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DETERMINATION OF GRAVITY RESISTANCE OF THE PAWL STRUCTURE DEVICE BETWEEN COTTON ROWS IN ONE PASS OF THE AGGREGATE

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ABSTRACT

The article describes the results of theoretical research to determine the traction resistance of the device, which forms a longitudinal pawl between cotton rows in one pass of the unit. This leads to a relative decrease in productivity due to high energy and resource consumption in the process of pawl formation between rows and additional density between rows. Typically, the work performed during the sowing and cotton growing periods is almost the same in all regions, differing only in the reclamation condition of the soil, mainly in the preparation of land for planting and irrigation of cotton, the number of irrigations of cotton. The two sides of the pawl are sanded and compacted using skies 6 to prevent the soil on both sides of the pawl being formed from flowing and invading the cotton.

KEYWORDS: *Pawl, Mechanization, Aggregate, Energy Saving, Frame, Overturned Surface Working Body, Protective Sheath, Grinding-Compacting Ski, Productivity.*

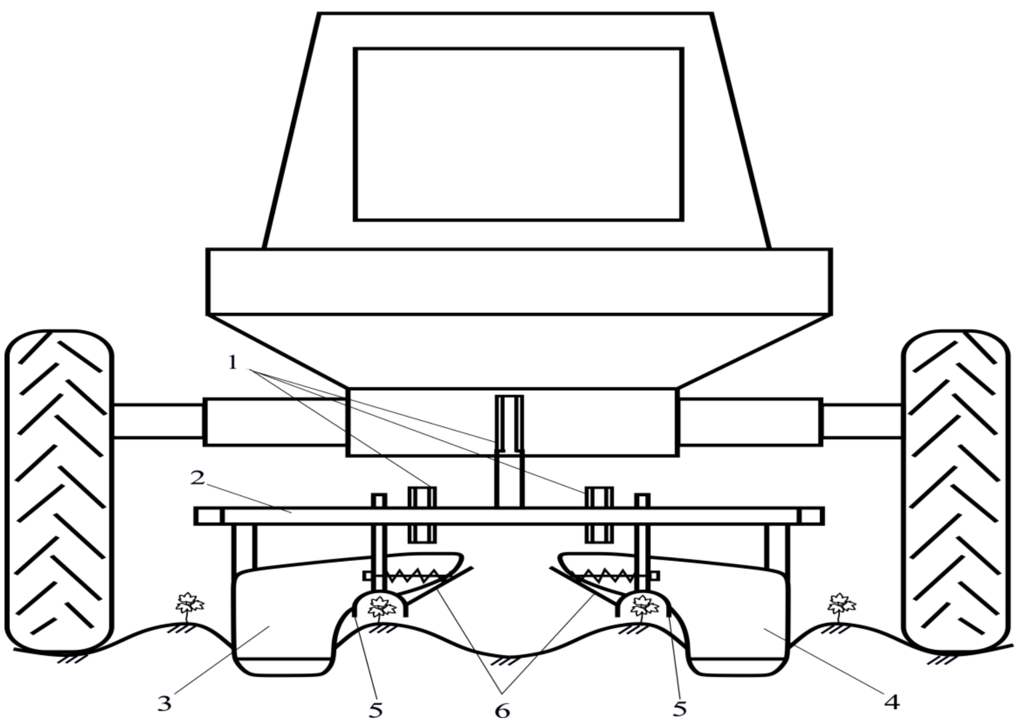
INTRODUCTION

Irrigated lands in the cotton-growing regions of the country are divided into three zones according to natural-climatic and soil conditions, mechanical composition of the soil, technology of its cultivation and types of machines used, agro-technical requirements to them. Typically, the work performed during the sowing and cotton growing periods is almost the same in all regions, differing only in the reclamation condition of the soil, mainly in the preparation of land for planting and irrigation of cotton, the number of irrigations of cotton [1]. For example, in the cotton-growing areas of the third zone, during the cotton-growing period, preparatory work is carried out on the irrigated areas before the first irrigation, longitudinal and transverse pawls are formed between the rows due to the slope of the field and its relative unevenness [2].

Today, the formation of the longitudinal pawl between the rows of cotton is carried out in two passes of the unit by means of overturning working bodies. This leads to a relative decrease in productivity due to high energy and resource consumption in the process of pawl formation between rows and additional density between rows. As a solution to the above problem, a device consisting of inverting working bodies that form a longitudinal between cotton rows in one pass of the aggregate was developed (Pic. 1). The frame 2, equipped with a tie device 1, and the right 3 and left 4 overturning working bodies and cotton sheets, which protect the seedlings from being buried by a pile of soil thrown from the overturning surface, and the skis, which grind and compact both sides of the pawl 6 composed of [3].

