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Experimental study of the operational characteristics of the new top harvesting machine

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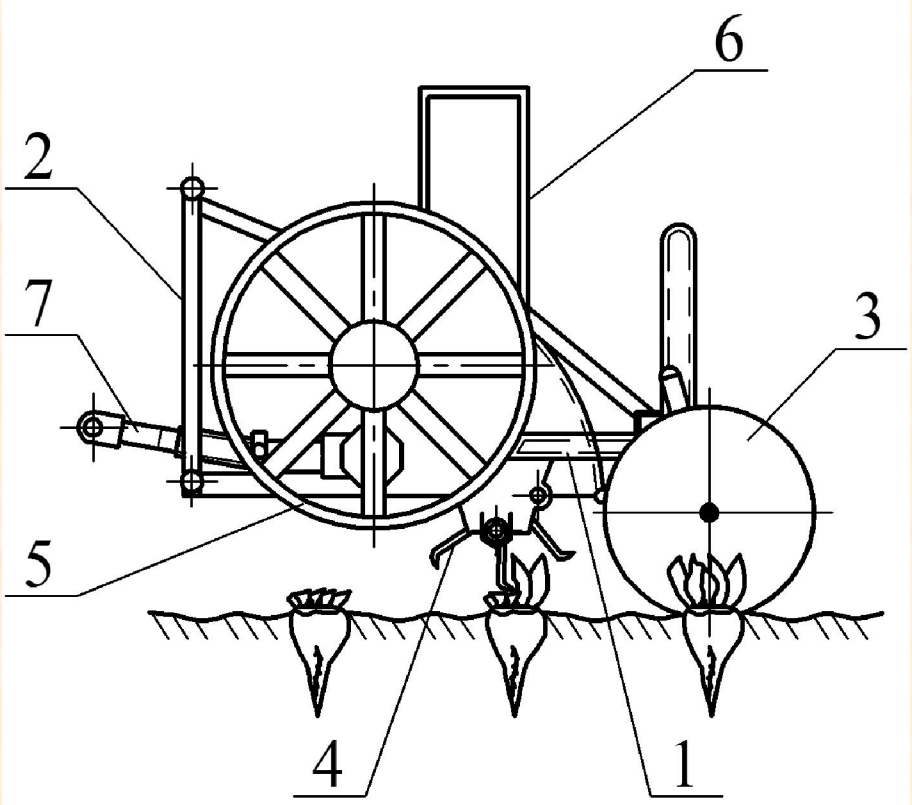
Purpose of research

- The purpose of the work is to determine the operational indicators (productivity, the fuel consumption, the power consumption) of a new experimental top-harvesting machine depending on the working speed, and to compare them with the most common analogue.

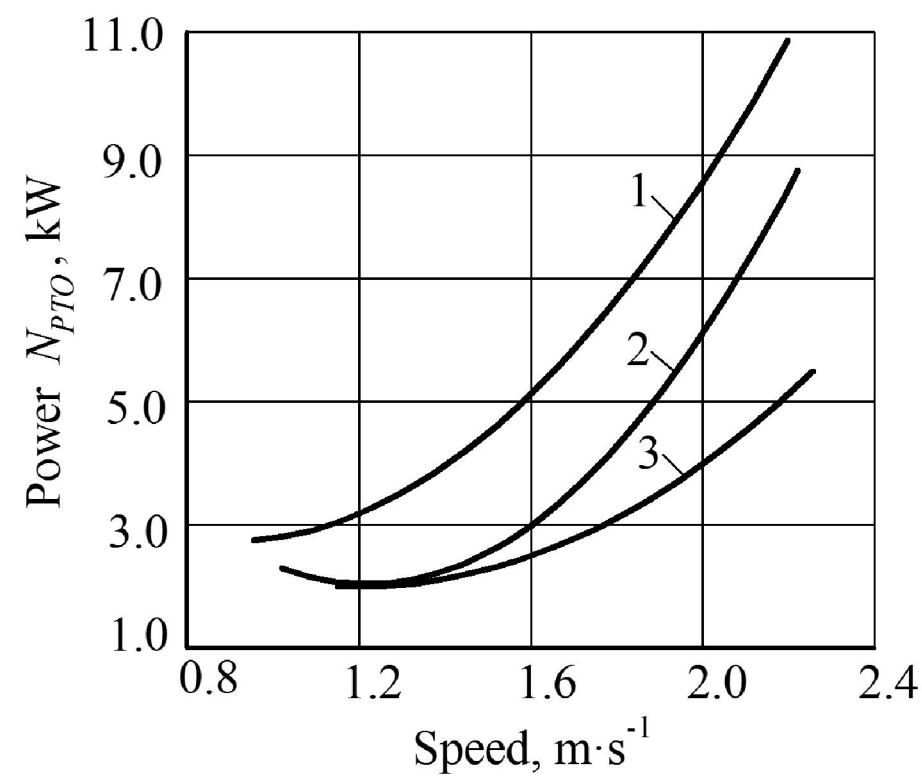
The structural and technological scheme of the new top removing machine



