# RESULTS OF QUALITATIVE ANALYSIS OF THE PULLED CORN PICKERS WORK EFFECTS DURING THE PICKING OF MERCANTILE CORN

**S. BARAĆ, A. VUKOVIĆ, M. BIBERDŽIĆ**

***University of Priština, Faculty of Agriculture, Lešak , Kopaonička bb, 38232 Lešak, Serbia***
***Bačka, 33/19, 11080 Zemun,***
*E-mail adress: sbarac@eunet.rs*

***Abstract:*** *The main characteristic of the pulled corn pickers is that they drawn in one pass separate ear of corn from the stalk and made it husking, while it achieves a different quality of work. Quality of collectors depends on a several factors: the condition of crops, defining of relevant parameters for the operation, technical accuracy and staff skills. When the relevant parameters are not well aligned, the quality of work is significantly decrease, resulting in increased losses and poor quality of the collected mass in the bunker of corn pickers. Modern solutions of the used devices should provide high-quality collection in different conditions, with realized losses and damage of grain which do not exceed the tolerance value. The aim was to determine the effects of three types of pulled corn pickers ZMAJ 222 (type A), Berko 025 (type B) and Tornado 80 (type C) in the standard and the control variant, at corn picking in the observed area. Method is the standard methodology of custom test equipment for corn picking, complemented by the necessary assessments. The study was conducted in two phases. The work conditions were determined in the first phase, while the work effects depending on the defined parameters were determined in the second phase. The quality of the picked corn ear, grain losses, the degree of damage and the coronation of grain, the amount of cut wood chips were determined. The fuel consumption was determined by volume method and the effect was determined by chronometric method. In the crowd picked by picker type B was measured the highest content of whole intact corn cobs and amounted 97.15% and the lowest content of nonhusked corn ears in the amount of 8.45% (standard version). The minimum content of whole undamaged corn ear was in the crowd picked by picker type A - 88.23% in the control variant. Also, at the same picker was measured the highest content of 17.24% nonhusked corn ears. Total losses were varied in the range of 1.42% (B picker, standard operating speed of 4.10 km $h^{-1}$), to 5.67% control variant (A picker, 7.21 km $h^{-1}$). The speed of movement significantly increased the amount of cut wood chips, so that it ranged from 18.68 - 31.53 cm (C picker type, standard, or control variant), and the other device 19.7-26.3 cm. Labour productivity ranged from 0.44-0.73 ha $h^{-1}$.*

***Key words*****:** *picker, corn, work quality, productivity, losses.*

## INTRODUCTION

Corn is one of the most important agricultural crops, with universal significance, both for human and domestic animals and for the processing industry and obtain bioethanol. From the industrial processing of corn can get over 500 different products. These are primarily food products (for infants, corn cereals, means for thickening foods, to improve the quality of bread, special breads, soups, pates, spices, chewing gum, starch, sugar), medical products (syrup), pharmaceutical and cosmetic funds, various drinks (alcohol, malic, lactic and citric acid), textile products (artificial fibers), chemicals (paints, polishes, asbestos, nitrocellulose, furfurol, paper and plastics) (TODOROVIC et al. 2003.). Despite the fact that the corn can get a large number of products, most of the corn grain used as fodder. Significant changes in the production of corn were allowed with introduction of powerful tractors, hybrid seed production and the development of high quality and sustainable maize pickers (ALLAN G. BOGUE, 2009).

