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Short communications

Mechanical correction of the wheeled tractor traction weight

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Abstract. *By ploughing is important to minimize the slipping of the tractors wheels. These are able through mechanical correction the linkage. The paper indicates theoretical the value of the traction weight, when the central link in the hitch is in different aimed orifice.*

Keywords: tractor linkage, traction weight

Introduction

With mechanical correction the traction weight, a wheeled tractor can rise the traction efficiency. Usually the farm machines are with 3-point hitch. The farm machines are completed with support wheel. The hydraulic cylinder of the hitch mechanism is in free condition. When the soil reaction at the support wheel or at the implement lowed, so the traction weight of the tractor rise. The correction of the mechanical hitch mechanism is ground at the principle of variable links geometry. The geometry changes the moment center of the linkage rotation. These achieves, when the central link of the mechanism catches to aimed orifice at the tractors frame.

The paper has an aim to indicate theoretical the value of the traction weight, by different mounting the central link of the hitch mechanism at a concrete model wheel tractor.

Material and methods

The object of the investigation is the wheel tractor at design 4x2, model TK-80, aggregated with plough PN-4-35. By ploughing is important to become small slipping and height traction efficiency. That whey is interesting to discover the support reaction by nominal traction force.

At Figure 1 are draw up the forces of the wheeled tractor, aggregating with a plough. Point $O_{R.C.}$ is the moment center of rotation the hitch system together with attached implement, for example a plough. Those is at distance $L_{R.C.}$ from rear axis of wheels the tractor. The lower links are usually horizontal. The vertical component R_H of the opposition force R_X, together with his weight G_H is relative to horizontal force R_X as:

$$R_B = R_x.tg\Theta \quad (1)$$

where Θ is the degree between direction of the force R_H and his lengthwise tractor axis.

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At reference date (Velev, 1972; Iankova, 2008) the force R_B is 0,06 – 0,30 R_X.

It is accept, that the weight force of the machine and the reaction of soil are in the same surface. The reaction on the soil the aggregate machine Z_H is recognized as equal of the moments the forces R_X , R_B and Z_H at point $O_{R.C.}$:

$$Z_H = R_x.tg\Theta - \frac{R_x.h_{R.C.}}{L_{R.C.} + l_H} \quad (2)$$

where $h_{R.C.}$ is the height of the point $O_{R.C.}$,

$L_{R.C.}$ – the lengthwise coordinate of the point $O_{R.C.}$,

l_H - the distance amongst rear wheel axis of the tractor and the force Z_H.

The equation (2) indicates that, when the length $L_{R.C.}$ reduce, the reaction Z_H lower. The support reactions at front and rear wheels of the tractor Z_K and Z_P are (Velev, 1972):

$$Z_K = \frac{G.a}{L} + \frac{R_x.h_{R.C.}.l_H - Z_H.l_H}{L} + R_x.tg\Theta \quad (3)$$

$$Z_P = \frac{G.b}{L} + \frac{R_x.tg\Theta.l_H - Z_H.l_H}{L} \quad (4)$$

where a and b – lengthwise coordinate of the tractors weight center,

G – the weight of the tractor,

L – lengthwise tractors basis.

Replace Z_H at equation (2) in equation (3) tractor weight force Z_K become:

$$Z_K = \frac{G.a}{L} + \frac{R_x.h_{R.C.}.l_H}{L(L_{R.C.} + l_H)} + R_x.tg\Theta \quad (5)$$

Formula (5) indicates that the force Z_K rise, when $L_{R.C.}$ reduce and l_H – rise. In result, the tractors sliping lowed. The values of the sliping depends logarithmic on traction weight Z_K or on traction factor T, where ($T = Rx / G$).

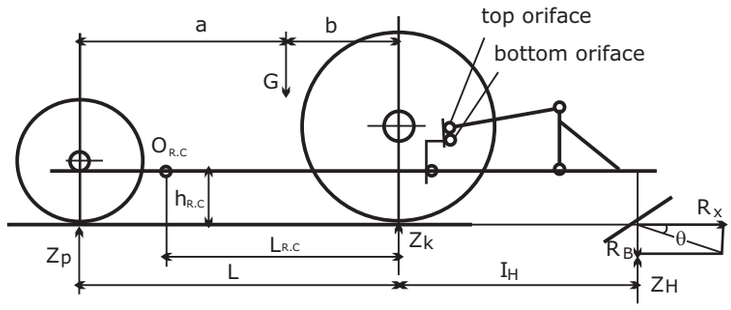

Figure 1. Scheme of a wheel tractor aggregated with implement on 3-point hitch.

Results and discussion

The initial date of the wheeled tractor TK-80, aggregated with plough PN-4-35 wanted to theoretical calculation of support reaction Z_P and Z_K are:

G = 33 kN,
a = 1,6 m,
b = 0,8 m.
Nominal traction force R_X = 14 kN,
$tg\,\theta$ = 0.3,
l_H = 1.87 m.

The wheeled tractor model UMZ-6L has like these date. His weight is 2 kN les toward the TK-80.

The distance $L_{R.C.}$ is indicated geometric. When central link and lower links are horizontal, then $L_{R.C.} = \infty$ and $Z_H = R_B$. When $L_{R.C.}$ = -0,33m, then $Z_H = 0$. By higher position of the central link, $L_{R.C.}$ = 3m. By lower position of the central link, $L_{R.C.}$ = 1,8 m.

The calculated date of the reaction Z_K, Z_P and Z_H in accordance whit formulas (2), (3) and (4), and the coefficients λ_P and λ_K are in Table1.($\lambda_P = Z_P/G$, $\lambda_K = Z_K/G$).

Table1. Calculated date for tractor TK-80.

The position of the central hitch link	Z_H , kN	Z_P, kN	λ_P	Z_K , kN	λ_K	T
Horizontal. $L_{R.C.} = \infty$	4.20	11.00	0.33	22.00	0.66	0.64
Higher orifice. $L_{R.C.}$ = 3m	2.76	9.87	0.30	27.33	0.84	0.51
Lower orifice. $L_{R.C.}$ = 1.8m	2.28	9.48	0.28	27.72	0.84	0.50

The analysis of the date in Table 1 discover, that with mechanical hitch correction of the tractors traction weight Z_K, by nominal traction force R_X = 14 kN, is achieved.

Conclusion

The support soil reaction Z_H of the farm machines or implement comparatively in horizontal position at the central link to the lower position give difference from 4,20 kN to 2,28 kN or approximately 46%.

The rear wheels reaction Z_K of the tractor at horizontal position the central link to lower position increase from 22,00 kN to 27,72 kN, or 20 %. Equivalency λ_K rise from 0,66 to 0,84.

The top position of the central link comparatively to bottom position changes the traction weight Z_K small – with 0,39 kN.

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The manuscript should be structured as follows: Title, Names of authors and affiliation address, Abstract, List of keywords, Introduction, Material and methods, Results, Discussion, Conclusion, Acknowledgements (if any), References, Tables, Figures.

The title needs to be as concise and informative about the nature of research. It should be written with small letter /bold, 14/ without any abbreviations.

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