3

1 – the frame; 2 – the hitch attachment; 3 – the supporting pneumatic copying wheel; 4 – the rotary top cutting apparatus; 5 – the transporting working tool; 6 – the unloading device; 7 – the power take-off shaft

The dependence of power on the drive of the working bodies of the top harvesting machine upon the speed of its forward motion



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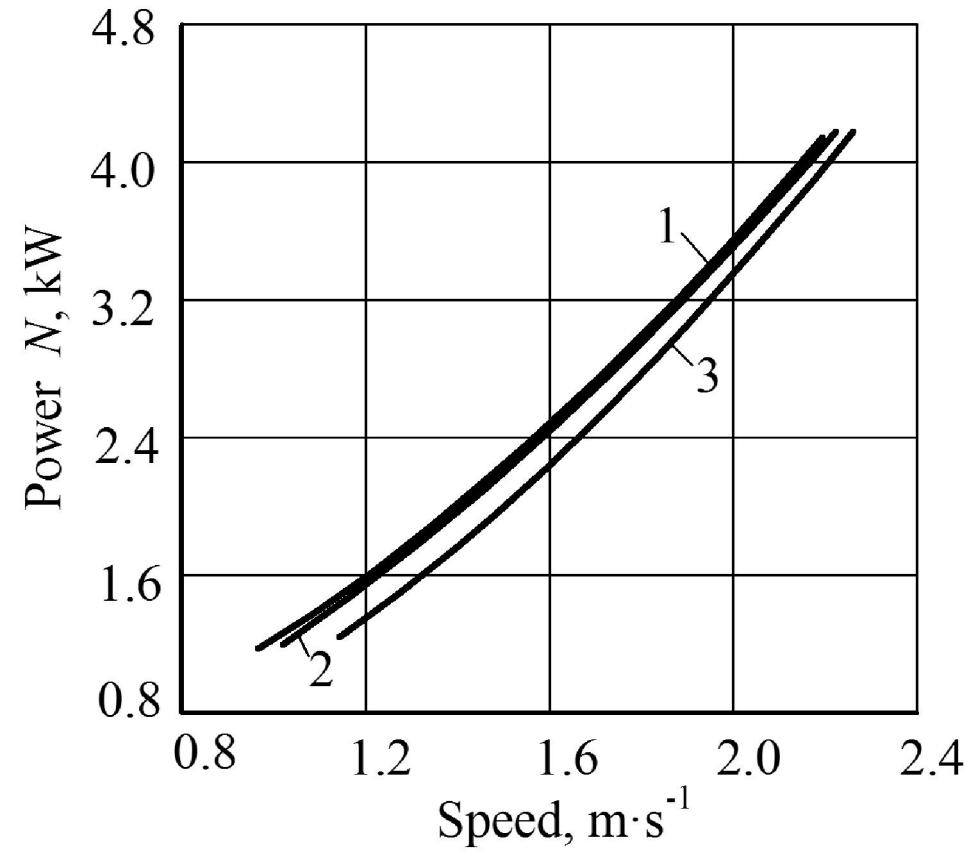
$1 - \omega_{po1} = 57\ s^{-1}$, $2 - \omega_{po2} = 39\ s^{-1}$, $3 - \omega_{po3} = 0$

The dependence of the traction power of the top harvesting machine on the speed of its movement



$1 - \omega_{po1} = 57\ s^{-1}$, $2 - \omega_{po2} = 39\ s^{-1}$, $3 - \omega_{po3} = 0$

