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Calculation of Capacity of Grain Harvesters for Cutting Harvest of Soy

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ABSTRACT: Studies show that when harvesting a grown crop of crops by combine harvesters, constant change and adjustment of their operating modes are required. Because the combines work in different harvesting conditions, depending on the type of crop, yield, field topography, uniformity of maturation, and the corresponding setting of the operating mode of the harvesting machine increases its productivity, while operating costs are reduced.**(The purpose of the research)** Give recommendations on soybean harvesting by determining the capacity of the harvesting machine by the size and mass indicators of soybean plants grown in various conditions. **(Materials and methods)** The capacity of the combines during harvesting soybeans was determined based on the results of previous studies, using existing theoretical formulas. **(Results and discussions)** The capacity of the combines during harvesting soybeans was determined based on the results of previous studies, using existing theoretical formulas. **(Conclusions)** According to the results obtained, it can be seen that for according to formulas (3) and (4), with the width of the header of the New Holland TS-5060 combine harvester 4.5 m, working speed within 1.2 m/s, grain yield within 12, 1 kg/ha - 14.1 kg/ha, and the results obtained above, the throughput of the combine was 18.5-28.9 kg/ha or 0.5-0.8 kg/s, and the actual throughput was 7, 5-8 kg/s. The operational performance of the combine according to the above results was 3.2-7 ha/hour. In fact, in the experiments it amounted to 1.3-1.9 ha/hour. Combine harvesters for soybean harvesting are used inefficiently, for their effective use it is advisable to use reapers with a wider working width. In this case, high performance indicators are achieved with minimal operating costs.

KEYWORDS: harvester, throughputs, capture of reapers, operating width of a header, straw, productivity, harvesting, soy plants

I.INTRODUCTION

Technological operations in a combine harvester are closely interrelated. The operating mode of the reel (number of revolutions, height of installation relative to the cutter bar, longitudinal distance from the cutter bar to the axis of the reel shaft) should ensure in the technological process the attraction of the processed mass to the cutter bar, its holding until the end of the cut, the cut stems should be fed to the auger, that is, to deliver the processed mass on the cutter bar and auger.

The quality and speed of the technological process operations determine the productivity (throughput) of the harvesting machine (figure) [1-5].

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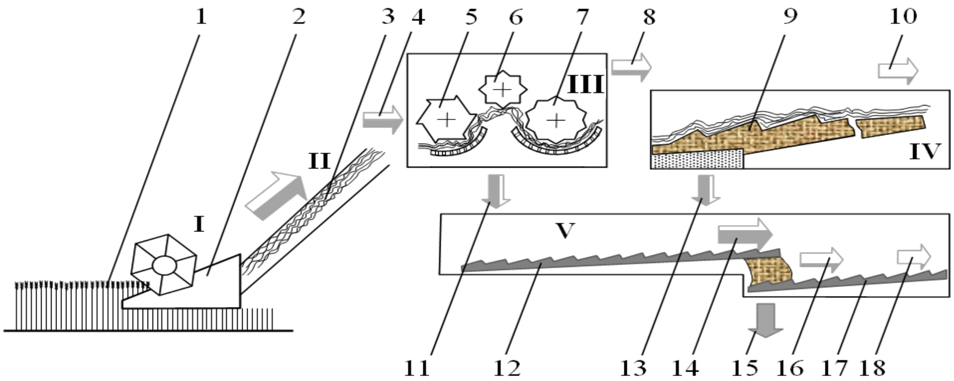

Figure: Flow chart of the New Holland TC-5060 combine harvester

1 - plants; 2 - harvester header; 3 - conveyor; 4 - process flow; 5 - threshing drum; 6 - receiving beater; 7 - rotary separator; 8 - technological stream "straw + grain"; 9 - straw walker; 10 - process flow “straw + grain losses”; 11, 13, 14 - technological flow "grain + small impurities"; 12 - shake board; 15 - process flow "grain"; 16, 18 - process flow "fine impurities"; 17 – sieve.

