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Determination Of Parameters Affecting The Performance Of Tracto Tires

Dots. Makhmudjon Melibaev, student Jaloliddin Yigitaliyev Adkhamjon ugli.

Namangan engineering construction institute.

Abstract: *The article discusses the main issues in operating conditions, fuel consumption, slippage and the average resource of tractor wheeled pneumatic tires.*

Keywords: *machine, tractor, unit, wheel, pneumatic, tires, pressure, fuel, slipping.*

Introduction. Agricultural tractor tires are expensive and wear-out elements of the running systems of machine-tractor units. During the service life of a universal row-crop tractor, they are renewed two or three times. The cost of tires in cotton farms is 10-15% of the cost of operating a machine and tractor fleet [1].

Specific soil and climatic conditions for the operation of tractors in cotton growing are one of the main reasons leading to a decrease in durability and an increase in the cost of maintaining agricultural tractors [2,3].

The planning and implementation of the experiment was carried out in accordance with the methodology described in the literature [1,2]. In accordance with the task of industrial research of the process of operating a tractor with a modernized tire from a technological operation for cultivation when processing cotton under operating conditions, a plan of a multifactor experiment was developed (2^4) in

Table 1

Multivariate Experiment Design

S/n	Factor	Speed tractor movement, m/s	Kryukovoe an effort, N	Support angle surfaces glad.	Angle of installation of the lug, glad.
		V	$P_{кр}$	α	β
1	Variables	X_1	X_2	X_3	X_4
2	Main level	3	11350	0,170	0,611
3	Upper level	3,5	14000	0,240	0,785
4	Variation interval	0,5	2250	0,070	0,174
5	Lower level	2,5	9300	0,105	0,436

Methodology: As an output factor (V1, V2, V3 and V4), the following were determined:

- the value of the half-transverse deviation from the specified trajectory, slipping, the amount of fuel consumption, the average resource of the operating time and wear of the tire tread, the number of steering influences during the period of correcting the trajectory of the tractor.

In accordance with the data in Table 1, we find the coefficients of the regression equations using the least squares method. In this case, the significance of the coefficients is checked using the Student's test with a confidence level of 95%. As a result of processing the experimental data on an IBM PC / 2 computer, adequate regression equations were obtained [4,5].

To create the hook resistance of the MTZ-80X tractor (more than 120 operating hours), the KKhU-4V cultivator was used, the operation of which was carried out on the II and III cultivation on the soil, under processing in the structure of light chestnut loamy with angles of aegate inclination in the intervals (0.80- 0.11), (0.11-0.16), (0.16-0.20), (0.20-0.23) rad. The choice of an experimental rut with a length of (30-40) m was carried out with the values of the hardness of the supporting surface (0.4-0.7) MPa - soil, with a moisture content of (10-16)% at a depth of 0.15 m.

Analysis and results: The analysis of the functional characteristics of the working elements of the upgraded sample of the propulsion unit in the operational mode was carried out in accordance with GOST 30745-2001 (ISO 789-9-90) [3,5].

The experimental data were processed using Microsoft Excel 2010, statistica10.

As shown by the verification of the obtained regression models, carried out according to the F-criterion of Fisher:

for tread wear: $F = 1.5 < Fcr = 30$;

for wheel slip: $F1 = 10 < Fcr = 25$;

for an average resource: $F2 = 60 < Fcr = 80$;

for fuel consumption $F3 = 1.5 < Fcr = 244$;

All the obtained expressions adequately describe the processes under study and response surfaces are constructed, giving an idea of the factor space, which makes it possible to carry out a formological study of the processes under study. (pic.1).

Slipping:

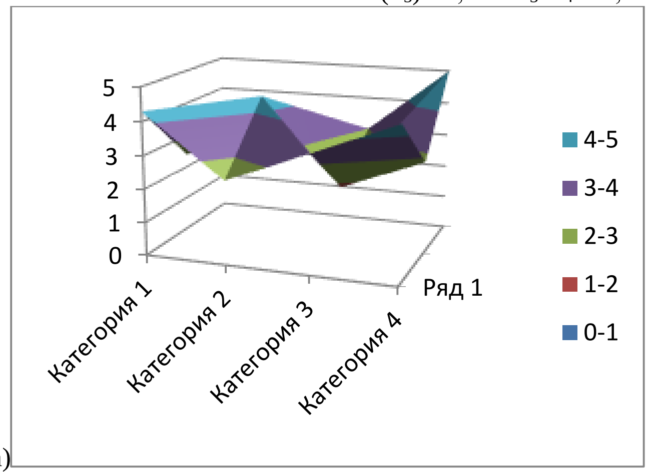
$$Y_1=48,087 - 0,859\cdot X_2 - 1,083\cdot X_3 -1,663\cdot X_4 + 0,638\cdot X_1\cdot X_2 - 0,274\cdot X_1\cdot X_3 + 0,222\cdot X_1\cdot X_4 + 0,687\cdot X_2\cdot X_3 + 0,553\cdot X_2\cdot X_4 - (F_1) - 0,461\cdot X_3\cdot X_4 + 1,027\cdot X^2{}_2\cdot + 1,6\cdot X^2{}_3 + +1,837\cdot X^2{}_4 . \quad (1)$$

