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# The use of electropulse treatment of agricultural plants for various diseases

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**Abstract.** The paper considers measures to combat diseases spread by nematode viruses that infect the root system of tomatoes and cucumbers grown in closed ground and sown areas of the Republic of Uzbekistan, by installing electrical impulse discharges. The use of electropulse treatment is discussed, which does not affect the cost of harvesting, i.e. this technology does not have the results of dangerous consequences, but on the contrary, that the method of electropulse treatment effectively fights against carriers of the disease with worms. The results of experimental studies of the treatment of pathogenic plants with electropulse current discharge are analyzed, recommendations for the use of this technology are given.

## 1. Introduction

The yield of crops is estimated by the amount of products produced on the sown areas. The increase in yield depends on the bonito of the land, the correct selection and placement of existing varieties and species of plants that are immune to natural influences and diseases, the creation and cultivation of new hybrid plant cell cultures, the development and implementation of new advanced technological techniques.

There are a number of objective and subjective measures to implement this growth; The eradication of weeds and the diseases they spread is one of them. According to experts, cultivated plants are currently seriously damaged by weeds and pathogens that live on these weeds and spread diseases. Therefore, at present, one of the urgent problems of crop production is, first of all, the clearing of crop areas from weeds and the diseases they spread.

The main purpose of the complex of technical measures carried out on sown areas with the help of advanced equipment and technical means is the timely processing of sown areas at the required level to achieve high yields. This complex is aimed at centralized provision of agricultural machinery and technical means, effective use of equipment, timely and high-quality implementation of technological processes of crop processing and further increase in yields. [1–9]. Nevertheless, this problem has not yet been solved, as it is negatively affected by the high cost of renting machines and mechanisms, a sharp increase in the cost of fuels and lubricants.

On the open and closed (greenhouses) sown areas occupied by cotton, cereals and vegetables - melons of the created farms of the republic there are various diseases. In recent years, due to nematode disease, crop yields have suffered serious damage [1–9]. Especially serious damage is caused to crops of vegetables, melons and crops in closed ground (greenhouses).

Tomatoes and cucumbers are the most used food products and in terms of production volumes occupy the second place in the republic after potatoes. The reason for the increased use of tomatoes and



cucumbers is the presence in them of vitamins and trace elements necessary for humans, as well as their simple canning. Nematode worms that develop in the roots of plants prevent the cultivation of these products. The following species of nematodes are often found in the sown areas of the republic: worms of the northern nematode *Meloidogyne hapli* Chitw, which are part of the group *Meloidogyne* Goel, nematodes of the southern *Meloidogyne incognita* Kof et White, Nematodes of the Javanese *Meloidogyne javanica* Treual and sand or nut nematodes *Meloidogyne arenaria* Neal.

Normally, viruses found in contaminated soil invade the root system of the plant, lay eggs, and develop by feeding on plant roots nutrients [1, 4, 7, 9]. Analysis of the literature [10-24] as well as their own studies confirm that, in addition to the defeat of plant infections, nematodes also lead to a decrease in yields. Nematodes cause very high damage to agriculture, for example, for potatoes this damage is 80%, for greenhouse tomatoes and cucumbers - 60%. Eliminating the effects of nematode infestation accounts for 30% of the costs in agriculture.

## 2. Methods and materials

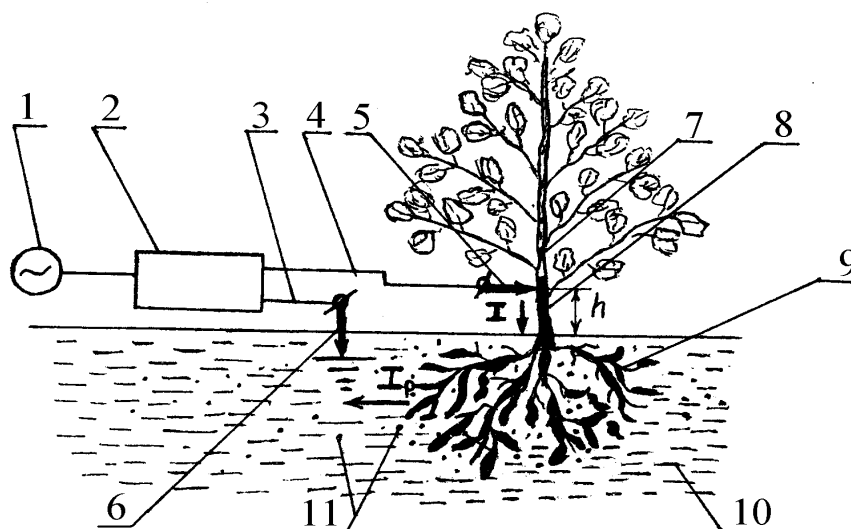
On the basis of many years of research at the Tashkent Institute of Irrigation and Agricultural Mechanization Engineers, a new technology has been developed to combat the nematode, as well as an electric pulse installation for its implementation [1, 3, 4, 7, 9]. The proposed technology is distinguished by the fact that it is economical, environmentally safe, effective in performing existing plant treatment techniques. The use of this technique does not affect the cost of harvest and, most importantly, it has no dangerous consequences. It is used in the summer after harvest or during autumn cultivation of the land.