Violation of one of the functions negatively affects the quality of work and operational characteristics of the unit (combine), therefore, it is important to adjust (adjust) the operating modes of the combine in accordance with different harvesting conditions.

In order to harvest soybeans efficiently, that is, with little damage and loss of beans, it is necessary to adjust (adjust) the operating modes of the combine in accordance with the physical and biological characteristics of the plants.

Research goal. Give recommendations on the harvesting of soybeans by determining the throughput of the harvester by the size and mass indicators of soybean plants grown in various conditions.

Materials and methods. The throughput of the harvesters during the soybean harvest was determined based on the results of previous studies using existing theoretical formulas.

Results and discussion. The throughput of a combine is the largest value of the processed mass without loss per unit of time [5-7].

The throughput of the harvester depends on the type of agricultural crop being harvested, the design of the working parts of the harvester and their settings.

Thus, the productivity of combine harvesters is determined by the value of the grain mass in the harvested crop. The amount of grain mass can be determined using the following formula:

$$P_g = y_g(1 + c_g), \quad (1)$$

where is the P_g mass of grain, t/ha;

y_g - grain yield, t/ha;

c_g - coefficient expressing the ratio of the mass of straw to the mass of grain in the harvested crop.

Investigation of the size and mass characteristics of soybean plants. Experiments to determine its total length, weight, number of pods, number and weight of beans in pods, the ratio of straw mass to grain weight and the entire biological yield, as well as its physical and mechanical properties, were carried out according to regulatory documents [1, 2, 7].

In the Urta-Chirchik, Yangiyul and Kuyi-Chirchik districts of the Tashkent region, the following results were obtained: the biological yield during the harvesting period varied from 283.6 to 395.3 g/m^2, that is, from 2.83 t/ha to 3, 95 t/ha; grain yield - 121.4-141.8 g/m^2, or 1.21-1.41 t/ha; and the ratio of the mass of straw to the mass of grain was in the range c_g = 2.3-2.8 [8-10].

According to the above data, the value of the grain mass, calculated by the formula (1), is in the range from 3.99 to 5.36 t/ha.

Repeated sowing of soybeans in the same fields improves their ameliorative condition, increases the humus

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content in the soil, and increases the yield several times in the following years [8-9].

The size of the grain mass mowed by the combine header and entering the threshing drum depends on the cut height. It can be taken approximately equal to the value proportional to the length of the cut part of the stems:

$$c_g = c_p\left(1-\frac{l}{l_0}\right), \quad (2)$$

where is the c_g coefficient expressing the ratio of the mass of straw to the mass of grain in the harvested crop.

c_p – coefficient expressing the ratio of the mass of the entire plant at the root to the mass of the grain;

l_0 – average plant height, m;

l - cut height relative to the field, m.

According to calculations, the coefficient expressing the ratio of the mass of the removed part of the straw to the mass of the grain is in the range of 1.84-2.41.

When analyzing the results, the existing regulatory sources were used. In addition, private methods were applied, with the help of which the values of the masses of plant components were studied at each site 5 cm long [8-9]. The total plant height in the regions on average is 63.0; 85.0 and 99 cm, average cut height - 10-15 cm.

After mowing, the grain heap enters the threshing apparatus for processing per unit of time. The amount of feed q can be determined by the following formula [6, 11, 12]:

$$q = 0{,}1B_M V_M y_g\left(1+c_g\right), \text{ cen/h} \quad (3)$$

or

$$q = \frac{B_M V_M y_g}{360}\left(1+c_g\right), \text{ kg/s}, \quad (4)$$

where q is the amount of feed, kg/s;

B_M - width of capture of the combine, m;

V_M - working speed of the combine, m / s.

The throughput of the threshing apparatus Q must be at least the value of the feed q, that is, $Q \geq q$, in this case, harvesting is achieved with minimal losses:

$$Q \geq \frac{B_M V_M y_g}{360}\left(1+c_g\right), \text{ kg/s}. \quad (5)$$

The operational performance of the combine is:

$$w_{op} = 36\frac{Q \cdot y_g}{P_g}\tau, \quad (6)$$

where w_{op} is the operational productivity of the combine, kg/s.

