Economy

ROSIAK E. 2004 – **Rapeseed Market – Present Situation and Projections for the Season of 2004/05** Rośliny Oleiste – Oilseed Crops n^{o} XXV (1) p. 233-240.

Based on the final GUS (Central Statistics Office) estimations, in 2003 there were 793 thousand tons of rapeseeds harvested in the country, i.e. 10.4% down from 2001 crop and 16.8% up from the average crop level achieved in the period of 1996–2000. Such decline in rapeseed production volume when compared to 2002 was primarily a consequence of both the reduced rapeseed acreage to 426.3 thousand hectares (2.9% down from 2001) and lower yields of 18.6 q/ha (14.3% down from 2002). So far in the season of 2003/04, the demand for rapeseeds has been in excess of supply. Therefore, rapeseed exports in the whole season will be limited to app. 6 thousand tons versus 30 thousand tons exported in the previous season. Total rapeseed supply (beginning stocks, production, and imports) in this season will be app. 825 thousand tons, 15% down from the previous season. Rapeseed imports are projected of 16 thousand tons. It is expected that crushing plants will process app. 750 thousand tons of rapeseeds this season, 12% down from the previous season. In 2003, following the growth of rapeseed prices, rapeseed production profitability substantially increased. According to CSO (Central Statistical Office) estimations, winter rapeseed area for this year harvest totalled app. 500 thousand hectares, 17% higher than the previous year. According to the CSO rapeseed crop in 2004 reached a record level of 1.5 million tons, which was 88% more than the previous year. Such bulk increase resulted primarily from record yields and also from some increase in the area planted.

ROSIAK E. 2005. **Domestic oilseed market in the 2004/05 season**. Rośliny Oleiste – Oilseed Crops, XXVI (1): 235-246.

In 2004, rapeseed crop in Poland reached a record level of over 1,6 million tons – twice as much as compared to the low production level recorded in the previous year, as well as 19% higher in comparison to the largest crop level in the last 15 years achieved in 1995. Such a considerable rapeseed production growth was a result of both record large yields (3.03 t/ha) as well as larger acreage (up by 26% to 538 thousand ha).

As a consequence of larger supply than demand for rapeseeds, rapeseed procurement prices decreased by 15% as compared to 2003. Despite such a procurement price reduction and high production costs, rapeseed production profitability increased, primarily due to both yield growth and direct payments received by rapeseed producers.

In the season of 2004/05, the oilseed industry is likely to crush and process 1.1 million tons of rapeseeds. Crude rapeseed oil production is expected to total app. 450 thousand tons, and rapeseed meal production – app. 680 thousand tons. Rapeseed exports are likely to reach app. 300 thousand tons this season versus 6 thousand tons exported the previous season. In contrast, rapeseed imports will be marginal.

It is projected that rapeseed crop in 2005 will exceed 1 million tons, but it will be much smaller than last year's crop.

Agronomy

BEČKA D., VAŠÁK J., ŠTRANC P., KUCHTOVÁ P. 2004 – **Growing technologies for genetically modified varieties of winter oilseed rape in Czech Republic** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 85-96.

Yield indices and the yield itself were examined in three different variety types of winter oilseed rape (line, hybrid and genetically modified hybrid) in three growing technology systems (intensive, standard and low input). The growing systems differed mainly in soil preparation before sowing, seed rate, chemical protection level, growth regulation and fertilization (mainly nitrogen). The weakness of low input technology without ploughing was in the weak root system, which negatively influenced the yield. The advantage of intensive technology is the strong root system, longer assimilation period. The yield of hybrid varieties (modified and not modified) was higher in comparison with the line variety. Genetically modified hybrid was comparable in all studied characteristics with the unmodified one.

KOTECKI A., KOZAK M., MALARZ W. 2004 – **The effect of different crop production systems on growth and yielding of winter rape cultivars** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 97-108.

In the years 2001–2003 in the Research Station Pawłowice owned by the Agricultural University of Wrocław, field and laboratory experiments were carried out in order to investigate the effect of a different crop production system on growth and yielding of winter rape cultivars. In a two-factor split-block experiment the following factors were investigated I – crop production system (A_1 – standard, A_2 – intensive) and II – winter rape cultivars (Lirajet, Wotan, Lisek, Contact, Kronos, Rafaela, Batory, Bazyl, Capio). Compared to the standard system A_1, the intensive system A_2 was characterized with a higher N fertilisation by 50 kg·ha^{-1}, a twofold application of fungicides and foliar nutrient fertilizers. The other tillage treatments concerning P and K fertilization and weed control are applied at the same rate in both the variants. The statistical analysis showed that Lirajet, Wotan, Kronos, Bazyl and Lisek gave the highest seed, crude fat and total protein yields. The application of the intensive crop production system resulted in an increased seed yield and a higher protein content in the seeds. However, the fat and protein yields were mostly dependent on the seed yield. Variable weather conditions in the investigated years had a significant effect on a number of plants after emergence and winter period, plants morphological features before the harvest, and seed, crude fat and total protein yields.

WÓJTOWICZ M. 2004 – **Effect of nitrogen fertilization and environment conditions on biological and commercial characters of oilseed rape composite hybrids Kaszub and Mazur** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 109-124.

The purpose of this investigation was to compare the response of two composite hybrid varieties of oilseed rape to nitrogen fertilization in different environmental conditions. Weather conditions significantly influenced plant development in spring. In 2002 the beginning and the end of flowering were earlier and flowering lasted longer than in 2003. In 2003 plants were 30 cm smaller than in 2002, however the number of branches produced by oilseed plants in two years of investigation were similar. Dark leaf and pod spot infestation (*Alternaria* spp.) were also dependent on weather conditions and higher in 2002. This year plants produced about 45 siliques more than in 2003. In 2003 smaller number of siliques was compensated by higher seed weight. Spring fertilization did not differentiate the beginning, the end and duriation of flowering, number of branches, height of plants, lodging and infestation by dark leaf and pod spot, but significantly influenced number of siliques per plant and per area unit. Investigated varieties differed in earliness but did not differ in number of branches, plant height, lodging and infestation by dark leaf and pod spot. Mazur produced more siliques but was distinguished by smaller number of plants per area unit. Varieties did not differ in number of siliques per area unit and other yield components. Effectiveness of fertilisation was dependent on year of investigation. In 2002 yield increased with the increase of spring nitrogen doses, while in 2003 nitrogen fertilization over 180 kg N ha^{-1} did not result in the increase of yield. Effectiveness of fertilization decreased with the increase of nitrogen doses. In 2003 fertilisation over 140 kg N ha^{-1} was not effective. The experiment showed significant yield differentiation between varieties in 2003. That year Mazur yielded 2,6 dt ha^{-1} lower than Kaszub. Nitrogen fertilization significantly influenced fat content in seeds and fat yield. Higher fat content and fat yield were also noticed in 2002. Nitrogen fertilization had not significant effect on glucosinolate content and fatty acid comosition in oil. Glucosinolate content in seeds of two varieties was low. Nevertheless Mazur had significantly lower alkenyl and total glucosinolate content in seeds. Varieties differed in palmitic, linoleic and linolenic acid content but differences did not exceeded 0,3 percentage point. Kaszub was distinguished by higher palmitic and linoleic acid content and lower linolenic acid content in seeds. Small but significant differences of fatty acid composition in seeds were registered between the years of investigation. In 2003 seeds of investigated varieties had more stearic, oleic and eicosenic acid and less linolenic one.

PIEKARCZYK J., WÓJTOWICZ M., WÓJTOWICZ A. 2004 – **Influence of nitrogen fertilisation and varieties on spectral characteristic of oilseed rape crop** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 281-292.

The effect of variety and nitrogen fertilisation on spectral characteristic of oilseed rape crop was estimated. Field spectral reflectance measurements were made with the field luminancemeter in three wavebands: visible (650 nm), near-infrared (850 nm) and shortwave infrared (1650 nm). Measurements were taken on three dates in the spring season. Three vegetation indices (NDVI, ELAI and STVI) were developed by combining two or three reflectance factors. The vegetation indices enable to seize differences in oilseed plant development resulted from applied experimental factors (nitrogen fertilisation, variety). Significant differentiation of NDVI and ELAI values, in budding and ripening stage, between BOH 3103 or DH W-15 and Mazur or MR 153 was demonstrated. Variance analysis of yield also showed significant differences between these varieties. In flowering stage significant differentiation between five varieties was proved only by the $SWO_{850.}$ Differentiation of fertilisation doses was reflected in spectral reflectance mainly in ripening stage. With the increase of nitrogen dose the increase of ELAI and NDVI indices and decrease of STVI index were observed. Significant difference of yield was noticed between plots fertilised by nitrogen with dose of 60 kg ha^{-1} and plots where 140, 180 and 220 kg N ha^{-1} were applied. Significantly higher ELAI and NDVI index values were registered from plots fertilised with dose of 180 and 220 kg N ha^{-1}. Coincidence of spectral characteristic and yields representing experimental combinations proved opportunity of applying vegetation indices to forecasting the yield of oilseed rape.

HŘIVNA L., RICHTER R., RAŠKOVÁ J. 2004 – **The correction of sulphur nutrition of winter rape (*Brassica napus* L.)** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 137-144.

In small-plot field trials conducted in 2000–2003 we studied the effect of sulphur applied in the form of liquid SAM 240 with two levels of nitrogen fertilization on seed yields, oil content and concentration of the major nutrients during vegetation. The effect of additional sulphur fertilization on the S concentration in plants in the DC 50 stage was positive. The sulphur concentration increased within the range of ca 0.015–0.085%, which constituted relative increase of 3–18.6%. Correcting the sulphur level in plants under optimal concentrations of the other nutrients increased seed yields statistically significantly and stabilised the oil content. Despite the very high variability of yields in the respective years, sulphur fertilization had a positive effect in all the years. Sulphurapplication increased seed yields, on average, by 5.94%.

LOŠÁK T., RICHTER R. 2004 – **Split application of nitrogen in the poppy (*Papaver somniferum* L.) nutrition** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 145-150.

Efficiency of partial doses of nitrogen in different growth stages applied to poppy (*Papaver somniferum* L.) plants, *cv.* Opál, was investigated in a pot experiment. Nitrogen was applied either in a single dose at the beginning of a growing season in doses of 0.6 and 0.9 g N per pot or in two split doses in the total amount of 0.9 g N per pot as ammonium nitrate. In these variants, the dose of 0.3 g N (1/3 of whole dose) was applied either at the stage of leaf rosette (DC 35) or stem elongation growth (DC 41) or flowering (DC 49). After harvest, the following parameters were evaluated: number of poppy capsules per plant and their volume, yield of seeds and percent of morphine in capsules produced for pharmaceutical industry (i. e. in empty capsules with 15 cm of stems). With increase of nitrogen fertilization from 0.6 to 0.9 g N per pot applied at the beginning of growing season poppy yield increased not significantly. The split application of the higher dose (0.9 g N per pot) in comparison with one application profitably influenced yield. The highest yield was achieved when the dose of 0.3 g N per pot was applied at the flowering time. The volume of poppy

capsules was dependent on nitrogen dose and the time of application. The highest value of this feature was noticed when the whole dose of 0.9 g N per pot was applied at the beginning of growing season. The increase of nitrogen fertilization from 0.6 to 0.9 g N per pot applied at the beginning of growing season increased significantly the number of capsules. Partitioned application of a higher dose (0.9 g N per pot) decreased the number of capsules per pot. With the increase of nitrogen fertilization the morphine content in capsules increased.

