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APPROVAL OF PARAMETERS OF IRRADIATION REGIME OF SEED POTATO WITH UBN USING THE METHOD OF MATHEMATICAL PLANNING OF EXPERIMENTS

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Annotation:
Optimal values of the parameters studied in fundamental and single-factor experimental studies on UBN exposure to DNA at the cellular level and UBN treatment of potato parenchyma were determined using the method of mathematical planning of multifactorial experiments.

In order to ensure the food security of the population of the earth by increasing the quality indicators of the seeds of agricultural crops, including potato seeds, ecologically clean, disease and pest resistant seeds and potatoes for the consumer in the world, energy and resource efficient and high productivity agrotechnologies and their implementation creation and introduction of technical means to production takes one of the leading positions.

When conducting research, the following were selected as factors affecting the quality of work: power of lighting lamps, W; UV radiation time, minutes; UV radiation height, centimeters Table 1 lists the factors, their conditional definition, variation (change) intervals and level. They were determined based on the results of theoretical studies and one-factor experiments. The influencing factors were conditionally defined (coded) as follows: X1 – Power of lighting lamps, W; X2 – UV radiation time, min; X3 – height of UB radiation, cm.

The main factors and their limits of change

Table 1

T/p	Naming of factors	Designation		Change limit			Change interval
		Real	Encoded	-1	0	+1	
1	Power of lighting lamps, W	P	X_1	30	60	90	30
3	UV exposure time,min	$t_{убн}$	X_3	5	10	15	5
2	UV emission height cm	$H_{убн}$	X_2	20	30	40	10

Experiments were conducted with UBN with wavelength λ=253.7 nm and λ=300 nm.

In addition, experiments were conducted using lamps together. Table 2 shows the factors, their conditional definition, variation (change) intervals and level.

The main factors and their limits of change

Table 2

T/p	Naming of factors	Designation	Change limit			Change interval
			-1	0	+1	
1	Power of lighting lamps, W,	X_1	P=30 λ=254 P=30 λ=300	P=60 λ=254 P=30 λ=300	P=30 λ=254 P=60 λ=300	
2	UV exposure time,min	X_2	10	20	30	40
3	UV emission height cm	X_3	5	5	10	15

It was assumed that the effect of the factors on the evaluation criteria is completely described by a second-order polynomial, and the experiments were conducted according to the Hartley-3 plan [3].

The weight of seed potatoes planted in the spring and the number of tubers were accepted as evaluation criteria for conducting multivariate experiments.

The data obtained from the experiments were processed according to the "PLANEX" program [3,4]. Cochran's criterion was used to evaluate the uniformity of variance, Student's criterion was used to evaluate the value of regression coefficients, and Fisher's criterion was used to evaluate the adequacy of regression models.

a) The results of the experiment were processed in the indicated order, and the following regression equations were obtained, which adequately represent the evaluation criteria, that is, the number of nodes:

- by the number of tubers of total potatoes, pieces;

$$Y1=+43,512-0,814X_1+1,245X_2+0,761X_3-6,859X_1X_1+0,499X_1X_2-$$
$$-0,263X_1X_3-4,886X_2X_2-0,213X_2X_3-3,133X_3X_3 \quad (1)$$

- large potatoes by the number of tubers, pieces;

$$Y2=+11,664-0,464X_1+0,542X_2+0,446X_3-2,136X_1X_1+0,223X_1X_2-$$
$$-0,355X_1X_3-2,134X_2X_2+0,635X_2X_3-0,441X_3X_3 \quad (2)$$

- average potatoes by the number of tubers, pcs;

$$Y3=+6,146-0,314X_1+0,024X_2+0,466X_3-0,731X_1X_1+0,048X_1X_2-$$
$$-0,038X_1X_3-0,731X_2X_2-0,603X_2X_3+0,969X_3X_3 \quad (3)$$

бregression equations that adequately represent the weight of nodes:

- total potatoes by tubers weight, kg;

$$Y4=+1,468+0,005X_1-0,030X_2-0,022X_3-0,360X_1X_1+0,044X_1X_2+$$
$$+0,011X_1X_3-0,188X_2X_2+0,011X_2X_3+0,014X_3X_3 \quad (4)$$

- large potatoes by tubers weight, kg;

$$Y5=+0,956+0,005X_1-0,030X_2-0,022X_3-0,360X_1X_1+$$
$$+0,044X_1X_2+0,011X_1X_3-0,186X_2X_2+0,012X_2X_3+0,014X_3X_3 \quad (5)$$

average potatoes by tubers weight, kg;

$$Y6=+0,678+0,004X_1-0,033X_2-0,033X_3-0,353X_1X_1+0,036X_1X_2+$$
$$+0,013X_1X_3-0,179X_2X_2+0,015X_2X_3+0,020X_3X_3 \quad (6$$

According to the analysis of regression equations (1) and (6), all factors had a significant effect on the evaluation criteria.

When determining the optimal values of the parameters, the regression equations (1) - (3) were solved on the PC "Intel i5" using the Excel program "search for a solution". The regression equations were solved under the condition that the number of potato tubers has a maximum value, and the values of the factors that ensure the fulfillment of this condition were determined. The obtained results are presented in Table 3.

Acceptable values (by the number of nodes)

Table 3.