τ - coefficient of use of shift time (determined empirically), in the experiments carried out it is equal to 0.65-0.70.

The working width of the New Holland TC-5060 combine harvester is B_M = 4.5 m, the working speed of the combine can vary within 1.0-1.6 m/s [3, 11.]. For calculations, we take V_M = 1.2 m/s, since when harvesting soybeans at high speeds, an excess of the permissible loss requirements in the area of the header of the harvesting machine is observed.

According to formulas (3) and (4), with a header width of 4.5 m, a working speed of 1.2 m/s, grain yield within 1.21-1.41 t/ha, the throughput of the combine was 0.5-0.8 kg/s, and according to the technical description - 7.5-8.0 kg/s.

The operational performance of the harvester according to the technical description is 3.2-7.0 hectares per hour. And according to the results of our experiments, this figure was 1.3-1.9 hectares per hour.

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II.CONCLUSION

According to the results obtained, it can be seen that combine harvesters are used ineffectively for harvesting soybeans. It is advisable to use headers with a larger working width. In this case, high quality indicators are achieved with minimal operating costs.

REFERENCES

1. Chaplygin M.E., Zhalnin E.V. Opredelenie kachestva r aboty zer nouboroch nyk h kombay nov [Deter mining the performance quality of combine harvesters operating]. Sel'skokhozyaystvennye mashiny i tekhnologii. 2019. Vol. 13. N4. 71-76 (In Russian)

2. Astafyev V.L., Zhalnin E.V. Efficiency evaluation of grain harvesters of different types under North Kazakhstan conditions. Sel'skokhozyaystvennye mashiny i tekhnologii. 2018. 12(3): 17-21. DOI 10.22314/2073- 7599-2018-12-3-17-21. (In Russian)

3. Shoumarova M., Abdillayev T. Agricultural machines. –T.: "O'qituvchi", 2019. – P. 380-404.(in Uzbekistan)

4. Zhalnin E.V., Godzhaev Z.A., Florentsev S.N. Conceptual principles of intelligent agricultural machines in the case of combine harvester. *Agricultural Machinery and Technologies*. 2017; (6):9-16. (In Russ.)

5. Jing Pang, Yaoming Li, Jiangtao Ji, Lizhang Xu. Vibration excitation identification and control of the cutter of a combine harvester using triaxial accelerometers and partial coherence sorting // Biosystems Engineering, 2019. Vol. 185. – P. 25-34.

6. Tashboltaev M. Theoretical and practical principles of increasing the productivity of machine-tractor units. - Tashkent: Spectrum Media Group, 2015. 88 p. (in Uzbekistan)

7. Zhenwei Liang, Lizhang Xu, Josse De Baerdemaeker, Yaoming Li. Wouter Saeys Optimisation of a multi-duct cleaning device for rice combine harvesters utilising CFD and experiments // Biosystems Engineering, 2020. Vol.190. – P. 25-40.

8. Carroll Justin. "Using Precision Agriculture Field Data to Evaluate Combine Harvesting Efficiency " (2015). Agricultural Education, Communications and Technology Undergraduate Honors Theses, 4.

9. Astonakulov K., Tashboltaev M., Ochildiev O. Preventing grain loss when harvesting wheat // Agriculture of Uzbekistan // № 4, 2014. - P.11-12.

10. Trubilin E.I., Ablikov V.A. Machines for harvesting crops (Construction, theory and calculation): Textbook. - 2 ed. reslave. and add. - KGAU, Krasnodar, 2010, - P. 115-118. (In Russian).

11. Zhalnin E.V., Tsench Yu.S., P'yanov V.S. Analysis method of combine harvesters technical level by functional and structural parameters // Sel'skokhozyaystvennye mashiny i technologii. 2018; Vol. 12; 2: 4-8.