

## MECHANIZATION TECHNOLOGY FOR WHEAT HARVESTING WITH SELF-PROPELLED GRAIN HARVESTING COMBINE

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**Abstract.** Self-propelled combines enter plots without prior opening of roads. It is indicated, however, that, at the end of the plot from the access road, two to three furrows are initially harvested to allow the entry of the means of transport and other means necessary for harvesting. For the rational use of the means of transport, of the work of each combine independently, for better supervision and faster organization of technical assistance, it is recommended to use group work, with each combine on its work post. The width of the posts should be 0.15-0.25 L (L = plot length) so as to allow the combine to work at least one day on the same post. In low-length chains, the width should be higher reaching the same size as the length of the plot. In the case of grounded crops, the direction of the plants grounded should be taken into account to ensure the harvesting in both directions with minimal loss without useless movements. In the case of uneven maturation plots, the areas of plants that cannot be harvested can be delimited, entering combines in the field and harvesting only areas with mature plants. The main agri-technical requirements for the harvesting of grassy cereals are the following: the harvest shall be done in the optimum period, the grain losses shall not exceed 3%, and the purity of the grains shall be at least 97%. Exceptionally, if there are not enough combines, the harvest period can increase by 1-3 days after the full maturation phase and, after the end of this phase, properly adjusting the machines; because grains are heavier in the maturation phase, the loss in not threshed grains grow and, in the over-maturation phase, the straw crumble greatly, making the process of threshing, shaking and separation more difficult. In order to ensure maximum working capacity and minimum consumption of fuels, the combines should be adequately ensured with sufficient means of transport of harvested products. The number of means of transport should correlate according to the hourly productivity of the combines and the distance of transport of the products.

**Keywords:** *mechanization technology, grain, combine*

### INTRODUCTION

The technological process of mechanized harvesting of grassy cereals is generally conditioned by a number of agri-biological factors characteristic of cereal crops, such as crop variety, maturation of grains and stems, the ratio of grains and stems, humidity of grains and stems, the degree of fall of stems, the degree of weeding, etc. (DRAGOȘ T., ȘI COLAB., 1981; OKROS ADALBERT, 2015; STĂNILĂ S., ȘI COLAB., 2003 ).

All these factors imposed, in time, the finding of appropriate constructive solutions, so that mechanized harvesting of the basic product, grains, and secondary, straw and chaff, should be done in the best conditions, observing the agri-technical requirements thus avoiding the loss of grains and their injury, in terms of ensuring a high degree of purity of the harvested product. (ILEA R., 2013; GOGA ANA-MARIA, DUMA – COPCEA ANIȘOARA, MIHUȚ CASIANA, ROBU VIORICA, 2016; ILEA R., 2013)

In general, it is known that, on a biological line, research has led to results favourable to the mechanized harvesting process of straw grains. However, the growth and development of plants is uneven, as uneven is the maturity of the cereal plants. ( R. ILEA, ANIȘOARA DUMA COPCEA, R. MILOȘ, 2017; NIȚĂ, K. LAȚO, SIMONA NIȚĂ, ALINA LAȚO, CASIANA MIHUȚ, 2013). Problems with solutions also raise the variation of the grain mass in the fields of the same crop, which makes the chain's maturation staged, leading to natural losses until the harvest begins. (TOMA D., 1981; BUCATĂ, I.V., DIACONESCU, Ș., GIERATHS, J, WEILLER, W, 2003)

The period of cereal harvest imposed by their biology is generally short and it begins when the grains are at the end of the maturation phase (AUNGURENCE N., POPA D., CIODARU G., 1997; NIȚĂ LUCIAN-DUMITRU, 2007). It is usually carried out until the beginning of full

maturation of grains. At this stage of maturation, the grains have a humidity of between 17% and 25%. (TONEA CORNELIA; 1996, CANARACHE A., 1997)

The combine bunkers will download on the go, otherwise the daily productivity decreases due to stopping the harvest during unloading.

In order to ensure continuous operation, technical assistance by the mobile workshop of maintenance and repairs equipped with the necessary devices should be ensured (NEAGU TR., ȘI COLAB., 1982)

### **MATERIAL AND METHOD**

The main technical and functional characteristics of the W-series John Deere combines are as follows:

The reaping platform gives a faster cutting at a lower height. The working width is between 4.3 and 10.7 meters.

The thresher has a 10-track batter with a diameter of 650 mm and provides a complete threshing with a low percentage of breakings.

The camper shaker has a large separation area which gives a complete repartition of straw and grain.

Powering the separation system is done with helical conveyors. This technical solution avoids the leakage of the material to one side in the harvesting on downhill terrain.

Self-propelled combines were created for the direct harvesting of the straw grains from the field, solving with good results the harvesting of grain crops developed normally in favourable weather conditions and low humidity.