Rich in mineral fertilizers, root crops of tomatoes and cucumbers are a source of nutrition for the nematode, which has the property of rapidly developing and destroying the structure of root crop cells, creating cavities and uneven ribbed nodes in them. In the III-IV periods of development of the body of mature female nematodes located in the root system of plants become round and cone-shaped. Mature female nematodes lay from 100 to 1500 larvae. The number of larvae laid by developed female nematodes can reach 3500 pieces. On the sown areas of vegetables in Central Asia and the Caucasus, the female nematode lays larvae from 3 to 7 times a year [1, 7, 9].

## 3. Outcomes

Experimental studies on the use of electropulse discharges to combat nematode virus vectors were conducted at experimental sites in the Gulistan cooperative farm in the Kagan district of Bukhara region. Field experiments on electropulse treatment of virus vectors were conducted with the participation of an entomologist of a cooperative farm [1, 7, 9].

In Fig. 1 shows a diagram of the effect of electropulse discharges on a plant infected with nematode worms.



**Figure 1.** Electropulse discharge treatment circuit an infected plant.

Where, 1 – power supply; 2 – high-voltage device; 3–4 – high-voltage electrical cables; 5–6 – electrodes; 7 – plant stem; 8 – infected roots of the plant; 9 – earth (clay); 10–11 are nematode larvae.

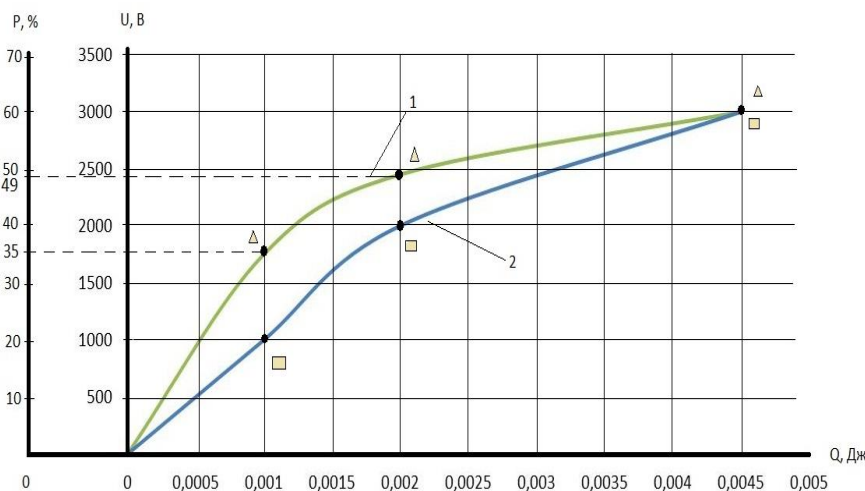
The order of work according to the scheme is: 1: a positive electrode is brought to the bottom of the stem, the negative electrode is connected to the ground. After connecting the device to the power source, an electric current begins to flow between the stem of the plant and the roots. High-voltage discharges of electric current pass through nematodes, infected plant roots and microorganisms spreading the disease. Current pulses act on the membrane plant cells and the surface of the nematode virus, which leads to the destruction and destruction of the root crop system and the membrane of nematode viruses. This method is used after harvesting infected plants. Table 1 and Figures 1 and 2 show the results of experimental studies of the treatment of pathogenic plants of tomatoes and cucumbers with electropulse current discharge.

