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Analyses of the results of electro technological treatment of cotton-plant before first picking of cotton

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ABSTRACT: This paper presents the electrophysiological characteristics of plants, especially the comparative electrical resistance of the plant, exploring the electrical parameters of the plant and the technological parameters of electro technical processing of crops. To know the value of electric current passing through the topping part and rest of the cotton determining negative impact of the electro technological topping cotton plants for cotton growth and yield by electronogical method, as well as topping part of cotton, death of larvae and pest seeds, the absence of negative impact on the remaining uncoated part of cotton by the proposed spark discharge according to the method of topping are given. An electrical circuit of laboratory equipment for studying high-voltage spark electrical impact on cotton was developed.

KEY WORDS: Electrical stimulator, electro technical treatment, electrical resistivity, dielectric, grounding, topping, direct and reverse currents, physiological state, imbalance current, agrotechnical measures.

I. INTRODUCTION

Nowadays, currently, another method has been created in agriculture that has a positive effect on yield growth, this is to use electrical stimulators in agriculture. The scientists of the Republic are doing great research works to increase the crops of agriculture plants by using the latest achievements of the science and technology, and they achieve influential success.

The possibilities of existing agricultural technologies (to increase of soil fertility, creation of new productive varieties, protection against pests and diseases) are decreasing to increase crop yields. The chemicals which are used to combat pests, also the methods of chemical stimulating plants not only influence negatively to the environment, but also impact badly to the purity of the products of agriculture plants [1].

In this case, increasing the productivity of crops by opening and controlling the internal physiological capabilities of seeds and plants is major challenges of our time. It is proved by scientists of the Republic that this goal can be achieved by the electrical influence of a complex biological object - "seeds, soil and plants" [2].

The main guarantee of high cotton yield in cotton growing depends on proper and timely agricultural activities, including progressive, science-based agrotechnical measures, during the vegetation period, with the harvest without loss of harvest.

II. SIGNIFICANCE OF THE SYSTEM

The paper mainly focuses on electrophysiological characteristics of cotton-plants, especially the comparative electrical resistance of the plant and technological parameters of electrotechnological processing of crops.

III. LITERATURE SURVEY

Electro physical indicators and characteristics of plants have been studied extensively and thoroughly by D. Bos, B. Scot, A.A Klimov, E.R Hasanov, B.N Torusov, D. Clarkson, V.N Khmelev, N.V Tsuglenok, V.N Savchuk, S.N Maslobrod, A.Muhammadiev, S.Medvedev, A.Panchenko [3]. Research shows that each researcher is limited to top cotton plants by electro technological methods. There are no studies on the physiological process that results from the spark discharge that passes below the point of the cotton. As part of the research, an electrical scheme of laboratory equipment for the study of high-voltage spark discharge effects on cotton was developed.

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The aim of the study. The aim of the scientific research is to study the efficiency of electric treatment of cotton plants by optimum time during the growing season.

Results of analysis and examples. The study of the electrophysiological characteristics of plants, more precisely the comparative electrical resistance, is necessary for the discovery of electrical mechanisms of the plant and the development of technological parameters of electrotechnical processing of agricultural crops.
The following are the results of the comparative electrical resistance of the cotton before and after topping by hand, mechanical and electrotechnological method. Specific electrical resistance of untopping cotton plants was measured, measurements were made every 3 days for 9 days in dynamics [4,5].

IV. METHODOLOGY

The comprative electrical resistance of the cotton was measured as follows. In a field where cotton was planted, 25 seeds were identified in several places, and the resistance of the cotton was measured after 10 minutes, 3 days, 6 days, and 9 days before topping, using a measuring tool VR-11A[6,7].
One pole of the VR-11A multimeter to measure the electrical resistance of the top of the cotton is connected to the root stem of the cotton, the other pole to the top of the central horn, then to measure electrical resistance of topping part of cotton-plant, one pole of the measuring device to the central branch of cotton-plant and other pole of measuring device connected to the topping point. The stem diameter of the cotton in each electrical resistance was measured, from the root stem to the top of the central branch of the cotton [8-11].

