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RELATION OF HARVEST TERMS TO RAPE SEED LOSSES*

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A b s t r a c t. The paper presents the results of a three-year field study, carried out in order to estimate the values of losses occurring during rape harvesting with a grain combine harvester, at different terms of harvest.

The study was performed on seven winter rape varieties (Mar, Ceres, Bolko, Liporta, Libravo, Leo, Polo) using single- and two-stage harvest technologies. While estimating the quantitative losses, methods elaborated at the Institute of Agrophysics of the Polish Academy of Sciences in Lublin were used.

Knowledge of the relationships between harvesting terms and rape seed losses allows us to perform the harvest during terms which ensure minimum losses.

K e y w o r d s: rape, seeds, harvest, losses, term

INTRODUCTION

Many years of studies carried out at the Institute of Agrophysics, PAS in Lublin, showed that during rape harvesting with a grain combine harvester, great seed losses appeared. Those losses were related to the following factors:

- proper adaptation of the harvester for harvesting (adaptation and regulation),
- proper harvest time (term),
- harvest technology used (single- or two-stage),
- weather conditions during harvesting (rainfall, wind force, sunshine).

The first three factors can be modified, while the last one is uncontrollable and often determines the level of losses during harvesting [2,3]. Therefore, while picking rape with an adequately prepared and tuned harvester [4], in proper harvest terms, and using appropriate technology, we can limit nagative effects of weather conditions during the harvest.

METHODS

During the present investigations, rape threshing was made by means of a Z 056 grain combine harvester on a distance of 25 m. Evened rape canopy was cut with the whole width of the cutting mechanism, at an average swath of 4 m. On such specified area (100 m^2), 20 special measuring frames of the area of 0.5 m^2 (0.5 x 1.0 m) were randomly placed. From the inside of those frames, the stubble was cut out, impurities were taken out, and shedded seeds were picked with suction machines (industrial vacuums). These samples were then screened on special sieve sets in order to remove the soil and plant residues.

Futher separation of dirties was made in a solution prepared especially for that purpose.

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Wet rape seeds were dried in a drier, light organic impurities were taken out, if any, and then the weight of the seeds was measured [1].

RESULTS

A three-year investigation period was taken into consideration while analysing the influence of harvesting terms on seed losses. The weather during the harvest in the first year of the research was typical (for Polish conditions). Specific was the second year, in which lots of rain fell down and the wind reached the speed of 19 m/s. The third year of the research was windless, and the weather was hot and rainless.

The following four rape harvesting terms were specified during the research:
- very early - 7-9 days before full maturity,
- early - 3-4 days before full maturity,
- optimal during full maturity,
- delayed - 7-8 days after full maturity.

The study was based on seven rape varieties (Mar, Ceres, Bolko, Liporta, Libravo, Leo, Polo), and the picking was made with a properly tuned and totally adapted grain combine harvester.

Losses occurring in the single-stage harvest technology in 1992 were about 3-9.6 % of the crop (Fig. 1). The smallest losses appeared in the Mar variety during the optimal term, using the working slot of 16 mm and threshing drum rotation speed of 600 r.p.m. The greatest losses appeared in the Liporta and Ceres vatieties during the delayed term with the working slot of 16 mm and threshing drum rotation speed of 800 r.p.m.

Delay of harvesting terms caused an increase in losses of seeds of all the varieties investigated. The increase was the smallest for the Bolko variety (1.2 % of the whole yield), for the Mar variety it was 1.9 %, for the Liporta variety 4.2 %, and in the case of the Ceres variety it was the greatest - it increased from 5 % to 9.6 % of the entire yield.

Much greater losses appeared during the second year of the study (Fig. 2a). Cumulative losses (of the whole harvesting period) were from 3.9 % for the Leo variety in the early term, up to 33.1 % for the Bolko variety in the delayed term. It should be explained that that variety matured later then the others, so it was exposed to unfavourable atmospheric conditions (strong wind in the final period of the delayed term) for a longer period of time. Similarly to the preceding year, delay in harvest time caused an increase of losses. This tendency, however, was more signifficant, which can be expained by the weather conditions described earlier.

