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DETERMINATION OF THE CROSS-SECTIONAL AREA OF THE THRESHOLD BETWEEN ROWS OF COTTON

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Annotation
The article presents analytical expressions related to the determination of the cross-section of the threshold during the formation of longitudinal thresholds between rows of cotton, depending on the height of the threshold and the natural angle of inclination of the soil. These presented expressions are considered important in determining the parameters of the technical means of forming a longitudinal threshold between rows of cotton, as well as the dimensions of the threshold sealer.

Keywords: cotton row spacing, longitudinal threshold, threshold height, angle of natural inclination of the ground, surface of the threshold cross-section, threshold seal, roller for sealing the thresholds.

Introduction

Creating a longitudinal threshold between rows of cotton is very important for watering cotton seedlings, saving the amount of water used for irrigation, and uniform growth and development of cotton seedlings. The quality of the threshold depends on the type of soil, its physical and mechanical composition, structure [1, 2, 3].

The condition of the soil after processing between rows of cotton, the degree of porosity, humidity, density and the natural angle of inclination of the soil play an important role in the formation of a longitudinal threshold between rows of cotton.

It does not take much time and effort to determine the angle of the natural slope of the geo soil, which is important when determining the shape of the longitudinal cross-section of the overlap formed to determine the indicator. The magnitude of this angle for different soils is determined as a result of numerous studies [4, 5, 6].

The shape and size of the threshold affect the irrigation technology and agrotechnical indicators of crop quality, especially the uniform germination of crops during the growing season. Consequently, the width between the rows of this agrotechnical event depends on $B_м$, threshold dimensions (floor height $h_П$ and the cross-sectional area $S_П$), as well as its shape [7, 8].

The shape of the resulting longitudinal section of the overlap can be expressed as a curvilinear equation of the periodic function [9].
Based on this, we can write the following equation describing the profile of the threshold:

$$z = 0{,}5h_{П}\left[1 - \cos\left(p_{м}x\right)\right], \qquad (2.1)$$

where z – ordinate of the point of the curve defining the overlap profile, m;
x – abscissa of the curve shape of the overlap cross-section, m;
$p_М$ – coefficient characterizing the shape of the overlap cross-section, rad/m; $p_М = 2\pi / B_М$ - rad/m [10].
In order to describe the cross section of the threshold in different ways using the expression (2.1), it is necessary to take into account the following:

$$z = 0{,}5h_{П}\left\{1 - \left[\cos\left(p_{м}x\right)\right]^{n}\right\}, \qquad (2.2)$$

where n is the exponent.
Using the expression (2.2) $h_П$, $p_М$ by setting n parameters, it is possible to express the surface of the area profile before and after the formation of the threshold in a general way, which allows theoretically modeling the process of threshold formation and the floor surface being formed.
The relationship in expression (2.2) should be limited so that the row between the rows of cotton corresponds to the actual process of floor formation, i.e. the angle of inclination of the side surface of the threshold is the natural angle of inclination of the soil γ_{eo} should not be more, i.e [11].

$$tg\gamma_{eo} \geq w^{\tau}, \qquad (2.3)$$

where w^{τ} – is the angular coefficient of the experiment on the curve z=f(x).
The angular coefficient w^{τ} of the test is determined by the following formula:

$$w^{\tau} = (z)' = \lim_{\Delta x \to 0}\left(\frac{\Delta z}{\Delta x}\right) \qquad (2.4)$$

where Δz – a growing function;
Δx – a growing argument.
Using expression (2.2), we find the product of the first order z:

$$\frac{dz}{dx} = 0{,}5h_{П} n p_{м} \sin(p_{м}x)[\cos(p_{м}x)]^{n-1} \qquad (2.5)$$

so

$$dz = 0{,}5h_{П} n p_{м} \sin(p_{м}x)[\cos(p_{м}x)]^{n-1} dx. \qquad (2.6)$$

It is known that in this case it takes the maximum value at the inflection point. This can be found in the following condition $\frac{d^2z}{dx^2}=0$

Taking the product of the second order from the expression (2.6), we obtain the following

$$\frac{d^2z}{dx^2}=0,5h_{П}np_{м}^2\left\{[\cos(p_{м}x)]^n-(n-1)[\sin^2(p_{м}x)][\cos(p_{м}x)]^{n-2}\right\} \quad (2.7)$$

or

$$d^2z=0,5h_{П}np_{м}^2\{[\cos(p_{м}x)]^n-(n-1)[\sin^2(p_{м}x)][\cos(p_{м}x)]^{n-2}\}dx^2. \quad (2.8)$$

To create a longitudinal threshold between the rows of cotton, the following is appropriate: $h_П \neq 0$, $п \neq 0$, $p_м \neq 0$ if , then $\frac{d^2z}{dx^2}=0$ if this happens

$1)[\cos(p_{м}x)]^{n-2}=0 \Rightarrow x_{01}=(\pi/2)p_{м}$;

$2)1-n[\sin(p_{м}x)]^2=0 \Rightarrow x_{02}=(1/p_{м})\arcsin(1/\sqrt{n})$.

Based on the solutions found, it is determined that the abscissa x_{02} is an inflection point. Since the calculation is performed for one threshold, the frequency is not specified in this case. Substituting x_{02} first into expressions (2.4) and (2.5), we then subtract the result into expressions (2.3) and get:

$$tg\gamma_{eo} \geq h_{П}p_{м}\sqrt{n[(n-1)/n]^{n-1}}. \quad (2.9)$$

The result of the analysis of expression (2.9) shows that geo is the height of the threshold by determining $p_м$ and п for different values.

Thus, (2.9) determines that the shape of the floor surface in real conditions depends on the physical and mechanical composition of the soil and the specified agrotechnical dimensions.

Using the expression (2.2), it is possible to determine the area of the longitudinal section of the threshold formed between the rows of cotton:

$$S_{П}=\int_0^{B_{м}}zdx=\int_0^{B_{м}}0,5h_{П}\{1-[\cos(p_{м}x)]^n\}dx \quad (2.10)$$

After a number of mathematical modifications, this expression takes the following form:

$$S_{П}=0,5h_{П}\{B_{м}-[(n-1)/n]\}\int_0^{B_{м}}[\cos(p_{м}x)]^{n-2}dx \quad (2.11)$$

(2.11) is true for n>1. In some cases, if n =1, it can be written as follows:

$$S_{П} = \int_{0}^{B_{м}} 0{,}5h_{П}[1-\cos(p_{м}x)]dx = 0{,}5h_{П}B_{м}. \qquad (2.12)$$

Thus, using expressions (2.11) and (2.12), it is possible to determine the area of the longitudinal cross-section of the threshold between rows of cotton, depending on the height of the threshold and the width of the aisles in accordance with the specified agrotechnical requirements [12].

(2.12) according to the formula $h_{П}$ = 24-25 cm and $B_{м}$ = 60 cm [13]

Calculations of the floor between rows of cotton showed that the surface area $S_{П}$ =720-750 cm^2.

These studies are important in determining the parameters of the technical means of forming a longitudinal threshold between the rows of cotton fabric, as well as the dimensions of the sealing roller [14].

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