The comarative electrical resistance of a cotton-plant is determined by the following

$$C = \frac{R \cdot S}{l}, \qquad \text{Om*m}$$

Where: R - electrical resistance of cotton-plant, Ω;
S- cross-sectional area of the central horn; m^2;
l - height of cotton, m.

V. EXPERIMENTAL RESULTS

The tables illustrate the relative electrical resistance of the cotton, before topping the cotton plant, after the manual topping, the mechanical topping, and by the electrotechnical method.
The relative electrical resistance of nontopped cotton-plant remained practically unchanged during the 10 days of measurements - 38.3 - 43.8Ω·м. (Table 1).

Table 1. The relative electrical resistance of the cotton, before topping the cotton plant

The number of plant	Days				
	3.08	6.08	9.08	12.08	15.08
	The comparative electrical resistance, $\Omega \cdot m$				
1	43,6	43,6	44,1	44,8	46,4
2	35,4	35,4	35,9	36,3	37,3
3	27,7	27,7	28,4	29,2	30,7
4	40,9	40,9	41,9	43,6	47,4
5	43,0	43,0	47,7	45,5	50,1
6	42,7	42,7	43,6	44,6	48,0
7	43,4	43,4	42,2	45,8	49,1
8	31,4	31,4	34,1	34,4	38,2
9	32,2	32,2	34,9	37,4	40,9
10	42,6	42,6	43,2	44,0	50,0
Average	38,3	38,3	39,6	40,5	43,8

The relative electrical resistance of hand-topped cotton changed 9 days after topping, changed bit higher than the nontopped cotton. Changes due to the physiological and biochemical processes in the cotton-plant happened in the topping proccess (Table 2).

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Table 2. The comparative electrical resistance of the cotton named Namangan 77 after topping by hand

The number of plants	The comparative electrical resistance, Ω· m				
	Before topping	10 minutes past after topping	After 3 days	After 6 days	After 9 days
1	38,3	36,3	44,0	46,2	46,5
2	47,5	40,2	41,1	46,6	57,3
3	42,1	41,2	47,6	51,1	55,5
4	54,3	52,2	55,2	58,1	67,1
5	42,6	42,1	47,5	53,5	63,3
6	58,0	55,5	60,0	68	69,6
7	45,0	44,2	48,3	62,5	72,3
8	49,3	47,0	53,2	61,5	68,5
9	46,5	43,1	47,8	52,9	58,9
10	48,7	45,8	51,7	54,3	61,8
Average	47,2	44,7	44,6	55,5	62

Table 3. The comparative electrical resistance of the cotton named Namangan 77 after topping by mechanical method

The number of plant	The comparative electrical resistance, Ω· m				
	Beforetopping	10 minutes past after topping	After 3 days	After 6 days	After 9 days
1	45,6	43,4	49,1	57,2	62,5
2	42,5	41,6	45,4	48,7	54,1
3	45,1	43,4	48,1	54,6	62
4	50,8	49,1	53,3	47,0	53,5
5	50,0	49,0	56,7	65	77,3
6	40,1	37,2	45,4	49,8	56,0
7	35,8	33,3	38,9	45,4	55,4
8	48,2	47,2	56,3	60,6	70,9
9	42,7	40,1	48,8	55,5	57,9
10	40,0	39,0	43,1	51,2	62,0
Average	44,1	40,0	48,5	53,5	61,1

The comparative electrical resistance of cotton-plants by topping mechanically consisted of 44,1 – 61,1Ωm, which is equivalent to the relative resistance of hand topping cotton (47.2 - 62 Ωm) (Table 3).

It has been determined that the average comparative electrical resistance of topping cotton by electrotechnological method decrease from 42,5 to 15 Ω*m in ten minutes after topping (resistance of topped cottons by hand fall from 47,2 to 44,7; when topped mechanically it changed from 44,1 to 40 Ω*m)

The comparative electrical resistance of topped cottons by electrotechnolical way consisted of 35,2 in three days, 69,8 in 6 days, 91,0 Ω*m in 9 days after topping.

