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Provide Working Position of Device Wiper Surface Bodies Which Create Longitudinal Pawl between Cotton Rows in Determined Deepness

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ABSTRACT

The article presents the results and method of study the process of formation of longitudinal ridges (pawls) in the rows of cotton. A schematic diagram on installation of the formation of longitudinal ridges (pawls) in cotton rows pacing is developed.

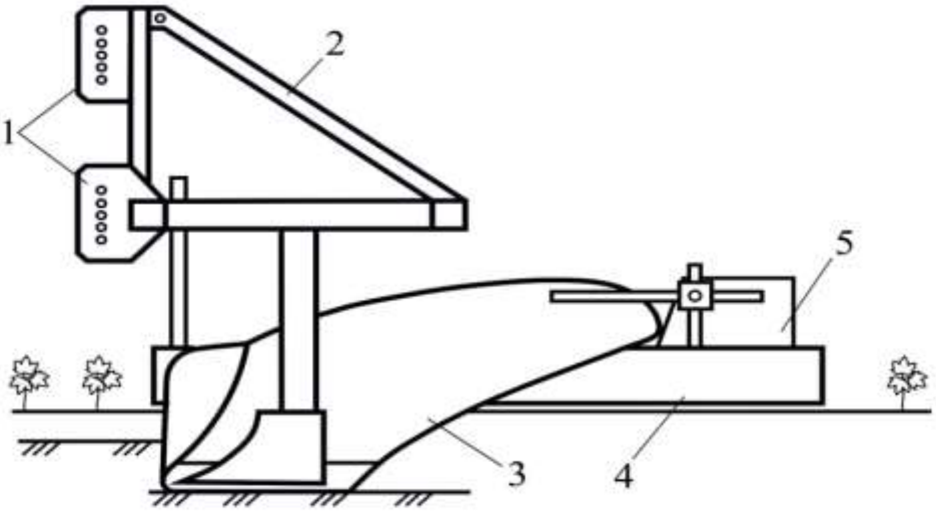
KEYWORDS: Pawl, pawl-forming devices, slope angle of soil, one pass of the unit, soil volume

INTRODUCTION

Today, the cluster method, which specializes in the production of made products, rather than cotton raw, is being introduced in the country. This, in turn, is a process that covers all stages, from preparing the land to sow seeds to the production of finished products from cotton raw grown. It is known that irrigated lands in cotton-growing areas are divided into three zones according to natural-climatic and soil conditions, mechanical composition of the soil, technology of its cultivation, types of machines and agro-technical requirements to it [1.5].

In the cotton-growing areas of the third zone, longitudinal and transverse pawls are taken between the rows due to the slope and unevenness of the field to irrigate the cotton before the first irrigation during the cotton growing period. The relative unevenness of the cotton fields prevents even irrigation of the field, leading to some rows of cotton seedlings becoming saturated with water or not irrigated at all [2.6]. The most optimal way to prevent this is to create a sufficient amount, taking into account the field unevenness of the longitudinal and transverse pawls between the cotton rows.

Today, the technological process of forming a longitudinal pawls between the rows of cotton is carried out by hand and in some farms by means of pawl-forming devices in two passes of the unit. This leads to a relative decrease in productivity due to the high energy and resource consumption in the process of forming the pawl between the rows and the additional density of the rows between the two passes of the unit. This, in turn, requires the creation of devices that provide energy and resource savings in the implementation of this technological process. As a solution to this problem, scientists of the Bukhara branch of Tashkent institute of agricultural mechanization engineers developed the design of a device to form a longitudinal pawls between cotton in one pass of the unit (Fig 1).



1-tie device, 2-frame, 3-overturned surface work bodies, 5-protective sheath, 6-grinding-compaction skis

Figure 1: Device scheme that forms a longitudinal pawl between cotton rows

MATERIALS END METHODS

The device consists of a frame equipped with a tie the right and left overturning working bodies and cotton sprouts, which protect them from being buried by a pile of soil thrown from the overturning surface, as well as grinding-compacting skis on both sides of the pawl [3.6].