Budzyński W.S., Jankowski K.J., Szczebiot M. 2004 – **Energetic efficiency with different cultivation technologies applied to seed winter oilseed rape** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 327-344.

This paper present the results of a 3-year investigation into the energy consumption of five winter rape cultivation technologies which differ mainly in the soil tillage. The standard technology was the most productive (34.4 dt·ha^{-1} seeds). Shallow plough cultivation or replacement with cultivating operations resulted in a decrease of seed yield to 6.4 dt·ha^{-1}. The lowest seed yield was obtained from direct sowing applied after stubble discing or its chemical treatment (yield decrease by 34–43%). The analyzed cultivation technologies did not significantly differ in respect to the nutritional components in the rape seeds. The energy value of 1 kg of rape seed oil increased with simplification of the cultivation technology. In contrast, the energy value of the fat-free dry matter was higher in the standard technology. Cultivation technologies did not affect energy value of 1 kg of straw. The greatest volume of energy (in oil) suitable for the fuel industry was obtained from the standard technology. The application of shallow plough cultivation or replacement with cultivating operations resulted in the decrease of the energetic value of oil yield by 9.1–9.40 GJ·ha^{-1}. The energy value of oil yield obtained with the technology of direct sowing was as much as 40% lower than in the standard technology. The total energy input per cultivation of 1 ha of rape amounts to 21–23 GJ. The energy consumption into a given technology was determined mainly by material input, whereas the energy consumption of the soil cultivation was determined by the energy of the fuel. The most advantageous energy efficiency factor of seed production (3.64) was obtained in the standard technology. This indicator ranged between 2.34–3.07 in the technologies of shallow plough cultivation or no-tillage cultivation. After adding the energy value of straw the rape cultivation efficiency indicator ranged from 6.93 (standard technology) to 5.25–6.39 (simplified technologies).

Wielebski F., Wójtowicz M. 2004 – **The influence of agrotechnical factors on chemical composition of seeds of restored hybrid BOH 3103 in comparison to open pollinated variety and composite hybrids** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 505-520.

The experiment in split-plot design was carried out during 2002/2003 in two locations: Zielęcin and Łagiewniki. The aim of the experiment was to determine the effect of the most important cultivation factors on chemical composition of the first domestic restored hybrid BOH 3103. The response of this variety to seeding rate (40, 80, 120 and 160 seeds/m^2) and fertilisation with nitrogen (60, 100, 140, 180 and 220 kg N/ha) and sulphur (0, 10, 40 and 80 kg S/ha) was evaluated. This hybrid was compared with open pollinated variety — Lisek and composite hybrids: Kaszub, Mazur, Pomorzanin and Lubusz. Nowadays restored hybrid BOH 3103 is being investigated in official trials carried out by COBORU. The low effect of fertilisation factor on chemical composition of seeds was observed. Fat and protein content in seeds were not significantly influenced by spring nitrogen and sulphur fertilisation. The investigated factors did not significantly influence composition of fatty acids in oil, but this composition was significantly dependent on the location and variety. In similar weather conditions investigated varieties cultivated on lighter soils in Zielęcin had lower fat content in seeds and lower value of PUFA (linoleic and linolenic acid) than in Łagiewniki on better soil. Sulphur fertilisation significantly influenced glucosinolate content in seeds. The increase of alkenyl glucosinolate in seeds was observed under the influence of applied sulphur doses. Restored hybrid BOH 3103 and Kaszub were characterised by the highest fat content in seeds. Restored hybrid BOH 3103 was distinguished by higher protein content. This hybrid had significantly lower glucosinolate content in seeds than composite hybrids but did not differ significantly from open pollinated variety — Lisek. Seed oil of restored hybrid BOH 3103 had significantly higher content of PUFA (linoleic and linolenic acid) and higher ratio of linoleic to linolenic acid than Lisek variety.

Podleśna A. 2004 – **The effect of sulfur fertilization on concentration and uptake of nutrients by winter oilseed rape** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 627-636.

Fertilizer recommendations published in Poland have been completed in recent years with sulfur fertilization particularly in relation to oilseed rape and other plants which have high requirements on this nutrient. In relevant literature there are few papers dedicated to the influence of sulphate sulfur present in fertilizers, on formation of concentration and uptake of the other nutrients. It was shown, however, that fertilizer sulfur can optymalize the ion balance in plants. Through these actions sulfur can indirectly effect the intensity and size of remaining nutrient uptake. From the agricultural point of view it is an important problem because it has repercussions not only at growth and yielding of plants but also at quality of agricultural products. The recognition of fertilizer sulfur effect on increase of rapeseed plant mass and on concentration and dynamics of uptake of the main nutrients from flowering until full maturity of seeds was the aim of conducted researches. It was found that applied sulfur had little effect on rape seed yield increase during the 3 years of studies. However, under the influence of sulfur fertilization the increase of N, S, Ca and Mg concentration in seeds and vegetative parts of rape was found. The P and K content in plants fertilized with S decreased at flowering while it did not differ significantly in plant material from both objects collected at later phases. Matured plants from an object with sulfur showed greater accumulation of nitrogen, sulfur, potassium, calcium and magnesium. In the period of seeds filling the remobilization of N and S and to a lesser degree S and Mg from vegetative to generative organs was found. Applied sulfur fertilization influenced little increase of seed and vegetative organs yield of oilseed rape. Plants fertilized with sulfur showed higher concentration of nitrogen, sulfur, calcium and potassium and lower content of phosphorus and the same content of magnesium, similar to control plants. The oilseed rape which origined from sulfur fertilized objects was

characterized by greater uptake of most of studied nutrients whereas phosphorus uptake was independent of this treatment. Sulfur fertilization caused more efficient nutrients uptake and their greater utilization in production of seeds and vegetative organs.

WIELEBSKI F. 2005. **Share of yield components in the creation of yield of winter oilseed rape hybrids**. Rośliny Oleiste – Oilseed Crops, XXVI (1): 87-98.

The paper presents the influence of yield components on seed yield creation of two types of oilseed rape hybrids in comparison with open pollinated varieties. To realize this aim results of biometry measurements of yield components and yield obtained from the field experiments conducted in 2001–2004 at Agricultural Experimental Stations in Łagiewniki (N 51°46'; E 17°14') were analyzed. The experimental factors were: two types of oilseed rape hybrids – composite hybrids (Kaszub, Mazur, Lubusz and Pomorzanin) — restored hybrids (BOH 3103, MR 153) and two pollinated varieties (Kana, Lisek). Years were the repetitions.

Analysis of correlation, multiple regression and path analysis were carried out to estimate significance of yield components in final yield creation.

The yield of composite hybrids was significantly correlated with the number of plants per area unit and the weight of 1000 seeds. The number of seeds per silique was positively correlated with yield of restored hybrids. Irrespective of the type of oilseed rape the number of pods per plant was positively correlated with the number of branches per plant and the plant height, and was negatively correlated with plant population density. The number of seeds per pod of open pollinated varieties and restored hybrids was poorly correlated with other features. This yield component of composite hybrids was, in contrast, negatively correlated with plant height and plant population density. The weight of 1000 seeds and the number of branches per plant of all investigated varieties was negatively correlated with plant population density.

The relationship between yield and detailed yield components: plant population density, number of pods per plant, number of seeds per pod and weight of 1000 seeds was determined by regression functions and analysis of path coefficient. The share of yield components in the creation of the yield of investigated types of oilseed rape was differentiated. The yield of open pollinated varieties was mainly determined by plant population density and weight of 1000 seeds. The plant population density and pod production with well developed seeds mainly influenced the yield of composite hybrids. Beside the plant population density, the number of seeds per pod determined mainly the yield of restored hybrids.

Path analysis precisely illustrated the significance of yield components in the final yield creation of winter oilseed rape hybrids.

WÓJTOWICZ M. 2005. **Effect of environmental conditions on variability and interaction between yield and its components in winter oilseed rape**. Rośliny Oleiste – Oilseed Crops, XXVI (1): 99-110.

The experiment carried out in Łagiewniki was undertaken in order to estimate basic (number of siliques per area unit and weight of seeds per silique) and detailed (number of plants per area unit, number of siliques per plant, number of seeds per silique, weight of 1000 seeds) yield components of oilseed rape. Experimental factors were: years (2003, 2004), spring nitrogen fertilization (60, 100, 140, 180, 220 kg $N \cdot ha^{-1}$) and cultivar of winter oilseed rape (Lisek, Mazur, Kaszub, BOH 3103, MR 153).

Calculation of variation coefficient showed that the most unstable feature was the number of siliques per area unit. Among detailed yield components the most variable trait was the number of siliques per plant. The least variable feature was the weight of 1000 seeds. All yield components except for the number of plants per area unit were more variable in 2004, which was characterized by frequent precipitation in spring-summer vegetation season. The yield was more variable in 2003, which was distinguished by long lasting water deficiency in soil. These dependencies showed that cultivar potential for creating particular yield component can come into existence in good moisture conditions. Among cultivars cultivated in the experiment distinguished in two years by the highest number of seeds per silique Lisek was characterised by the highest fidelity of yielding.

The seed yield was mostly influenced by environmental conditions. Nitrogen dose had a slightly higher effect on yield than cultivar. All yield components changed mostly under random factors. The number of siliques per area unit was the least dependent on cultivar. Nitrogen dose, in contrast, had the smallest effect on the weight of seeds per silique. The number of plants per area unit was more conditioned by cultivar than by environmental conditions. The variability of silique number per plant was mainly environmental conditions and nitrogen fertilization. Cultivar had higher effect on the number of seeds per silique than environmental conditions and nitrogen doses. Variability of the weight of 1000 seeds was more dependent on environmental conditions and cultivar than on nitrogen doses.

Significance of correlation between yield and its components was dependent on environmental conditions. In conditions of long lasting water deficiency yield was significantly correlated with the number of siliques per area unit and the number of seeds per silique. In conditions of frequent precipitation in spring-summer vegetation season significant correlation occurred between yield and the number of siliques per plant.

The weight of seeds per silique was better correlated with the number of seeds per silique than with the weight of 1000 seeds irrespective of environmental conditions. Significance of correlation between the number of siliques per area unit and its components was dependent on environmental conditions. This basic yield component was better correlated with the number of plants per area unit in conditions of water deficiency but in good precipitation conditions, it was better correlated with the number of siliques per plant.

KOTECKI A., KOZAK M., MALARZ W. 2005. **The effect of different systems of crop production on the growth and yielding of winter rape cultivars**. Rośliny Oleiste – Oilseed Crops, XXVI (1): 111-124.