Picking of mercantile corn in the ear can be done in different ways. Hand corn picking in baskets and storage is the oldest method which is now kept in a very small scale. Usual method of corn picking is using of pulled corn picker-husking machine or using self-propelled combine harvesters. Mercantile corn is collected in the stage of technological maturity, i.e. in the phase of transition from wax to full maturity. When there are opportunities for redrying, corn picking is done with the water content in grain of 35%. In cases with no redrying, picking is done at the stage of full maturity. In the Republic of Serbia in 2010. year corn was sown on a total of 1 235 000 hectares and picked from 1 229 573 ha, with the realized production of 7 207 191 t with a yield of 5.9 t $ha^{-1}$. In the region of southern and eastern Serbia under maize in 2010. year, 219 000 ha were planted, picked 218 714 ha, with production of 952 110 and average yield of 4.4 t $ha^{-1}$ (Statistical Yearbook of Serbia, 2011.). Intensive corn production involves the use of harvesting machines and pickers and combines. From modern equipment solutions for maize harvesting requires the quality picking in all conditions and without exceeding the tolerance value of losses and grain damage. The quality of corn pickers can be seen in amount of the realized losses and the quality of the collected mass. Under the environmental conditions of southern Serbia are used different corn pickers, with less usage of corn harvesters. In recent years, as a consequence of the economic crisis, there is a trend of buying used corn pickers imported from Western Europe, while new harvesters and pickers are buying in a much smaller number. Considering the problems of picking corn in the ear, it can be concluded significant presence of these issues in the works of various authors. The quality corn harvesting combines implies good quality of the collected mass and assuming that the allowable losses do not exceed 1.5% said PINTARA (2000.). FURMAN et al. (2001.), suggest that the losses of grain during harvest corn picker "Berko" and speed of 5.62 km $h^{-1}$ amounted to 1.13%, while the coronation amounted to 5.0%. The same authors state that the measured fuel consumption of 5.63 l $h^{-1}$. Maximum total losses in terms of higher biological yield of 11.3 t $ha^{-1}$ were in the range of 1.5-1.6% of the biological yield. There has been piston flow of 45 t $h^{-1}$ while the total losses were in tolerable limits and with purity of 99.5%, low damage and breakage to 3% (LAZIC et al. 2002). Examining the JD 2264 harvester in corn harvesting MALINOVIĆ et al. (2002.), point out that the amount of residue stalks, i.e. wood chips and cutting height was within the range of 234-473 mm, depending on the speed of the harvester. At increased operating speeds chopped stem length increases: at least 50 mm to 120 mm at the highest speed. The total grain losses for JD 2264 harvester were close to the tolerance value of 2%. Self-propelled combine harvesters and pickers used to harvest mercantile corn cob, in addition to high technical reliability, should meet the requirements of high energy and capacitive harmony, easiness in operation and maintenance, high quality picking, husking and cleaning (Malinović et al. 2002). The productivity of modern collectors should be in the range of 1-2 ha $h^{-1}$ depending on the conditions for the application of the high efficiency of work time, or a small loss of time for the technical-technological servicing, empty cycles and others, according to the same authors. Examining the self-propelled agricultural machine "BERKO 041", Malinović et al. (2003.) reported that losses of picking sections were within the permissible range of values and ranged from 2.3-3.54%, depending on the mode. The content of whole corn ear varied from 97.3-97.5%, 0.9-1.5% broken and nonhusked 12-15%. Overall losses were within 1% at the devices A and B, and for the device C in certain conditions and high speeds (10 km $h^{-1}$) were from 1.5-2%. (MALINOVIĆ et al., 2003). The same authors state that the amount of residue stalks, i. e. wood chips or cutting height varied in the range of 18.5-23.9 cm for device of type A, 18-23 cm for devices of type B and 23.4-43.7 cm for devices of type C, in which the increase of speed significantly affect no more cutting height. Based on tests of Claaas Lexion 450 combine in corn harvest conditions, showed that consumption of fuel during harvest was 14.04 l $ha^{-1}$ and 58.97 l $h^{-1}$, for a performance of 4.2 ha $h^{-1}$ and the average speed

of 8.0 km $h^{-1}$ (ĐEVIĆ et al., 2004.). At the corn picker speed of 2 m $s^{-1}$ was in the flow of 1.9 kg $s^{-1}$ corn ear on husker, while the speed of 1.53 m $s^{-1}$ flow was 2.18 kg $s^{-1}$. Losses of free grain varied in the range of 0.75-4.02% and total 2.5-4.9%, cite MEŠI et al. (2009.). In order to create conditions for the stable, bigger and cheaper production of field crops, it is outdated machinery to replace the new collection. The average annual purchase of self-propelled combine harvesters and pickers in the Republic of Serbia is within 30 to 50 pieces, which is less than 1% of total demand, according to NIKOLIC et al. (2010.). The quality of maize in the bunker was very good with over 95% of the undamaged and 9.40-15% of nonhusking corn ears. Losses can be considered satisfactory because they are in tolerant values (0.54-1.79%) for both collectors. A higher level of piston crowning is reached at speed of 4.65 km $h^{-1}$ (BARAC et al., 2011.). The same authors state that the measured fuel consumption was 5.90-8.90 l $h^{-1}$. The process of corn picking involves losses that can not be reduced to zero percent, but with the proper choice of the relevant patrameters could be controlled at an acceptable level, according to MOSTOFI (2011.). The same author states that the investigations were performed with three moisture content and to 19, 23 and 27%, with speeds of 0.8, 1.2 and 1.6 m $s^{-1}$. The same author states that the losses were varied in the range 2.34-2.65%, and that the losses due to bad weather conditions were in the range of 0.95-5.42%, with total losses were changing from 1.55 to 4.02%.

