IJRD International Journal of Research & Development Organisation
ISSN-3785 - 0855
JOURNAL OF COMPUTER SCIENCE AND ENGINEERING

DETERMINATION OF RATIONAL VALUE REW-SPACING OF DISKS AND OPERATING MODES OF THE SKATING RINK DISK OF THE ADAPTATION

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Abstract: The article presents an experimental study of the determination of rational parameters values between racks is determined disks, the vertical load on the disk, the translational speed of qualitative indicators of the unit. Rational values of size of disks and operating modes of a disk skating rink defined the use of a method of mathematical planning of multiple-factor experiments and the joint solution of the received regression equations.

Key words: mode, rate, tillage, fraction size, width, disk load.

INTRODUCNION

Now intermediate (repeated) cultures in the Republic are cultivated after cleaning winter grain (generally wheat). Thus on a surface of the soil there is a significant amount of the vegetable remains, weeds and their seeds. Employment of moldboard or minimum processing of the soil under intermediate (repeated) cultures leads to the increased contamination of crops during their vegetation and therefore to decrease in amount of the nutrients consumed by the cultivated plants that oppresses the last and reduces their productivity. Besides, the leafy layer mass remaining on a surface of the soil and in its top layers leads to deterioration of quality indicators of work of seeders and tools for interrow processing the row of cultures.

In modern world practice the adaptation at the same time with plowing are applied to a surface treatment of the soil with reverse plows, and their main working body is the disk sealing skating rink with a wedge-shaped profile of a working surface of a disk in combination with which various types of skating rinks, the cultivating of the condensing and leveling workers of bodies are applied [1,2].

The analysis of the stated shows that for the soil climatic conditions of the Republic with the farmlands big percent of the spaces occupies average and low-contour maps with average and heavy soils on mechanical structure, most we accept hinged option of the adaptation design of which will provide high maneuverability of the unit; it is possible to apply disk skating rinks with a wedge-shaped profile of a working surface to consolidation of the lower horizons of an arable layer, dyeing of soil blocks and large lumps, and for high-quality performance of the chosen technological process of the combined processing of the soil, it is necessary to find the additional working bodies providing application of consolidation of the top horizon of an arable layer, alignment of a field and creation of the leafy layer horizon on its surface [1,2].

MATERIAL AND METHODS

Rational values of size row-spacing of disks and operating modes of a disk skating rink defined the use of a method of mathematical planning of multiple-factor experiments and the joint solution of the received regression equations.

Parameters of the adaptation have been chosen from regime for it's investigation of received regression equations vertical loading of a disk and forward speed as its works which are most influencing quality and energetic indicators were chosen from regime parameters of the adaptation for researches.

As functions of a response 10 cm and the traction resistance of the adaptation falling on 1 m of width of capture of a skating rink since the first has restriction according to agrotechnical requirements (not less than 80%) are accepted percentage

of soil fractions less than 25 mm in size in the horizon 0…10 sm, and the second has essential impact on a consumption of fuels and lubricants and productivity of the unit.

On the basis and aprioristic information and results of one-factorial experiments the levels and intervals of a variation of factors given in table 1 were chosen.

Table 1.

Levels and intervals of a variation of factors.

Factors	Unit. measurements	The coded designation of factors	Variation intervals	Levels of factors		
				Lower (-1)	basic (0)	top (+1)
1. Size row-spacing disks, *l*	sm	X_1	5	15	20	25
2. Vertical load of a disk, Q	N/piece	X_2	37,5	537,5	575,0	612,5
3. Forward speed, V	м/s	X_3	0,5	1,5	2,0	2,5

Thickness (30 mm), corner of sharpening (60^0) and diameter of a disk (400 mm) of a disk were accepted without change. Corners of the installation condensing (26^0) and a bend leveling (140^0) parts of the equalizer, income corner to the soil of the mulching plates (154^0) and size of their row-spacing (10 cm) also didn't change.

Experiments were given with use of three disk workers of skating rink bodies and according to the accepted levels of sizes row-spacing of disks of 15 cm, 20 cm and 25 cm. Width of capture of the equalizer with the mulching plates equaled 33 cm, 43 cm and 53 cm. These values are accepted taking into account thickness of a disk of a skating rink and need of the movement a trace of the extreme mulching plates and disks. Thus on each equalizer the quantity of the mulching plates (n_n) which is determined by a formula was established

$$n_n = \frac{2 \cdot l}{l_1} + 1, \quad (1)$$

i.e. at l of equal 15 cm, 20 cm, 25 cm and l_1 =10 cm, the quantity of the mulching plates made respectively 4 pieces, 5 pieces and 6 pieces.

Assuming that the most fully influence of factors on function of a response will describe a polynom of the second order, the plan of B_3 [3,4] was realized.

For reduction of influence of uncontrollable factors by function of a response on sequence of carrying out experiments it was appointed with use of the table of random numbers.

