

EDITORIAL GUEST

DIRECTIONS OF THE IMPROVEMENT OF RAW MATERIALS THROUGH
APPLYING NEW TECHNOLOGY OF HARVESTING AND POST-HARVESTING
TREATMENT OF RAPE SEEDS

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A b s t r a c t. The main aim of this study was to broaden the knowledge of the raw material improvement through applying new technology of harvesting and post harvesting treatment of rape seeds. Knowing the range of variability of physical properties of rape, studies were undertaken to adjust the existing agricultural machines to new specific rape varieties in order to diminish the quantitative losses of seeds during the ripening of seed harvesting and in order to apply such parameters of combine-harvester subassemblies to minimize the damage of seeds. The reasons of the seed damage during the after-harvesting treatment were looked for and, apart from this, the quality of the raw material as well as the quality of the products obtained from it, knowing the previous damage, were evaluated. Such a complex study of this problem, not only, allowed us to complete the knowledge in this respect but also to draw practical conclusions, which entitles us to apply the results in the production as well as to propose new or modified technological treatments.

These multi-factorial problems, as well as the interdependence between many properties of the studied material, have been presented in more detailed publications included in the following volume, devoted to one problem. The references are also presented in these papers pertaining to all the questions presented in the present article which introduces the problems and contents of the subsequent publications.

K e y w o r d s: rapeseed, harvest technology, improvement

Rape seeds as the raw material for the fatty industry changed considerably within the recent years both in the respect of their chemical composition as well as their physical properties. New, double-zero varieties of rape

differ considerably from those highly erucic previously grown. The breeders often neglected such features as, for example, siliques susceptibility for cracking while they paid great attention to the quality of the material and so, the quality of the products produced from them. It turned out that the improved varieties are several times less resistant and easily shed seeds. That is why the yield differed a lot from the crop. Apart from this, the seeds of those varieties show greater susceptibility to damages. In the effect, the rape growers - applying the traditional technology of harvesting - suffered large losses in the quantity of seeds and the fatty industry was getting the raw material which was under all the standards pertaining to mechanical damage, which greatly diminished their value.

The studies of physical properties of rape have been started on a great scale quite recently, in the second half of the 70ties. The Institute of Agrophysics of the Polish Academy of Sciences in Lublin should be mentioned as the initiator and performer of this research where these problems were thoroughly studied. The earlier publications, and there were very few of them, evaluated in a very simple and subjective manner some properties of rape numbered among physical properties, however,

the scientific value of these works and their applicability were very insignificant. The lack of proper methodology and equipment caused this to a great extent. That is why, it was impossible to compare the results and apply them in practice in plant breeding and technology of harvesting. Therefore, to fill this gap in it was necessary to work out new, objective methods and prototype equipment, adjusted to the specific properties of rape. Already the first study of physical properties of rape and, first of all, the susceptibility of siliques for cracking, brought unexpected results. It turned out that they contradicted then the handbook recommendation to harvest rape after dew or rain because, according to the handbooks, the losses were comparatively small then. However, the results obtained from the mass study proved that, when the rape is fully rape, any moistening of siliques causes a rapid decrease of their resistance to cracking, and this easier shattering of seeds during unfavourable weather and during harvest. Numerous tests and measurements confirmed this regularity in the conditions of production and this fact had a great influence on the significant enlargement of the range of the research to other physical properties of rape. The main aim of these operations was to broaden the knowledge in this respect, which was given by the basic research. Consequently, knowing the range of variability of physical properties of rape, studies were undertaken to adjust the existing agricultural machines to new specific rape varieties in order to diminish the quantitative losses of seeds during the ripening of seed harvesting and in order to apply such parameters of combine-harvester subassemblies to minimize the damage of seeds. The reasons of the seed damage during the after-harvesting treatment were looked for and, apart from this, the quality of the raw material as well as the quality of the products obtained from it, knowing the previous damage, were evaluated. Such a complex study of this problem, not only, allowed us to complete the knowledge in this respect but also to draw practical conclusions, which entitles us to apply the results in the production

as well as to propose new or modified technological treatments.

Such a wide and complex range of research enabled us to get to know and understand many relationships thanks to the methods and equipment which had been worked out. In the recent years the research has been carried out according to the scheme which illustrates the major elements belonging to the range of these problems (Fig. 1).