Mathematical model

Mathematical model (regression equation) of the impact of variable factors upon the total power N_T consumed by the top harvesting machine in the form:

$$Y = f(X_1, X_2), \quad (1)$$

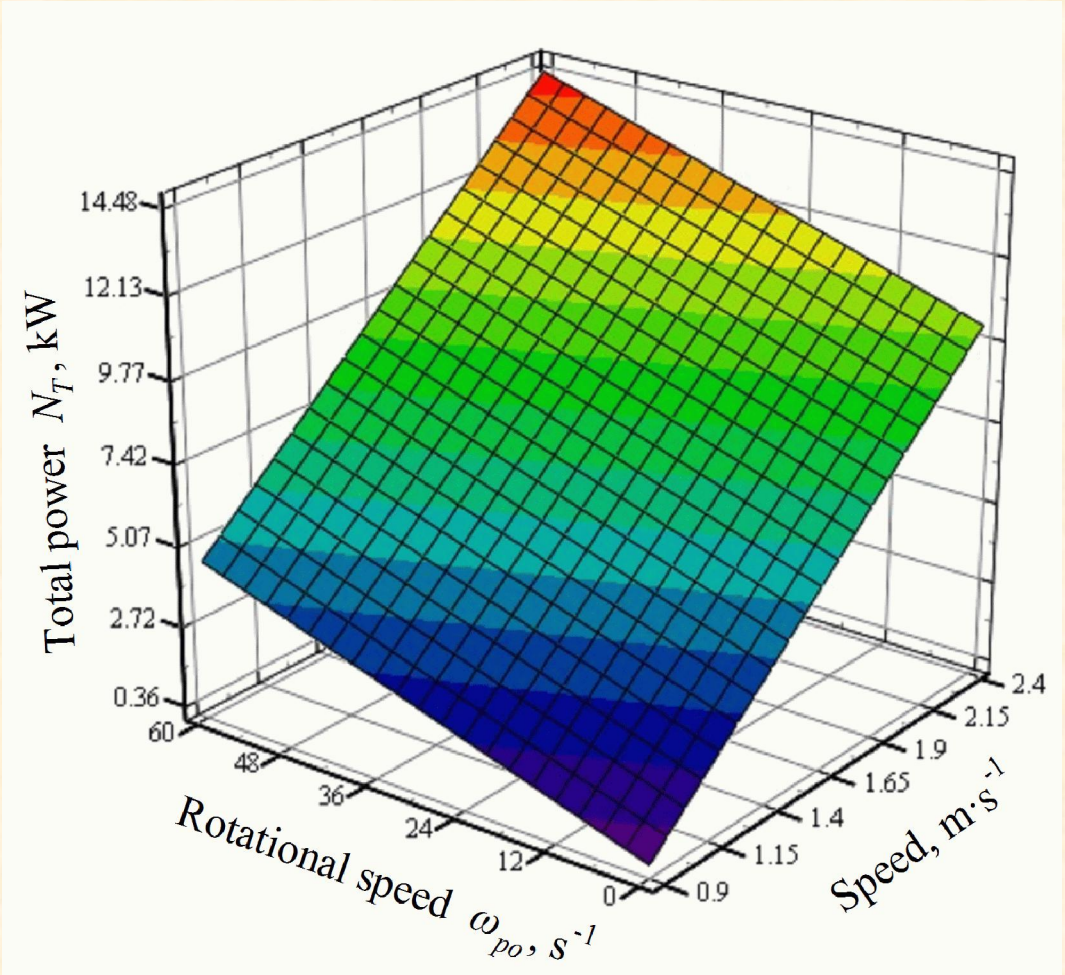
where X_1 – the forward speed of the top harvesting aggregate studied, $m \cdot s^{-1}$;

X_2 – the angular velocity of rotation of the working bodies for transportation and loading of tops, s^{-1}.

The dependence that describes the change in the power consumption N_T, necessary for the operation of the top harvesting machine, is shown in Fig. 4, and written in the form of such a regression equation:

$$Y = -2.5655 + 6.5861X_1 + 0.0707X_2. \quad (2)$$

The dependence of the total power consumption N_T of the top harvesting machine upon the speed v and the angular velocity of rotation of the working bodies for the transportation and loading the



Conclusions

- 1. Based on the results of the experimental field investigations, operational performance indicators of the new top harvesting machine are obtained. So the efficiency, when aggregated with a class 1.4 wheeled tractor, is 2.15 ha·h^{-1}; the specific fuel consumption – 3.02 kg·ha^{-1}; the specific investments – 10.79 USD·ha^{-1}; the reduced operating costs – 16.34 USD·ha^{-1}.
- 2. The total capacity for the execution of the entire technological process of the sugar beet top harvesting is 14.48 kW. The maximum value of the traction power does not exceed 3.6 kW at the optimum speed of the forward movement. In addition, the power required to cut the tops is 6.0...6.2 kW, and to ensure transportation and loading of the cut tops into the vehicle, the power of 3.5...4.8 kW is needed.
- 3. The operational indicators, obtained by the results of the experimental field investigations of the three-row top harvesting machine, developed by us, with a rotary top cutting apparatus, are 1.5...1.8 times less than the top harvesting machines of the same class of a commercial output.

Thanks for attention!

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