresh air is reduced, the weight of one cocoon is 1.95 grams.

$$I_v = 0{,}44 \cdot 10^{-12n^2}\ , \text{A} \quad (1)$$

Then the total current was determined

$$I = I_v V_{\Pi} \cdot 10^{-6}, \quad A \tag{2}$$

Vp- the volume of the building (m3).

The following (initial) expression was used to determine the relative current strength:

$$I_l = \frac{I}{l}, \text{ Amper/metr (A/m)} \tag{3}$$

where: λ is the total length of electrodes generating a corona discharge.

It was determined by experiment or formula.

$$U = \varepsilon_0 K G, \text{ kV}, \tag{4}$$

where: ⍰0-dielectric constant:

$$\varepsilon_0 = 8{,}85 \cdot 10^{-12} \frac{Ф}{м}, \tag{5}$$

Mobility of K-ions

$$K = \nu / E, \quad m^2/s \cdot kV, \tag{6}$$

where: V- the average speed of the directed movement of ions.

E- electric field intensity kV/h;

G- is a function of the geometric size and voltage of the given electrode system [13,14,15].

Based on the determined indicators, the following principle electrical scheme of the aeroionizer device for silkworm rearing rooms was used:

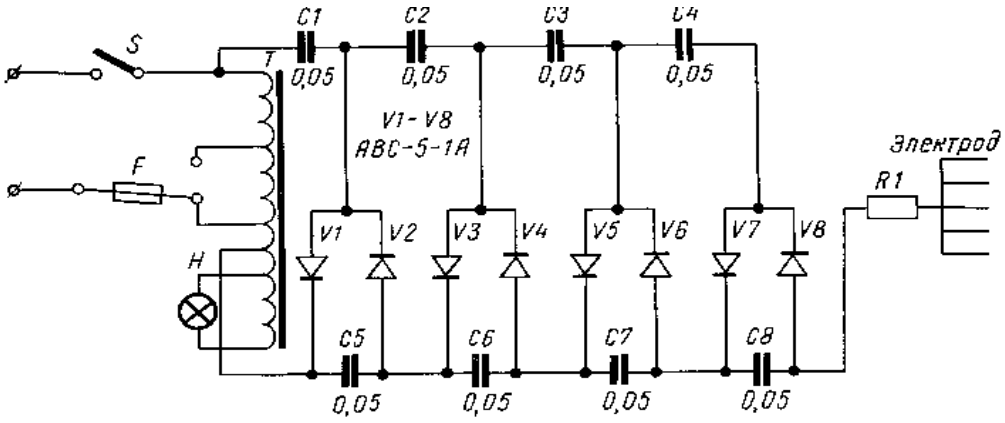

Figure 1. The main electrical scheme of the air ionization device.

Analysis of research results

An experimental model of the ionization device was developed based on the basic electrical scheme of the aeroionizer device and primary experiments were conducted. Ionized air was given in the 1st room where the experiment was conducted, in combination with ventilation for 20 minutes every 120 minutes during the revival and maintenance of silkworm seeds. In this case, 6 kV voltage was applied to the electrodes of the electrotechnological device.

Local (Ipakchi 1 x Ipakchi 2) hybrid seeds (eggs) of mulberry silkworm were put into the incubator for revival. According to the data presented in Table 1, the average viability of seeds (eggs) of local (Ipakchi 1 x Ipakchi 2) hybrids of mulberry silkworm seeds in the experiment is 97.9%, and in comparison, mulberry silkworm seeds are average recovery was 95.5%. In addition, the lifespan of mulberry silkworm seeds has been reduced by 2 days.

The revived worms were cared for according to the agrotechnical method intended for white-cocoon breeds. Worms were enumerated at age 2 in three rounds of returns, with 200 in each round of returns

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Table 1
Effect of electro-technological device on the survival of mulberry silkworm seeds

Variantlar	Zot va duragay-lar nomi	Qaytarish	Tajribaga qo‘yilgan urug‘larni soni, dona	ɔnlanma ɑn urug‘lar ɔni, dona	Jonlanish foizi, %	Inkubatsiya davrini davomiyligi, kun
1-inkubatoriya (tajriba)	Ipakchi 1	1	200	6	97,0	6
		2	200	2	99,0	6
		3	200	4	98,0	6
		o‘rtachasi	200	4	98,3	6
	Ipakchi 2	1	200	4	98,0	6
		2	200	6	97,0	6
		3	200	5	97,5	6
		o‘rtachasi	200	5	97,5	6
2-inkubatoriya (qiyoslovchi)	Ipakchi 1	1	200	10	95,0	8
		2	200	8	96,0	8
		3	200	12	94,0	8
		o‘rtachasi	200	10	95,0	8
	Ipakchi 2	1	200	10	95,0	8
		2	200	6	97,0	8
		3	200	8	96,0	8
		o‘rtachasi	200	8	96,0	8

The biological indicators collected during the care of mulberry silkworms are presented in Table 2.