## MATERIAL AND METHODS

Laboratory-field and exploatation tests of the effects of pulled twolined corn pickers for mercantile corn ear picking and the quality of the collected mass of the three types of pickers during marcantile corn picking on sample fields were carried out in climatic and soil conditions of southern Serbia (Toplica county, 43°17'26" N, 21°17 '05" E) in 2011. year. In the testing, there were present corn pickers ZMAJ 222 (labeled as a picker type A), BERKO 025 (picker type B) and SIP tornado 80 (picker type C). Picking A and C are in a multi-year operation, while the picker type B is new product on the market of Serbia and has recently been in operation. Testings were conducted in two phases. In the first stage the selection of land was done and were established working conditions: biological yield (yield of maize, grain yield, number of plants, average plant height, average height set on of ear, the average thickness of the stem at 30 cm and thickness of the sample below), the condition of soil and climatic conditions. Attention is taken of consistency and uniformity of the assembly plant and ear height and the presence of weeds. Surfaces to which the tests were carried out were mostly flat and hybrids ZP 600 and NS 640 were planted. The second phase determined the effects of work depending on the defined parameters. It was determined by the quality of the piston in the bunker liners: the degree of cleaning and husking, grain losses, the degree of damage and the coronation of grain sampling husked corn ears from the bunker liners. Sampling was conducted in five replicates. In addition, the specific fuel consumption were determined by volume method and the effect of pickers by chronometric method. Pickers working in the aggregate with tractors, power of 45, 47 and 52 kW. During operation of picker type A regime with operating speeds of 3.95, 6.44 gap between the plates was 35 mm at the entrance, and 41 mm at the exit. Speed of movement of 7.21 km $h^{-1}$ was used as controls (clearance between the door panel on entrance was 38, and on exit 46 mm). For pickers of type B in the standard version, the speeds were 4.10 and 6.23 km $h^{-1}$ (the clearance between the door panel on the entrace was 34mm, and on exit 40mm), while in the control variant, speed was 7.10 km $h^{-1}$ (gap 39 and 45 mm). Picker C-type had speeds of 3.78 and 6.15 km $h^{-1}$ (standard, 34 mm gap at the entrance, 40 mm at the exit) and 7.34 km $h^{-1}$ in the control (clearance of 38 and 44 mm). It is important that the pickers settings were performed as directed, under the terms of the experimental plots, where the setting were carried out by the owners (the gear selection, and the spacing between

the plates) served as a control option. The research used containers, stopwatch, sample bags, and other flagpole. The results were statistically analyzed and presented in tables. The applied methodology was standard for field- laboratory and exploatation tests and concern the testing of equipment for corn picking and harvesters (ISO 8210).

Specifications of tested pickers to mercantile corn ear picking are shown in the table number 1.

*Table 1*

Technical data examined corn picker

| Parameters | | Type of corn pickers | | |
|---|---|---|---|---|
| | | Zmaj 222 | BERKO 025 | SIP Tornado 80 |
| Number of rows | | 2 | 2 | 2 |
| Length | (m) | 5.15 | 4.97 | 5.50 |
| Width | (m) | 3.20 | 3.19 | 3.00 |
| Height | (m) | 3.20 | 2.980 | 2.94 |
| Mass | (kg) | 3140 | 2030 | 3020 |
| Productivity | (ha $h^{-1}$) | 0.4-0.7 | 0.5-0.8 | 0.6-0.8 |
| Hopper volume | ($m^3$) | 3.0 | 3.8 | 2.90 |
| Maximum transport speed | (km $h^{-1}$) | 14 | 15 | 16 |
| Discharge height | (mm) | 2250 | 2700 | 2700 |
| Required power | (kW) | > 35 | > 36 | > 35 |
| Speed emptying bunkers | (sec) | 26 | 30 | 35 |
| Chopping | | Cylindrical 32 blade | 2 + 2 Horizontal blade | Cylindrical 33 blade |
| Snapper section | | Ribbed rollers with shear panels | Ribbed rollers with shear panels | Ribbed rollers with shear panels |
| Husking section (number of pairs of rollers) | | 8 | 6 | 6 |
| Type rollers | | Metal + Rubber | Rubber | Metal + Rubber |
| Rpm PTO | ($min^{-1}$) | 480-560 | 480-560 | 480-560 |
| Distance roll gap to feed | (mm) | 20-45 | 20-45 | 20-40 |

## RESULTS AND DISCUSSION

Table 2 presents the basic data about the state of maize crop in the plots on which tests are performed. On the basis of which notes that the pickers worked in similar production conditions.

