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JUSTIFICATION OF RATIONAL INTERACTION PARAMETERS COMBINE HARVESTERS AND TRAILER-CONVEYORS

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An analytical dependence for determination of rational interaction parameters combine harvesters, trailers and cranes in their work group.

Combine harvesters, trailers conveyors, performance, analytical dependence rational parameters.

Problem. There are general approaches formation of complexes with cars duringastosuvannya handling harvesting and transport technologies (ZTT) using loader cranes (PP). Changes in work systems and organization of group forms of work require adjustment of their parameters.

Therefore, the study of the effect of these changes in terms of the formation of complex rational parameters are relevant.

Analysis of recent research. Previously developed method of determining the quantity and the quality of the assembly-transport complexes does not reflect the complete picture of the interaction combines reloaders, because it does not takes into account the change of working conditions in the different grain arrays (yield, an area of the field, a different number of pieces of equipment complex, their performance) and does not the possibility of a comprehensive assessment of combine harvesters (HCC) [1]. These factors significantly affect the potential of using chain "HCC - PE".

The purpose of research. Increase productivity transporting grain from harvesting through study rational interaction parameters HCC and PP.

Research results. The effectiveness of PE as a central link in the chain "HCC - PP - heavy vehicles (ATZ)" defined reasonable number of granule cells (mKP) that are served by each PE, comprising the assembly-transport sector (ZTK). In turn, the number of granule cells that are served by each PE is the number of bins of grain harvesters, which are loaded into each box trailer.

To determine the number of granule cells that are served by a trailer-conveyors, consider the technological chain interaction HCC and PP. After loading the first hopper grain of HCC PP moves to the next harvesters who served him, loaded with grain, goes to the edge of the

field, unloaded a body ATZ and returns to the first unloaded LC for the next download.

For this sequence will make the technological balance of time, which is as follows:

$$t_{П} - t_{ЗАВ} + t_{РОЗ} = t_{Б} + t_{Х}\,, \quad (1)$$

where *TP* - The sum of these components of PP time: the duration of journeys on the field, waiting time for loading grain bins of HCC group and downloading. According to studies [2,3] set this empirical relationship:

$$t_{П} = 0{,}08 + 0{,}12\rho_{П}\,, \text{ H.}, \quad (2)$$

where $\rho_{П}$ - the number of bins of grain, which is loaded into a private one for his Haulage equal to the number of units HCC (mKP)Served by a private one:

$$\rho_{П} = m_{КП}\,, \text{ Ed.}, \quad (3)$$

tZAV - Download Time to private grain silo HCC:

$$t_{ЗАВ} = \frac{\omega_{К} d_{В}}{W_{ШК}}\,, \text{ H.} \quad (4)$$

ωK - volume hopper combine m3;

dB - grain bulk density, t / m3;

WSHK - performance vygruznogo screw HCC, t / h .;

$$t_{РОЗ} = \frac{K_{Р}\omega_{К} d_{В}\rho_{П}}{W_{ШП}}\,, \text{ H.} \quad (5)$$

KR - coefficient taking into account the extra time to maneuver PE PE unloading;

WSHP - performance vygruznogo screw PE, t / h .;

TB - filling hopper harvester

$$t_{Б} = \frac{\omega_{К} \cdot d_{В}}{W_{КР}}\,, \text{ H .;} \quad (6)$$

$W_{КР}$ - Productivity per hour working HCC (primary) time, t / h .;

tX - duration of idle moves on turns, which accounts for 1 cycle of the combine (filling grain silos), defined as

$$t_{Х} = \frac{t_{Б}(1-\varphi)}{\varphi}\,, \quad (7)$$

where φ - Coefficient of working strokes, whose value according to research accepted as $\varphi = 0{,}85$ for the average length of the runs 1000 m.

