FIELD TESTS OF ROSTSELMASH CEREAL HARVESTING COMBINE

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Abstract

Agriculture and plant cultivation has been and will continue to be a vital field of human activity, since the beginning of mankind, agriculture has been part of man's daily life. Man instead looked for methods, mechanisms and technologies to ease the work and capitalize on the biological potential of cultivated crops. As a result, this field, which is a science in and of itself, has had a constant need for advancement and knowledge. The transition from manual tools to modern, self-guiding machines and from manual grain harvesting to the creation of true mobile processing factories known as generic combine harvesters makes this technological advancement represent a true revolution of modern technologies, integrated in the most important activity sector of humanity, agriculture.

Key words: cereal, harvest, combine.

Ever since the first models of grain harvesters that had stationary modes of operation, the only process carried out by them being threshing and cleaning of seeds, systems were followed and developed through which the quality and energy indices of this mobile processing station fulfill as many functions as possible, be easily adaptable for several types of agricultural crops and carry out grain threshing works in the shortest possible time (Petcu G., 2018). Thus, at the moment we are building high-capacity grain harvesters, which present multiple integrated systems for improving the quality of the harvested products (Ibănescu A., 2015).

The current harvesting machines that are available on the market must meet certain requirements and principles coming from both the farmers, but also requirements coming from the technology systems of the plants grown in intensive regimes or in combined systems (Huzum N., 2013).

Thus, the harvesters must meet the following conditions:

- to require a balanced consumption of energy and fuel depending on the needs of each farmer;
- to be suitable for multiple types of culture, and the harvesting machine to be able to adapt to different types of work equipment, to present a simple operative character, and the transition from one culture to another to be relatively simple to achieve;
- to present integrated processing systems for the crops to be harvested: to cut the plants, thresh the ears, separate the seeds from the rest of the plant, to ensure the storage of the grains for a short period of time and at the same time to carry out the shredding or chopping of the vegetable remains left unthreshed;
- to be able to perform the threshing and harvesting of the seeds of different crops with the greatest possible precision, achieving a minimum of crop losses and a minimum of damage to them;
- to ensure continuous operation regimes, with increased reliability and a minimum of mechanical interventions that can harm the postponement of the harvest of agricultural crops (Cazacu D. and Rosca R., 2020).

As a result of these specific characteristics of the agricultural machines for harvesting cereals and not only, we understand that the permanent development of the technologies applied in agriculture is absolutely necessary, in order to carry out efficient works with a minimum of losses, but also for the efficiency of agricultural technologies by recording the quantities of harvest threshed from a certain area (Leontescu M., 2016).

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flow, more precisely the harvesting of grain crops (Cazacu D., 2021).

The harvesting of cereals is a complex process, based on well-established operations in the technological flow to be harvested, which are: cutting the plants, threshing the plant (represents the action of detaching the seeds from the vegetative part of the plants), collecting and transporting the resulting product in after harvesting (Izmailov A. Yu. *et al*, 2018).

This process is one of the most important works within the technological flow of growing agricultural crops, because the harvest decades are well established being as short as possible so that there are no grain losses, even the smallest delays can lead to losses meaningful (Zhalnin E.V. *et al*, 2018).

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Thus, harvesting is done in the shortest possible time, respecting the optimal harvesting stage depending on each crop (6-10 days), with the limitation of grain losses and with as little damage or damage to them as possible (Zhalnin E.V., 2013).

The grain harvesters, through their process of use, have gradually expanded, being able to be equipped with different equipment that enables the harvesting of several agricultural crops, initially they were designed as fixed machines, which only carried out the beating, shaking and cleaning of the seeds, cutting and transorting the plants to be harvested to the threshing machine, being done manually by humans.

Currently, harvesters allow the harvesting of various grain crops and not only, such as: wheat, corn, sunflower, soybean, pea, oilseeds and grasses, etc., by simply changing the components of the working organs and the operating regime, they lend themselves for harvesting multiple agricultural crops (Lobachevsky Y.P., 2016).

Thus, this field has had a permanent need for development and knowledge, being a science in itself, the evolution from manual tools to modern, self-guided machines and from the manual harvesting of grains, to the construction of real mobile processing factories called generic combine harvester, makes this technological development represent a true revolution of modern technologies, integrated in the most vital activity sector of mankind, agriculture.

MATERIAL AND METHOD

The analyzed combine has an engine with the characteristics describe in table 1.

