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# INVESTIGATE A SMOOTH RIDE OF THE FRONT PART OF THE PLOW, CONSISTING OF WORKING PARTS HANGING FROM THE FRONT AND BACK OF THE TRACTOR, ALONG THE DRIVING DEPTH

M. T. Mansurov
Doctor of Technical Sciences, Namangan Engineering Construction Institute, Namangan, Republic of Uzbekistan, E-mail: m_mansurov_1978@mail.ru

O. N. Toshpulatov
Student of Namangan Engineering Construction Institute, Namangan, Republic of Uzbekistan

**Annotation**
This article presents ideas and considerations for the study of a flat stroke of the front part of the plow, consisting of working parts hanging from the front and back of the tractor, along the driving depth.

**Keywords:** Push-pull plug, working parts of the plug that hang on the front and back of the tractor, housings, support wheels.

## Introduction

One of the most important ways to reduce energy and resource consumption in tillage and increase productivity is the widespread use of push-pull tillage machines, which are mounted on the front and rear of the tractor [1-6]. When using such machines, it is possible to combine different technological processes, their traction increases due to the optimal distribution and increase of loads on the engines of tractors. Based on the above, our institute conducts research on the development of tillage machines in the "push-pull" system and the justification of their parameters, which can be used in agricultural production in our country.

This article presents the results of research on the development of the basics to ensure that the driving depth of the front part of the plow (hereinafter the plow) hanging on the front and back of the tractor is uniform.

Ensuring that the driving depth is uniform is an important performance indicator of the plug. This is because when this condition is met, the same conditions are created for the development and harvesting of agricultural crops grown throughout the country, as

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well as for the simultaneous ripening of the harvest.
According to the research [7, 8], the vertical compressive force applied to the ground by the plug base wheel must have a certain optimal value to ensure that the drive depth is uniform, i.e.

$$G_{Tp} = G_{мақ}, \qquad (1)$$

in this $G_{Tp}$- the vertical compressive force applied to the ground by the base wheel of the front part of the plug;
$G_{мақ}$- the optimum value of the vertical compressive force applied to the ground by the base wheel of the front part of the plug, ensuring that the driving depth is a flat one.
(1) When the condition is met, the support wheel of the front part of the plow is constantly pressed against the field surface during the operation and it does not sink deep into the ground. As a result, the plug sinks to the specified depth and the drive depth is uniform.
In order to determine what factors can satisfy the condition (1) for the front part of the plug, we determine the vertical compressive force applied to the ground by its support wheel using the diagram shown in the figure.

$$G_{Tp} = Q_{zp} = \Big\{ G_p (X_{\pi p} + l_{2p}) - R_p^{xz} \Big[ (Z_{\pi p} - H_p - H_{2p}) \cos\psi_p^{xz} -$$

$$- \left( X_{\pi p} + k_{np} + \frac{n_p - 1}{2} L_k - \frac{\rho_p^{xz}}{\sin\psi_p^{xz}} \right) \sin\psi_p^{xz} \Big] - F_{xp} (Z_{\pi p} - H_p - H_{2p} + 0{,}5 b_o) \Big\} :$$

$$: \Big[ (X_{\pi p} + l_{3p}) + \mu_k (Z_{\pi p} - H_p - H_{2p} + 0{,}5 d_m) \Big], \qquad (2)$$

in this $Q_{zp}$ - the vertical component of the soil reaction force acting on the base wheel of the front part of the plug;
$G_p$ - the weight of the front of the plug;
$X_{\pi p}$- the longitudinal distance from the lower hanging points of the front part of the plug to its instantaneous center of rotation;
$l_{2p}$- the longitudinal distance from the point where the weight of the front part of the

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plug is applied to the hanger;

$R_p^{xz}$ - the anterior part of the plug is an equal component of the forces acting on the lemexi and the overturners;

$Z_{\pi p}$- the vertical distance from the upper hanging point M of the front of the plug to its instantaneous center of rotation;

$H_p$- The front part of the plug points to its lower suspension from the base surface *E (E₁)* vertical distance to;

$H_{2p}$- the vertical distance between the lower and upper hanging points of the front of the plug;

$\psi_p^{xz}$ - $R_p^{xz}$ the angle of deflection of the force relative to the horizon;

