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NECESSARY ADAPTATIONS OF COMBINE FOR RAPE HARVESTING*

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A b s t r a c t. This paper shows how even small adaptations and adjustments in a grain combine harvester can cause a significant decrease of rape seed losses during harvesting to the level of about 3 %. For this reason, the following were introduced: an extended header floor, an active canopy divider, tailings sieve and lower sieve of the grain pan with a changed design. The above mentioned adaptations and suitable adjustment of combine assemblies in connection with the knowledge of the strength properties of siliques and the physical state of canopy, allow to reduce seed losses to the level of about 3 %.

K e y w o r d s: rape, combine harvesting, seed damage

INTRODUCTION

The standard version of the Bizon grain combine harvester used for rape seed harvesting causes considerable losses of seeds. During rape seed harvesting it is possible to identify in the combine some subassemblies in which losses appear or can appear. They can be caused by technical reasons (improper preparation of the combine to harvesting) and by technological causes (improper selection of parameters of the combine operation).

The rate of seed losses depends to a high degree on the plant variety which is gathered. Double-low varieties of rape of high quality (Ceres, Bolko, Liporta, etc.) which are introduced now, are more sensitive to seed shattering than other varieties cultivated earlier [4]. These losses are caused first of all by the operation of the header and thresher together with the cleaning assembly of the thresher [1].

COMBINE ADAPTATIONS

Observations carried out showed that even small changes in the combine design may cause a considerable decrease of seed losses. For this reason the following were introduced: an extended floor of the header, an active canopy divider, tailings sieve and lower sieve of the grain pan with changed design. The above mentioned adaptations and suitable adjustment of combine assemblies in connection with the knowledge of the strength properties of siliques and the physical state of canopy, allow to reduce the seed losses to the level of about 3 % [5]. The losses caused by a typical header are from 50 to 70 % of the total losses caused by the work of a combine with standard equipment. It is, among others, the result of the cutting assembly and the auger-and-finger feeder being installed too close to each other.

While such a design is convenient for cereal harvesting (the stalk is tipped with an ear whose threshing requires a considerable expenditure of force and energy), rape plants together with their numerous branches delicate

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siliques do not find enough room in the small space between the cutting assembly and the feeder. Hence, at the moment of cutting, this feeder transporting the upper part of the plant causes cracking of siliques and shaking seeds loose. Irretrievably lost are seeds which, at the moment of cutting, are shed before the cutting bar or directly over it and also seeds knocked out by the work of the reel and by the fingers of the feeder [6].

To adapt a standard header for rape seed harvesting, an adapter elongating the floor of the header by 40 cm was designed. The adapter can be mounted on every header of the Bizon grain combine harvester with the width of 4.2 m. The header adapted in such a manner assures a considerable reduction of seed losses, especially in fields with rape varieties susceptible to cracking and harvested in retarded time.

The adapter (Fig. 1) consists of a frame (1) mounted to standard header, and of an extended floor (2). The frame is attached to the finger bar, to the flanks of the header and to the floor. In the frontal part of the frame is mounted a new complete finger bar (3) with a cutting bar (the finger bar in the standard header is not disassembled). The adaptation also consists in moving the drives to the new cutting assembly. For this purpose, the left side of a header was strenghten; the bracket (4), the ball-and-socket joint, the handles of the knife strip lever drive and the angle lever drive with the axle and arm (5) were moved to the new place. The new bar is driven with a pitman with extended length (6).

RESULTS

Comparative measurements of the standard and adapted assemblies were performed with various varieties. The results obtained (Table 1) show that much higher losses of seeds (8.1 %) were caused by the standard header (with reel - 9.4 %) than by the adapted header - 4.2 % (with reel - 4.7 %). The positive effect of the extended floor is visible especially at the retarded harvest when greater susceptibility of siliques to cracking and seeds to shedding appears. The adapter is characterized by a simple design, and it is easy to install and remove.

The operation of the canopy divider has a great influence on the rate of seed losses during harvesting. In rape harvesting with the standard header a passive divider which is a part of the combine equipment is commonly