This indication shows that it is two times and more times than the comparative electrical resistance of topped cotton by hand and mechanical way, this can cause deep biochemical changes by the result of topping the cotton in electrotechnological way (Table 4).

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Table 4. The comparative electrical resistance of the cotton named Namangan 77 after topping by electrotechnological method

The number of plant	The comparative electrical resistance,Ωм				
	Before topping	10 minutes past after topping	After 3 days	After 6 days	After 9 days
1	28,9	10,4	23,6	60,0	84,1
2	39,9	12,7	36,1	71,5	102,5
3	38,4	16,4	38,5	58,1	88,6
4	36,8	18,7	34,6	64,9	81,0
5	43,3	21,8	42,6	75,9	106,0
6	34,3	12,1	33,4	75,3	86,7
7	44,0	21,0	41,7	97,0	101,1
8	42,0	16,0	40,2	75,3	96,5
9	44,1	22,4	34,3	63,8	87,8
10	31,3	19,4	26,7	56,6	82,2
Average	42,5	15,0	35,2	69,8	91

One pole of the high-voltage power source is connected to the top of central stem's branch, other pole to the one of the terminal ofmilliampere meter, the otherterminal of milliampere meterconnected to the upper part of the cotton, One pole of the high-voltage power source is connected to the ground (Figure 1).

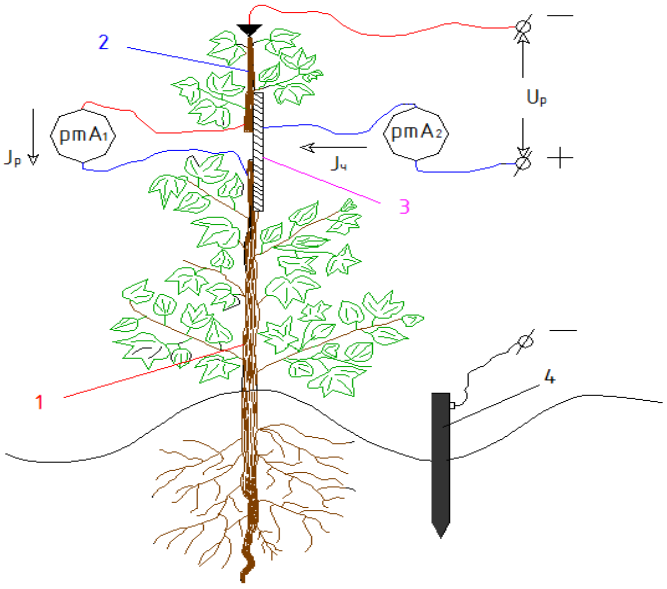

Fig 1. The method of measuring the electric current which passed through the cotton during topping by electrotechnical method

1 – cotton;2 – topping part;3 – dielectric;4 – ground connector;

The plant is connected to high-voltage power source with 2000,3000 and 4000 V voltage.The result of measure was given in the Table 5.

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Table 5. Electric current through topping and other part of the cotton-plantsby electrotechnical topping of cotton

The number of the plant	The topped part of the cotton or the distance between electrodes, mm	The voltage between electrodes,V	Electric current,mA		The ratio of currents (I_T /I_{NT})
			Electric current which passed through the topped part of the cotton, (I_T)	Electric current which passed through the rest upper part of the cotton, (I_{NT})	
1	2	3	4	5	6
1	50	2000	95	1,0	95,0
2			90	1,0	90,0
3			96	1,1	87,2
4			100	1,1	90,9
5			95	1,0	95,0
1	50	3000	110	1,15	95,6
2			115	1,20	95,8
3			110	1,15	95,6
4			120	1,20	96,0
5			110	1,25	91,6
1	50	4000	180	1,90	94,7
2			195	2,00	97,5
3			200	2,05	97,0
4			185	1,95	94,8
5			190	2,00	95,0

