# BASE ON THE COVERAGE WIDTH OF THE TILTING PLUG HOUSING, WHICH CAN BE PROCESSED FLAT ON THE GROUND

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***Abstract**. In our country, traditional plows are mainly used for basic tillage. Their main drawback is that in the fields plowed with them, open fields and boundaries are formed, and additional leveling work must be carried out to level them.The better the quality of the soil, the better the plants will germinate and develop, the higher the yield, and the less additional treatment with other tools will be required.Therefore, this scientific research was showed the correct selection of the coverage width of the plow body and the correct aggregation of the plow with the tractor will reduce the plowing quality as well as the straight line flatness and traction resistance of the plow.*

***Keywords**: roots and seeds, pests and pathogens.*

## Introduction

It is known that the most common method of basic tillage is soil tillage [1-7]. Its main function is to bring the top layer of soil down and the bottom layer up. This includes weed residues, their roots and seeds, pests and pathogens, as well as mineral and local fertilizers applied before plowing. Also, the cultivated soil is deformed, crushed and crushed. As a result, weeds, diseases and pests are reduced in the field, mineral and local fertilizers are well mixed into the soil, and the soil is softened, creating favorable conditions for plant growth and development.

In our country, traditional plows are mainly used for basic tillage. Their main drawback is that in the fields plowed with them, open fields and boundaries are formed, and additional leveling work must be carried out to level them.

The better the quality of the soil, the better the plants will germinate and develop, the higher the yield, and the less additional treatment with other tools will be required [8].

It is known that in the current world practice, plows are aggregated with tractors in two ways:

All the wheels of the tractor move in the groove, i.e. on the uncultivated area (Fig. 1, a);

The right wheels of the tractor (when working with a normal plug) or the right and left wheels move in turn (when working with a rotary plug) in the groove formed in the front passage of the unit (Figure 1, b).

When all the wheels of the tractor are moving in the groove, as shown in Figure 1, a, the center of resistance of the plug $C_n$ is located at a distance (longitudinal axis) from the longitudinal axis of the tractor, and it (longitudinal axis) is $R_{xy}$ (where $R_{xy}$ is equal to the forces acting on the plow in the horizontal plane). a large angle (angle $\alpha_{r1}$ in Fig. 1, a) is formed between the forces. As a result, the lateral force $R_{xy}\sin\alpha_{r1}$ acting on the tractor will have a large value and as a result it will be difficult to control the tractor.