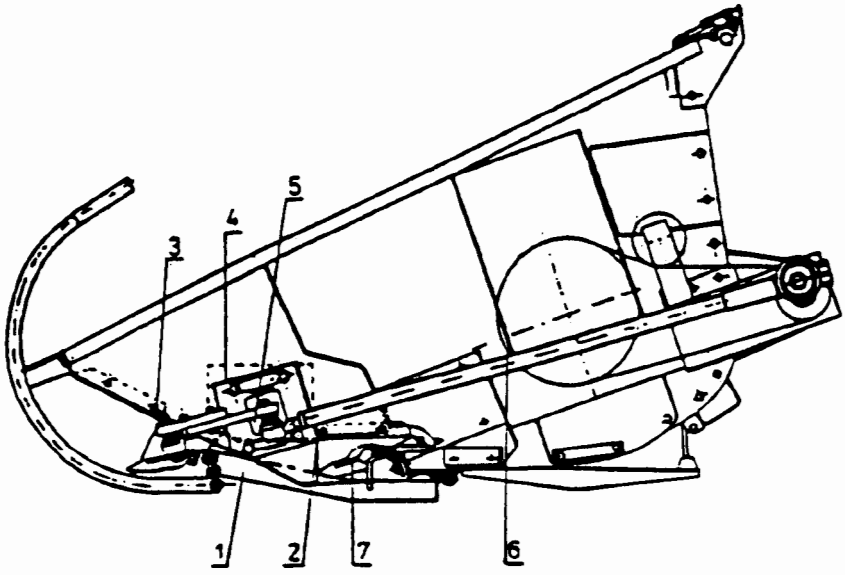

Fig. 1. Adapter extending the floor of the header.

Table 1. Rape seed losses (kg/ha) in the headers compared (one-stage harvest)

Header	Adapted		Standard	
	with reel	without reel	with reel	without reel
Yield losses (%)	4.7	4.2	9.4	8.1

used. Its operation is disadvantageus, especially when plants are inclined, the canopy is weedy or very thick. The use of an active divider (Fig. 2) eliminates completely the defects of the passive divider.

Comparative investigations of both types of dividers showed much better operation, higher efficiency and lower seed losses when the combine is equipped with an active divider. Dividers: passive standard, active fingerless mechanically driven, active fingerless driven with a hydraulic or electric motor, have been examined. The active divider driven with a hydraulic or electric motor was found to be the best, as its operation caused the lowest seed losses. The extended floor and the active canopy divider made possible the maximum reduction of rape seed losses (below 50 kg/ha), especially when cutting against plant inclination. The work of passive divider causes losses higher than 150 kg/ha (Table 2).

The adaptation of the cleaning assembly of the grain pan of the Bizon combine for rape seed harvesting (Fig. 3) consists in replacing the standard tailings sieve with a sieve with ∅ 6 mm circular holes, and replacing the lower shutter sieve with a sieve with ∅ 4 mm circular holes. The standard tailings sieve, consisting of a pocket Grepl's sieve and a finger grate (comb) allowed for the return of a part of the mass of chaffs and crushed stems with the worm and tailings auger back to the threshing assembly and then to the floor of the grain pan. This caused an additional excessive loading of the upper shutter sieve of the grain pan. As a result of this a part of seeds located in the upper layer of chaffs fell with them out to the field. This fact is the main reason of losses in the thresher during rape seed harvesting. The rate of these losses exceeds 100-150 kg/ha, and improper adjustment of the working parameters of the header and threshing assmebly additionally increases losses which can even exceed 500 kg/ha. The use of the new tailings sieve with 6 or 7 mm circular holes significantly unloads the grain pan of the combine. Moreover, the lower shutter sieve is replaced by a sieve with 4 mm circular holes. It improves

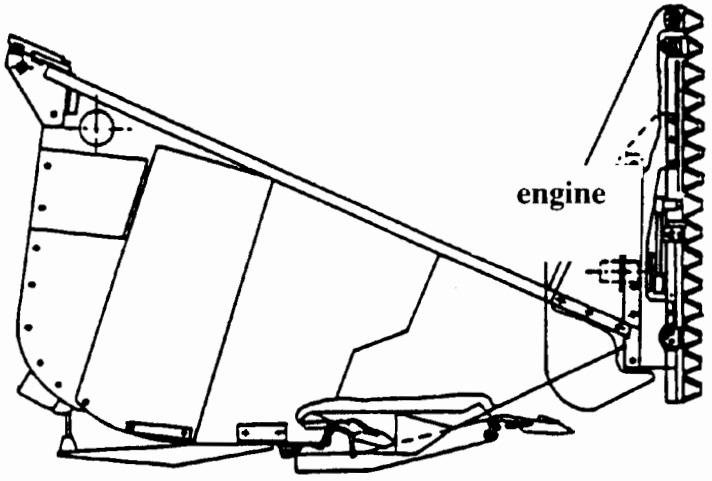

Fig. 2. Active fingerless canopy divider.