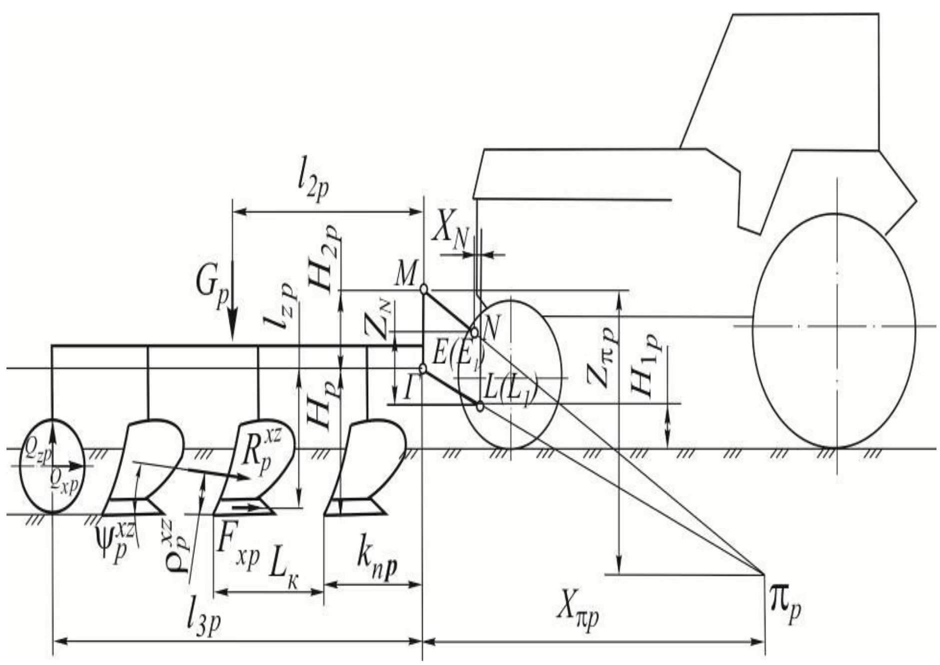
$k_{np}$- the longitudinal distance from the front part of the plug to the end of the first housing;

$n_p$- the number of plug front body housings;

$L_k$- the longitudinal distance between the bodies of the front part of the plug;

$\rho_p^{xz}$ - the distance from the tip of the conditional middle body lemexi to the force of the front part of the plug;

$F_{xp}$- the front of the plug is an equal effect of the frictional forces acting on the field boards;




Schematic for determining the vertical compressive force applied to the ground by the base wheel of the front part of the plug

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$b_\partial$- the height of the field boards in front of the plug;
$l_{3p}$- the longitudinal distance from the front part of the plug to the suspension device to the base wheel;
$\mu_k$- the rolling coefficient of the base wheel of the front part of the plug;
$d_m$- The diameter of the base wheel of the front part of the plug.
(2) in the expression $X_{\pi p}$ and $Z_{\pi p}$ we express them by the dimensions of the tractor front suspension mechanism and the front part of the plug suspension device

$$X_{\pi p} = \Big\{H_{2p}\sqrt{(l_1^{\delta})^2 - 0{,}25\ (l_1 - k_1)^2 - (H_p - H_{1p} - h)^2} \times$$

$$\times\Big[\sqrt{(l_1^{\delta})^2 - 0{,}25\ (l_1 - k_1)^2 - (H_p - H_{1p} - h)^2} - X_N\Big]\Big\}:$$

$$:\Big\{(H_{2p} - Z_N)\sqrt{(l_1^{\delta})^2 - 0{,}25\ (l_1 - k_1)^2 - (H_p - H_{1p} - h)^2} + (H_p - H_{1p} - h)X_N\Big\} \qquad (3)$$

and

$$Z_{\pi p} = \Big\{H_{2p}\sqrt{(l_1^{\delta})^2 - 0{,}25\ (l_1 - k_1)^2 - (H_p - H_{1p} - h)^2}(H_p + H_{2p} - H_{1p} - h - Z_N)\Big\}:$$

$$:\Big\{(H_{2p} - Z_N)\sqrt{(l_1^{\delta})^2 - 0{,}25\ (l_1 - k_1)^2 - (H_p - H_{1p} - h)^2} - (H_p - H_{1p} - h)X_N\Big\}, \qquad (4)$$

in this $H_{1p}$- from the base plane of the tractor it is the fixed hinges of the lower traction of the front suspension mechanism $L(L_1)$ vertical distance to;
$X_N$, $Z_N$ - according to the front suspension mechanism of the tractor $L(L_1)$ and $N$ longitudinal and vertical distances between hinges;
$l_1^{\delta}$ - the length of the lower longitudinal traction of the front suspension mechanism of the tractor;
$h$- processing (driving) depth;
$l_1$- the transverse distance between the lower hanging points of the front part of the plug hanging device;

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$k_1$- the transverse distance between the lower fixed hinges of the front suspension mechanism of the tractor.