*Table 2*

Biological conditions of testing

| Parameters | | | Type of corn pickers | | |
|---|---|---|---|---|---|
| | | | Zmaj 222 | BERKO 025 | SIP Tornado 80 |
| Yield | Biological yield | (kg $ha^{-1}$) | 13240 | 13438 | 14010 |
| | Corn ear yield of maize | (kg $ha^{-1}$) | 6620 | 6719 | 7005 |
| | Grain yield | (kg $ha^{-1}$) | 5561 | 5644 | 5884 |
| Characteristics of crops | Number of plants | (plants $ha^{-1}$) | 50659 | 51203 | 52329 |
| | The average plant height | (m) | 2.28 | 2.53 | 2.46 |
| | The average height set on ear | (m) | 1.35 | 1.39 | 1.30 |
| | The average distance between plants | (cm) | 28.2 | 27.9 | 27.3 |
| | The average thickness of stem at a height of 30 cm | (cm) | 27.2 | 28.3 | 27.9 |
| | The average thickness of the stalk below the ear | (cm) | 22.2 | 23.5 | 22.9 |
| | Corn grain moisture | (%) | 24.80 | 23.95 | 24.20 |
| | 1000 grain weight | (g) | 447 | 452 | 458 |
| | The average length of a corn earcm | | 25.3 | 26.8 | 28.90 |
| | The amount of weed plants | (kg $m^{-2}$) | 0.5-1.7 | 0.8-2.3 | 0.7-1.9 |
| | Average height of weeds(m) | | 0.92 | 1.20 | 1.40 |
| Distance of sher panels | At the entrance | (mm) | 35; 38 | 34; 39 | 34; 38 |
| | At the exite | (mm) | 41; 46 | 40;45 | 40;44 |

Average grain yield ranged from 5561-5884 kg $ha^{-1}$, while the average height of stalks of corn ranged from 2.28 to 2.53 m. The average height set on of the piston stem varied from 1.30 to 1.39 m. For both investigated plots were present weeds of a height between 0.92 -1.40 m, the quantity of 0.5-2.30 kg $m^{-2}$.

Table 3 shows data of the maize quality in the bunker liners. The presented results indicate that the regime change of working speed between sher panels showed a significant effect on the quality of the pickers.

*Table 3*

The quality of a corn ear in hopper pickers

| Type of pickers | Test | Distance of sher panels (mm) | Working speed (km $h^{-1}$) | Quality of the husking (%) | | Nonhusking corn ears of the maize (%) | Total Losses (%) | Coronation corn ears (%) |
|---|---|---|---|---|---|---|---|---|
| | | | | Husking | Damaged | | | |
| A | The first | Standard (35;41) | 3.95 | 95.28 | 4.72 | 11.27 | 1.92 | 2.53 |
| | | | 6.44 | 92.85 | 7.15 | 14.52 | 2.26 | 6.45 |
| | | ∅(38;46) | 7.21 | 88.65 | 11.35 | 16,97 | 4.35 | 8.24 |
| | The second | Standard (35;41) | 3.95 | 94.35 | 5.65 | 10.85 | 1.87 | 2.17 |
| | | | 6.44 | 91.20 | 8.80 | 13.97 | 2.63 | 5.43 |
| | | ∅(38;46) | 7.21 | 88.23 | 11.77 | 17.24 | 5.67 | 7.98 |
| B | The first | Standard (34;40) | 4.10 | 97.15 | 2.85 | 8.45 | 1.42 | 2.30 |
| | | | 6.23 | 94.60 | 5.40 | 12.93 | 2.10 | 4.76 |
| | | ∅(39;45) | 7.10 | 90.23 | 9.77 | 15.86 | 4.10 | 6.34 |
| | The second | Standard (34;40) | 4.10 | 95.32 | 4.68 | 7.89 | 1.95 | 1.98 |
| | | | 6.23 | 93.68 | 6.32 | 11.32 | 2.67 | 4.25 |
| | | ∅(39;45) | 7.10 | 89.95 | 10.05 | 16,10 | 3.99 | 6.81 |
| C | The first | Standard (34;40) | 3.78 | 96.32 | 3.68 | 9.63 | 1.70 | 1.97 |
| | | | 6.15 | 93.92 | 6.08 | 13.68 | 1.84 | 5.44 |
| | | ∅(38;44) | 7.34 | 91.20 | 8.80 | 15.94 | 4.23 | 7.24 |
| | The second | Standard (34;40) | 3.78 | 94.86 | 5.14 | 8.47 | 1.73 | 1.86 |
| | | | 6.15 | 92.15 | 7.85 | 12.72 | 2.10 | 5.32 |
| | | ∅(38;44) | 7.34 | 89.24 | 10.76 | 16.21 | 4.68 | 6.99 |