In the years 2001/2002–2003/2004 field and laboratory experiments were conducted to investigate the effect of different systems of crop production on the growth and yielding of 5 winter rape cultivars at Pawłowice Research Station near Wrocław, Poland. Experiment was made in a two-factor split-block design. Following factors were investigated: I — different systems of crop production (A — standard, B — intensive) and II — winter rape cultivars (Lirajet, Lisek, Contact, Kronos and Capio). In the standard system (A), fertilisation was applied at the following rates (kg·ha^{-1}): 140 N, 60 P_2O_5 and 120 kg K_2O. This system also included a standard weed and pest control. In the intensive system (B), N fertilisation was increased by 50 kg·ha^{-1}, and additionally fungicides and foliar fertilisers were applied twice.

It was observed that differentiated crop production systems had a significant effect on the number of stripped siliques per plant, canopy height to plant height ratio, number of seeds per stripped silique, crude fat content and total protein percentage content in seeds, seed yield, as well as on yield of standard nutrients. Taking into account average values from the three-year study, the highest rape seed yield (4.35 t·ha^{-1}), fat yield (1.89 t·ha^{-1}) and protein yield (0.87 t·ha^{-1}) were obtained with the intensive production system.

It was also noticed that rape morphological features were considerably differentiated by genetic properties of particular cultivars. Among the investigated cultivars, Lirajet, Lisek and Kronos produced high seed yields 4.33, 4.23 and 4.19 t per ha, respectively, while the lowest seed yield was recorded for Contact (3.70 t·ha^{-1}). Crude fat yield and total protein yield were also the lowest in Contact. It was also noted that weather conditions in the years of the experiment had a significant effect on majority of the investigated morphological features of winter rape, seed yield as well as crude fat and total protein yields.

All the morphological features of rape plants, seed mass per silique, 1000 seeds mass as well as seed yield, total crude fat yield and total protein yield were determined mostly by weather conditions in the years of the experiment and to a lesser degree by crop production and a cultivar type.

Compared to the standard crop production (A), the intensive production (B) increased the number of siliques per plant by 12%, and the number of seed per silique by 8%. The intensive crop production also resulted in the increased canopy height to plant height ratio, seed yield (by 13%), crude fat yield (by 7%) and total protein yield (by 22%).

In Lower Silesia, the cultivars Lirajet, Lisek and Kronos were the most productive among the investigated varieties and gave seed yield of 4.33, 4.23, 4.19 t·ha^{-1}, respectively. Lirajet also produced the highest crude fat yield (1.95 t·ha^{-1}).

JĘDRZEJAK M., KOTECKI A., KOZAK M., MALARZ W. 2005. **I. The effect of different N doses on the growth and yielding of spring rape**. Rośliny Oleiste – Oilseed Crops, XXVI (1): 125-138.

In 2001–2003 field and laboratory experiments were carried out to investigate the effect of N fertilisation on five cultivars of spring rape at Pawlowice Reseach Station near Wroclaw, Poland. This was a split–plot experiment with four replications, having two variable factors: I spring rape cultivars: population varieties Bolero (DE) Licosmos (DE), Sponsor (SE), Star (DK) and a hybrid Margo (PL); II. N fertilisation: 60, 90 (60 + 30), 120 (60 + 60), 150 (60 + 90) kg N·ha^{-1}.

Different weather conditions in years of the experiment had a more significant effect on the length of a vegetation period, numerical values of most of the morphological features, plant height, yield structure elements, seed yield and seed chemical content as well as crude fat and total protein yields than the type of a cultivar or N fertilisation.

The cultivars had a bigger influence than N fertilisation on such features as length of vegetation period, plant height, number of branches on a plant, yield structure elements, total protein, crude fat and ash contents, the content of nitrogen free extract compounds and seed energy. But a cultivar type did not affect the seed yield.

The best results were obtained with 120 kg N·ha^{-1} (60 kg pre-sowing + 60 kg top dressing at bud forming stage). Compared to the control (60 kg N·ha^{-1}), such fertilisation increased the number of seeds per silique by 2.3%, seed weight per silique by 3.9%, total protein content by 1.2%, seed yield by 6.6%, but lowered crude fat content by 1.1% and seed energy by 1%.

JĘDRZEJAK M., KOTECKI A., KOZAK M., MALARZ W. 2005. **II. The effect of different nitrogen doses on the profile of fatty acids in spring rape oil**. Rośliny Oleiste – Oilseed Crops, XXVI (1): 139-148.

In 2001–2003 field and laboratory experiments were carried out to investigate the effect of top- dressing N fertilisation on fatty acid profile in oil of five spring rape cultivars at Pawlowice Research Station near Wroclaw, Poland. This was a split-plot experiment with four replications, having two variable factors: I spring rape cultivars population varieties Bolero (DE) Licosmos (DE), Sponsor (SE), Star (DK) and a hybrid Margo (PL); II N fertilisation: 60, 90 (60 + 30), 120 (60 + 60), 150 (60 + 90) kg N·ha^{-1}.

The content of particular acids and the sum of both saturated and unsaturated acids (including essential unsaturated fatty acids: linoleic and linolenic acids, eighteen carbon length fatty acids: vaccenic, oleic, linoleic and linolenic) depended on genetic factor, N fertilisation and weather conditions.

The highest content of eighteen carbon length fatty acids and the greatest unsaturated to saturated acids ratio was recorded in the cultivar Margo. The linoleic to linolenic acid ratio was the most favourable in the cultivar Star which also contained the most of erucic acid.

Compared to the control (60 kg N·ha^{-1}), N fertilisation with the dose of 120 kg N·ha^{-1} increased the content of palmitic acid, stearic, linoleic and linolenic acids, and it decreased the content of oleic acid.

JAKUBUS M., TOBOŁA P. 2005. **Content of total and sulphate sulphur in winter oilseed rape depending on fertilization.** Rośliny Oleiste – Oilseed Crops, XXVI (1): 149-162.

The research work on influence of the kind of fertilizer and the time of its application on total and sulpate sulphur content in winter oilseed rape was performed. The study was realized on the basis of a 3-year field experiment carried out on cambisols with winter oilseed rape 'Lirajet'. The scheme of randomized blocks method included combinations of fertilizers applied presowing (single superphosphate, potassium sulphate, elemental S, gypsum and ammonium sulphate), as top dressing after spring vegetation renewal (gypsum and ammonium sulphate) and as foliar application (ammonium sulphate). The tested agents were fertilizers applied to soil in autumn or spring in the amounts corresponding to the dose of 50 kg S·ha^{-1}, and 7.2 kg S·ha^{-1} in the case of fertilizer used as foliar application. The plant samples were collected in V terms corresponding to the particular growth stages of winter oilseed rape, determined according to BBCH key.

The research confirmed the fact that total sulphur content as well as sulphate content increase with the age of a plant and the highest content was recorded at flowering (IVth term of sampling). On average of 3 years these values changed in the range from 0.80 to 1.09% for total sulphur and from 0.39 to 0.52% for sulphate sulphur. Also time of application and a kind of fertilizer had some importance in shaping of sulphur level in a plant. It was especially distinct on treatments with ammonium sulphate and gypsum applied as top dressing. As a result of this type of fertilization was twofold increase in content of S-SO_4 and 1.5-time of total S in plant material in comparison to control. Ammonium sulphate used before sowing and its foliar application influenced the amounts of total sulphur in seeds of winter oilseed rape. In contrast elemental sulphur and ammonium sulphate in foliar application had the weakest influence on the level of content of both sulphur forms in plants. Nevertheless, compound uptake by winter rape under elemental sulphur application was one of the biggest next to gypsum and ammonium sulphate applied before sowing.

As a result of the performed field experiment it was found that applied sulphur fertilization did not increased significantly the seed yield of oilseed rape. Taking into consideration the efficiency of used fertilizers, single superphosphate revealed low effect on crop yield. Also no significant influence of fertilizers on sulphur content in seed was found.

SIENKIEWICZ-CHOLEWA U. 2005. **The importance of boron and copper for rapeseed cultivation in Poland.** Rośliny Oleiste – Oilseed Crops, XXVI (1): 163-172.

Average yield of rape in Poland, about 2 t/ha, is rather low in comparison with EU, where it exceeds 3.2 t/ha. High yield of rape requires optimal level of nutrients. High yields cause gradual depletion of micronutrients in soil which are not supplied systematically. In Poland 79% agricultural soils show insufficient concentration of boron and 39% insufficient concentration of copper for plants. Deficiency of these nutrients deepens and contributes to yield decrease.

The investigation of rape fields in Poland, conducted by IUNG revealed boron deficiency in soil from 88% of the tested fields. Additionally, plants from 65% plantations showed low level concentration of this nutrient. The lowest rape yield came from fields where B deficiency was very high. Boron concentration in rape plants increased with the increasing level of yield. However, even in a group of the highest yield (3.3–5.0 t·ha^{-1}), B concentration in leaves was too low in relation to plant requirements. Copper deficiency was found in soils from 17% plantations, and 28% plants showed copper undernutrition. Copper concentration in rape seeds was too low.

In field trials where rape was fertilized with boron (2 kg B·ha^{-1}), copper (8 kg Cu·ha^{-1}), and B+Cu together, the 6–9% significant yield increase was found.

MAJCHRZAK B., WALERYŚ Z., CISKA E. 2005. **Phytosanitary value of cruciferous plants as pre-crops of cereals.** I. Glucosinolate content in stems and roots of mature plants of Brassicaceae family. Rośliny Oleiste – Oilseed Crops, XXVI (1): 199-210.

The aim of the present study was to determine quantitatively and qualitatively the glucosinolate content of vegetative parts of various cruciferous plants at the end of growing.

The experimental material comprised vegetative parts (stems and roots) of spring cruciferous plants, such as spring rape cv. Margo, white mustard cv. Heter, Chinese mustard cv. Małopolska, oleiferous radish cv. Pegletta, false flax cv. Borowska and crambe cv. Borowski. GLSs were extracted from plant material according to the Official Journal of European Communities (1990). GLS concentration was estimated by HPLC according to Heaney et al. (1986).

The vegetative parts of cruciferous plants contained aliphatic, aryl and indole GLSs. Aryl GLSs dominated in stems (6.16 mg/g d.m.), and indole GLSs — in roots (10.5 mg/g d.m.). Considerably higher amounts of GLSs were extracted from roots than from stems. The highest concentration of these compounds (5.12 mg/g d.m.) was recorded in the roots of camelina, and the lowest (1.32) — in the roots of white mustard. The highest level of GLSs (6.02) was observed in the stems of white mustard, and the lowest (0.13 mg/g d.m.) — in the stems of camelina. 4-methylthiobut-3-enyl (radish) and glucobrassicin (camelina) dominated in the roots of the cruciferous plants tested in the study, whereas sinalbin (white mustard) and glucoraphenin (radish) were extracted from their stems in the largest amounts. Weather conditions affected GLS concentration in both roots and stems. In roots the highest level of GLSs was recorded in 2001 (14.3 mg/g d.m.), and the lowest — in 2000 (1.61). In stems GLS content was the highest in 1999 (7.32 mg/g d.m.), and the lowest — in 2000 (0.48).

LOŠÁK T., PÁLENÍČEK L. 2005. **Using nitrogen and sulphur for the poppy (*Papaver somniferum* L.) nutrition**. Rośliny Oleiste – Oilseed Crops, XXVI (1): 261-268.

