DETERMINATION OF ACCEPTABLE VALUES OF COMBINED MACHINE WINDING PARAMETERS

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Abstract: *This study aims to determine the optimum values for the winding parameters of the combination machine. Winding parameters play a crucial role in the performance and efficiency of machines, especially those involving complex combinations. The study applies a comprehensive analysis to determine the optimum values for various winding parameters, taking into account factors such as speed, voltage and material compatibility. Through experimental studies and analytical modeling, research aims to establish a set of guidelines or criteria that define acceptable ranges for these parameters. The findings help improve the reliability and efficiency of integrated machine systems, and provide valuable insights for engineers and practitioners to optimize packaging processes.*

Key words: *Combination, speed, analytical modeling, optimal value, range, physical-mechanical, regression.*

INTRODUCTION

In our country, crops such as winter wheat, which are planted in areas freed from repeated crops, and vegetables and potatoes, which are sown as repeated crops in areas freed from it, are planted in new, i.e. directly before sowing, plowed areas. In this, plowed land is prepared for row planting and then planting activities are carried out.

In our republic, the preparation of plowed land for planting is carried out separately many times with toothed and disk harrows and various levelers. This leads to the deterioration of physical and mechanical properties of the soil, a lot of moisture loss from the soil , and an increase in fuel consumption and other costs. The analysis of the scientific achievements achieved at the world level and the researches previously carried out in our Republic shows that these shortcomings in the preparation of newly plowed land for planting include all the technological processes of preparing the soil for planting (full compaction of the driving layer, leveling and grinding of the surface of the field) in one pass through the field. that is, it can be eliminated by developing a machine that ensures that it

is fully processed in one pass before planting. The use of such a machine in row tillage before planting on newly plowed land increases productivity, improves the quality of tillage and prevents moisture loss, while reducing fuel consumption and other costs due to the addition of technological processes and the reduction of the number of aggregates passing through the field. it allows to plant crops on time and collect the harvest.

Conduct of work. On the basis of the above, a machine for plowing plowed land was developed and its experimental copy was prepared and tested [1;2].

This article describes the results of the multifactorial experiments conducted to determine the optimal values of the parameters of the gear-plate roller of the developed combined machine.

Table 1 lists the factors, their definitions, change intervals and levels.

When conducting multi-factor experiments, the level of soil compaction in layers 0-10, that is, the amount of fractions smaller than 25 mm in size (Y_1, %), density (Y_2, g/cm^3) and specific resistance to the roller (Y_3, N /m) was accepted. In this case, it was considered that the influence of the factors on the evaluation criteria is fully explained by the second-order polynomial, and the experiments were conducted according to the V_4 plan. [2].

In order to reduce the influence of uncontrollable factors on the evaluation criteria, the sequence of experiments was established using a table of random numbers [3]. In addition, in the experiments, for all options, the angle of installation of the roller plates in relation to its axis was assumed to be 15º.

Table 1

Determination of factors, levels and intervals of change

of factors to be named	Measurement unit	Find the factors mark - niche	Factors - ng average of variation	of factors levels		
				lower (−1)	main (0)	high (+1)
1. The diameter of the plate roller, *D*	cm	X_1	5	35	40	45
2. The number of plates installed on the reel, *n*	piece	X_2	2	8	10	12
3. Vertical load applied to the plate roller , *Q*	N/m	X_3	100	700	800	900
4. Unit movement speed , *V*	km/ h	X_4	2	5	7	9

Research results. The data obtained in the experiments were processed according to the program "PLANEXP" developed in the experiment planning laboratory of the National Institute of Scientific Research. 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.

The results of the experiment were processed in the indicated order, and the following regression equations were obtained that adequately represent the evaluation criteria:

- **according to the degree of soil compaction in the 0-10 cm layer (%)**

$Y_1 = +80.136 - 0.980X_1 + 1.674X_2 + 1.830X_3 + 2.494X_4 +$

$+ 0.614X_1X_1 - 0.588X_1X_2 - 0.583X_1X_3 - 0.583X_1X_4 - 0.936X_2X_2 -$

$-0.587X_2X_3 - 0.588X_2X_4 + 0.498X_3X_3 - 0.592X_3X_4 - 0.652X_4X_4$ (1)

- **by the density of the soil in the 0-10 cm layer (g/cm^3)**

$Y_2 = +1.121 - 0.030X1 + 0.026X_2 + 0.033X_3 - 0.060X_4 +$
$+0.017X_1X_1 + 0.024X_1X_2 + 0.055X_1X_3 - 0.014X_1X_4 - 0.038X_2X_2 +$
$+0.006X_2X_3 + 0.010X_2X_4 + 0.013X_3X_3 + 0.013X_3X_4 + 0.040X_4X_4$ (2)

- **according to the relative resistance to the pull of the sheet roll (N/m)**

$Y_3 = +214,534 - 16,926X_1 + 14,870X_2 + 14,593X_3 +$
$+27.315X4 + 13.299X_1X_1 + 1.937X_1X_4 + 8.799X_2X_2 -$
$-3.368X_3X_3 + 1.937X3X4 + 7.799X4X4$ (3)

It can be seen from the analysis of the obtained regression equations that all factors had a significant impact on the evaluation criteria. Regression equations are solved from the conditions that criterion U_1 is greater than 80%, criterion U_2 is in the range of 1.1-1.2 g/cm^3 and criterion U_3 has a minimum value, and the rolling speed is in the range of 6.0-8.0 km/h was found to have the following parameters.

So, in order for the rollers to ensure high-quality processing of the field surface with low energy consumption at working speeds of 6.0-8.0 km/h, the diameter of their discs is 39.38-40.06 cm, the number of installed plates is 10 pieces and the vertical loading is applied to it. It should be in the range of 0.83-0.86 kN. In this case, the degree of compaction of the soil is 80.48-82.03%, the density of the soil in layers of 10-20 cm is 1.12-1.18 g/cm^3 and the relative resistance of the roller to the pull

It is 214-239 N/m.

Summary

In order for the roller with toothed plates to ensure high-quality processing of the field surface with low energy consumption at working speeds of 6.0-8.0 km/h, the diameter of their discs is 39.38-40.06 cm, the number of installed plates is 10 pieces and vertical loading is applied to it. It should be in the range of 0.83-0.86 kN. In this case, the degree of compaction of the soil is 80.48-82.03%, the density of the soil in layers of 10-20 cm is 1.12-1.18 g/cm^3, and the relative resistance of the roller is 214-239 N/m.

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