In view of the components of equation (1) and (2-7) we obtain the following expression:

$$0{,}08 + 0{,}12\rho_{П} - \frac{\omega_{К} d_{В}}{W_{ШП}} + \frac{K_{Р}\omega_{К} d_{В}\rho_{П}}{W_{ШП}} = \frac{\omega_{К} d_{В}}{W_{КР}\varphi}\,. \quad (8)$$

Hence we obtain:

$$\rho_{П} = m_{КП} = INT \frac{\omega_К d_В (\frac{1}{W_{КР}\varphi} + \frac{1}{W_{ШК}}) - 0{,}08}{0{,}12 + \frac{K_Р \omega_К d_В}{W_{ШП}}}, \text{ Ed.} \quad (9)$$

where INT - function that returns the nearest integer less.

Based on this equation and applying this information basis for the circuit "HCC - PE" ZTK (Table. 1), which are classified into groups basic parameters of machines we built tracker $\rho_{П}$ and from mKP WKR (Fig. 1).

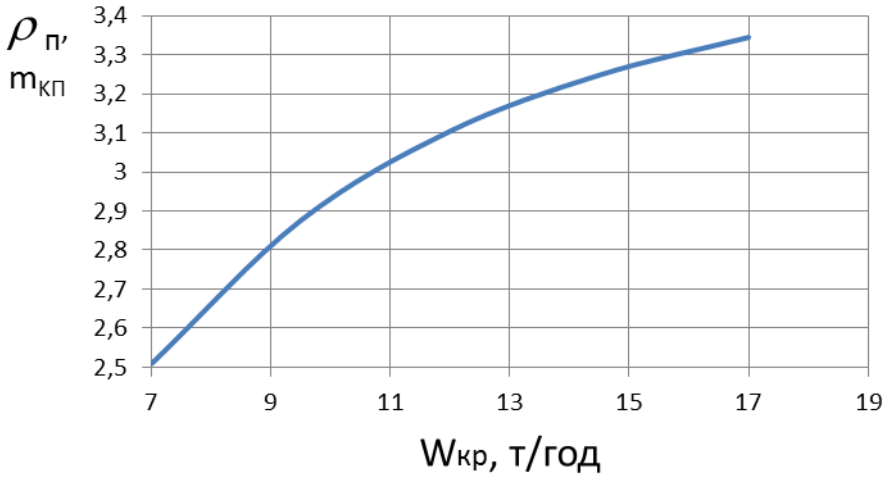

Fig. 1 Dependence of the number of grain bins $\rho_{П}$, Ed., Loaded into a private one for his Haulage and the number of HCC mKP served by a private, on the performance of HCC WKP.

The graph shows that **for**ilkist grain bins $\rho_{П}$ That is loaded into a private one for his Haulage, as well as the number of HCC mKP served by a private, increases of 2 (2.5) 3 (3.35) with increasing productivity HCC WKP 7 to 17 t / h. This is due to a simultaneous increase capacity bins HCC from 3.0 to 10.5 m3, which allows you to have more time to service another trailer HCC. Thus the total number of service trailer certain number of granule cells increases with increasing performance and capacity hopper HCC HCC.

Consider in more detail the impact Tsikh parameters in a wide range of changes. Fig. 2 shows the tracker (9) the number of grain bins $\rho_{П}$, Ed., Loaded into a private one for his Haulage and the number of HCC mK, served by a private, capacity hopper of granule cells in the range from 3 to 13 m3 for HCC with a certain capacity WKP = 9,5; 12.0; 14.5 and 17 t / h.

1. Information base circuit "LC - PE" ZTK.

Group (№,	Number param-	Conditi onal	Parameter Name and unit of measure	The values of certain levels

name)	group	tag.		1	2	3
I. Grain-picks-tal harveste r	1	W_{CA}	par. productivity, t / h.	7	12	17
	2	ωK / qk	capacity, m3 / Capacity grain silo, t	3 / 2.25	7 / 5.25	11 / 8,25
	3	W_{HQ}	product. vyvantazhuv. screw, t / h.	45	194	325
II. Prychep-re van tazhuvac h	1	ωP /q_P	capacity, m3 / PP capacity, t	20/15	30 / 22.5	40/30
	2	W_{IM}	product. vyvantazhuv. screw, t / h	180	270	360