According to the results shown in Table 3, we observed that the interaction of regime change in operating speed and size of the gap between the sheer panels significantly affect the value of realized losses and the quality of the tested corn pickers. The highest content of the whole corn ear was found in the picker B (BERKO 025) working at a speed of 4.10 km $h^{-1}$ and was 97.15%. (second experimental plots, the standard version) and lowest in A picker (ZMAJ 222) 88.23%. at 7.21 km $h^{-1}$ (control, another sample plot). At picker C content of the whole undamaged sample ranged within 89.24-96.32%. Bearing in mind the results can be seen that in all the pickers with the increase of operating speed significantly reduces the content of whole undamaged corn ear, with the largest on the control variety. As far as the damaged ears of corn, there is a similar impact parameters. With the change of regime operating speeds increasing the contents of damaged corn ear and ranged from 2.85 (A picker, 4.10 km $h^{-1}$, standard) up to 11.77% (A picker, 7.21 km $h^{-1}$-control). Content of nonhusking corn ear varied in the range of 7.89% to 17.24% of type A (7.21 km $h^{-1}$, the second sample size, control variant). A similar effect of defined parameters changes on content of picked nonhusked corn in mass is observed with C-type picker (8.47 to 16.21%). The highest total losses were measured in type A picker and amounted to 5.67% (control variant, the second experiment, the working speed of 7.21 km $h^{-1}$), and lowest in picker type B 1.42% (first experiment, the working speed of 4.10 km $h^{-1}$, standard version). And the picker type C was observed similar to the impact of changing the parameters defined by the value of total losses. In all studied corn

pickers it was observed the corn ear coronation so that the content is varied in the range of 1.98-8.24% (picker type B or type A).

Correction of the relevant parameters are made in relation to the control variant had resulted in a significant reduction of total losses and higher work quality in all the testing pickers during mercantile corn picking (total losses are decreased with 5.67% for type A picker to 1.42% in picker type B).

Differences in the quality of the collected mass and total losses were obtained with the same parameters defined in the second field experiment in relation to first can be explained by the varying moisture content of grain and a slightly different test conditions.

These results are consistent with results of other authors (PINTAR, 2000.; FURMAN et al., 2001.; LAZIC et al., 2002.; MALINOVIC et al., 2003.; MEŠI et al., 2009., BARAC et al., 2011., MOSTOFI, 2011.).

An important parameter in analyzing the efficiency and quality are the production parameters of the corn pickers. Depending on the operating mode combines speed (choosing the right gear and setup for which is estimated to achieve the best effects in relation to working conditions), measurements were carried out exploiting characteristics of pulled corn pickers within which is conducted chronometrics, measured fuel consumption and cutting height of the boot toping while cutting corn stalks. In Table 4 are given average values of tested pickers for both experiments.

*Table 4*

Average values of exploiting characteristics and height of the beet toping for tested pickers

| Type pickers | Working speed (km $h^{-1}$) | Productivity (ha $h^{-1}$) | Fuel consumption (l $h^{-1}$) | Fuel consumption (l $ha^{-1}$) | Height of the beet toping (cm) |
|---|---|---|---|---|---|
| A | 3.95 | 0.44 | 6.21 | 14.11 | 18.76 |
| | 6.44 | 0.63 | 8,75 | 13.89 | 22.48 |
| | 7.21 | 0.73 | 9.34 | 12.79 | 27.95 |
| B | 4.10 | 0.46 | 5.28 | 11.48 | 19.20 |
| | 6.23 | 0.61 | 6.32 | 10.36 | 21.54 |
| | 7.10 | 0.70 | 7.10 | 10.14 | 29.82 |
| C | 3.78 | 0.42 | 5,46 | 13.00 | 18.68 |
| | 6.15 | 0.60 | 7,92 | 13.20 | 21.36 |
| | 7.34 | 0.72 | 8.51 | 11.82 | 31.53 |