**Table 1.** Resource requirements by component

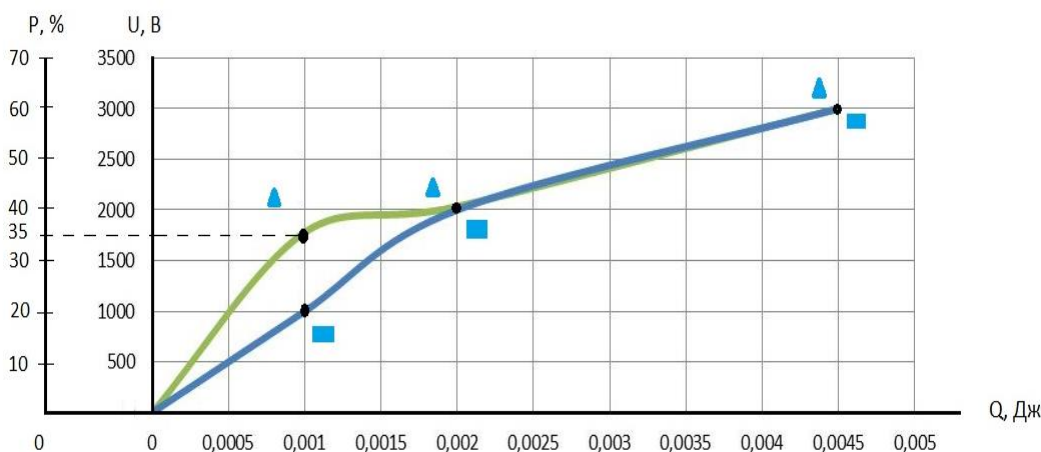
Results of experimental studies of treatment of pathogenic plants of tomatoes and cucumbers with electropulse current discharge

No. p.	Experiment	Voltage, V.	Processing time, sec.	Pulse Energy, J. S.	Degree of neutralization, %
Tomatoes					
1	1	1000	0,2	0,0010	35
2	2	2000	0,2	0,0020	49
3	3	3000	0,2	0,0045	60
Cucumbers					
4	1	1000	0,2	0,0010	35
5	2	2000	0,2	0,0020	40
6	3	3000	0,2	0,0045	59

The dependencies of the degree of neutralization on the pulse voltage  $U = f(Q)$  and the pulse energy  $P = f(Q)$  for tomatoes and cucumbers are given in the characteristics of Figures 2, 3.



**Figure 2.** Graph of the change in the voltage value from the pulse time of the electropulse current discharge for tomatoes.



**Figure 3.** Changes in the magnitude of the voltage from the pulse time of the electropulse current discharge for cucumbers.

#### 4. Discussion

Analysis of the results of the studies showed that in 60% of infected plants, the nematode virus was destroyed with the following parameters of electropulse treatment: discharge voltage  $R_p$  3 kV, current flow time  $p$  0.2 s, discharge energy  $=\tau=Bp$  0.0045 G. Considering the above, we can conclude that the method of electropulse treatment effectively fights against carriers of the disease with worms [1, 3, 7, 9]. Electropulse discharges act on the upper layers of the soil, where the main root system of the plant is located, on the lower layers, in which inactive (sleeping) nematode larvae can be found, discharges act to a lesser extent.

If in areas without crop rotation, and without neutralizing measures, in 2-3 years the same crop is sown again, the number of nematodes can grow to 1 billion per 1 m<sup>2</sup> of land. Some plants increase the species of nematodes and especially nematodes with parasitic properties. The increase in the number of nematodes in the soil greatly harms crop yields.

#### 5. Findings

Based on the studies performed and the results obtained, it will be possible to draw appropriate conclusions that the applications of the proposed device show a decrease in the number of nematode

virus and larvae in the ground treated with electropulse discharges, compared with untreated areas by 65-68%. According to the results of repeated checks, the number of nematode larvae before sowing the second growing season of plants was 15%.

Experimental studies of the treatment of pathogenic plants of tomatoes and cucumbers with electropulse current discharge have shown their effectiveness at the parameters of electropulse treatment: discharge voltage  $U_p = 3\text{kV}$ , current flow time  $\tau_p = 0.2\text{ s}$ , discharge energy  $W_p = 0.0045\text{ G}$ .

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