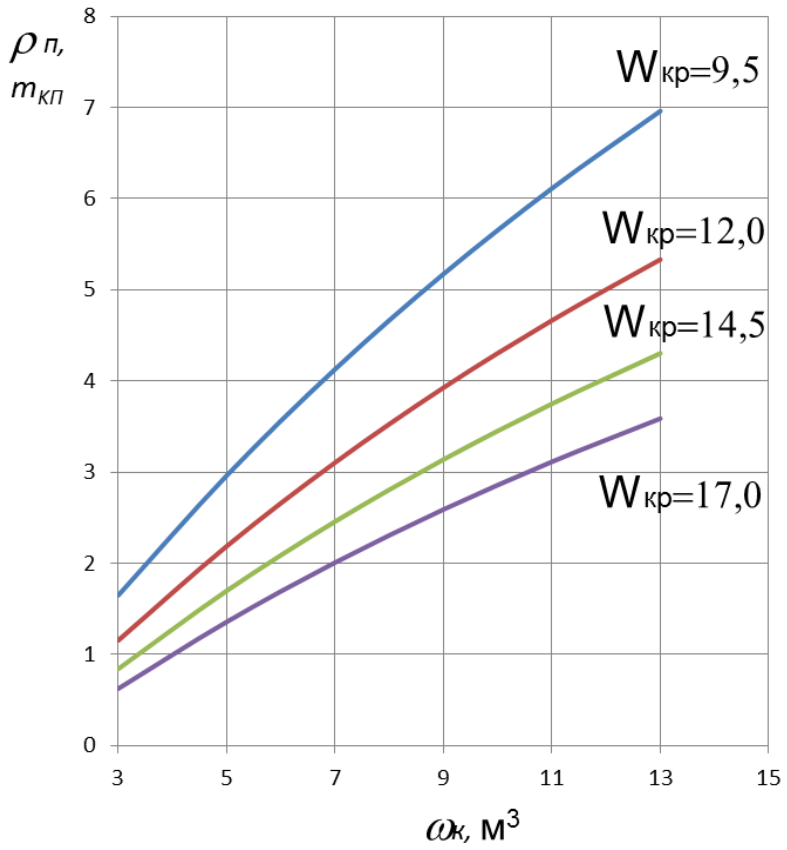

Fig. 2. Dependence of the number of grain bins $\rho_П$, Ed., Loaded into a private one for his Haulage and the number of HCC mK, served by a private, capacity hopper of HCC for a specific performance WKP = 9,5; 12.0; 14.5 and 17 t / h.

Reduced dependency analysis shows that the most significant factor that influences the amount of grain that is loaded in one working cycle in PP is capacity hopper HCC. This is served by increasing number of granule cells that have lower performance and therefore PP should have more capacity for grain on the number of bins $\rho_П$. So the number of HCC WKP = 9,5 t / h. That can be served by one PP increases with 1 (1.7) and 6 (6.1) units with increasing capacity hopper from 3 to 11 m3. Accordingly, you should increase the capacity of PE 1 (1.7) and 6 (6.1)

units bins $\rho_П$. This growth naturally slows down performance HCC increases. For HCC with WKP = 17 t / h. these parameters grow only 0 (0.7) 3 (3.5) units. when changing ωK in this range.

As a minimum number of bins of grain that fit in PP is 2 units. (The PP still serves as the drive), then the graph shows that there is a reasonable minimum allowable chain "HCC - PE". This minimum is determined for HCC with a capacity of 9.5; 12.0; 14.5 and 17.0 t / h. capacity bins corresponding HCC from 3.5 to 12 m3 and are both rational, as a private fully loaded a certain number of HCC. At lower capacity ωK for these operating modes productivity PP does not fulfill the necessary technological function and its use impractical. The minimum capacity hopper ωK m3 HCC served by a private (with a capacity of ωP m3) in the group by the number of MC determined according to the graphic dependence Fig. 2 and presented in Table. 2.