In the last year of the study, the losses were a little smaller than in 1992 (Fig. 2b). The greatest losses (7.7 %) were observed while harvesting the Bolko variety in the delayed term. The smallest losses were also noted for the Bolko variety (2.9 %) in the optimal term.

To draw conclusions from the three-year experimental studies, the multi-factorial analysis

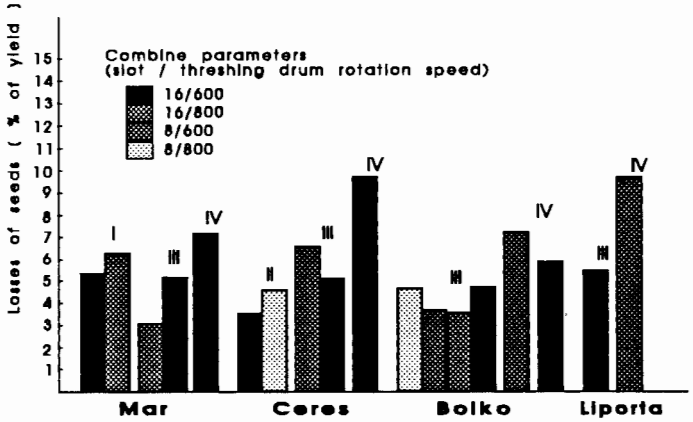


Fig. 1. Quntitative losses of rape seeds occurring during single-stage harvesting in 1992.

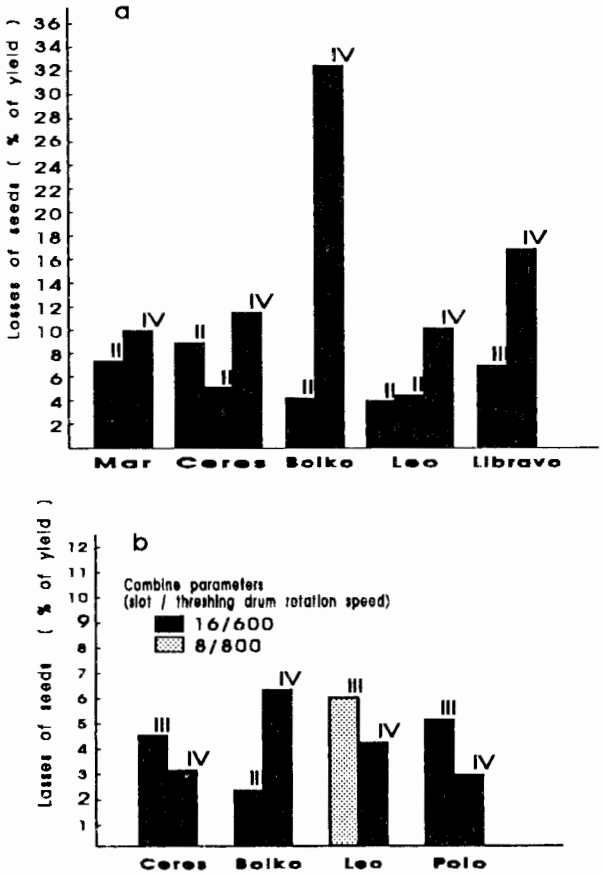


Fig. 2. Quantitative rape seed losses occurring during single-stage harvesting in 1993 (a) and 1994 (b). Harvest time: II - early, III - optimal and IV - delayed.

of variance of seed losses values, in relation to the same varieties (Bolko, Ceres) gathered with the same harvest technological parameters (16 mm slot, 600 r.p.m. rotation speed of the threshing drum), was performed taking into consideration the optimal and the delayed harvesting terms.

Differentiation of mean seed losses in particular years is illustrated in Fig. 3.