All the significant external and internal factors were taken into account to determine the full range of variability of agrophysical properties of rape, as well as the interdependence between specific features and their groups. Six rape varieties most widespread in production were studied in the research, including the most recent ones (Lco and Polo). The whole period of ripening was analysed in detail: the influence of fertilization, the density of sowing in a surface unit, morphological and biometrical properties, the dynamics of canopy withering (siliques, stems and seeds), the variability of mechanical properties of siliques, as well as the influence of various preparations diminishing siliques cracking connected with self-shattering and seed-losses during ripening and harvesting.

Silique resistance to cracking was evaluated on the basis of different strength parameters. The results obtained clearly proved the thesis that double-zero varieties easier shatter seeds than high erucic or single-zero varieties. Siliques of improved rape varieties are very susceptible to cracking, which is proved by calculated resistance coefficients (Fig. 2). The possibility of improving this unfavourable feature was shown by applying various chemical preparations.

Crop was determined and compared to yield. During the study of physical properties of seeds both varieties, as well as their ripeness and moisture, which was very significant for the resistance to the influence of the external conditions on the seeds, were taken into consideration, as these are the main factors of the occurrence of various damages caused by the activity of various working units of the

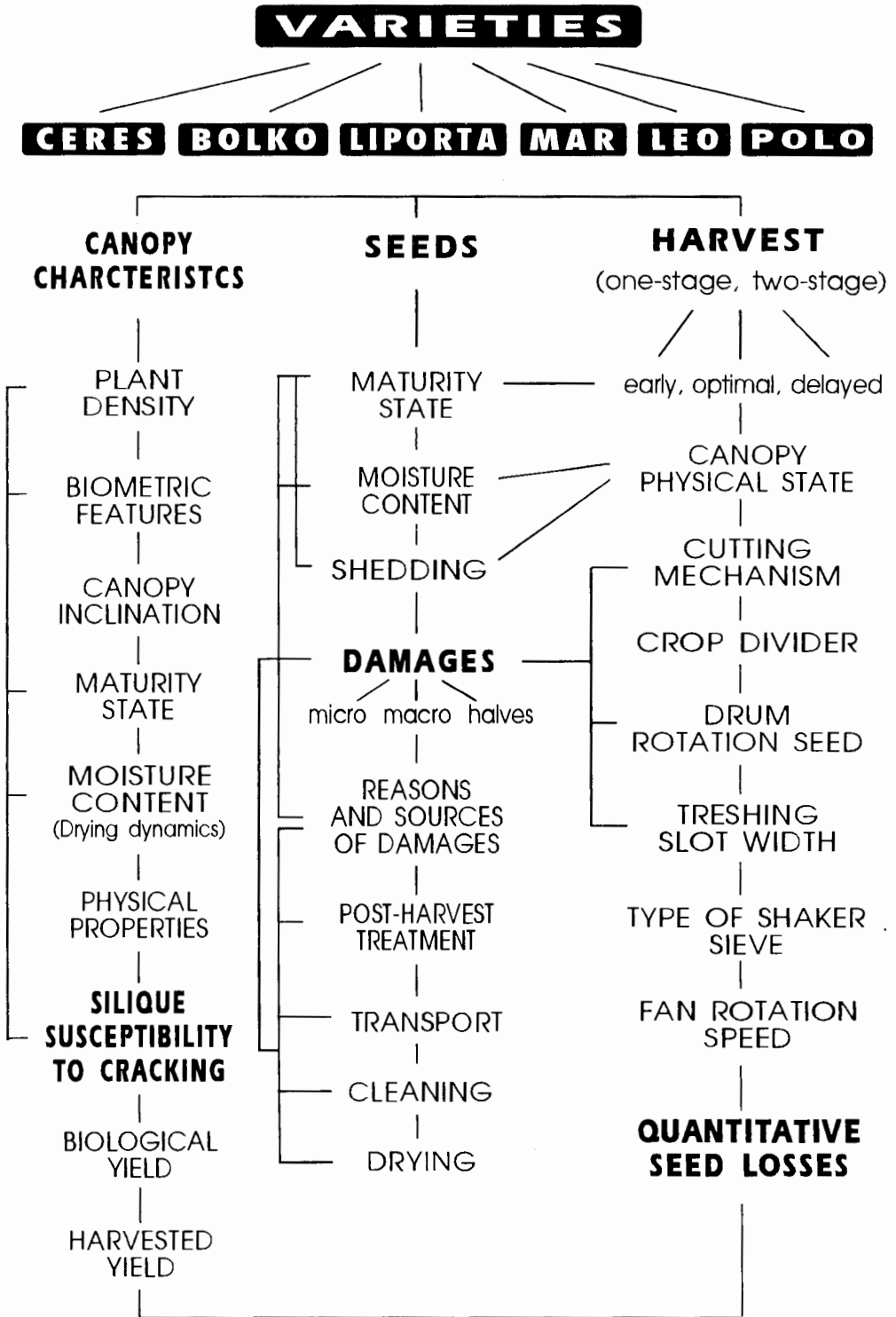


Fig. 1. Block diagram of rape studies.