In the edges of the cotton rows there are no unevenness in the longitudinal direction, which leads to a significant change in the depth of sinking of the device overturning surface working bodies into the soil. With this in mind, in order to simplify the design and reduce energy and material consumption, the device is not equipped with stronghold wheels and its overturning surface working bodies are held by the vertical racks of the lower longitudinal traction of the tractor suspension mechanism at the specified working depth. In this case, the instantaneous center of rotation of the device in the longitudinal-vertical plane of the forces immersing them in the ground during operation, so that the working surface of the overturning surface of the device sinks to a certain depth and moves steadily at this depth. "π_z" (Fig. 2) must be greater than the sum of the moments of the forces trying to bring them out of the ground, in the following condition must be met

$$\sum M_б > \sum M_ч,$$

(1)

in this $\sum M_б$ - the sum of the moments of the forces trying to immerse the surface working bodies of the overturning device relative to the center of instantaneous rotation in the longitudinal-vertical plane.

$\sum M_ч$ - the sum of the moments of the forces acting on the surface of the overturning surface working bodies relative to the center of instantaneous rotation in its longitudinal-vertical plane.

(1) When the condition is met, an upward reaction force is generated in the pulleys of the tractor suspension mechanism, which keeps the device in the fixed position.

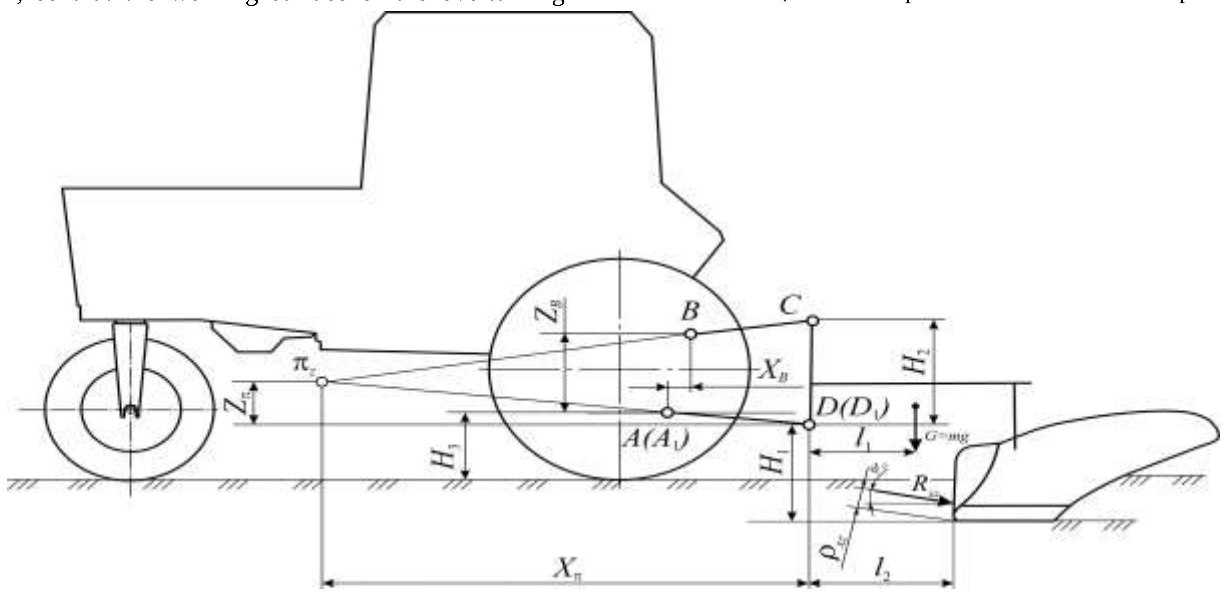


Figure 2: Scheme of the influences longitudinal –vertical plane forces in the device

According to the scheme shown in picture 2

$$\sum M_б = m_к g(X_π + l_1) + R_{xz}(X_π + l_2 + \frac{\rho_{xz}}{\sin\psi_{xz}})\sin\psi_{xz} \quad (2)$$

and

$$\sum M_ч = R_{xz}(Z_π + H_1)\cos\psi_{xz}, \quad (3)$$

where $m_к$ -is the mass of the device;

g -acceleration of free fall;

$X_π$ -the horizontal distance from the lower hanging points of the device to the center of its instantaneous rotation in the longitudinal-vertical plane;

l_1 -longitudinal distance from the lower hanging points of the device to its center of gravity;

R_{xz} -equal effect of forces acting on the working surface of the overturning surface in the longitudinal vertical plane;

l_2 -longitudinal distance from the lower hanging points of the device to the lemmas of the overturning surface working bodies;

ρ_{xz} -the distance from the beak (tip) of the lemmax of the working surface of the overturning surface to the line of action of the force R_{xz};

ψ_{xz} -The angle of deviation of the force R_{xz} from the horizontal plane;