The pot trial was carried out to estimate the effect of interaction of nitrogen and sulphur fertilization on seed yield, number of capsules per plant and concentration of morphine in the poppy straw (i.e. empty capsule + 15 cm of the stem) of the variety Opál. The natural content of sulphate sulphur in the soil was 18.3 mg S-SO_4^{-2}·kg^{-1} of soil. The respective variants were supplied with ammonium sulphate (20,5% N and 24% S) to the level of 40 mg S-SO_4^{-2}·kg^{-1} of soil.

Nitrogen fertilization was applied in three doses: 0.3 – 0.6 – 0.9 g $N \cdot pot^{-1}$. Nitrogen was made up to the appropriate level with ammonium nitrate (34.5% N). The fertilisers were applied in one single application after emergence of the stand.

The increase in seed yields in all the fertilised variants was statistically highly significant, i.e. by 54.8 – 143.7%, compared to the unfertilised control, and the yields increased with the doses of nitrogen. The increase in the level of sulphate sulphur in the soil from 18.3 mg $S\text{-}SO_4^{-2}$ (control) to 40 mg $S\text{-}SO_4^{-2}$ did result in a statistically significant increase in yields by 12.6%, but only in conjunction with the lowest dose of nitrogen (0.3 g $N \cdot pot^{-1}$). In the other variants the joint application of nitrogen and sulphur had no statistically significant effect compared to the same variants without sulphur.

A statistically significant increase in the number of capsules per plant was seen with increasing N doses, in the fertilised variants ranging between 1.0 and 2.2 capsules per plant, compared to 1.0 per control plant. Irrespective of sulphur content in the soil the highest number of capsules per plant (2.11 and/or 2.20) was noticed in the variants fertilized with the highest dose of nitrogen (0.9 g $N \cdot pot^{-1}$).

The concentration of alkaloids of morphine in the poppy straw of the fertilised variants varied only a little, i.e. 0.63–0.76%, compared to 0.61% in the control. The highest dose of N resulted in the highest morphine concentration; sulphur showed no major effect.

WOJTOWICZ A., WOJTOWICZ M., PIEKARCZYK J. 2005. **Application of the remote sensing to monitoring oilseed rape crop and estimation its productivity**. Rośliny Oleiste – Oilseed Crops, XXVI (1): 269-276.

Remote sensing involves acquiring, processing and interpreting images that record the interaction between electromagnetic energy and matter.

Interactions of electromagnetic radiation and plants are mostly determined by optical features of leaves dependent on chlorophyll content, water content and structures of plant cells. The unique spectral characteristic of plants in the visible and the near infrared wavelengths were used to develop vegetation indices defined as radiometric measure used to estimate vigour of plants. Vegetative indices were incorporated to the studies on plant productivity, water resources management, land use and the protection of the environment. In agriculture the vegetation indices are used for crops monitoring, biomass estimation and forecasting of yields. Biomass of oilseed rape crop was estimated with the help of remote sensing by Brown et al. (1997). The studies of Basnyat and McConeya, and Piekarczyk et al. (2004) show that remote sensing helps to monitor oilseed rape crop and predict its yield. The experiments which focused on comparison of remote sensing results with the yield of oilseed rape proved that interaction between the studied elements was strongly influenced by the time of recording of measurements. Knowledge about spectral reflectance is also used for estimation of fields infestation by weeds and helps to diminish the number of herbicide applications (Deguise et al. 1999) and for mapping weeds in fallow fields after the harvest of oilseed rape (Lamb and Weedon 1998). Remote sensing is also very helpful in determining fertilisation requirements of oilseed rape (Behrens et al. 2004) and early detection of crop water stress (Mogensen et al. 1996).

BOROVKO L. 2005. **Application of biological preparations to spring oilseed rape under ecological conditions**. Rośliny Oleiste – Oilseed Crops, XXVI (2): 361-368.

Field trials on biological protection of spring oilseed rape against diseases and pests were carried out in the LUA Research Institute of Agriculture in Latvia. Research was necessary to provide environment friendly and ecologically clean oilseed rape production suitable for organic farming.

The seed treatments with Trichodermin (6 $ml \cdot kg^{-1}$ seeds), Azotobacterin (6 $ml \cdot kg^{-1}$ seeds) and Germin (5 $ml \cdot l^{-1}$ water$\cdot l \cdot kg^{-1}$ seeds) for control of root diseases (*Pythium, Rhizoctonia, Fusarium* spp., *Phoma lingam*) were effective and increased spring rape seed yield by about 0.35–0.74 $t \cdot ha^{-1}$. The highest increase of seed yield (0.74 $t \cdot ha^{-1}$) and net profit (161.77 $EUR \cdot ha^{-1}$) was obtained in the variant with Germin preparation (complex of phytohormones).

Spraying plants with Trichodermin 30 $l \cdot ha^{-1}$ at the beginning of flowering to control dark leaf spot of crucifers (*Alternaria* spp.), downy mildew (*Peronospora*), dry rot (*Phoma*) and others was effective. The most effective was variant seed treatment with Germin and spraying with Trichodermin which increased the seed yield by 0.6 $t \cdot ha^{-1}$ with net profit 76.28 $EUR \cdot ha^{-1}$.

The spraying with Bacilon at the stage of germination for control of cabbage stem flea beetle (*Psylliodes chrysocephala* L. and *Phyllotreta nemorum* L.) and at the stage of flowering for control of oilseed rape blossom beetle (*Meligethes aeneus* F.) provided essential increase of yield by 0.40 $t \cdot ha^{-1}$ and extra net income of 41.16 $EUR \cdot ha^{-1}$.

BUDZYŃSKI W.S., JANKOWSKI K.J., RYBACKI R. 2005. **Organisation, habitat and agronomical determinants of production of raw material for oil industry in selected big area farms**. Rośliny Oleiste – Oilseed Crops, XXVI (2): 387-406.

The paper presents results of three year pool performed by the University of Warmia and Mazury in Olsztyn and Oil Processing Plant „Kruszwica" joint-stock company in Kruszwica. The aim of the pool was to diagnose the habitat and agronomical factors of production of winter seed oil for food oil in big area farms. 291 farms of total area of 25,500 ha in the following provinces ofPoland: warmińsko-mazurskie, pomorskie, kujawsko-pomorskie, zachodniopomorskie, lubuskie, wielkopolskie, mazowieckie i łódzkie were monitored. In the farms under studies share of winter oil rape in sowing structure was higher than the level considered as optimal from natural point of view. Oil seed rape was grown on soils of good and medium quality with high level of available nutrients. Cereals were grown as forecrops what was reflected in delayed sowing date (more than 50% of pooled plantations were sown too late). Majority of growers sown 3.1–4.5 kg seeds per hectare.

The average rates of phosphorus and potassium which amounted respectively to 60 kg $P_2O_5 \cdot ha^{-1}$, and 120 kg $K_2O \cdot ha^{-1}$ were applied. In majority of farms (i.e. 76%) before sowing the rate of 60 kg $N \cdot ha^{-1}$ was applied.

Nitrogen fertilization can be considered as intensive. On 57% of pooled area the rate of nitrogen applied in spring ranged from 181 to 240 kg $N \cdot ha^{-1}$. Sulphur was applied in spring at the rate of 90 kg $S \cdot ha^{-1}$ on 40% of pooled area.

Rape was intensively protected against pests and diseases (index of number of sprayings amounted to 5.69). On 99% of the studied area herbicides were applied, on 97% insecticides and on 91% fungicides were used. On more than 1/3 of studied area in autumn or/and spring growth regulators were applied.

In farms under pool average level of yield (in the period of 2001–2004) reached 3.12 $Mg \cdot ha^{-1}$. This level was higher than average yield in Poland (in the same period) by 28%. Particularly high yield of seeds was obtained in Kujawy-Pomorze and Eastern Agrotechnical Region.

BUDZYŃSKI W.S., JANKOWSKI K.J., TRUSZKOWSKI W. 2005. **Agricultural and economical effectiveness of production technologies of winter oilseed rape in selected big area farms.** Rośliny Oleiste – Oilseed Crops, XXVI (2): 407-420.

The paper presents results of three year studies (in the period of 2001–2004) carried out by the University of Warmia and Mazury in Olsztyn and Oil Processing Plant „Kruszwica" joint-stock company in Kruszwica on productivity and economical effectiveness of production of winter oilseed rape (high, medium and low input).

Materials to be used in the analyses were obtained from pools performed in farms of big area (from 100 to 5000 ha) located in the area of Western Region, Wielkopolska Region, Kujawy-Pomorze and Eastern Region of Agrotechnics of Oil Processing Plant „Kruszwica". In total 291 winter oilseed rape plantations were pooled of total area of 25,500 ha. Two indices of effectiveness of oilseed rape production were applied in the paper: productive (yield of seeds) and economical (direct surplus).

In the structure of variable costs the most essential was the cost of mineral fertilizers which constituted 49–52% of total variable costs and cost of herbicides whose share amounted to 14–16% in the structure of material cost irrespectively of the method of seed production. Circular cost at a level above 1500 $PLN \cdot ha^{-1}$ (high input technology) resulted in winter oilseed rape production at a level of 3.55 $Mg \cdot ha^{-1}$. Reduction of input by 21% and 43% resulted in yield decrease by 0.46 and 1.05 $Mg \cdot ha^{-1}$. The best economical efficiency (measured as a value of direct surplus per 1 ha) was obtained in farms where the share of oilseed rape in sowing structure amounted to 11–20%. The increase of oilseed rape share in sowing structure above 21% resulted in the decrease of value of direct surplus by 4–7%. In the period of studies the value of direct surplus on 1 ha was the highest in high inputs technology. It was obvious that according to the law of reducing effectiveness of inputs the increase of circular inputs (variable costs) resulted in the reduction of its effectiveness (as intensity of production increased profitability of circular inputs was reduced). The best value of direct surplus per 1 ha for 1 PLN of variable costs was obtained in 2001–2004 by farmers from Kujawy-Pomorze region.

BUDZYŃSKI W.S., JANKOWSKI K.J., RYBACKI R. 2005. **Relation between plant protection measures and yield of oilseed rape in big area farms.** Rośliny Oleiste – Oilseed Crops, XXVI (2): 421-436.

The paper presents results of a three year pool performed by the University of Warmia and Mazury in Olsztyn and Oil Processing Plant „Kruszwica" joint-stock company in Kruszwica. The aim of the studies was to determine effects of variable intensity of plant protection practices introduced in big area farms. In total 291 plantations of winter oilseed of overall area of 25.500 ha were monitored.

Effectiveness of weeding was expressed as yield increase by 30% after herbicides application in autumn or in spring and autumn but only 10% when herbicides were applied only in spring. Desisting from plant protection against pests resulted in seed yield reduction by 54%. The increase of the amount of saved yield depended on the increasing number of sprayings against pests in spring. The third and the fourth spraying saved 10 and 26% yield, respectively. Fungicides application increased yield by 21 and 19% for autumn and spring date of fungicides application, respectively. In spring the highest effectiveness for spraying was found at the date of petals falling from the main stem. When spraying was performed in early spring, smaller amount of seeds was saved. Regulation of rape growth was done by tebukonazole, chlometaquate and metakonazole application in 33–35% of studied farms. The final result of those practices was a significant (11–22%) increase of seed yield with tendency to the decrease of oil content. Desiccation before harvesting (by gliposphate) tended to increase seed yield and to decrease oil content.