2. Rational PE capacity (capacity hopper for the corresponding HCC ωK, 3), which serves the HCC group.

Productivity-ness HCC WKP, t / h.	Rational private capacity, m3 (Corresponding capacity hopper for HCC ωK, 3), which serves the HCC group with the number mKP, ed .:				
	2	3	4	5	6
9.5	7.0 (3.5)	15.3 (5.1)	27.2 (6.8)	44 (8.8)	64.8 (10.8)
12	9.0 (4.5)	20.4 (6.8)	37.2 (9.3)	60 (12.0)	-
14.5	11.6 (5.8)	26.1 (8.7)	48 (12.0)	-	-
17	14.0 (7.0)	31.8 (10.6)	-	-	-

The data show that high-HCC with WKP = 14,5 - 17 t / h. need for a private service with a capacity of 11.6 to 48 m3. Reduced productivity to WKP = 9,5-12 t / h. thus increasing the number of HCC obsluhovuyemyh 5-6 units. through the use of a private capacity to 44-65 m3.

Selection of PP performed his duty performance and capacity based on the conditions of the multiplicity of indicators for silo and hopper PP granule cells under the following expressions:

$$1)\ q_П \geq \omega_K \mathrm{d_в} \rho_П, \qquad (10)$$

where $q_П$ - rated load hopper chosen PP;

$$2)\ \omega_П \geq \omega_K \rho_П, \qquad (11)$$

ωP - capacity hopper chosen PP.

Based on these expressions choose appropriate $q_П$ of PP and recommended for a tractor.

Number of PE, serving HCC group for a given quantity, defined as

$$n_{П} = CEILING\frac{m_K}{\rho_{П}} = CEILING\frac{m_K(0{,}12 + \frac{K_P\omega_K d_B}{W_{ШП}})}{\omega_K d_B(\frac{1}{W_{KP}\varphi} + \frac{1}{W_{ШК}}) - 0{,}08}, \text{ Ed.} \quad (12)$$

where $CEILING$ - function that returns the nearest integer.

Each interaction with a group of private HCC provides technological line of work, when one serves a private group of HCC, which sequentially (serially) discharged in PP that assigned to them.

The total number of rational HCC who works in a certain ZTK defined as

$$m_K = m_{K\Pi} \cdot n_{\Pi}, \quad \text{units.}, \quad (13)$$

Conclusions

1. On the basis of the balance of the operating cycle time PP The analytical relationship, which allows you to make rational selection number private message to ZTK during application handling technology transport grain from HCC. Total number of service trailer certain number of granule cells increased with HCC capacity hopper and decrease productivity.
2. Established rational (minimum allowable) capacity bins HCC chain "HCC - PE". This minimum is determined for HCC with a capacity of 9.5; 12.0; 14.5 and 17.0 t / h. capacity bins corresponding HCC from 3.5 to 12 m3. At lower capacity ωK for these operating modes productivity PP does not fulfill the necessary technological function and its use impractical.
3. Each interaction with a group of private HCC provides for such a technological line of work, when one serves a private group of HCC, which sequentially (serially) discharged in PP that assigned to them.
4. For handling technology is the most effective PP with high capacity of up to 40-60 m 3, which can increase the number of HCC, serviced, and reduce the number of members ZTK.
5. Established that PE with a capacity of 26 to 48 m3 serves 3-4 HCC with high-WKP = 14,5-17 t / h. Reduced productivity to WKP = 9,5-12 t / h. increases the number of granule cells, which served to 5-6 units. through the use of a private capacity to 44-65 m3.

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Ustanovlenы analytycheskye dependence for definitions ratsyonalnыh interaction parameters zernouborochnыh combine and prytsepov-perehruzhateley at hruppovoy s work.

Zernouborochnыe kombaynы, trailers, perehruzhately, proyzvodytelnost, analytycheskaya dependence, ratsyonalnыe Options.

It is found out the analytical dependences for the determination of rational interaction parameters of combine harvesters and trailers, cranes for their group work.

Combine harvesters, trailers, cranes, performance, analytical dependence, rational parameters.