$Z_π$ -the vertical distance from the lower hanging points of the device to the center of its instantaneous rotation in the longitudinal-vertical plane;

H_1 -vertical distance from the base plane of the device to the lower hanging points;

$\sum M_б$ and $\sum M_ч$ Substituting the values of (2) and (3) into (1) gives the following expression

$$m_к g\left(X_π + l_1\right) + R_{xz}\left(X_π + l_2 + \frac{\rho_{xz}}{\sin\psi_{xz}}\right)\sin\psi_{xz} > R_{xz}\left(Z_π + H_1\right)\cos\psi_{xz} \quad (4)$$

or

$$m_к g\left(X_π + l_1\right) + R_{xz}\left[\left(X_π + l_2 + \frac{\rho_{xz}}{\sin\psi_{xz}}\right)\sin\psi_{xz} - \left(Z_π + H_1\right)\cos\psi_{xz}\right] > 0. \quad (5)$$

These conditions are included in their composition to determine at the expense of what factors $X_π$ and $Z_π$ we express the distances by the size and parameters of the tractor's lifting mechanism and the device's lifting device, and for this we pass the XZ coordinate system from the point D (D1) in pictire 2, and in this system D(D$_1$) (0;0) and $A(A_1)(\sqrt{l_б^2 - 0,25(l_к - d)^2 - (H_3 + h - H_1)^2}$; $H_3 + h - H_1$) and C(0; H_2) and $B(\sqrt{l_б^2 - 0,25(l_к - d)^2 - (H_3 + h - H_1)^2} - X_B$; $H_3 + h - H_1 + Z_B$) the equations of straight lines passing through the points are constructed. They will have the following appearance accordingly [5.10]

$$Z = \frac{\left(H_3 + h - H_1\right)X}{\sqrt{l_б^2 - 0,25\left(l_к - d\right)^2 - \left(H_3 + h - H_1\right)^2}}; \quad (6)$$

and

$$Z = \frac{\left(H_3 + h + Z_B - H_1 - H_2\right)X}{\sqrt{l_б^2 - 0,25\left(l_к - d\right)^2 - \left(H_3 + h - H_1\right)^2} - X_B} + H_2, \quad (7)$$

in this H_3- vertical distance from the base plane of the tractor to the fixed hinges $A(A_1)$ of the lower traction of the suspension mechanism, m;

$l_б$ - length of the lower traction of the tractor lifting mechanism, m;

X_B, Z_B - longitudinal and vertical distances between the fixed hinges $A(A_1)$ and B of the lower and central traction of the tractor hoist, m;

H_2 - vertical distance between the lower and upper suspension points of the device, m;

$l_к$ - transverse distance between the lower hanging points of the device, m;

d–transverse distance between the fixed hinges of the lower longitudinal traction of the tractor suspension mechanism, m.

Joint solution of equations (6) and (7), X_π and Z_π gives

$$X_\pi = \frac{H_2\sqrt{l_б^2 - 0,25(l_к - d)^2 - (H_3 + h - H_1)^2}}{(H_2 - Z_B)\sqrt{l_б^2 - 0,25(l_к - d)^2 - (H_3 + h - H_1)^2} - (H_3 + h - H_1)X_B} \times$$

$$\times\left(\sqrt{l_б^2 - 0,25(l_к - d)^2 - (H_3 + h - H_1)^2} - X_B\right); \qquad (8)$$

and

$$Z_\pi = \frac{H_2(H_3 + h - H_1)\left(\sqrt{l_б^2 - 0,25(l_к - d)^2 - (H_3 + h - H_1)^2} - X_B\right)}{(H_2 - Z_B)\sqrt{l_б^2 - 0,25(l_к - d)^2 - (H_3 + h - H_1)^2} - (H_3 + h - H_1)X_B}. \qquad (9)$$

Considering expressions (8) and (9), expression (5) takes the following form

$$m_к g\left(\frac{H_2\sqrt{l_б^2 - 0,25(l_к - d)^2 - (H_3 + h - H_1)^2}}{(H_2 - Z_B)\sqrt{l_б^2 - 0,25(l_к - d)^2 - (H_3 + h - H_1)^2} - (H_3 + h - H_1)X_B} \times\right.$$

$$\left.\times\left(\sqrt{l_б^2 - 0,25(l_к - d)^2 - (H_3 + h - H_1)^2} - X_B\right) + l_1\right) + R_{xz} \times$$

