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Effect of Electrical Treatment of Seed Tubers on the Growth, Development, and Yield of Potato Cultivars

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Annotation: The study was conducted to investigate the effects of electrical treatment applied to seed tubers on the growth, development, yield, product quality, and seed-tuber characteristics of potato cultivars. Analytical results showed that pre-planting electrical exposure accelerated sprouting by 3–4 days depending on the variety, increased plant height by 3–7 cm, and raised the number of stems per plant by 0.3–0.4. Electrical treatment also expanded the assimilation surface area by up to 2000 m² per hectare, reduced the expression of viral disease symptoms, and ensured an additional yield of 2.6–3.5 tons per hectare.

Keywords: potato, electrical treatment, plant height, developmental stages, biometric indicators, viruses, viral diseases, productivity, yield, yield fraction.

Materials and methods. Field experiments were conducted during 2024–2025 at the experimental fields of the Samarkand Institute of Agri-Innovation and Research and the Samarkand Experimental Station of the Research Institute of Vegetable, Melon Crops and Potato Production. The objects of study were the potato cultivars Arizona, Evolution, and Sante.

Seed tubers were pre-sprouted for 50–60 days under light conditions at a temperature of 20–25°C. Before planting, the tubers were treated using a portable, hand-operated radio-impulse biostimulator (RIBA). The device consisted of two lamps operating at 220 V and an antenna that emits low-frequency electromagnetic impulses.

Phenological observations and biometric measurements during the growth and development of the cultivars and samples were carried out according to the NIIQX methodology (M., 1967).

Viral infections were assessed visually and identified for specific viruses. Infection with potato viruses X, S, M, and Y was determined twice during the growing season (at budding and flowering) using serological analyses based on Methodological Guidelines for Diagnosing Viral and Mycoplasma Diseases (M., 1977).

Experimental data were processed statistically following the methodology of B.A. Dospekhov (1979).

Results. Phenological observations showed that electrical treatment (electrostimulation) accelerated plant emergence by 3–4 days, depending on the cultivar. In the treated variant, plant height increased by 3–7 cm, the number of stems per plant increased by 0.3–0.4, and the number of leaves—and consequently the assimilation leaf area—increased by an average of 2000 m² per hectare.

The results on the effect of electrical treatment on viral infections demonstrated that the application of this technique reduced not only the incidence of latent viral infections but also the expression of visible disease symptoms. For instance, in the cultivar Evolution, the proportion of plants exhibiting clear virus symptoms was 6% in the electrically treated variant, compared to 8% in the control. Similar trends were observed in the other cultivars studied (see Table 1).

Table 1. EFFECT OF ELECTRICAL TREATMENT ON THE GROWTH, DEVELOPMENT, AND YIELD OF POTATO CULTIVARS (2023–2024)

№	Indicators	Varieties					
		Sante		Arizona		Evolution	
		Treated	Contro	Treated	Control	Treated	Control
1	Days from planting to emergence, days	20	22	19	23	20	24
2	Plant height, cm	82	75	68	73	86	79
3	Number of main stems, pcs	4.1	3.8	3.9	3.5	4.3	3.9
4	Number of leaves, pcs	127	119	120	109	128	116
5	Number of lateral stems, pcs	21	17	16	12	23	14
6	Assimilation area (at flowering), thousand m²/ha	38	36	34	32	40	38
7	Virus infection rate, % A)Manifest (visible) form B)Latent (hidden) form	6 26	8 31	8 20	11 25	5 18	7 21
8	Productivity, g/plant	540	516	530	480	585	548
9	Marketable yield, g/plant	34,7	31,2	32,0	29,4	37,2	35,3
10	Yield structure, % < 30 g 30–80 g > 80 g	5,0 74,2 20,8	6,1 76,4 17,5	6,8 73,5 19,7	7,0 77,8 15,2	4,8 70,1 25,1	5,4 71,3 23,3

In the experiments, the potato cultivar Sante produced an average of 540 g per plant in the variant where seed tubers were exposed to electrical treatment prior to planting, compared to 516

g in the control. For the cultivar Arizona, the corresponding values were 530 g and 480 g, while for Evolution, yields amounted to 585 g and 548 g in the treated and control variants, respectively.

The increase in yield, depending on varietal characteristics, resulted in an additional 2.6 t/ha (Arizona) to 3.5 t/ha (Sante). Across all cultivars, the improvement in yield was primarily associated with a decrease in the proportion of small tubers (<30 g) and an increase in the proportion of large tubers (>80 g).

Electrical treatment increased the yield of all potato cultivars studied (Sante, Arizona, and Evolution). Both the average tuber mass per plant and the total yield per hectare were higher compared to the control. The increase in yield was mainly due to a reduction in the number of small tubers and an increase in the number of large tubers.

Conclusion. Electrical stimulation of seed tubers before planting accelerated the progression of phenological stages and enhanced biometric indicators, including an increase in assimilation surface area. It also reduced the incidence of viral diseases. As a result, the yield increased by 7.4% in the cultivar Arizona and up to 13.2% in the cultivar Sante, demonstrating the effectiveness of electrical treatment as a technological element in potato cultivation.

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