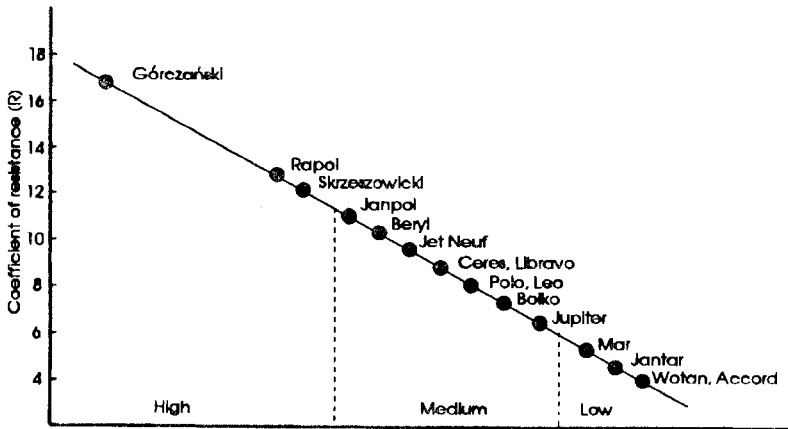


Fig. 2. Resistance of rape siliques to cracking.

combine-harvester and other machines used during the after-harvest treatment including transport, drying, cleaning and storage. Complex field-technology study was carried out to understand in the sources and reasons of damage occurrence as well as to look for the most favourable solutions allowing to minimize these losses. Single- and two-stage harvests in various periods were taken into consideration so that the material during the accelerated, optimal and late harvest could be obtained. Apart from the systematic analysis of the physical condition of canopy, the work of the cutting mechanisms, crop divider, drum rotary speed control, threshing slot, fan revolution and air stream distributor were taken into account. Several tests were carried out with the use of various sieves in the shaker shoe for the diminishing the quantitative losses and correct translocation of the bulk in the combine-harvester. For each of the numerous combinations of the experiment the loss of the quantity of seeds was evaluated on the basis of the unique and objective method which allowed us to determine the sources and causes of this loss as well as its amount for each test very precisely. Simultaneously, the study of structure of the damage, considering macro- and micro-damages and breaking into halves was carried out to determine such parameters of combine-harvester work, which would diminish this unfavourable phenomenon to minimum.

During the long-term study it was simultaneously stated that a standard combine-harvester causes great loss of seeds of double-zero rape varieties amounting up to, and even exceeding 30 % of crop, as well as numerous damages of seeds. The results obtained here constituted the base to the construction of simple replaceable adapters for the combine-harvester adjusted to the specific properties of rape. First of all, the harvesting unit with the distributor and shaling table underwent considerable changes. Moreover, the principles of subsequent sub-units regulation were worked out, to limit, depending on the variety features and the physical condition of canopy, not only the quantitative loss but seed damages as well.

Checking tests carried out widely on large productive plantations of rape, as well as the initial works on the application of new inventions in practice showed that thanks to the utilization of the results of agrophysical research and introduced adaptations and regulations of combine harvester, considerable economic profits were obtained, giving the producers profit by, on the average 2.5 q/ha of seeds, which had been up till then completely lost. The changeability of these profits is, naturally, dependent on various factors, which is illustrated in Fig. 3.