JANKOWSKI K.J., RYBACKI R., BUDZYŃSKI W.S. 2005. **Relation between fertilization and yield of oilseed rape in big area farms.** Rośliny Oleiste – Oilseed Crops, XXVI (2): 437-450.

The paper presents the results of a three year pool carried out by the University of Warmia and Mazury in Olsztyn and Oil Processing Plant „Kruszwica" joint-stock company in Kruszwica. The aim of the study was to determine the effects of some agrotechnical factors on winter rapeseed yielding in big area farms. In total 291 rapeseed plantations of overall area of 25,500 ha were monitored.

Yielding effect of potassium appeared to be equally low within the range of rates 60–120 and above 120 kg $K_2O \cdot ha^{-1}$. Phosphorus showed even smaller effects. It was characteristic that potassium as well as phosphorus, when applied in two split rates before and after sowing, increased yield in relation to the rate applied only before sowing.

The level of nitrogen application could be estimated as high in studied farms. Before sowing nitrogen application did not bring any yielding effects despite cereals as forecrops. The increase of nitrogen rates to the level of 181–240 kg $N \cdot ha^{-1}$ in spring resulted in significant yield increase maintaining high productivity of nitrogen unit. It was significant that splitting of spring nitrogen rate into two or three sub-rates resulted in favourable yield increase.

Low effectiveness of sulphur applied before sowing did not justify purposefulness of its application. Linear increase of seed and oil yield resulting from sulphur application in spring was observed up to the highest applied rate (90 kg $S \cdot ha^{-1}$).

PASZKIEWICZ-JASIŃSKA A. 2005. **The effect of selected agrotechnical factors on development yielding and quality of white mustard. The effect of nitrogen fertilization and sowing density on the development and yielding of white mustard (*Sinapis alba* L.).** Rośliny Oleiste – Oilseed Crops, XXVI (2): 451-466.

In the years 1998–2000 in the Experimental Agricultural Station Pawłowice (near Wrocław) there were caried out field and laboratory experiments regarding the influence of the increasing doses of nitrogen and the seed rates on the development and yielding of white mustard. The field experiments started in two series, regarding variable factors, according to „split-plot" pattern, repeated four times. The series I included Ascot cultivar, series II — Nakielska. The factors under investigation in both series were as follows: A — nitrogen fertilization — the doses in kg·ha^{-1}: 30, 60, 90, 120; B — seed rates (1 m^2): 50, 75, 100, 125. It was stated that the length of vegetation period of white mustard was shaped by weather conditions and the term of sowing. The shortest vegetation period (107 days) was recorded in a dry year 1999, in which sowing, because of unfavourable weather conditions, was delayed by two weeks. In the two remainig years of investigation vegetation period of the examined cultivars lasted 125 days. The periods of drought in 1999 negatively effected total height of plants and the height up to the lowest branching, seed weight from a silique, weight of 1000 seeds, as well as seed yielding. Out of the examined cultivars Nakielska produced more siliques on a plant. It was also featured by higher values of seed weight from a silique and a plant, weight of 1000 seeds and stand deflection. Ascot cultivars were characterised by higher plants with a higher place of branching. Seed yielding, i.e. mean values of three years of investigation, was not much diversified. Nakielska cultivar resulted in seed yield by 1.5% higher than Ascot cultivar. The increase in nitrogen fertilization doses from 30 to 120 kg·ha^{-1} caused the increased number of I line branching, stand deflection, the number of siliques per one plant, seed weight obtained from one plant, as well as seed yielding. As the number of sown seeds increased from 50 to 125 seeds per 1 m^2, the decrease was recorded in plant height, the number of branches, siliques and seed weight per one plant, while plant height up to the lowest branches increased. The latter tendency also involved stand deflection and the number of siliques per one unit of area. In the conditions of the Lower Silesia Lowland it is sufficient for Ascot cultivar to sow 100 seeds per 1 m^2, while Nakielska cultivar should be sown in the amount of 125 seeds per 1 m^2. Both cultivars benefited most from nitrogen fertilization of 120 kg·ha^{-1}.

PASZKIEWICZ-JASIŃSKA A. 2005. **The effect of selected agrotechnical factors on development yielding and quality of white mustard. The effect of nitrogen fertilization and sowing density on chemical composition of white mustard (*Sinapis alba L.*).** Rośliny Oleiste – Oilseed Crops, XXVI (2): 467-478.

In the years 1998–2000 in the Experimental Agricultural Station Pawłowice (near Wrocław) there were carried out investigations on the effect of differentiated nitrogen fertilization and the quantity of sown seed rate on the content of crude fat, total protein and glucosinolates in seeds, as well as on fatty acids content in oil of white mustard. The field experiments started in two series, regarding variable factors, according to „split-plot" pattern, repeated four times. The series I included Ascot cultivar, series II — Nakielska. The factors under investigation in both series were as follows: I — nitrogen fertilization — the doses in kg·ha^{-1}: 30, 60, 90, 120; II — seed rates (per 1 m^2): 50, 75, 100, 125. It was recorded that the content and yield of crude fat and total protein considerably depended on weather conditions. The highest content of crude fat in seeds was recorded in 1998, since humidity conditions in that year enabled accumulation of crude fat in seeds, while such weather unfavorably effected the value of total protein. The content of crude fat and unsaturated fatty acids in oil, as well as the yield of crude fat and total protein were conditioned by a cultivar factor. Nakielska cultivar contained by 3% more crude fat in seeds and by 0.3% more all unsaturated fatty acids in comparison to Ascot cultivar. Nakielska cultivar also accumulated by 5% more crude fat and by 2% of protein from 1 ha. Increased nitrogen fertilization from 30 to 120 kg·ha^{-1} resulted in decreased crude fat content in seeds, as opposed to increased crude fat yield and total protein. Sown in the amount of 125 seeds per 1 m^2 Nakielska cultivar resulted in the highest yield of fat and total protein per 1 ha. Ascot cultivar provided the highest values of crude fat yield per one unit of area when 100 seeds were sown and the yield of crude protein was achieved for sowing 75 seeds per 1 m^2. The cultivars under examination significantly differed in the content of two saturated fatty acids — stearic and behenic and all the examined unsaturated fatty acids. The most considerable cultivar differences were recorded for the content of erucic and oleic acids. Ascot cultivar contained by 6.7% more erucic acid, while Nakielska cultivar featured by 7.4% more oleic acid than the other cultivar. The content of glucosinolates in seeds of the examined cultivars depended mainly on weather conditions. In 2000 the highest content of progoitrin was recorded, while the lowest values featured the remaining glucosinolates.

Genetics and breeding

KRZYMAŃSKI J., KRÓTKA K., PIĘTKA T. 2004 – **Discontinuous components in distribution of oleic acid content in seed oil of inbred lines of double low winter oilseed rape (*Brassica napus* L.)** – Rośliny Oleiste – Oilseed Crops n^o XXV (1), p. 11-26.

Distribution of oleic acid content in seed oil of 1151 inbred lines of double low winter oilseed rape (*Brassica napus* L.) was studied. Statistical study included histograms made with different resolutions, analyses of variance, the lowest significant differences estimations, grouping of lines with the cluster method using k means with maximisation of distances among groups. Next the significance of differences among obtained groups was tested and their descriptive

statistics were calculated. Results of these statistical analyses were the base for study on genetic control of oleic acid content in seed oil and the role of oleic acid desaturase activity.

Differences between histogram classes according to the mean content of oleic acid were statistically significant for classes, which contain 6 or more lines (horizontal line on fig. 2). Conformability of histogram to normal distribution was examined using χ^2 test. This test concerned the range between 55–67% of oleic acid (range with significant differences between classes). Calculated χ^2value was 71.633. Probability that histogram had normal distribution was p = 0.00704 with df = 45. Histogram deviations from normal distribution were statistically highly significant.

The lines were grouped using cluster analysis. Following criteria were used to estimate the optimal number of groups:

1) number of groups should be similar to number of unresolved peaks on histogram,

2) variance analysis for groups should give F-value as high as possible,

3) histograms for groups should have single peaks and look roughly similar to normal distribution.

Following conclusions can be made as a result of the study:

1. High number of inbred lines in the population used in the study allowed to obtain good resolution, which helped to detect discontinuous elements in histogram. Several not fully dissolved peaks could be observed on histogram. Mean values for oleic acid content in these peaks differed significantly.

2. Better resolution and cluster analysis enabled to divide inbred line population on 14 groups. The mean values of these groups for oleic acid content were sharply differentiated. This differentiation was statistically highly significant.

3. Histograms for these groups had only one peak (excluding border groups) and distribution roughly similar to normal.

4. These groups formed according to statistical analysis represented probably genotypes composed of allele combinations of genes controlling the content of oleic acid in seed oil. This assumption should be verified using examination of DNA polymorphism among particular groups.

5. These genes controlled rather the use of oleic acid in desaturation to linolic acid than the synthesis of oleic acid from stearic acid.

6. Activity of desaturase had crucial influence on oleic acid content in seed oil. Correlation between these characters was negative and very highly significant.

7. Histograms for the activity of oleic acid desaturase made for groups were better resolved and had more regular shape than histograms for oleic acid content.

8. The distances in mean contents of oleic acid between neighbouring groups were almost constant and amounted about 0,69 per cent.

SONNTAG K., RUDLOFF E., WANG Y. 2004 – **Development of *Brassica napus* with improved seed oil quality.** – Rośliny Oleiste – Oilseed Crops n^o XXV (1), p. 27-40.

Rapeseed is one of the most important annual oilseed crops in the world, ranking third with respect to oil production after soybean and palm. Modification of the fatty acid composition to make oilseed rape more competitive in various segments of the industrial oil markets has recently been an important objective of molecular genetics and in plant breeding. One of the most important goals of rapeseed breeding is the modification of seed oil by maximising the proportion of specific fatty acids. The present report demonstrates the use of different methods for the modification of oil quality via microspore culture combined with in vitro mutagenesis, symmetric and asymmetric hybridisation and genetic transformation especially to obtain a high level of erucic acid.

POTAPOV D.A., OSIPOVA G.M. 2004 – **Breeding of yellow-seeded summer rapeseed (*Brassica napus* L.) in West Siberia** – Rośliny Oleiste – Oilseed Crops n^o XXV (1), p. 51-61.

Yellow seeds of *Brassica napus* may have more oil, protein and lower fibre content than black seeds. In addition, it is much easier to determine the degree of ripening in the yellow seeds, as the occurrence of chlorophyll is not masked by the dark seed coat. The development of early maturing, high yielding, and yellow-seeded cultivars of *Brassica napus* is a high priority for the Oilseed Breeding Program of Siberia. Research towards the development of yellow-seeded *B. napus* has been conducted at the Siberian Institute of Fodder Crops since 1987. The methods of interspecific hybridization, inbreeding, *in vitro* propagation, and selections have been used to develop new lines of summer rapeseed suitable for cultivation in West Siberia. Yellow-seeded and light-pigmented genotypes of *B. campestris*, *B. juncea* and *Sinapis alba* have been employed as material for interspecific crosses. The inbreeding of the heterozygous breeding material of summer rapeseed was used as a method of genotypical differentiation. The variability of seed colour of inbred lines substantially depended on genotypical features of the initial material. In the sixth generation of inbreeding, several practically stable yellow-seeded lines were identified. These lines, tested during 1999-2002, demonstrated high seed productivity and early maturing. The average oil, protein and carbohydrate contents of the new SNK-32 line exceeded the corresponding values of a black-seeded SibNIIK 198 cultivar by 7%, 8% and 31%, respectively, while the fibre content was 19% lower and the seed yield was 45% higher. The prospective lines are currently used in the breeding of the yellow-seeded cultivars of *B. napus.*

SPRINGER B., WOJCIECHOWSKI A. 2004 – **The assessment of overcoming prezygotic barrier in interspecific crosses of three species from Brassica genus** Rośliny Oleiste – Oilseed Crops n^o XXV (1), p. 67-76.