$$\times\left[\left(\frac{H_2\sqrt{l_б^2 - 0,25(l_к - d)^2 - (H_3 + h - H_1)^2}}{(H_2 - Z_B)\sqrt{l_б^2 - 0,25(l_к - d)^2 - (H_3 + h - H_1)^2} - (H_3 + h - H_1)X_B} \times\right.\right.$$

$$\left.\times\left(\sqrt{l_б^2 - 0,25(l_к - d)^2 - (H_3 + h - H_1)^2} - X_B\right) + l_2 + \frac{\rho_{xz}}{\sin\psi_{xz}}\right)\sin\psi_{xz} -$$

$$-\left(\frac{H_2(H_3 + h - H_1)\left(\sqrt{l_б^2 - 0,25(l_к - d)^2 - (H_3 + h - H_1)^2} - X_B\right)}{(H_2 - Z_B)\sqrt{l_б^2 - 0,25(l_к - d)^2 - (H_3 + h - H_1)^2} - (H_3 + h - H_1)X_B} +\right.$$

$$\left.\left. + H_1\right)\cos\psi_{xz}\right] > 0. \qquad (10)$$

Analysis of this expression shows that the operation of the device at a certain depth depends on its weight and the point at which it is placed, the amount, direction and points of forces acting on the surface of the overturning surface, the parameters of the device, the size and parameters of the device and the tractor. depth of subsidence (h) depends on. However, the dimensions and parameters of the tractor suspension mechanism and the vertical distance between the lower and upper suspension points of the pawl forming device (H_2) standardization and knowledge of the tractor [5.9.10], the parameters and mass of the device are mainly based on the conditions of reliable and high-quality performance of the specified technological process, low energy and material volume, (5) condition and hence the device overturning surface work the vertical distance from the base plane to its lower hanging points H_1provided by changing the.

H_1 We determine the value of (10) that ensures that the condition is satisfied. To do this, use the left side of expression (10) $\sum M_y$ that is,

$$\sum M_y = m_\kappa g \left(\frac{H_2\sqrt{l_б^2 - 0,25(l_\kappa - d)^2 - (H_3 + h - H_1)^2}}{(H_2 - Z_B)\sqrt{l_б^2 - 0,25(l_\kappa - d)^2 - (H_3 + h - H_1)^2} - (H_3 + h - H_1)X_B} \times \right.$$

$$\left. \times \left(\sqrt{l_б^2 - 0,25(l_\kappa - d)^2 - (H_3 + h - H_1)^2} - X_B \right) + l_1 \right) + R_{xz} \times$$

$$\times \left[\left(\frac{H_2\sqrt{l_б^2 - 0,25(l_\kappa - d)^2 - (H_3 + h - H_1)^2}}{(H_2 - Z_B)\sqrt{l_б^2 - 0,25(l_\kappa - d)^2 - (H_3 + h - H_1)^2} - (H_3 + h - H_1)X_B} \times \right. \right.$$

$$\left. \times \left(\sqrt{l_б^2 - 0,25(l_\kappa - d)^2 - (H_3 + h - H_1)^2} - X_B \right) + l_2 + \frac{\rho_{xz}}{\sin\psi_{xz}} \right) \sin\psi_{xz} -$$

$$- \left(\frac{H_2(H_3 + h - H_1)\left(\sqrt{l_б^2 - 0,25(l_\kappa - d)^2 - (H_3 + h - H_1)^2} - X_B \right)}{(H_2 - Z_B)\sqrt{l_б^2 - 0,25(l_\kappa - d)^2 - (H_3 + h - H_1)^2} - (H_3 + h - H_1)X_B} + \right.$$

$$\left. \left. + H_1 \right) \cos\psi_{xz} \right] > 0. \qquad (11)$$

Using this expression $\sum M_y = f(H_1)$ we build a graphical link. To do this, in (7) R_{xz} power can be expressed as follows [4]

$$R_{xz} = 2\left(k + \varepsilon V^2\right) Bh / \cos\psi_{xz}, \qquad (12)$$

in this k - specific resistance of the soil to the surface working bodies of the device overturned, Pa;

ε - coefficient taking into account the effect of velocity on the traction resistance of the surface working bodies of the device, H·s^2/m^4;

V - speed of the device, m/s.