By advancing the combine into the field, the cutting apparatus cuts off the plants and the device tilts them towards the helical conveyor that drives them from the edges to the middle of the central transporter with the scrapes that send them to the thresher of the combine.

The threshing process results in two fractions:

The first fraction is thrown by the batter (drum) on the shaker (campers) and comprises straw, ears not threshed and free grains in straw. Heavy particles (grains and ears not threshed) fall through the shaker's grate on the inclined plane and slide on it to the oscillating conveyor and the light and long particles (straw) are shifted to the rear side and fall on the stubble;

The second fraction passes through the counter-batter and comprises grains, chaff, minted straw, ears not threshed and impurities, and reaches the oscillating plane from where it is routed to the cleaning system.

In the cleaning system, with the help of the sieve and air current produced by the fan, a new fraction is held, namely:

-The chaff and ears not threshed are trained by the fan air current to the back of the combine; at the end of the sieve with blinds, ears not threshed fall through the extension of the upper sieve and reach the spike snail from where, with the help of the ear elevator, are taken to the thresher and reinserted into the threshing circuit.

-The chaff is evacuated by the current of air and falls on the stubble;

-The grains passed through the sieves reach the grain snail from where they are taken from the grain elevator and transported to the combine bunker. After filling the bunker, the grains are discharged using the unload snail.

### **RESULTS AND DISCUSSION**

Since the harvesting process of the straw grains, as well as all production processes in agriculture, is carried out under the direct and permanent influence of natural conditions and in particular climate factors, which vary greatly in time and space, the organisation of work is necessary to continuously adapt these conditions.

The scientific organization of the harvesting of the straw cereals can result in a shortening of the harvest period and an increase in labour productivity. In order to achieve these objectives, as well as for the rational exploitation of the combines, it is necessary to take a number of organisational measures, among which:

- Preparation of the field for harvest;
- Choice of methods of movement of combines in the field;
- Ensuring the transport of main production.

The preparation of the field for harvest begins with the determination of the maturation status, marking dangerous places for combines, establishing the road of access for means of transport and fire guard points.

The method of traveling to harvest of straw cereals with combines, in which a high value of the working course coefficient is ensured, is the circular method of starting work from the outside of the plot and executing the turn to the right.

To avoid plant falling on the return surface of the combines, we should run, at the beginning of work, on each plot, diagonal crossings. The width of the diagonal roads ranging from 10-12 m ensures the making of turns eliminating the losses caused by the grounded plants. The roads open on the diagonals of the plot also serve for the circulation of transport aggregates serving the combines.

The road-to-right movement method allows the bunker unload tube to be directed towards the harvested terrain. The best way back to the corner of the plots is the return with the movement of the aggregate. At the end of the furrow, the combine moves about 1.5 m rotating the steering wheel to the right while the cutting platform rises and, at the time of stopping, start rotating the steering wheel to the left. Then, we should connect the walk backwards and break the left wheel until the blade is exceeded by the cutting apparatus about one metre, after which it stops combining and starts working in the furrow, breaking a little the right wheel if necessary and descending to the height of cutting. Due to the controls provided on the driving platform, the combine can cope in any situation with minimal crop loss.

The trailers that transport the production should be sealed and disinfected against wheat pests. In general, there are still grains from the former campaign, wandering on the joints of the shutters attracting this pest during storage.

## **CONCLUSIONS**

The organization in good conditions of the harvesting of straw cereals, through the full use of working time, by avoiding unnecessary stops and movements, using machines at their maximum working rate and with specific fuel consumption requires the correct work on plots, choosing the most appropriate method.

The unnecessary movements of the machines results, for the most part, from their returns at the ends of the plots. The combine bunkers will download on the go, otherwise the daily productivity decreases due to stopping the harvest during unloading.

In order to ensure continuous operation, technical assistance by the mobile workshop of maintenance and repairs equipped with the necessary devices should be ensured. It is of great importance that daily maintenance is carried out to avoid defects and, implicitly, the stopping of the combines. Any malfunctions occurring during work should be remedied as soon as possible.

It is recommended that, during the work, the engine operates at maximum rate to properly work the organs of the thresher.

For optimum use of working time, we need to correlate the number of combines according to the surface of the plot to be harvested, taking into account the productivity of the combines and the production per hectare. This is of particular importance in shortening the harvest period because it avoids moving the combines from one plot to another during the day when conditions allow harvesting.

To increase the period of use of the combines, it is recommended to cultivate plant varieties with broken maturation phases; to reduce losses it is recommended to use the plant varieties resistant to falling and shaking.

During harvesting, the movement speed will be correlated depending on the condition of the field in such a way that the thresher of the combine is supplied with an optimum, constant flow of material and that ensures maximum productivity with minimal loss.

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