Average losses in 1992 reached 195.4 kg/ha, in the next year they grew over twice as high (up to 475.4 kg/ha), and in 1994 they dropped to 137.5 kg/ha. Therefore, considering the variability of the mentioned factors (influencing the range of losses in particular years), the year of 1993 was considered significantly different from the two other years (LSD = 133.35).

The specific nature of the year of 1993 in relation to 1992 and 1994 can also be seen while analysing the scale of seed losses increase in the delayed term of rape harvesting (Fig. 4).

The delayed harvesting term, in relation to the optimal term, shows the tendency of quantitative losses to increase in all investigated years. This dependency can be easily recognized in the year of 1993, which showed unfavourable atmospheric conditions during the harvest (heavy and frequent rainfall, strong wind during the delayed term).

The influence of the harvesting term on the amount of seed losses was also investigated in the two-stage technology. In this method, rape was cut and formed into swaths by a Fortschritt E 303 swath mower, equipped with an E 327 rape swath pick-up runner.

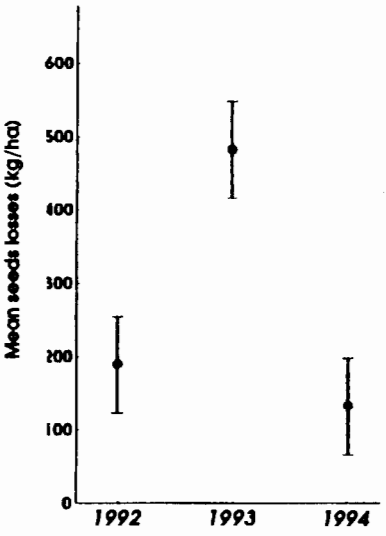
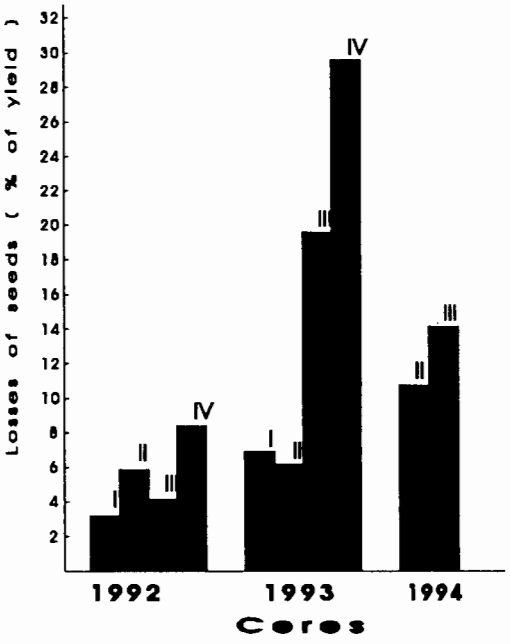


Fig. 3. Mean rape seed losses in three consecutive years.



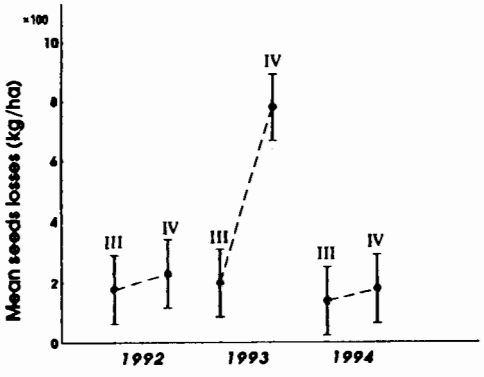


Fig. 4. Mean rape seed losses occurring in two harvest terms (III - optimal and IV - delayed) in three consecutive years of investigation.

When seed moisture decreased to about 10 % (which happened after 7-10 days), the swath was picked by the harvester equipped with the drum swath pick-up runner. The research was carried out with the Ceres variety, using the 16 mm harvester working slot and threshing drum rotation speed of 600 r.p.m. during threshing (same as in one-stage harvest). Losses in this technology are illustrated in Fig. 5.