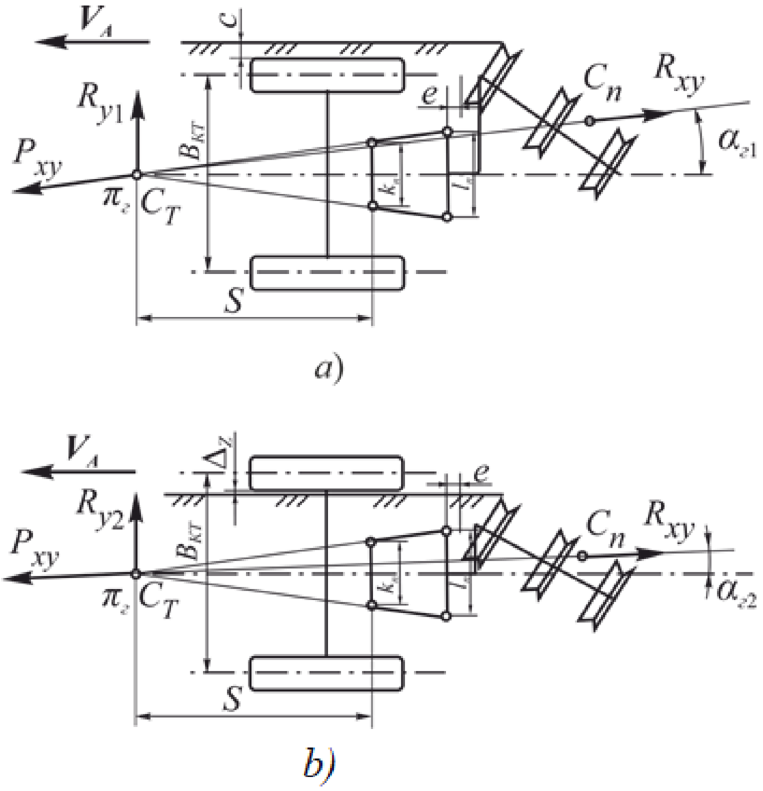


***Figure 1. Schemes of aggregation of a plow with a tractor. a) all the wheels of the tractor move in the groove; b) one side wheels of the tractor move inside the saddle***

**Materials and methods**

According to the schemes shown in Figure 1 and previous studies [7, 8, 9, 10]

$$\alpha_{г1} = \arcsin\left(\frac{c + 0,5(b_ш + B_{KT}) - (n-1)b_к}{S + M + e + 0,5nL}\right) \quad (1)$$

and

$$\alpha_{г2} = \arcsin\left(\frac{0,5(B_{KT} + b_ш) - \Delta_Z - (n-1)b_к}{S + M + e + 0,5nL}\right), \quad (2)$$

Where:

c– is the distance from the egat wall to the leading wheel, m;

$b_ш$–number of plug housings, pcs;

*S*–the lower longitudinal traction of the tractor suspension mechanismlongitudinal distance from the point of connection to it to the center of pressure of the wheels, m;

$$M = \sqrt{l_б^2 - 0,25(l_n - \kappa_n)^2 - (H + a - H_1)};$$

$l_б$ –The lower longitudinal traction of the tractor suspension mechanismlength, m;

*ln*–the lower hanging (tie) points of the plug hanging devicetransverse distance between, m;

*kn*–The lower longitudinal traction of the tractor suspension mechanismtransverse distance between points connected to the tractor, m;

*H*–the vertical distance from the base plane of the tractor to the front hinges S (S1) of the lower traction of the suspension mechanism, m;
*a*–driving depth, m;
$H_1$–the vertical distance from the base plane of the plug to the lower tie point of the hanging device, m;
*e* –longitudinal distance from the lower hanging point of the plug to the first housing, m;
*L*–longitudinal distance between plug housings, m.
Given the expressions (1) and (2) and Rx = nkabk (where Rx is the traction resistance of the plow; k is the relative resistance of the soil to plowing; a is the depth of tillage; bk is the width of the plow body). The lateral forces acting can be expressed as follows

$$R_{y1} = n \cdot \kappa \cdot a \cdot b_{\kappa} \cdot tg\left(\frac{c + 0{,}5(b_{ш} + B_{KT}) - (n-1)b_{\kappa}}{S + M + e + 0{,}5nL}\right) \quad (3)$$

And

$$R_{y2} = n \cdot \kappa \cdot a \cdot b_{\kappa} \cdot tg\left(\frac{0{,}5(B_{KT} + b_{ш}) - \Delta_Z - (n-1)b_{\kappa}}{S + M + e + 0{,}5nL}\right), \quad (4)$$

**Results and Discussions**

In order to study the effect of these expressions on the lateral forces acting on the tractor, the coverage of the plow body was changed from 30 cm to 45 cm.

$n$=3 pics; $\kappa=6\cdot10^4$Pa; $b_\kappa$=0,45 m; $a$=0,3 m; $c$=0,3 m; $b_ш$=0,393 m; $B_{KT}$ = 1,8 мм; $\Delta_Z$ = 0,1 m; $e$ = 0,24 m; $S$ = 1,387 m; $l_б$ = 0,8 m; $l_n$ = 0,8 мм; $k_n$ = 0,48 m; $H$= 0,73 m, $H_1$ = 0,65 m accepted, and the calculations carried out by expressions (3) and (4) determined the values of the lateral forces acting on the tractor when all the wheels of the tractor are moving in the groove at different coverage widths of the plug body and when one side wheels are moving in the groove. Their results are shown in Figure 2.