In the present paper the possibility of overcoming the incompatibility barriers in wide hybridization of *Brassica* species has been estimated. Three species of *Brassica* genus were used for diallel crossing. These were: *B. oleracea* var. *botrytis* (broccoli), *B. hirta*, and two winter and two spring cultivars of *B. napus* var. *oleifera* (oilseed rape). The assessment was made by applying fluorescent microscopy technique. The observations of pollen grains germination and pollen tubes penetration were made in pistils of female component of interspecific crosses. Several ways of pollination were applied, i.e. pollination on stigma, pollination on style after removing the stigma, pollination on

manualy shortened style and pollination on an ovule of pistil after the removing of style. The applied pollination ways have presented different ability of pollen tubes penetration in particular cross combinations. Generally, better pollen germination and penetration of pollen tubes were observed in a cross combination where *B. napus* was used as a pistil parent. Better pollen germination after pollination on style without stigma in several crosses was observed. The penetration of pollen tubes into ovules was observed only in this particular way of pollination.

SZULC P.M., DROZDOWSKA L. 2004 – **The effect of sulphur on glucosinolate content in seedlings of spring oilseed rape Star** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 125-136.

The effect of sulphur on the content and turnover of glucosinolates in ontogenesis of spring oilseed rape was studied in an experiment carried out under controlled in vitro cultures. Three-day-old germinating seeds and 6 to 21-day-old oilseed rape seedlings were studied. They were grown on the modified Murashige and Skoog medium (1962) without sulphur (control) and containing from 172 to 767 mg $S\text{-}SO_4$ dm^{-3}. Germinated seeds and seedlings were lyophylised and homogenised and than analysed for glucosinolate content with high performance liquid chromatography (HPLC) according to EN ISO 9167-1. Main glucosinolates in three-day-old seedlings were alkenyl glucosinolates (mainly progoitrin), whereas in 9–21 day-old seedlings indolyl glucosinolates (mainly neoglucobrassicin) predominated. Lack of sulphur as well as its deficit in the medium in early steps of ontogenesis accelerated catabolism of glucosinolates. It suggested that products of hydrolysis of those compounds can be used as a source of sulphur by the developing embryo at a heterotrophic phase of germination.

Cegielska-Taras T. 2004 – **Doubled haploids in oilseed rape (*Brassica napus* L.)** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 345-352.

At present, the androgenic induction of haploid is the most economical way to produce haploids in cereals, rapeseed and numerous other crops. There are many factors influencing the development of doubled haploids (DHs) in plant breeding. The paper presents the results of the application of some breeding strategies, including the doubled haploid technique for the winter oil seed rape. It will discuss several examples of taking advantage of doubled haploids in breeding programs.

Liersch A., Bartkowiak-Broda I., Ogrodowczyk M. 2004 – **Analysis of the variability of yield components and heterosis effect of CMS *ogura* hybrids of oilseed rape (*Brassica napus* L.)** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 371-382.

The breeding of oilseed rape hybrid varieties in Poland is based on the CMS *ogura* system. Obtained experimental F_1 hybrids yield at different levels, therefore the investigations of factors deciding on hybrid yield are being carried out. The aim of this study was to evaluate yield and yield component variability of F_1 hybrids and their parental lines also heterosis effect, and qualitative traits such as oil and glucosinolate content in seeds. In the years 2001/2002 to 2003/2004 fourteen F_1 hybrids and their parental lines were examined in the field trials conducted in two localities. High yielding composite hybrid varieties Mazur, Kaszub, Pomorzanin, Lubusz and restored F_1 hybrids with different yield levels. Statistical analysis included a summary analysis of variance for locations, calculations of average, range, heterosis effect, coefficient of variability and matrix of correlation between investigated traits. It was stated that the yield of hybrids and qualitative traits such as oil and glucosinolate content in seeds are significantly depended on genotypes and environmental conditions. Composite hybrid varieties yielded higher than restored hybrids. It has been stated the correlations between yield of hybrids and mean yield of parental lines and heterosis effect.

Spasibionek S. 2004 – **The traits of winter oilseed rape mutants with changed fatty acid composition** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 383-402.

Conducting selections in successive generations $(M_2)_2$ – $(M_2)_6$ three mutants with significantly changed fatty acid composition were found: M-10453, M-10464, M-681 after mutagen ethyl methanesulphonate (EMS) treatment. Two mutants M-10453 and M-10464 in stabilized $(M_2)_6$ generation were characterized by higher level of oleic acid (77.6% and 80.8% respectively) and lower level of linoleic (7.6% and 6.0% respectively) and linolenic (7.0% and 6.3% respectively) acid contents. The third mutant M-681 had avery low linolenic acid content (to 1.2%) and increased linoleic acid content (to 26.1%). The lines obtained from mutants investigated in field experiment maintained characteristic for them relation of fatty acids despite the possibility of free fertilization between plots. The mutant lines M-10453, M-10464 had oleic acid content in oil of seeds increased to 75.1% and 76.4%, and linoleic acid content reduced to 9.7% and 9.8% and linolenic acid content to 6.8% and 6.5%. The mutant M-681 had linolenic acid content reduced to 4.7%. The evaluation of characters of plant in field experiment showed that obtained mutants M-10453, M-10464 and M-681 are not cultivable because of reduced yield of seeds. Low yield resulted not only from damages a during mutagen treatment, but also from inbred depression caused by inbred breeding carried out through many generations. The characters possess sufficiently high agricultural value to be used in breeding works. High oleic mutants: M-10453 and M-10464 were characterized by good overwintering and semi dwarf plants were resistant to lodging, low linolenic mutant: M-681 is very early and resistant to lodging and characterized by dwarf and semi dwarf type plants. In the group of 13 lines in which statistically significant changes of fatty acids composition during selection were not observed, on the basis of the more exact results from field experiment with four replications, two lines PN 4851/00 and PN 4856/00 were characterized by increased oleic acid content to 72.8% and linoleic acid content reduced to 11.9%. Three lines PN 4919/00, PN 4920/00 and PN 4924/00 are characterized by reduced linolenic acid content to 5.2%. Six lines from this group yielding at the level of standard — Kana (from 36.1 dt/h to 39.8 dt/h). The obtained lines were after a possibility of selection and choice of initial material to further breeding works.

Piętka T., Krótka K., Krzymański J. 2004 – **Double low white mustard (*Sinapis alba* L.) – alternative spring oilseed crop** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 403-414.

In Poland there are no plants that can be grown profitably after winter losses on winter oilseed rape plantations. It is necessary to have a spring oilseed plant giving good and stabile seed yield, independent of climatic conditions during the growing period. Yellow mustard (*Sinapis alba* L. syn. *Brassica hirta*) may be such a plant providing, that it would be improved in chemical composition. Cultivated varieties of yellow mustard contain erucic acid in seed oil and glucosinolates in seed, which are left mainly in extraction meal or press cake during processing in the oil mill. If we wanted like to have yellow mustard as an oil and protein bearing plant, we should improve it by removing erucic acid and lowering glucosinolate content as it was done in the case of double low oilseed rape. Presented results concern research works in the breeding of yellow mustard for double low quality. Initial materials for selection were composed by crosses between our low glucosinolate lines and low erucic lines obtained in previous stages of research. Progenies of the crosses were selected for low erucic acid in oil and low glucosinolate in seed at once. Individual selection was conducted with several methods. The bases for these selections were chemical analyses made on seeds collected from single plants. Differentiations in erucic acid and glucosinolate contents are shown on histograms. Calculated correlation coefficients between examined traits are significant and differentiated according to known ways of their biosynthesis. High coefficients of variability for erucic acid and for glucosinolate, but first of all for main mustard glucosinolate sinalbin, convince us that further possibilities for lowering the contents of these unwanted components exist and effective selection is possible.

Bury M., Nawracała J. 2004 – **Preliminary evaluation of yield potential of soybean cultivars (Glycine max (L.) Merrill) cultivated in Szczecin region** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 415-422.

Soybean, the most popular oil and protein bearing plant in the world has not got good climatic conditions for cultivation in North-West Poland. Cultivars of soybean bred in Department of Genetics, and Plant Breeding of Agricultural University in Poznań gives new possibilities of soybean cultivation in Szczecin region. In years 2001–2002 field experiments with three cultivars of soybean, Nawiko, Gaj and Augusta (PGR 399) were conducted in Agricultural Experimental Station Lipki near Szczecin. These experiments were carried out on brown soils in four replications after winter oilseed rape (2001) and spring wheat (2002). Growth and development of soybean and specially the length of vegetation period depended on weather conditions. Yield ranged between 11.6–15.2 dt·ha^{-1}. Low yield level was the result of drought in both years and probably lack of nodules. Three examined cultivars of soybean, Nawiko, Gaj and Augusta, do not differ significantly in seed yield.

Kluza-Wieloch M., Muśnicki Cz. 2004 – **Variability of some morphological and utilitarian character of shoots and inflorescences of different cultivar types oleaginous form of sunflower (*Helianthus annuus* L.)** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 423-438.

In the years 1997–1999 in the Experimental Station in Przybroda near Szamotuły two simple-cross line hybrids and one population cultivar were tested. The extent of biometric measurements presented in this part of the paper included stems, leaves and inflorescences. Height in various developmental stages, as well as their diameter, length of internodes, number of leaves, length and width of mid-stalk leaves, their petiole length and diameter and surface of head and its sterile part, its fraction in the total surface, degree of head inclination and receptacle thickness were analysed in detail. The obtained data allowed for drawing conclusions on variability and heritability of these features. The tested sunflower line hybrids were characterised by only slightly more consistent morphological features than the population variety. In comparison to the cultivar Wielkopolski they had longer shoots, which can be considered a highly feature. The most heritable features were the height of plants and the number of leaves on the shoots. The variability of other features were to the largest extent influenced by random factors.

Kluza-Wieloch M., Muśnicki Cz. 2004 – **Variability of some morphological and utilitarian character of fruits in whole capitula and from its separate lots of different cultivar types oleaginous form of sunflower *(Helianthus annuus* L.)** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 439-460.