Swaths were done in the first two years of research in four terms, while in 1994 - only in the very early and optimal terms. Minimum losses of all the investigated years were observed in 1992 in the very early term (3.2 % of the entire yield), while maximum losses were noted in 1993 in the delayed term (30.5 %). Such great losses in 1993 should be related (same as in one-stage harvest) to very unfavourable atmospheric conditions.

Fig. 5. Quantitative rape seed losses occurring during two-stage harvest in 1992-1994. Harvest time: I - very early, II - early, III - optimal and IV - delayed. Working parameters of combine: slot - 16 mm and threshing drum rotation speed - 600 r.p.m..

These differences are shown in Fig. 6 for the four harvesting terms in 1992 and 1993.

CONCLUSIONS

1. The factor which significantly differentiates the amount of seed losses in one- and two-stage harvest is the term of rape harvesting.

2. The delay in harvest time in relation to the optimal term causes a signifficant increase (even 4 times) of losses in all investigated years.

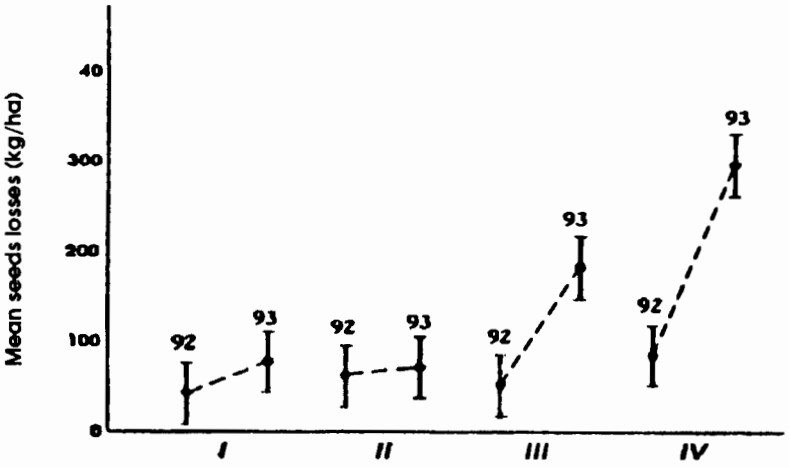


Fig. 6. Seed losses occurring in two investigated years 1992 and 1993 and four harvest terms (I - very early, II - early, III - optimal and IV - delayed) during two-stage harvest.

3. Significant differences were stated between quantitative losses occurring during one-stage harvest in 1992 and 1994 and losses in 1993. Such great differences were caused by continuous rainfall during the harvest of 1993.

4. Similar tendency was noted for the two-stage harvest, where the delay of the harvest time in 1993 caused the amount of losses to increase by 10.7 % of the yield.

5. In the three-year period of research, minimum losses occurred in one-stage harvest of the Bolko variety in the optimal term in 1994 and they reached 2.8 % of the total yield. The greatest losses (33.1 %) were observed in 1993 for the same variety in the delayed term. In both cases harvesting was performed using optimal working parameters of harvester: threshing slot - 16 mm and threshing drum rotation speed of 600 r.p.m.

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TERMINY ZBIORU A STRATY NASION RZEPAKU

Praca obejmuje wyniki trzyletnich badań polowych, które były przeprowadzone w celu określenia wielkości strat występujących przy zbiorze rzepaku kombajnem zbożowym dla różnych terminów zbioru.

Doświadczenia przeprowadzono na siedmiu odmianach rzepaku ozimego (Mar, Ceres, Bolko, Liporta, Libravo, Leo, Polo) stosując jedno i dwuetapową technologię zbioru. Przy określeniu strat ilościowych wykorzystano metodykę opracowaną w Instytucie Agrofizyki PAN w Lublinie.

Znajomość zależności istniejących między terminami zbioru a występującymi stratami nasion rzepaku pozwala na przeprowadzenie żniw w terminach, które zapewniają minimalne straty ilościowe.

S ł o w a k l u c z o w e: rzepak, nasiona, zbiór, straty, termin.