Considering expression (12), expression (11) has the following form

$$\sum M_y = m_\kappa g \left(\frac{H_2\sqrt{l_б^2 - 0,25(l_\kappa - d)^2 - (H_3 + h - H_1)^2}}{(H_2 - Z_B)\sqrt{l_б^2 - 0,25(l_\kappa - d)^2 - (H_3 + h - H_1)^2} - (H_3 + h - H_1)X_B} \times \right.$$

$$\times\left(\sqrt{l_б^2-0,25\left(l_к-d\right)^2-\left(H_3+h-H_1\right)^2}-X_B\right)+l_1\Bigg)+\frac{2\left(k+\varepsilon V^2\right)Bh}{\cos\psi_{xz}}\times$$

$$\times\Bigg[\Bigg(\frac{H_2\sqrt{l_б^2-0,25\left(l_к-d\right)^2-\left(H_3+h-H_1\right)^2}}{\left(H_2-Z_B\right)\sqrt{l_б^2-0,25\left(l_к-d\right)^2-\left(H_3+h-H_1\right)^2}-\left(H_3+h-H_1\right)X_B}\times$$

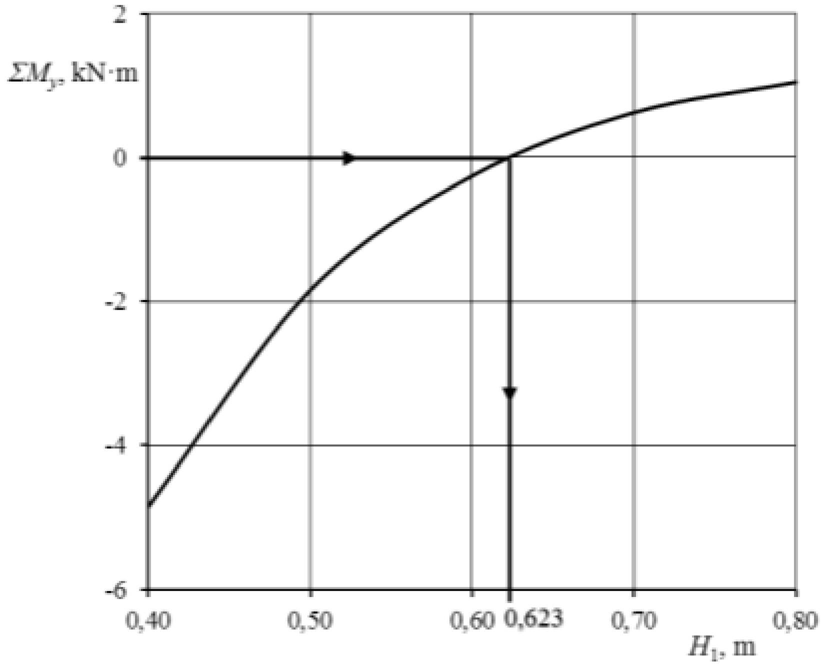
$$\times\left(\sqrt{l_б^2-0,25\left(l_к-d\right)^2-\left(H_3+h-H_1\right)^2}-X_B\right)+l_2+\frac{\rho_{xz}}{\sin\psi_{xz}}\Bigg)\sin\psi_{xz}-$$

$$-\Bigg(\frac{H_2\left(H_3+h-H_1\right)\left(\sqrt{l_б^2-0,25\left(l_к-d\right)^2-\left(H_3+h-H_1\right)^2}-X_B\right)}{\left(H_2-Z_B\right)\sqrt{l_б^2-0,25\left(l_к-d\right)^2-\left(H_3+h-H_1\right)^2}-\left(H_3+h-H_1\right)X_B}+$$

$$+H_1\Bigg)\cos\psi_{xz}\Bigg]>0. \qquad (13)$$

RESULTS AND ITS DISCUSSION

m_k=400 kg, g=9,81 m/s^2, k=0,9·10^5 Pa, e=2000 Ns^2/m^4, V=2 m/s, B=0,26 m, h=0,15 m, ψ_{xz}=– 12°, ρ_{xz}=0,15 m and H_1=0.61 m, H_3=0,6 m, $l_б$=0,8 m, $l_к$=0,78 for wheeled tractors of class 0,9-1,4 m, d=0,56 m, X_B=0.204 m, Z_B= 0.406 m are taken and shown in picture 3. $\sum M_y = f\left(H_1\right)$ a graphical link is built



Picture 3. Graph of change of ΣM$_y$ depending on H_1

It is clear from it $\sum M_y > 0$ for this to happen, the vertical distance from the base plane of the device to the lower hanging points must be at least 62,3 cm.

CONCLUSION

Theoretical studies have shown that the vertical distance H_1 from the base plane of the device to the lower hanging points must be at least 62,3 cm to ensure that the longitudinal pawl forming device sinks to the specified depth.

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