In three trials conducted in the years 1997–1999 in the Przybroda Experimental Station quantitative and qualitative changes in seeds from whole capitula and its separate lots in two simple-cross hybrids and one population variety was evaluated average of whole capitula. There were analyzed the size of achene, 1000-seed weight, and weight of seeds per one head, distribution of achene in capitula, content of hull as well as fat, protein, ash, fiber and nitrogen-free extract content. Experiments showed that position in the head influenced to a great extent all the above mentioned features. Line hybrids yield per one head was higher. They, however, differed to a large extent from each other. When one was characterized by the highest fat and protein content and the lowest hull and fiber content, the characteristics of the other were exactly the opposite. The population variety had the thickest and widest seeds; however, despite considerable 1000-achene weight, the weight of seeds per one head was the lowest among the studied cultivars. The most heritable feature was the content of hull in seeds. Fiber and fat content were to a large extent determined by the genotype. Heritability of width and thickness of achene, 1000-seed weight and protein content were also significant. 1000-achene weight, content of hull, oil, ash and nitrogen-free extract in hybrids exhibited the highest values of variance coefficient. The most variable features were the fibre content and achenes weight from one head and the most consistent ones were length and width of seeds as well as fat, protein and nitrogen-free extract content.

Kluza-Wieloch M., Muśnicki Cz. 2004 – **Effect of environment and agrotechnic on selected achene's features from various parts of head in oleaginous form of sunflower (*Helianthus annuus* L.)** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 461-478.

In the years 1997–1999 the influence of environment and cultivation factors on chosen achene's features from various head lots in oily form of common sunflower were evaluated. Field experiments were conducted in the Experimental Station in Przybroda on various soil types. The experiments were conducted on two nitrogen fertilization levels: 60 and 120 kg N/ha in three different plant densities: 50, 75 and 100 thousand plants/ha. In the first and third year of the study sunflower was grown on black earth, and in the second year on brown soil proper. The lowest amount of rain in the vegetation period was noted in 1999, the highest was observed the year before. The first three months of vegetation (April – June) were the warmest in 1998, three following ones were the warmest a year later. Head was divided into three equal parts: outer, central and inner. The size of achene: length, width, thickness and 1000-seed weight were analyzed in detail, as well as achene weight distribution in various portions, content of hull, fat, protein, fiber, ash and nitrogen-free extract in achene. The biggest fruit, in terms of length, width and thickness was produced by sunflower in 1998, a year of high humidity. However, in that year 1000-seed weight was the lowest, and seeds included little nitrogen-free extract (NFE) whereas their protein content was the highest. The heaviest fruit was formed in plants a year earlier. Achene included the lowest amount of hull harvested in the dry year of 1999; however, fat content was high. Fruit of the largest size and the highest 1000-seed weight were obtained from plants of the lowest population density. They were also characterized by high level of nitrogen-free extract. Achene of sunflower of highest population density contained substantial amounts of fat and protein. The highest amount of fiber was typical of plants of medium population density. Lower amounts of fertilizer had a positive effect on 1000-seed weight and fat content, and a negative one on protein and fiber content. The longest fruits were found in the central portion; the widest and thickest ones, in the outer one. The smallest fruits were formed in the inner portion; there they also had the lowest weight and hull content. However, their fat, protein and nitrogen-free extract content were high. The heaviest was achene in the outer portion of the head, but it also contained more fruit coat and fiber, and less ash. This part was characterized also by the highest percentage of fruit mass.

Ogrodowczyk M., Wawrzyniak M. 2004 – A**doption of the path-coefficient analysis for assessment of relationships and interrelationships of yield and yield parameters of winter oilseed rape** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 479-492.

The aim of the study was to determine the influence of chosen traits on yield of winter oilseed rape in climatic conditions of north-eastern Poland. The investigated traits were: score of plant development in autumn and in spring, per cent of overwintering plants, beginning and length of flowering and plant height. The research was carried out on 18 strains and lines of winter oilseed rape sown during the two years of research in two locations. Each of the experiments was statistically analyzed. Relations between investigated traits and seed yield were determined by correlation coefficients and path-coefficient analysis. In all experiments large variation of seed yield and smaller variation of other traits were observed. Analysis of simple correlation showed in all experiments a significant positive correlation of score made in spring and seed yield, in three experiments also significant positive correlation of plant height and seed yield and in two – significant correlation of beginning of flowering with seed yield were observed. Path analysis proved significant correlation of plant height and seed yield. Direct effects statistically significant in three experiments proved that this trait to be correlated with yield. Similar direct effect of influence on seed yield, observed in all experiments independent of environment, was also characteristic for the length of flowering. In the case of the score of plant made in spring the situation was inverse. Path-analysis showed that the significant positive correlation of plant score with seed yield was confirmed by direct effect only in one experiment. Indirect effects slightly influenced corresponding correlation coefficients In two years of research in those two stations. Most visible indirect effects on seed yield were caused by traits describing plant flowering.

Popławska W., Bartkowiak-Broda I. 2004 – **Investigation of reasons to worsen the quality of oil row material from seeds of rapeseed** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 493-504.

In the last few years the existence of other plants of cruciferous species on oilseed rape plantations have been observed. Their presence causes a lower value of material delivered for oil industry because of high amount of erucic acid in the seeds. Therefore the investigations concerning morphological, chemical and genetical characteristics were undertaken. The observed plant material was collected from the field after harvest of winter rapeseed plantation of Lisek variety in the region of Pszczółki. Observations were made also on plants obtained after sowing seeds collected from this plantation. Morphological observations were conducted for such features as: leaf colour and shape, presence of trichomes on the leaf surface, flower colour, pod shape and size. Plant material was divided into two groups: rapeseed-like plants and turnip-like rape after morphological observations. For estimation of plants ploidity cytometric analyses of relative nuclear DNA content were performed using measurement of fluorescence intensity. Relative nuclear DNA content in allotetraploid oilseed rape var. Lisek was 217.36, and in diploid turnip rape var. Brachina was 101.98. For rapeseed-like plants it reached from 229.16 to 238.63. For turnip-like rape plants it has an average value 160.15. The composition of fatty acids and content of a particular glucosinolate were determined in the seeds which were produced by self-pollination. Analysed seeds of turnip like plant had high glucosinolates content (mean 84.4 μM/g of seeds) and erucic acid (mean 25.8%). It can be stated that chemical composition of seeds of turnip-like rape plants had seeds quality similar to traditional turnip rape variety. Obtained results allow to conclude that most of the observed turnip-like rape plants are segregants from spontaneous hybrids between oilseed rape and turnip rape.

Havel J. 2004 – **Breeding poppy with increased content of thebaine** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 613-620.

Thebaine is a precursor of morphine and codeine and so there may be a mutation of poppy (*Papaver somniferum*) containing an increased content of thebaine. Using screening methods of TLC and precise HPLC, studies were made of poppy (*Papaver somniferum*) genetic resources and breeding materials under development. About 10% of genotypes containing thebaine were identified but in a majority of genotypes the progenies produced unstable thebaine content. Lines with stable, although relatively low thebaine content, high seed yields and very good commercial characteristics were found.

Matuszczak M. 2004 – **Protection of oilseed rape breeders rights – the concept of Essentially Derived Variety (EDV)** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 655-670

Oilseed rape varieties are protected according to the rules of national and EU law as well as the UPOV Convention 1991 Act. The present possibilities of modern biotechnology techniques make it possible to develop new varieties that derive predominantly from existing initial variety. The rules, which use the concept of Essentially Derived Variety (EDV), are established to protect the breeder of an initial variety. Currently, the studies on essential derivation in many crop species are conducted. A few years ago such studies, dedicated specially for rapeseed varieties, were also started by an international working group.

CEGIELSKA-TARAS T., ADAMSKA E., SZAŁA L., KACZMAREK Z. 2005. **Estimation of the genetic parameters for fatty acids content in DH lines obtained from winter oilseed rape of F_1 hybrid (DH O-120 × DH C-1041).** Rośliny Oleiste – Oilseed Crops, XXVI (1): 11-18.

Thirty two doubled haploids (DH), hybrids F_2, F_3 as well as standard cv. Kana were objects of three field experiments led in one locality during 1999/2000, 2000/2001, 2001/2002. Doubled haploid lines of winter oilseed rape were obtained from F_1 hybrid (DH O-120 × DH C-1041) using isolated microspore culture. The seeds of these genotypes were analyzed for their fatty acid content using gas chromatography. The content of the following fatty acids: palmitic acid ($C_{16:0}$), stearic acid ($C_{18:0}$), oleic acid ($C_{18:1}$), linoleic acid ($C_{18:2}$), linolenic acid ($C_{18:3}$) was determined.

On the basis of a population of doubled haploid lines as well as suitable early generations the genetic parameters were estimated. The estimates of additive gene effects [d], dominance effects [h], homozygous × homozygous interaction effects [i] and heterozygous × heterozygous interaction effects [l] were found for individual fatty acid content in every year of study as well as for three years jointly.

The effects of additive genes action calculated for every year separately as well as jointly for three years were significant for all analysed fatty acids. The dominance was significant for the palmitic acid only.

Effects concerning interaction between homozygous loci influenced positively the increase of oleic acid content. The effects connected with non-allelic interaction of heterozygous loci were not significant for all studied acids.

The number of genes or group of linked genes controlling the content of individual fatty acids, which differeciated parental genotypes, were as follows: for stearic acid and palmitic acid one gene, for linoleic and linolenic acids three genes and for oleic acid four.

NOWAKOWSKA J., BARTKOWIAK-BRODA I., OGRODOWCZYK M. 2005. **Preliminary investigations of relationship between heterosis effect of F_1 winter rapeseed hybrids (*Brassica napus* L.) and genetic distance of parental lines**. Rośliny Oleiste – Oilseed Crops, XXVI (1): 19-34.

The breeding of oilseed rape hybrid cultivars in Poland is based on the CMS *ogura* system. The proper selection of both parental components of hybrid cultivar is required in order to obtain F_1 hybrid progeny characterized by high yield of seeds. The aim of this work was to investigate a correlation between genetic distance values of parental lines and heterosis effect revealed by F_1hybrids. In vegetative season 2004/2005 eighteen F_1 hybrids and their parental lines were examined in the field trials conducted in two localities. For yield of seeds, 1000 seeds weight, length of pods, number of seeds per pod, chlorophyll content and oil content mean trait values, heterosis effect and coefficients of variability were estimated. Positive correlations were obtained between genetic distance values of parental lines, based on 150 polymorphic RAPD markers and F_1 hybrid heterosis effect in seeds yield. Hybrid combinations with the highest values of genetic distance were characterized by a high heterosis effect of investigated traits.

SPASIBIONEK S. 2005. **The ways of mutation treatment and variability of mono- and polyunsaturated fatty acid content in seeds of winter oilseed rape**. Rośliny Oleiste – Oilseed Crops, XXVI (1): 35-50.

Induced mutagenesis plays significant role in the development of new fatty acid variability in oilseed crops. The aim of experiments was to find optimal conditions to induce mutagenesis for the increase of variability of polyunsaturated fatty acids in winter rapeseed.

In vegetative season 1998/99, the seeds of double low winter oilseed rape strain PN 5282/98 with typical fatty acid composition in oil: 4.7% of palmitic acid, 1.5% of stearic acid, 67.1% of oleic acid, 16.8% of linoleic acid and 8.6% of linolenic acid were treated with ethyl methanesulphonate (EMS).

The application of high mutagen concentrations as well as multiple repetition of mutagenesis caused not only large changes in contents of 18 carbon acids in oil of seed, however it was the cause of unprofitable morphological deformations and reduced vitality of plants.