RESULTS AND DISCUSSION

As a result of realization of a matrix and the plan of B_3 the regression equations which are adequately describing are received:

Percentage of fractions less than 25 mm in size, %

$$U1 = 82{,}975 - 6{,}363X_1 + 1{,}947X_2 + 7{,}837X_3 - 6{,}372X_1^2 + 1{,}821X_1X_2 - 2{,}421X_1X_3; \quad (2)$$

the traction resistance falling on 1 m of width of capture of the adaptation, kN/m.

$$U_2 = 1{,}367 - 1{,}113\ X_1 + 0{,}104\ X_2 + 0{,}240\ X_3 - 0{,}068\ X_1 X_3 + 0{,}075\ X_2 X_3. \quad (3)$$

Calculation of coefficients of regression, checking of reproduction of process and hypothesis of adequacy of the received equations were carried out by a well-known technique on the personal computer of the Pentium.

The hypothesis of uniformity of dispersion at identical number of repetitions of experiences was estimated by means of Kohren's criterion (T_o), the importance of coefficients of regression determined on Students' criterion, and adequacy of model

of process determined on Fischer's (*F*) criterion. Values of coefficients of reproducibility and adequacy are given in tab. 2 from which it is visible that experiments are reproduced, and regression models (2), (3) adequately describe processes with confidential probability of 95% and don't contradict the obtained experimental data, as $K_{tabl}>K_{pict}$, "$F_{tabl}>F_{pict}$".

The table value of criterion of Student for 5% a significance value put 2,048 for both regression models (2 and 3) describing process.

The analysis of the equations of repression shows that the row-spacing of disks happens to increase in size, decrease in fractions less than 25 mm in size and traction resistance (U_2) in the capture of a skating rink falling on 1 m width, and at increase in vertical loading and forward speed of the movement these indicators increase. Moreover, the speed factor, and less essential - vertical loading has more essential impact on functions of a response.

Table 2

Checking of reproducibility and adequacy of models.

№	Designation of function of a response	Dispersions		Freedom degrees				Criterion			
		Reproducibility	Adequacy	Reproducibility		adequacy		to Kokhren's, K		Pischers, F	
				V_1	V_2	V_1	V_2	Tabl	Calculation	Tabl	Calculation
1	U_1	7,141	2,557	2	14	7	28	0,33	0,229	2,36	1,074
2	U_2	$9,9*10^{-3}$	$2,05*10^{-3}$	2	14	8	28	0,33	0,187	2,29	0,622

From the equations it is visible the influence that on the U_1 function interaction of factors (X_1) and vertical loading (X_2), row-spacing of disk (X_1) and the speed (X_3),

and has impact on the U_2 function – interactions of factors of row-spacing (X_1) and the speed (X_3) of vertical loading (X_2) and speed (X_3). These interactions have impact on intensity of response of the functions change them depending on the level of interaction component factors is fixed. So, for example, at smaller values of size of disks (X_1) with increase in the forward speed (X_3), function of a response (U_1 and U_2) increase with bigger intensity, than at great values of X_1 or at great values of vertical loading (X_2) change of speed leads to more intensive change of U_2 and vice versa, to a t.a of function of a response the row-spacing of disks (X_1), vertical loading (X_2) and speed of the movement (X_3) are in difficult dependence on size

The joint solution of the equations of regression (2) and (3) had been received optimum values of factors in the studied range of their change (Table 3) proceeding from U_1 > 80% and U_2--->min.

Table 3

Optimum values of factors

Factors	Unit of measurements.	Conventional sigh	Code values	Natural values
l	sm	X_1	-0,2508	18,75
Q	N/piece	X_2	-0,990	538
V	м/s	X_3	-0,3175	1,84

From tab. 3 it is visible that the optimum size of a high-speed operating mode of the adaptation has low value which predetermines the small productivity of the unit. That's why the optimization at preset values of forward speed was performed.

CONCLUSIONS

Results are given in Table 4

Table 4

Rational values of parameters

V (X_3), м/s		l(X_1), см		Q (X_2), N/piece	
Coded	natural	coded	natural	coded	natural
-1,0	1,5	There is no decision			
-0,5	1,75	-0,3	18,5	0,0	564
0	2,0	0,1	20,5	-1,0	527
+0,5	2,25	0,4	22,0	-1,0	527
+1,0	2,5	0,6	23,0	-1,0	527

Thus during the work at speeds of movement of 1,75…2,50 m/s the demanded maintenance of soil fractions less than 25 mm in size in the horizon 0…10 cm at the minimum traction resistance will be provided if: l = 18,5…23,0 cm and Q_d = 527…564 N/piece.

In the range of forward speeds of 2,25…2,5 m/s (Table 4) are available rational value of disks (l = 22,5 cm) entering **l** =22…23 cm which multiply and will provide to width of capture of the case (45 cm), at a rational arrangement of a skating rink, influence of its adjacent disks serially on a hollow and a height of estuarine a surface of a cross profile of an arable land. Therefore we accept this value row-spacing of disks l = 22,5 cm as rational. Besides, at such size the row-spacing in the range above the marked speeds (V=2,25…2,5 m/s) doesn't change rational values of necessary vertical load of a disk of equal 527 N/piece, to a t.a for a three-case plow capture of 135 cm wide the necessary quantity of disks will be 7 pieces, and vertical loading of the kg Q_k=347 adaptation.

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