Considering expressions (3) and (4), expression (2) has the following form

$$G_{Tp}=\Bigg\{G_p\Bigg\{\Big[H_{2p}\sqrt{(l_1^{б})^2-0{,}25(l_1-k_1)^2-(H_p-H_{1p}-h)^2}\Big]\times$$

$$\times\Big[\sqrt{(l_1^{б})^2-0{,}25(l_1-k_1)^2-(H_p-H_{1p}-h)^2}-X_N\Big]:$$

$$:\Big[(H_{2p}-Z_N)\sqrt{(l_1^{б})^2-0{,}25(l_1-k_1)^2-(H_p-H_{1p}-h)^2}+(H_p-H_{1p}-h)X_N\Big]+l_{2p}\Bigg\}-$$

$$-R_p^{xz}\Bigg\{\Bigg\{\Bigg[\Bigg[H_{2p}\sqrt{(l_1^{б})^2-0{,}25(l_1-k_1)^2-(H_p-H_{1p}-h)^2}\times$$

$$\times(H_p+H_{2p}-H_{1p}-h-Z_N)\Bigg]:\Bigg[(H_{2p}-Z_N)\sqrt{(l_1^{б})^2-0{,}25(l_1-k_1)^2-(H_p-H_{1p}-h)^2}-$$

$$-(H_p-H_{1p}-h)X_N\Bigg]-H_p-H_{2p}\Bigg\}\cos\psi_p^{xz}-\Bigg\{H_{2p}\sqrt{(l_1^{б})^2-0{,}25(l_1-k_1)^2-(H_p-H_{1p}-h)^2}\times$$

$$\times\Big[\sqrt{(l_1^{б})^2-0{,}25(l_1-k_1)^2-(H_p-H_{1p}-h)^2}-X_N\Big]:\Bigg[(H_{2p}-Z_N)\times$$

$$\times\sqrt{(l_1^{б})^2-0{,}25(l_1-k_1)^2-(H_p-H_{1p}-h)^2}+(H_p-H_{1p}-h)X_N\Bigg]+k_{np}+$$

$$+\frac{n_p-1}{2}L_k-\frac{\rho_p^{xz}}{\sin\psi_p^{xz}}\Bigg\}\sin\psi_p^{xz}\Bigg\}-F_{xp}\Bigg\{\Bigg[\Bigg[H_{2p}\sqrt{(l_1^{б})^2-0{,}25(l_1-k_1)^2-(H_p-H_{1p}-h)^2}\times$$

$$\times(H_p+H_{2p}-H_{1p}-h-Z_N)\Bigg]:\Bigg[(H_{2p}-Z_N)\sqrt{(l_1^{б})^2-0{,}25(l_1-k_1)^2-(H_p-H_{1p}-h)^2}-$$

$$-(H_p - H_{1p} - h)X_N \Big] - H_p - H_{2p} + 0{,}5b_\partial \Big\}\Big\}:$$

$$:\Big\{\Big[H_{2p}\sqrt{(l_1^{б})^2 - 0{,}25(l_1 - k_1)^2 - (H_p - H_{1p} - h)^2}\Big]\times$$

$$\times\Big[\sqrt{(l_1^{б})^2 - 0{,}25(l_1 - k_1)^2 - (H_p - H_{1p} - h)^2} - X_N\Big]:\Big[(H_{2p} - Z_N)\times$$

$$\times\sqrt{(l_1^{б})^2 - 0{,}25(l_1 - k_1)^2 - (H_p - H_{1p} - h)^2 + (H_p - H_{1p} - h)X_N}\Big] + l_{3p}\Big\} +$$

$$+\mu_k\Big\{\Big[\ H_{2p}\sqrt{(l_1^{б})^2 - 0{,}25(l_1 - k_1)^2 - (H_p - H_{1p} - h)^2}(H_p + H_{2p} - H_{1p} - h - Z_N)\ \Big]:$$

$$:\Big[(H_{2p} - Z_N)\sqrt{(l_1^{б})^2 - 0{,}25(l_1 - k_1)^2 - (H_p - H_{1p} - h)^2} -$$

$$-(H_p - H_{1p} - h)X_N\Big] - H_p - H_{2p} + 0{,}5d_m\Big\}\Big\}. \quad (5)$$

Dimensions of the tractor suspension mechanism $X_N$, $Z_N$, $H_{1p}$, $l_1^{б}$, $k_1$ and $l_1$ distance standardization [9] and known, the dimensions and parameters of the front part of the plug $k_{np}$, $L_k$, $l_{2p}$, $l_{3p}$ and, given that the given technological process is accepted on the basis of reliable and high-quality conditions of performance, (5) expression analysis shows that (1) the condition is fulfilled and hence the dimensions of the suspension device $H_p$ and $H_{2p}$ can be achieved by changing the

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