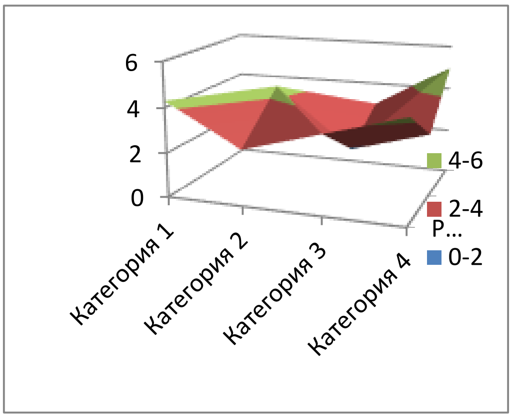
Average service life:

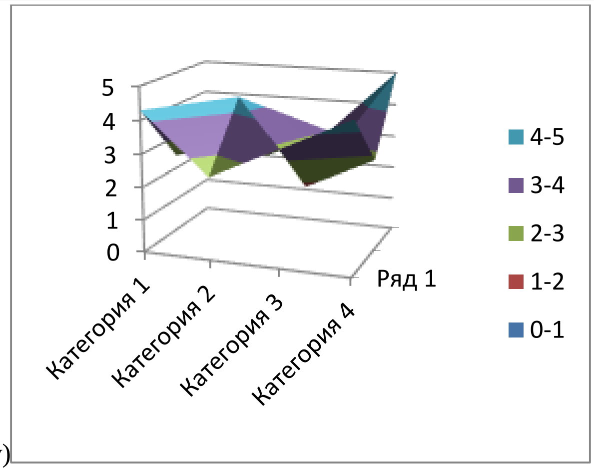
$$Y_2=48,087 - 0,859\cdot X_2 - 1,083\cdot X_3 -1,663\cdot X_4 + 0,638\cdot X_1\cdot X_2 - 0,274\cdot X_1\cdot X_3 + 0,222\cdot X_1\cdot X_4 + 0,687\cdot X_2\cdot X_3 + 0,553\cdot X_2\cdot X_4 - (F_2) - 0,461\cdot X_3\cdot X_4 + 1,027\cdot X^2{}_2\cdot + 1,6\cdot X^2{}_3 + +1,837\cdot X^2{}_4 . \quad (2)$$

Fuel consumption per hour:

$$Y_3=48,087 - 0,859\cdot X_2 - 1,083\cdot X_3 -1,663\cdot X_4 + 0,638\cdot X_1\cdot X_2 - 0,274\cdot X_1\cdot X_3 + 0,222\cdot X_1\cdot X_4 + 0,687\cdot X_2\cdot X_3 + 0,553\cdot X_2\cdot X_4 - (F_3) - 0,461\cdot X_3\cdot X_4 + 1,027\cdot X^2{}_2\cdot + 1,6\cdot X^2{}_3 + +1,837\cdot X^2{}_4 .$$

a) 

b) 

v) 

Pic.1. Change a-slip (δ); b-average service life (X cf); c) -hour fuel consumption (Gt) depending on the output parameters

Discussions: The obtained results of the study for the maximum transverse slope of the egat recommended by the manufacturer (0.24 rad) show that the value of transverse displacements in the work of movement with designated protective zones for the experimental tractor is 15-22% less than the value of the slip of the serial tractor (provided: φ = 0.5-0.6, a decrease in the number of influences on the controls - 27%, in the range of inclination angles of the egate of the supporting surface 0.1-0.17 rad). In addition, due to the smaller tires of the wheels, the experimental tractor consumes less fuel by 7.1% than the serial one [6,7,8].

Comparing the experimental indicators of the serial and modified model, it is possible to state the specificity of the driving mode of the tractor with the developed tread in a given technological operation. If on surfaces with angles up to 0.17 rad for different soils both tractors, both serial and modernized, behave within the framework of agrotechnological requirements adequate to the critical limits of the design ranges in a full-factor experiment, then at angles 0.17-0.25 rad the mode the movement of the experimental tractor tends to decrease the amplitude of oscillations in comparison with the serial model, i.e. “Yaw” the tractor starts to be minimized, which is not observed with a standard tread [9,10].

Conclusions. Thus, when the tractor enters the range of angles 0.17-0.25, the intervals of operating parameters will be respectively: fuel consumption 16-21 kg / h; the amount of slipping is 10-23%, which corresponds to the steady movement of the unit during the cultivation operations when processing cotton.

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