Looking at the results of average values have been shown for investigated corn pickers it can be concluded that the most part as expected. Thus, the achieved performance was within the limits of 0.42 ha $h^{-1}$ (C picker, working speed of 3.78 km $h^{-1}$), to 0.73 ha $h^{-1}$ (A picker, 7.21 km $h^{-1}$), which is close to the declared values. In all tested pickers can be seen the increase with the effects achieved by changing the gear and increase operating speed.

When it comes to fuel consumption, the results shown in Table 4 show that the changes defined parameters showed a significant effect on the measured values of fuel consumption in all the pickers. The fuel consumed expressed in l $h^{-1}$ limits ranged from 5.28 h $l^{-1}$ (B-type picker, 4.10 km $h^{-1}$) to 9.34 l $h^{-1}$ in type A picker mode at operating speeds of 7.21 km $h^{-1}$. Different values of fuel consumption is primarily explained by the different mass pickers and current conditions in the plots.

Height of beet toping is a very important indicator, given the fact that low cut and well-shredding stalks provides seamless primary processing and other agrotechnical operations are carried out after corn picking. On the basis of these results suggests that the regime change of working speed significantly increased the amount of beet toping. Based on the obtained results show that in all the pickers with increased speed and increased cutting height of corn stalks. Height of cut corn stalks varied in the range of 18.76 cm (A picker, 3.95 km $h^{-1}$) to 31.53 (C-type picker, 7.34 km $h^{-1}$). In type B pickers cutting height of maize was in the range

of 19.20-29.82 cm. Comparing the average results have been shown with data from Western European countries and America, we can see that they are different in tested conditions, and the reason should be sought primarily in the varietal and location specifics.

## CONCLUSION

Based on the results of the effects of corn pickers ZMAJ 222, Berko 025 and SIP Tornado 80 for mercantile corn ear picking, we can conclude the following:

- The interaction of the regime change of working speed and size of gap between the plates significantly affected the value realized losses and the quality of the tested corn pickers.
- The content of the whole undamaged corn ear in harvester bunker was in the range of 88.23% for the picker type A (control variant, the operating speed 7.21 km $h^{-1}$), up 97.15% in the picker type B (standard, 4.10 km $h^{-1}$).
- The content of ddamaged corn ears had varied 2.85% (picker type B, standard variant), to 11.77% in control (picker type A).
- The minimum content of nonhusking corn ears was measured in mass pickers of type B in the standard version and was 8.45% and the highest in the control of 17.24% (picker type A).
- The greatest total losses were measured with the picker type A and amounted to 5.67% (control variant, the operating speed 7.21 km $h^{-1}$), and lowest in picker type B 1.42% (operating speed of 4.10 km $h^{-1}$, the standard version).
- Corrections of the relevant parameters we performed a standard variant compared to control had resulted in a significant reduction of total losses and higher work quality in all the pickers in the course of pickin corn ear.
- Achieved effects are moved within the limits of 0.42 ha $h^{-1}$ (C picker, working speed of 3.78 km $h^{-1}$), to 0.73 ha $h^{-1}$ (A picker, 7.21 km $h^{-1}$), which is close to the declared values.
- Fuel Consumption expressed in l $h^{-1}$ limits ranged from 5.28 h $l^{-1}$ (B type picker, 4.10 km $h^{-1}$) to 9.34 l $h^{-1}$ in type A picker mode at operating speeds of 7.21 km $h^{-1}$.
- Height of cut corn stalks varied in the range of 18.76 cm (A picker, 3.95 km $h^{-1}$) to 31.53 (C-type picker, 7.34 km $h^{-1}$).
- Better effects of B type pickers in relation to other pickers are primarily explained by the fact that was new picker (short term exploated), as well as better harmonised relevant pickers in the current situation and conditions on the field on which the experiments were performed.
- The general conclusion of our research is that the pulled pickers ZMAJ 222, Berko 025 and Tornado 80 can be successfully used to corn ear picking in the study area and beyond, with a better operator training and optimization work may come to the fore.

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