According to the data presented in Table 1, the mortality of silkworms (average of three returns) in experimental variants of Ipakchi 1 hybrid silkworms was 0.3%. In the control option (in the room without the device), 3.0% was detected. When comparing the results of the study with the control option, it was confirmed that it decreased by 2.7%.

Table 2
Biological indicators of mulberry silkworm

№	Variantlar	Qaytarish	Mahalliy duragayi pakchi 1 x Ipakchi 2	
			Qurtlar o‘limi, %	Qurtlarni hayotchanligi, %
1	Qurilma qo‘yilgan qurtxona (tajriba varianti)	1	0,9	90,0
		2	0,3	93,5
		3	0,2	94,0
		O‘rtacha	**0,5±0,05**	**92,5±1,5****
2	Qurilma qo‘yilmagan qurtxona	1	4,0	86,5
		2	4,2	86,0
		3	4,4	85,5
		O‘rtacha	**4,2±0,21**	**86,0±0,01**

	(nazorat varianti)			

It is worth mentioning that no diseases were observed in the worm house where the researched device was placed. However, bacterial and yellow (nuclear polyhedrosis) diseases occurred in the worms kept in the normal room (control), albeit in small quantities.

During the care of silkworms, their mortality was found to be 0.5% in the experimental variant and 4.2% in the comparative one. The viability of silkworms was 92.5%, and in the comparative version it was 86.0%. A difference of 6.0% was found when comparing these indicators. In turn, it is no exaggeration to say that this is another positive feature of the used device.

Worm care was continued until cocooning. After the worms cocooned, the cocoons were picked, cleaned and analyzed. The results of the analysis of the productivity of cultivated cocoons are presented in Table 3.

Table 3

Indicators of productivity of cocoons

T/r	**Variantlar**	**Qay-tarish**	**Mahalliy duragayi Ipakchi 1 x Ipakchi 2**		
			Normal pillalar soni, dona	**1 dona pilla og‘irligi, g**	**Ipak-chanlik, %**
1	Qurilma qo‘yilgan qurtxona (tajriba varianti)	1	180	1,70	23,8
		2	189	1,66	23,2
		3	186	1,69	23,6
		o‘rtacha	**185**	**1,68**	**23,53**
2	Qurilma qo‘yilmagan qurtxona (nazorat varianti)	1	162	1,61	22,5
		2	166	1,63	20,9
		3	164	1,65	19,7
		o‘rtacha	**172**	**1,63**	**21,0**

In our research, productivity indicators of mulberry silkworm (normal number of cocoons, their mass, average weight of one cocoon, cocoon silkiness) were determined.

The above-mentioned local hybrid worms were able to wrap 185 normal cocoons in the experiment and 172 cocoons in the control variant. It turned out that the average weight of the cocoon was 1.69 grams in the experiment and 1.63 grams in the comparative version. In addition, 15 male and 15 female cones were selected from each variant, cocoon shell weight, cocoon weight was determined and cocoon silkiness was calculated.

It was selected visually from the experimental and control options and sent to the Margilan Institute of Natural Fibers for spinning to determine the technological parameters, and the following was found: the researched device also showed a positive effect on the silkiness of the cocoon. In this case, it was found to be 23.53% in local hybrids in the experimental variants, and 21.0% in the control variant.

According to the results of the above research, the economic efficiency of the current technology used in the revival and maintenance of mulberry silkworm seeds (up to 1-3 years) and the artificial aeroionization and ventilation of the air in the revival and maintenance of mulberry silkworm seeds was calculated based on the results obtained by the electrotechnological method. Table 4 lists the types of electrotechnological equipment for artificial aeroionization and artificial ventilation of air and the amount of energy resources used

for the revival and maintenance of 1 box of mulberry silkworm seeds.