When the device moves along the furrow with the help of a tractor, the soil on the two side furrows is lifted up along the right 3 and left 4 rolling surface working bodies and the cotton seedlings are lifted over the sheath 5 protecting the soil from the rolling surface and rolled to the middle furrow. The two sides of the pawl are sanded and compacted using skies 6 to prevent the soil on both sides of the pawl being formed from flowing and invading the cotton.

This paper presents the results of theoretical research to determine the gravitational resistance of a longitudinal pawl-forming device between cotton rows.



1 -tie device, 2- frames, 3, 4- right and left overturning surface working bodies, 5- protective sheaths, 6-grinding-compacting skis

Picture 1. General scheme of the device that forms a longitudinal pawl between cotton rows

The gravitational resistance of the device can be summarized as follows

R = R_1 + R_2 , (1)

where R is the total gravitational resistance of the device, N;

R_1 - traction resistance of the surface of the device, N;

R_2 - traction resistance of the device grinding-compaction skis, N.

Expressing R_1 and R_2 in (1) by the physical and mechanical properties of the soil and the parameters of the device, we obtain the following final result

$$R = 2\left\{ Tt_T \frac{B}{\sin\gamma} + \left\{ \left[(B_м - 2\Delta)^2 - B_л^2\right] tg\psi_ё - h_э\left[\frac{B_м}{\pi}\sin\frac{2\pi\Delta}{B_м} + (B_м - 2\Delta)\right]\right\} \times \right.$$

$$\times\left\{\frac{\tau_c}{2\cos\frac{1}{2}(\alpha+\varphi_1+\varphi_2)}\left[\sin\frac{1}{2}(\alpha+\varphi_1+\varphi_2) + f\cos\frac{1}{2}(\alpha-\varphi_1-\varphi_2)\cos\alpha\right] + \right.$$

$$\left. + \rho\left[\frac{gc\cos^2\alpha\sin(\alpha_1+\varphi_1)}{2\sin\gamma\cos\varphi_1} + V^2\frac{\sin\alpha\sin\gamma\sin(\alpha_1+\varphi_1)}{\cos\varphi_1}\right]\right\} + f\rho g l_o \left.\right\} +$$

$$+\left\{\frac{2B_ч h_o^2 q_o\left[1+\kappa_v v(\cos\beta - \sin\beta tg\varphi_1)\sin\beta\right]\times\sin(\beta+\varphi_1)}{\sin 2\beta\cos\varphi_1}\right\}. \quad (2)$$

where T-is the hardness of the soil, Pa;

t_T-thickness of lemex blade, m;

B-coverage of working bodies with a rolling surface, m;

γ-fixing corner of overturned surface working body lemex relatively to furrow wall, degree;

α-fixing corner of overturned surface working body lemex relatively to furrow root, degree;

$B_м$-width between cotton rows, m;

Δ-width of the protection zone of cotton rows, m;

$\psi_ё$-lateral fracture angle of the soil, degrees;

φ_1-a worker of the working body lemex with a rolling surface of the soil angle of friction to the surface, degrees;

$h_э$-deepness of furrow between cotton rows, m;

φ_2-angle of friction of soil with soil, degree;

f-coefficient of friction of the soil on the working surface of the lemex;

τ_c-specific resistance of soil to displacement, Pa;

ρ-soil density, kg/m^3;

c-length of the working surface of the lemexi of the overturning working body, m;

$\alpha_1 = arctg(tg\alpha \sin\gamma)$, degree;

l_o-length of the working surface of the overturner, m;

V-is the speed of movement of the device m/s;

$B_ч$-width of the device grinding - compaction skis, m;

h_o-depth of immersion of grinding-compaction skis on the slopes of the floor, m;

q_o-coefficient of static volume compaction of soil, N/m^3;

κ_v-coefficient of proportionality, s/m.

T=1,2·106 Pa, $t_т$=0,001 m, B=0,26 m, γ=55^o, $B_м$=0,6 m, Δ=0,1 m, $\psi_ё$=60^o, $h_э$=0.1 m, τ_c=2·104 Pa, α=30^o, φ_1=30^o, φ_2=40^o, *f*=0.57, ρ=1300 kg/m^3, c=0,15 m, g=9,81 m/s^2, l_o=0,8 m, $B_ч$=0,3 m, h_o=0,03 m, q_o= $3\cdot10^6$ N/m^3, k_v=0,1 s/m, the calculations performed by expression (2) show the resistance of the device to gravity at speeds of 1,7-2,2 m/s 8,22-8,37 showed that kN.

CONCLUSION

Studies have shown that the tensile resistance of the longitudinal pawl forming device between cotton rows in one pass of the unit is at a speed of 1,7-2,2 m/s. 8,22-8,37 showed that kN.

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