Table 1

Engine specification

Manufacturer/model	**RSM 161**
Engine type OM	502 LA
Cilindrical capacity	15,928 cm^3
Number of cylinders	8
Position the cylinders in the crankcase	V
Rated power	395 kW / 537 hp
Maximum power	430 kW / 585 hp
Emission standard	Tier 4 / Stage IV
Fuel tank capacity	1.150 liters

The beating and separation system from the Rostselmash harvester (*figure 1*) composed of the APS system, together with the Roto Plus system are part of the important systems used in the harvesting process, and are described in table 2:

Figure 1 **Rostselmash RSM 161 Harvester**

Table 2

The beating and separation system from the Rostselmash harvester

Manufacturer/model	**RSM 161**
Acceleration drum diameter	450 MM
Beater width	1700 MM
Beater diameter	600 MM
The speed of the batter	400 – 1050 rot./minute
Beater speed in the low speed range (beater reducer gear 1)	180 – 450 rot./minute
Beater speed in the high speed range (gear 2 of the beater reducer)	400 – 1050
The number of beater rails on the grain beater	8 elements
The range of adjustment of the opening of the counter-beater	7 – 50 MM
The number of segments of the preliminary contraband	3 section
The total area of the contraband	1.73 qm
The segment of the preliminary contraband, the perforation of the stamped basket for corn	19x40 MM
The segment of the preliminary contraband, the perforation of the stamped grain basket	6.5 x 40 MM
Angle of winding of the contraband	142a
Thresher processing – number of threshing segments	3
Number of Roto Plus axial rotors	2 rotors
Rotor diameter	444 MM
Rotor length	4200 MM
The separation surface at the level of the Roto Plus system	3.7 qm
Rotor speed with adjustment mechanism	400 – 1000 rot./minute
The number of separator baskets	10 Baskets
The number of rotor flaps actuated by the 4D Cleaning slope cleaning control system	3 Baskets/rotor
The number of blind bins	4 Baskets/rotor
The mesh surface of the baskets	16x50 MM

RESULTS AND DISCUSSIONS

As a result of these specific characteristics of the agricultural machines for harvesting cereals and not only, we understand that the permanent development of the technologies applied in agriculture is absolutely necessary, in order to carry out efficient works with a minimum of losses, but also for the efficiency of agricultural technologies by recording the quantities of harvest threshed from a certain area.

The integration of automatic adjustment and piloting systems offers greater ease in operating these machines that perform the last but also the most important work in the technological flow, more precisely the harvesting of grain crops.

For corn crops, the feed rate is between 23-25 kg/s with a loss coefficient of less than 1.5% at speeds between 4.5-5 km/h, combined with the large working width, this combine offers the possibility of harvesting of 3.8-4 ha/h in the maize crop.

The high percentage of losses is found at the level of the front attachment used for the corn crop, namely the header, it considerably increases the percentage of grain losses because the plant residue chopping system has an adjustable minimum rotation speed that is too high, thus the stems of the corn is quickly chopped and the cobs with grains are fragmented or discharged on the ground.

For the sunflower crop where the harvester combination was monitored this determined a feed rate of 19-21 kg/s with a loss coefficient below 3%.

The degree of damage to the grains was increased due to the humidity of the plants at harvest, its value registering 6-6.3%.

For sunflower culture, the hourly working capacity varied between 3.4 and 3.8 ha/h with an average production of 3700 kg of seeds per hectare.

The auxiliary systems for a better cleaning of the seeds in slope conditions have facilitated the good operation of the combine and the quality of the work performed, thanks to the running system with tracks, the studied combine does not have the possibility of mounting a copying system on the slope, instead it offers support through systems integrated regulation and directing of sieves, seeds and air, to achieve the best possible cleaning with a minimum of grain losses.

The specific fuel consumption expressed in liters/ton is of particular importance as it represents a fundamental criterion for assessing the performance of the grain harvester.

Thus, taking into account the high working capacity but also the high energy performance of up to 530 horsepower, the average fuel consumption for one ton of harvested product did not exceed the value of 3.2 liters/ton, which in the current economic conditions, renders this combination has an added advantage for low consumption and maximum performance.

CONCLUSIONS

It must be acknowledged that although providing them in large quantities and at a relatively high buy price, foreign corporations do not provide to evaluate the caliber of their manufactured harvesters' performance under the conditions of harvesting our country.

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