In the current method: after opening the windows for 40 minutes every 120 minutes, it took an average of 50 minutes to reheat the room. The resuscitation period lasted 8 days, and the maintenance period lasted 7 days (up to 1-3 years). In this method, we calculate the consumption of energy resources to revive silkworm seeds using the following expression (500 kg of coal was used for heating):

$$W_i = T_k\, P_i;\ kg\ day$$

Here: T_k-days of revitalization and maintenance of mulberry silkworm seeds, T_i-daily energy resource used for heating (black coal);

$$W_{i1} = 15 \cdot 33{,}3 = 500\ kg\ day$$

Table 4

Technological process of revitalizing mulberry silkworm seeds and energy consumption

№	Texnologik jarayon	Usul	Jonlanishi (%) va xosildorligi (kg) (bir quti ipak qurti urug‘idan)	Tut ipak qurti urug‘ini jonlantirishda1 sutkadagi energiya resursi sarfi; (kg · suta)	Tut ipak qurti urug‘ini jonlantirish va parvarishlash muddati (1-3-yoshgacha); (kun)
1	Tut ipak qurtini urug‘ini jonlantirish va parvarishlash	Havoni suniiy aeroionlovchi ham sun’iy shamollatuvchi elektrotexnologik qurilma	97,9/60,0	3,33	6/7
2	Tut ipak qurtini urug‘ini jonlantirish va parvarishlash	Amaldagi usul: har 2 soatda oynalarni 25 daqiqa ochib shomollatish	95,5/56,0	8,93	8/7

Air was enriched with ions by using the proposed artificial air ionizer and artificial ventilator (at the same time as natural ventilation) with a power of 0.020 kW/h. In this case, every 120 minutes, the furnace was ventilated for 20 minutes and the furnace was reheated for 20 minutes. During the season, the electrotechnological device consumed 1.04 kWh of electricity. Also 200 kg of coal was used. We calculate the relative energy resource consumption in the revival and maintenance of silkworm seeds:

W_i2=13·15.38=200 kg·day

Today, 2,762 boxes of silkworms are revived in Baghdad district. The number of hatcheries in the district is 12, and on average 230 boxes are distributed. We determine the difference in the consumption of comparable energy resources in the incubator designed to revive 230 boxes of silkworm seeds according to the current and proposed technology:

〖ΔE〗_e=(W_i1-W_i2) ·N·Q sum,

where:- N-number of hatchery Q-price of black coal:

〖ΔE〗_e=(500-200)·12·1450=5,220,000 soums.

If in one season mulberry silkworm seeds are revived in the district and care is carried out by the electrotechnological method, the economic efficiency achieved by taking into account the additional (4 kg of cocoons) obtained from each silkworm seed:

〖ΔE〗_(q.p)=n_(q)· M·k_n,

where: n_q-number of boxes of silkworm seeds, M_q-additional cocoons, k_n-cost of cocoons with additional compensation (1 kg of cocoons cost 29,500 soums):

〖ΔE〗_(q.p)=2762·4.04·29 500 =329175160 soums.

District-wide economic efficiency obtained in one season:

ΔE=〖ΔE〗_e+〖ΔE〗 _(q.p)=329175160 +5 220 000 =334395160 soums.

334395160 soums of additional efficiency is achieved in one hatchery in one season.

If we subtract the cost of the electrotechnological device for artificial aeroionization and artificial ventilation of the air from this benefit, 3455000 soums and the cost of electricity consumed by the electrotechnological device, 306.8, the economic efficiency expected at the district level for one season at the district level is 334395853.2 soums. .

In addition to cleaning the air in the worm house from various microorganisms and bacteria, this device increases the amount of negative ions in the air, so during the care of the mulberry silkworm, the spread of diseases was not observed, and it had a positive effect on the development of the silkworm, passing them from one age to another. it was evaluated by its yield and quality cocoon wrapping.

Conclusions

1. As a result of the research, it became known that the ionic composition of the room differs from the ionic composition of the outside air due to the fact that the silkworm is kept in a completely closed building. Part of the light ions coming with the air settles on the elements of the ventilation system, and the remaining light ions inside the building are lost, turning into heavy ions. As a result, it is often observed that silkworms get sick, and their nutrition decreases.

2. Theoretical and scientific experimental studies were conducted to study the effect of artificial electric ionization on the environment of the room where silkworms are kept. In this case, it was found that in the ionized air, the susceptibility of silkworms to diseases decreases by 5-10%, their nutrition increases by 12%, and the productivity of silkworms increases by 10%.

If this device is used in the conditions of production, i.e. in the seed production enterprises, breeding stations, special worm houses and worm breeding houses of our Republic, it will be appropriate to successfully spend the silkworm care season and obtain a high-quality cocoon harvest.

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