The obtained effects entitle us to state that the results of the basic and applied research solved the problem, which has existed up till

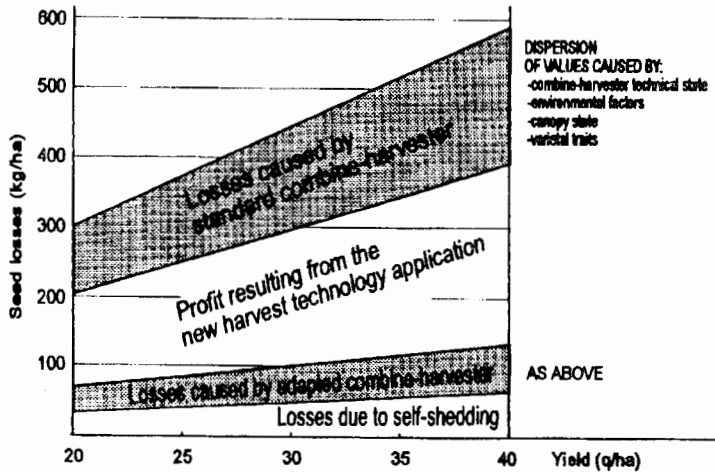


Fig. 3. Relationship between seed loss occurrence and winter rape yield during harvesting with standard combine-harvester and adapted harvester considering various factors.

now, of high quantitative loss and damage of rape seeds. Although it is impossible to avoid the loss entirely, after introducing the new technology of harvest and applying the restrictions pertaining to the regulations of combine harvester, this loss is insignificant comparing to the way of harvesting which has been applied up till now.

Another significant question is the post-harvest treatment of seeds which during various operations change their mechanical properties (in connection with the change of humidity) and they undergo further damage. That is why the testing of seed resistance to the effect of forces, considering variety properties, moisture content and temperature were performed first. Next, the influence of subsequent appliances during transport, drying and cleaning on the extend of macro- and micro-damages, as well as on making halves of seeds in the conditions of production was evaluated, while looking for the sources and reasons of these unfavourable phenomena. The results which were obtained in this research allowed us to formulate practical conclusions which indicate the possibility of further limiting the damage of seeds during the whole course of post-harvest treatment. This gives a chance of obtaining for the fatty industry raw material of the highest quality.

Whithin the agreement of cooperation

with the Division of Food Science of the Institute of Animal Breeding and Food Research in Olsztyn, samples of rape seed gathered at the known conditions of harvesting, known damages and parameters of work of the combine-harvester were subjected to qualitative inspection. This enabled us to determine the effect of damages on the quality of albumin and fat, as well as the effect of drying and storage on the physical properties of seeds and their technological usefulness.

The entire research of complex character indicates univocally that a considerable gap both in the state of knowledge and in practice has been filled in. The completed research programmes and the conclusions coming from them constitute the source of the most recent information pertaining to the possibility of obtaining rape seeds at the maximal limitation of quantitative loss, as well as improving the quality of the raw material for the fatty industry. These multi-factorial problems, as well as the interdependence between many properties of the studied material, have been presented in more detailed publications included in the following volume, devoted to one problem. The references are also presented in these papers pertaining to all the questions presented in the present article which introduces the problems and contents of the subsequent publications.

KIERUNKI POLEPSZANIA JAKOŚCI SUROWCA
POPRAZ ZASTOSOWANIE NOWEJ TECHNOLOGII
ZBIORU I OBRÓBK POZBIOROWEJ
NASION RZEPAKU

Głównym celem tych badań było wzbogacenie wiedzy na ten temat, co dawały badania podstawowe, a w następnej kolejności - znając zakres zmienności właściwości fizycznych rzepaku - podjęto badania ukierunkowane na przystosowanie istniejących maszyn rolniczych do specyficznych cech nowych odmian rzepaku, aby maksymalnie ograniczyć straty ilościowe nasion w czasie dojrzewania i zbioru oraz zastosować takie parametry pracy poszczególnych podzespołów kombajnu, by zminimalizować uszkodzenia nasion. Poszukiwano też przyczyn powstawania uszkodzeń nasion w czasie obróbki pozbiorowej, a także oceniano jakość surowca i wytwarzanych z niego produ-

któw, znając określone wcześniej uszkodzenia. Tak kompleksowe ujęcie zagadnienia pozwoliło na obecnym etapie prac nie tylko uzupełnić wiedzę w tym zakresie, ale również wyciągnąć praktyczne wnioski, upoważniające do wdrożenia wyników w produkcji i zaproponowania nowych lub zmodyfikowanych rozwiązań technologicznych.

Wieloczynnikowość tej problematyki, jak też współzależność między wieloma cechami badanego materiału zostały zaprezentowane w szczegółowych publikacjach zawartych w niniejszym, monotematycznym tomie wydawniczym. W tych pracach zamieszczono też wykaz literatury, dotyczącej wszystkich zagadnień omawianych w niniejszym artykule, sygnalizującym problematykę i treść kolejnych publikacji.

S ł o w a k l u c z o w e: rzepak, technologia zbioru, ulepszenie.