T a b l e 2. Rape seed losses caused by the operation of three types of canopy dividers

Direction of combine work in canopy	Losses caused by divider in kg/ha		
	passive	mechanical drive	hydraulic drive
Against plant inclination	156	74	30
With plant inclination	110	87	41
Inclined to the right	184	100	59
Inclined to the left	155	73	56

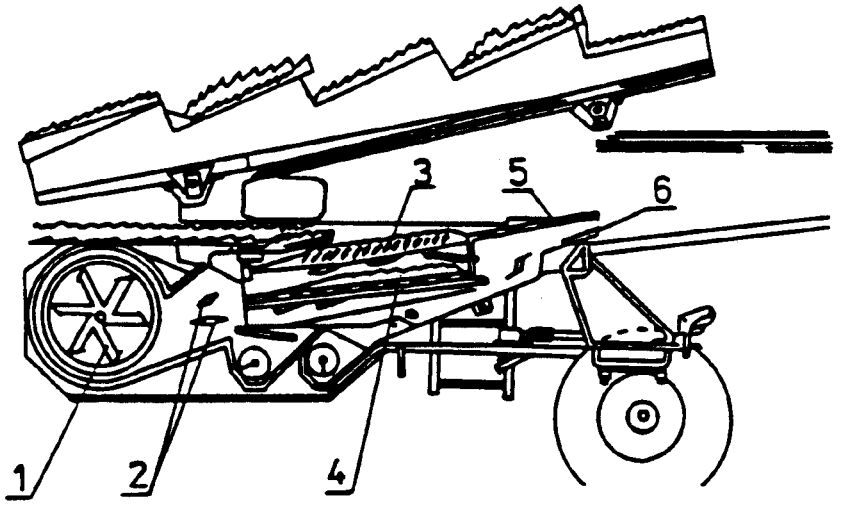

Fig. 3. Grain pan of combine. 1 - fan, 2 - air guide bars, 3 - upper shutter sieve, 4 - lower punched-plate-screen with 4 mm circular holes, 5 - tailings sieve with 6 mm circular holes.

the process of separation and contributes to the increase of seed purity (above 94 %). Such combine adaptation is now a unique chance to decrease the exessive losses of rape seeds in harvesting high-quality rape varieties which will cover more and more of the rape growing area in our country.

The adaptations and adjustment of the combine allowed for a decrease of rape seed losses by about 2.4 q/ha, which was confirmed during practical application of the elaborated technology at many farms.

CONCLUSIONS

The adaptation and adjustment of a grain combine harvester Bizon allowed for a significant decrease of rape seed losses during harvesting, which was confirmed during practical application of the technology at many farms.

REFERENCES

1. **Szot B., Szpryngiel M., Tys. J., Grochowicz M.:** Adaptation and setting of the Bizon combine harvester for rape harvest (in Polish). Institute of Agrophysics, Polish Academy of Sciences, Lublin, 1991.
2. **Szot B., Szpryngiel M., Grochowicz M., Tys J.:** Application of active long crop dividers to rape harvest (in Polish). V Symp., Płock, 127-129, 1991.
3. **Szpryngiel M., Grochowicz M., Królikowski M., Mucha C.:** Realization construction mechanical power active crop divider (in Polish). V Symp., Płock, 123-126, 1991.
4. **Szot B., Grochowicz M., Tys J., Szpryngiel M.:** Technology of harvesting rapeseed (in Polish). Institute of Agrophysics, Polish Academy of Sciences, Lublin, 1991.
5. **Szot B., Tys J., Szpryngiel M., Grochowicz M.:** Determination of the reason for rapeseed losses at combine harvesting and some methods of their limitation. Zesz. Probl. Post. Nauk Roln., 389, 221-23, 1992.
6. **Szot B., Szpryngiel M., Grochowicz M., Tys J.:** The effect of the physical properties of rape and of the working parameters of the combine on the extent of seed losses. Zemed. Technika, Nitra, 1994.

NIEZBĘDNE ADAPTACJE KOMBAJNU DO ZBIORU RZEPAKU

Kombajn zbożowy Bizon w wersji standardowej zastosowany do zbioru rzepaku powoduje znaczne straty nasion. Przeprowadzone obserwacje wykazały, że zastosowanie zmian konstrukcyjnych w kombajnie może doprowadzić do znacznego ich ograniczenia. W związku z tym zastosowano: wydłużoną podłogę zespołu żniwnego, aktywny rozdzielacz łanu, sito kłosowe i dolne sito podsiewacza o zmienionej konstrukcji. Zastosowanie powyższych adaptacji wraz z odpowiednią regulacją kombajnu, w powiązaniu ze znajomością cech wytrzymałościowych łuszczyn i stanu fizycznego łanu stwarza możliwość ograniczenia strat nasion do poziomu ok. 3 %.

S ł o w a k l u c z o w e: rzepak, kombajn zbożowy, uszkodzenia ziarna.