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Justification for Plough Body Grip Width

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ABSTRACT: In the article, the result of toric studies on the justification of the width of the body grip. It has been established that the criterion for selection of the widened body grip can be taken to ensure its interaction with the soil patch in full under the conditions of unlocked cutting. In order to ensure stability of the laid formation, the housing must be equipped with a coal detection.

KEYWORDS: Plough body, plough body grip width, furrow wall, unlocked cutting, blocked cutting, stability of laid formation, angular.

I.INTRODUCTION

The width of the body grip is one of the onus parameters of the plough, which has a significant impact on the quality and energy indicators of its operation. Despite this, it has not yet had sufficient scientific justification.

This article attempts to fill this gap.

Consider the interaction of the plough body with the soil formation as an oblique (trihedral) wedge with the soil projection open on one side (movement of the plough body along the open furrow). The figure shows the scheme of impact of oblique wedge of AES on soil formation. Here it is assumed that the soil shearing takes place along the plane that forms the angle [theta] n with the horizontal.

Depending on the values of the parameters of the wedge (plough housing) and the physical and mechanical properties of the soil, there may be two cases of soil shearing:

-The boundary line A 'C 'of the shearing plane A 'B 'C 'reaches the wall of the furrow BC and extends to its surface;

-The boundary line A 'E of the shearing plane A 'B 'DE does not reach the wall of the furrow BC and the surface of the field is extended.

The first case occurs when

$$\frac{b_k}{a} < \frac{\sin\delta}{\sin\psi_n}, \qquad (1)$$

and the second – at

$$\frac{b_k}{a} > \frac{\sin\delta}{\sin\psi_n}, \qquad (2)$$

Where a is the depth of processing (remember);

bk is the width of the body grip;

$\delta$is the angle between the direction of movement of the plow and the projection on

Horizontal plane of boundary line A 'C '(A 'E)

A 'B 'C '(A 'B 'DE).

In the first case the soil formation is deformed by the housing completely under the conditions of unblocked cutting, and in the second case - the part of the formation, which is close to the heap of the plum-in the conditions of unblocked cutting, and the part, which is close to the toe of the plum-in the condition of blocked cutting. As is known [1,2], when the soil is deformed under the conditions of unlocked cutting, the energy intensity

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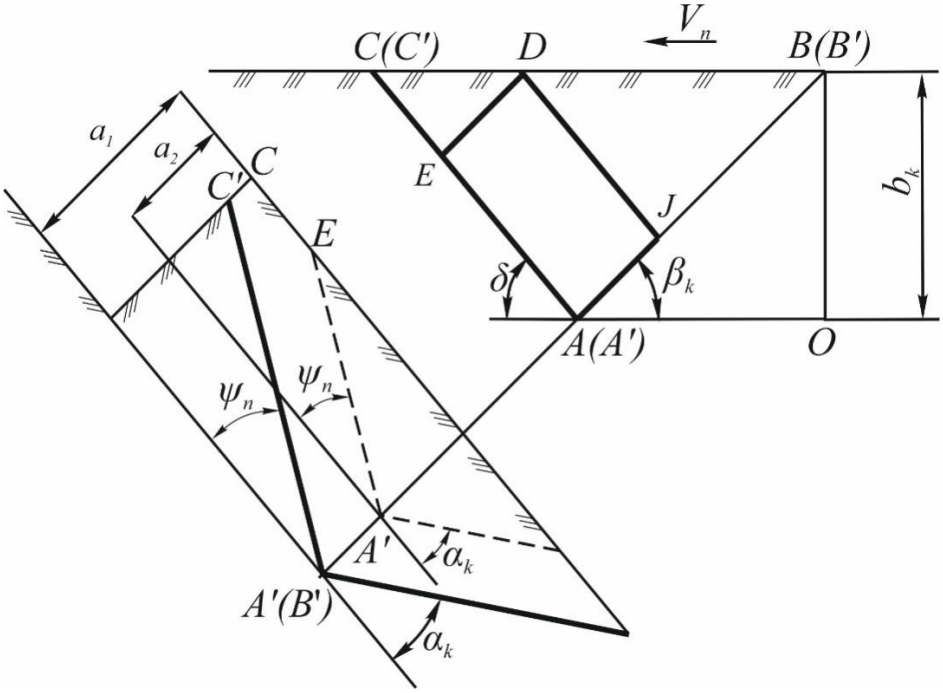

Scheme of impact of oblique wedge of AES on soil formation: AC-wall of open furrow; Case ploughshare AV-edge

Its treatment is 1.5 - 2.0 times less than under conditions of blocked cutting. Therefore, in order to reduce the energy consumption of the ploughing, the parameters of the ploughshare body must be such that it interacts with the soil completely under the released cutting conditions, that is, the plane of soil shearing resulting from the action of the body must extend to the surface of the furrow wall.

As can be seen from the inequality analysis (1) for a particular soil type and a given treatment depth, the release of the shearing plane to the furrow wall surface is mainly provided by the selection of the plough body grip width.

Solving inequality (1) relative to bk and considering that

$$\psi_n = \frac{1}{2}\left[\pi - \left(\alpha_k + \varphi_1 + \varphi_2\right)\right], \tag{3}$$

iprinimy we will receive

$$b_k < a\cos\beta_k / \cos\left(\alpha_k + \varphi_1 + \varphi_2\right), \tag{4}$$

whereβ_k–The angle of installation of the body ploughshare blade to the furrow wall;
α_k – angle of ploughshare installation to furrow bottom;
φ_1 – angle of soil friction against metal;
φ_2 – soil-to-soil friction angle.

It follows from the inequality analysis (3) that the value of the body grip width, which ensures its interaction with the soil completely under the conditions of unblocked cutting, depends on the depth of ploughing, the angles of installation of the ploughshare blade to the wall and to the bottom of the furrow, as well as the angles of soil friction against the body material and soil.

Substituting in (3) known values

$$\beta_k=40^o, \alpha_k=30^o, \varphi_1=30^o \text{ и} \varphi_2=40^o,$$

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let's receive $b_k < 1,2a.$ (5)

Therefore, in order for the plough body to interact with the soil completely under the released cutting conditions, the width of its grip should not exceed 1.2 a. And on the other hand, as is known [3], in order to ensure stability of the laid formation, the width of the body grip must not be less than 1.27a. Such a mismatch can be solved by supplying the plough bodies with coals which cut out the upper part of the decoupled formations and drop it to the bottom of the furrow, whereby the angle of inclination of the laid formation to the horizon is reduced, and therefore the laid formation is arranged with the width of the body grip less than 1.27a.

Thus, on the basis of the foregoing, it can be argued that the criterion for selecting the grip width of the body may be to allow the body to interact with the soil formation under the released cutting conditions. In order to ensure stability of the laid bed, the plough bodies must be provided with angular patterns.

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