According to the results of the experiments, the current passes through the topped part of the cotton-plantin process of electrotechnological topping 90-100 more times than nontopped part of them.
Electrotechnological topping doesn't damage to the rest of the cotton intensely.Biochemical processes in cotton-plant are accelerated and yields are reduced by 5 to 7 days. It makes physiological proccessin two level in the plant as a result of spark discharge current which passed from the point of the topping point of the cotton.
The physiological process in the first level makes the cotton stimulates, as a result, cottongreen bolls get ripen quickly. In the second stage of the physiological process, according to the field experience, green leaves of the cotton become reddish, exactly, the separation joint part which is between the branch and the leaf get empty and leaves become to fall. This process shows that spark discharge makes the cotton give the chance of defoliation.
As part of the scientific research, the electric scheme of experimental setupwas made for studying the impact of the high voltage discharge current to the cotton-plants.(Figure 2)

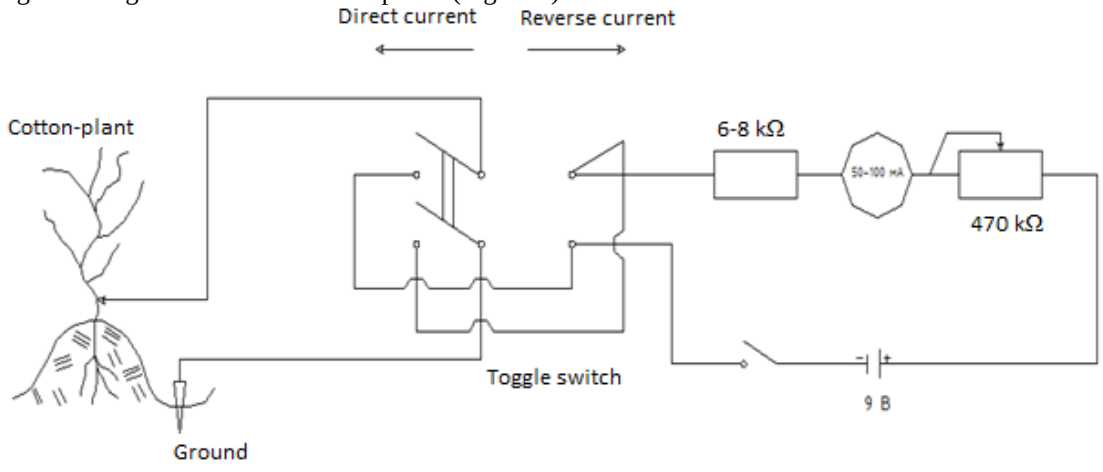

Fig 2.Electrical scheme of measuring apparatus for direct and reverse currents passing through plant and soil circuits

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Also, afterpassing electrical impact on the cotton field in the vegetation period by electrotechnological method, depending on the physiological state of the imbalance current from cotton, developed an electrical scheme of measuring instruments to study the electrotechnological effects on the physiological state of cotton. The measuring tool has been tested in field experiments, indicating whether or not this physiological process changes when the current is transmitted to the cotton.If healthy, the current does not change at all, and if ill, it shows imbalance.

VI. CONCLUSION AND FUTURE WORK

Topping the cotton is the main agrotechnical measure which makes the crops faster. This measure is carried out when 2-4 green bolls are formed on the lower branches of the cotton, or when there are 16–20 tubers in each cotton.Cotton topping is carried out manually, mechanical or chemical way, each of which has its own advantages and disadvantages.For instance, topping the cotton in mechanical way is higher productive than topping by hand, but mechanical topping has to be done several times, because all cottons are not the same. According to the analsys of the research, although electrotechnological topping has given positive result, this method hasn't been put into practice yet because of technical issues.

The results of the electrotechnical method of cotton topping have been thoroughly analyzed and the research work on elimination of defects in electrotechnical processing of cotton during the vegetation period has been continuing at JSC "BMKB-Agromash" since 2018.

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