X_1		X_2		X_3	
Encoded	Natural , W	Encoded	Natural , cm	Encoded	Natural , m
1	P=30 λ=254 P=30 λ=300	-0,635	23,65	0,3556	16,7779
0	P=60 λ=254 P=30 λ=300	0,125	31,25	0,1172	15,5860
-1	P=30 λ=254 P=60 λ=300	0,051	30,50541	0,7788	18,8938

Using the above method, the regression equations (4) - (6) of potato tubers were solved under the condition that the weight of potato tubers has a maximum value, and the values of the factors ensuring the fulfillment of this condition were determined. The obtained results are presented in Table 4.

Acceptable values (by the weight of the pods)

Table 4.

X_1		X_2		X_3	
Encoded	Natural W	Encoded	Natural , cm	Encoded	Natural , m
1	P=30 λ=254 P=30 λ=300	0,066	30,66	0,6270	18,1350
0	P=60 λ=254 P=30 λ=300	-0,051	29,49	0,5974	17,9870
-1	P=30 λ=254 P=60 λ=300	-0,226	27,73936	0,4914	17,4568

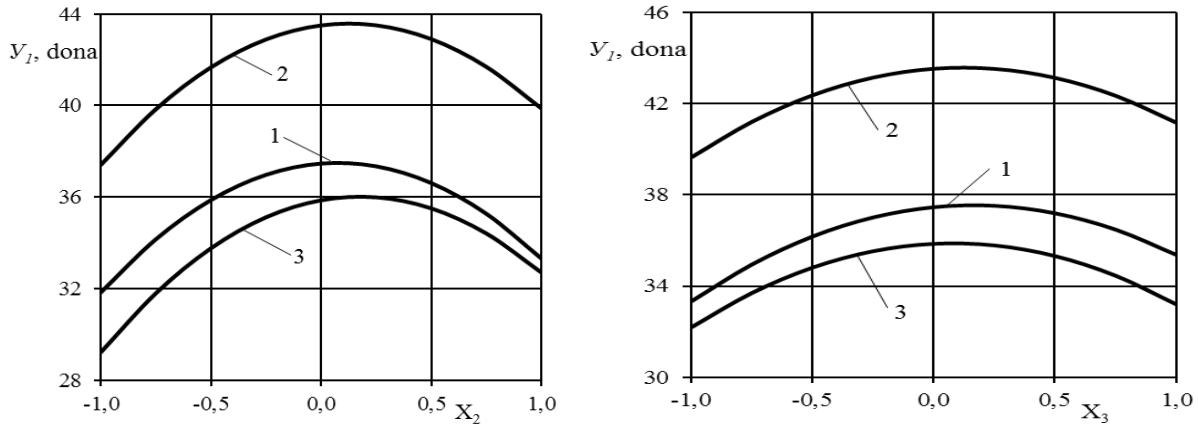

Figure 1. Dependence of factors X2 and X3 on the total number of potato tubers

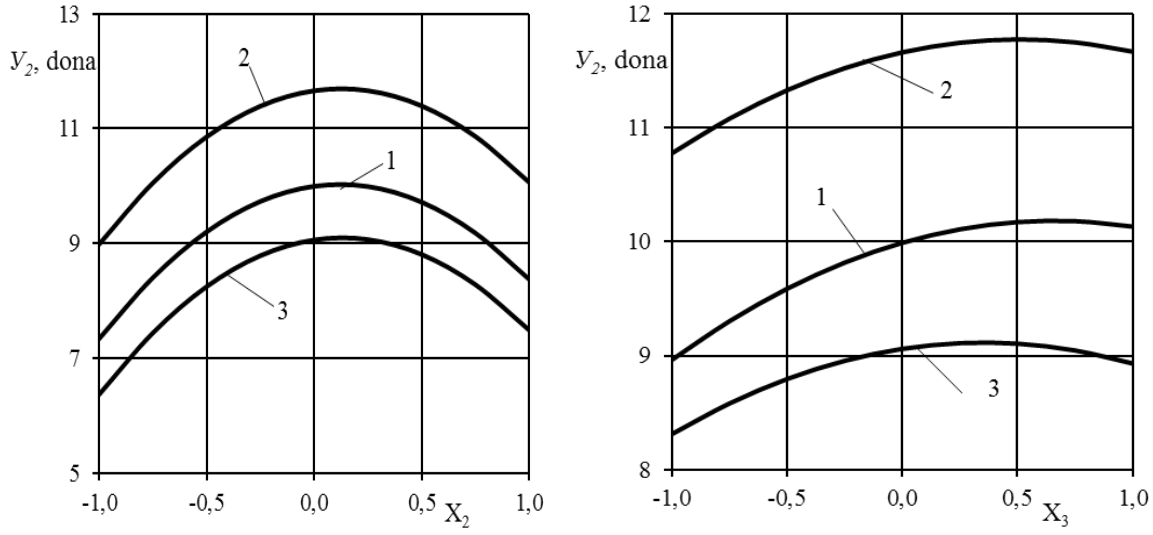

Figure 2. Dependence of factors X2 and X3 on the number of tubers of large potatoes

Summary

Based on one-factor experiments, a series of regression equations were obtained that adequately represent the evaluation criteria of potatoes planted in the spring season with the help of electrotechnology and potatoes planted in the summer season with the help of electrotechnological processing of these potatoes as seeds, that is, the number and weight of tubers.

In one-factor field experiments under production conditions, parameters of optimal mode of electro technological processing of potato seeds to soil and plants in spring and summer season were determined.

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