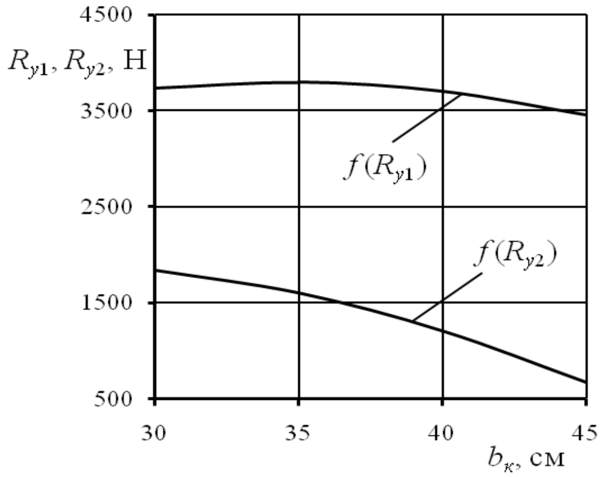


***Figure 2. Graph of change of lateral forces acting on the tractor depending on the width of the plug body, when all the wheels of the tractor are moving in the groove and when one side of the wheels is moving in the groove.***

The results of the study show that when the body width varies from 30 cm to 45 cm, the lateral forces acting on the tractor first increase and then decrease when all the wheels of the tractor move in the groove, and the lateral forces decrease evenly when one side of the tractor moves in the groove. This can be explained by the decrease in the angle $\alpha_г$ between the longitudinal axis of the tractor and the force acting on the plow in the horizontal plane, $R_{xy}$, which is equal to the forces acting on the plow with increasing body width.

The results of research to determine the ratio of the effect of lateral forces on the movement of one side of the wheels in the groove when all the wheels of the tractor are moving in the groove shown in Figure 3.

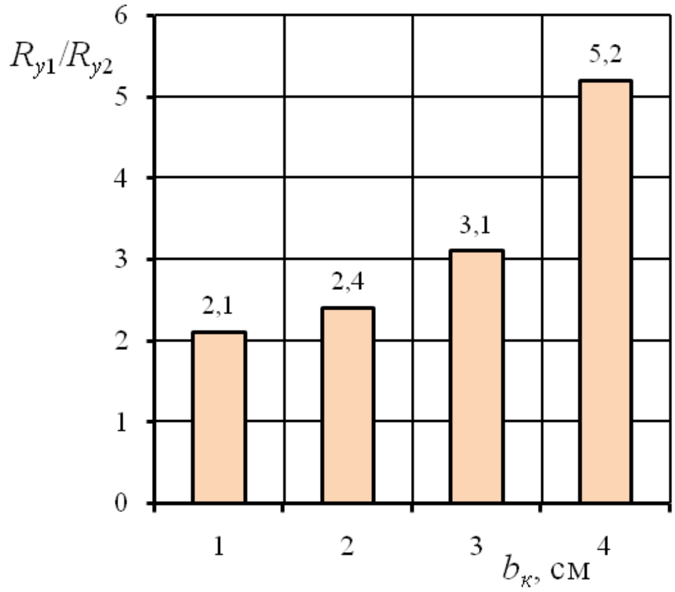


***Figure 3. The ratio of the effect of lateral forces on the movement of all the wheels of the tractor in the groove relative to the movement of one side of the wheels in the groove.***

The data in Figure 3 show that with an increase in body coverage from 30 cm to 45 cm, all side wheels of the tractor are affected by 2.1 to 5.2 times more lateral forces, respectively, than when one side wheels move in the groove.

**Conclusions**

In conclusion, the correct selection of the coverage width of the plow body and the correct aggregation of the plow with the tractor will reduce the plowing quality as well as the straight line flatness and traction resistance of the plow.

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