In order to develop new mutative changes in fatty acids composition, lower concentration of EMS (0.5% and 1%) was used and the time was lengthened of operation on the seeds in 1998.

In collected population of 1476 plants of M_1 generation the seeds of M_2 generation were obtained, in which oleic acid content increased to 72.8%, and linolenic acid content decreased to 5.4%. In M_3 – M_5 generations oleic acid content

grew up to 77.7% and linolenic acid content in seed oil was reduced to 4.7%. Beside obtained significant changes in fatty acids composition, the mild conditions of mutagen treatment did not cause morphological deformations, that hence the mutants kept good vigour.

TROCZYŃSKA J. 2005. **System myrosinase – glucosinolates — its character and functions in plant.** Rośliny Oleiste – Oilseed Crops, XXVI (1): 51-64.

Glucosinolates, secondary metabolites commonly occurring in plants of *Brassicaceae*, together with the enzyme myrosinase, constitute a two-component defensive system against pathogens and pests (Krzymański 1995, Rask et al. 2000, Fahey et al. 2001). In intact plant, the enzyme is stored separately from glucosinolates. Upon tissue disruption, for example by pests, glucosinolates are degraded and toxic compounds such as thiocyanates, isothiocyanates, nitriles, epithionitriles are released. A large number of glucosinolates occurring in plant and multiple isoforms of myrosinase indicate that these compounds are necessary for plant development (Thangstad et al. 1993, Rask et al. 2000). Glucosinolates may be a source of C, N and S and serve as precursors for plant hormone indole-3-acetic acid (Clossais-Besnard and Larher 1991, Normanly and Bartel 1999, Rask et al. 2000). Glucosinolate degradation products have antinutritional as well as protective (cancer-preventing) effects in higher animals and human. This paper describes current knowledge on biosynthesis and degradation of glucosinolates considering genes involved in these processes andtheir regulation, physiological functions of myrosinase – glucosinolates system and the compartmentation of these components in plant.

KUČERA V., VYVADILOVÁ M., KLÍMA M., KOPRNA R., MACHÁČKOVÁ I., ČURN V. 2005. **Innovations in breeding procedures of winter oilseed rape for development of improved initial materials and the use of biotechnological methods in Czech Republic**. Rośliny Oleiste – Oilseed Crops, XXVI (1): 75-86.

The research activities in the Czech Republic are directed to increase effectiveness of breeding procedures in winter oilseed rape using innovated methods. Initial plant materials for breeding line and hybrid cultivars, original self-incompatible doubled haploid lines, improved CMS and male fertility restorer lines (Rf) for Ogu-INRA and Shaan 2 systems were obtained by means of doubled haploids. About 1000 microspore culture regenerants have been produced every year. Tests of disease resistance especially against *Phoma lingam* and *Sclerotinia sclerotiorum* have been carried out in laboratory and in the field conditions. Frost tolerance laboratory tests of rape plants are performed and a method of *in vitro* selection has been developed. Molecular methods based on PCR technique are used for identification of self-incompatible genotypes and for detection of materials with modified seed quality and disease resistance. Perspective lines and hybrids are evaluated in breeders' joint multi-location trials before entering official trials.

PIĘTKA T., KRÓTKA K., KRZYMAŃSKI J. 2005. **Combining ability and heterosis in glucosinolate content in seeds of winter rape (*Brassica napus* L.) estimated with diallel crossings between doubled haploid lines**. Rośliny Oleiste – Oilseed Crops, XXVI (2): 311-324.

Six DH lines with very different glucosinolate content were crossed in complete diallel design. Obtained hybrids of F_1 generation and parental lines were grown in field trial in complete random block design in four replications. Seeds of F_2 generation were obtained from F_1 plants through inbreeding. In next autumn trial the hybrids of F_2 generation and parents were grown in two replications. Analyses of glucosinolate content and composition were made using gas chromatography of sillyl derivatives of desulphoglucosinolates. Calculations of GCA and SCA were performed following Griffings method. The analysis of variance showed that the GCA effects for investigated glucosinolates were statistically very significant. Significant effects of SCA were found for gluconapin and progoitrin. SCA for 4-hydroxybrassicin was not significant. Differences between reciprocal crosses were not significant, either. Heterosis effects were calculated for pedigrees of individual parents and for hybrids as compared with parent means. Highly significant heterosis effects in F_1 generation lost their significance in F_2 generation. Heterosis effects for individual hybrids were directed to higher or lower values in respect to parent means, but average effect of heterosis was directed to higher value.

KACZMAREK Z., ADAMSKA E., CEGIELSKA-TARAS T., SZAŁA L. 2005. **Multivariate statistical methods used for evaluation of DH lines of winter oilseed rape on account of various fatty acid compositions**. Rośliny Oleiste – Oilseed Crops, XXVI (2): 325-334.

This article discusses the application of multivariate statistical methods to evaluation of genotypes taking into account some combinations of variables. These methods were used for the analysis of data from an experiment with 35 genotypes of winter oilseed rape (32 doubled haploid lines, 2 parental forms and standard cv. Kana). The experiment was carried out in a completely randomized block design with three replications. The aim of the study was the evaluation of doubled haploid lines of winter oilseed rape in respect of the requirements concerning five fatty acids: palmitic, stearic, oleic, linoleic and linolenic. For estimation of DH lines in terms of their further usefulness, especially in food, pharmacology, chemical and petrol industry, multivariate analysis of variance (MANOVA) and canonical variates analysis were used.

POTAPOV D.A., OSIPOVA G.M. 2005. **Approaches to efficient use and to increase the diversity of genetic resources for the development of prospective breeding materials of yellow-seeded *Brassica napus* L. for conditions of Siberia**. Rośliny Oleiste – Oilseed Crops, XXVI (2): 335-348.

Brassica napus L. is a primary oilseed crop grown in extreme climatic conditions of Siberia. The advancement of the crop quality, while keeping its early maturing and high yielding characteristics, requires the efficient use and diversification of genetic resources. Our breeding program utilizes the following approaches to achieve this task.

(I) Studies on a collection of yellow-seeded species of family *Brassicaceae* (*B. campestris*, *B. juncea*, and *Sinapis alba*) under provocative field conditions. The studies made it possible to select early maturing, high yielding and disease resistant forms that are currently used in the breeding process.

(II) In order to optimize the breeding process, a genetic analysis of the seed coat colour and its relationship with other characters has been carried out.

(III) Increasing the diversity of available genetic resources through the application of a number of methods: hybridization, inbreeding, *in vitro* propagation and selections. By now, Siberian germplasm of *B. napus* with various seed coat colour has been developed.

(IV) Systematization of available breeding material and efficient search for the sources of desired breeding characters. For these purposes, the Siberian Yellow-seeded *Brassica* Database (SBDB) has been developed. At this moment SBDB includes 1813 accessions. The data are listed in 7 or 14 standard fields of the passport descriptors. In addition to these descriptors, non-standard descriptors have been also developed to reflect the specificity of the breeding material.

The combination of approaches applied in our research proved to be fruitful for the development of new breeding material and for the optimization of breeding process.

The utilized strategy made it possible to increase the diversity of initial material, to improve the efficiency of search for the sources of desired breeding characters and to create new prospective yellow-seeded forms of *B. napus* suitable for specific conditions of Siberia.

KLUZA-WIELOCH M., MUŚNICKI CZ. 2005. **Dynamics of quantitative changes of achenes in common sunflower (*Helianthus annuus* L.) during their ripening**. Rośliny Oleiste – Oilseed Crops, XXVI (2): 349-360.

Field trials were conducted in the years 1998–2001 at the Experimental Station of the Agricultural University of Poznań in Przybroda. One open pollinated variety — Wielkopolski and two hybrid varieties, Frankasol and Coril were tested. The experiment was carried out each year, in constant density of plants 50 000/ha and constant amount of nitrogen fertilizer — 60 kg/ha. Only environmental factors were variable. Fruit was collected every seven days from the outer part of the head. It was collected for the first time a week after flowering. The analysis concerned the size of fruit, thousand achenes weight and hull content.

Varieties differed in respect of the length, width and thickness of fruit. Length was the least variable factor during fruit formation. Width and thickness of achenes were increasing between the 1st and 2nd week of their ripening.

Thousand achenes weight in each of the studied varieties was increasing as the achenes were maturing. The most considerable differences were observed between the 1st and the 4th week of flowering. The dynamics of increase of thousand fruit weight was decreasing between the 4th and 6th measurement. The content of hull was decreasing substantially in all compared varieties between the 1st and the 3rd week from flowering. Between the 3rd and 5th term of fruit collection the dynamics of change was smaller.

The dynamics of change of quantitative character of achenes was similar in all years of the study. Only small amount of precipitation in 1999 influenced negatively the size of fruit.

CICHY H., BUDZANOWSKI G., CEGIELSKA-TARAS T., SZAŁA L. 2005. **Winter oilseed rape cultivar produced by the use of doubled haploids**. Rośliny Oleiste – Oilseed Crops, XXVI (2): 589-594.

Doubled haploid lines (DH) of winter oilseed rape have been successively tested in field trials at Plant Breeding Strzelce Ltd., Co., Division at Małyszyn in years 2001–2005. The DH lines were produced through isolated microspore culture in the Laboratory of Plant Tissue Culture at Plant Breeding and Acclimatization Institute in Poznań. Seeds from doubled haploid plants were sown at first on multiplication plots and in the next year they were tested in preliminary trials. Selected best yielding DH lines were evaluated in the replicated trials across Poland. The line DH MA 103 was the best among the lines selected in the project. This line is characterized by superior yield and superior performance when compared to the leading cultivars Lisek and Californium. This DH line is tested now in official trials to be registered as a new cultivar of winter oilseed rape in Poland.

FÜRGUTH A., BARTKOWIAK-BRODA I. 2005. **A new RAPD marker identifying restorer lines for CMS ogura system**. Rośliny Oleiste – Oilseed Crops, XXVI (2): 595-602.

78 winter oilseed rape lines used in the breeding of hybrid varieties (31 CMS *ogura* lines and 47 restorer lines) were subjected to research on their DNA polymorphism. The owner of investigated lines is Plant Breeding Company Strzelce Ltd. RAPD method with the use of 27 arbitrary 10-bp-long oligonucleotides as primers (Operon Technologies) was applied to the analysis of this breeding material. The investigations aimed at evaluation of genetic distance between all lines mentioned above (the results will be published separately). At the same time they made it possible to search for new markers of restorer gene for CMS *ogura*. A new band developed by OPY-15 primer, which appears in restorer lines was discovered. Among 188 polymorphic products of amplifications it was the only characteristic of all restorer lines,

apart from the marker OPC-02_{1150} already known and applied to selection. The band generated by OPY-15 primer probably can be a new marker of restorer gene, however it should be verified in further investigations.

WAWRZYNIAK M., OGRODOWCZYK M. 2005. **Morphine content in capsules from main and lateral stems of *Papaver somniferum* L. plants**. Rośliny Oleiste – Oilseed Crops, XXVI (2): 603-610.

During research and selection works high variability of alkaloid content in capsules was observed, making it harder to select breeding material. The aim of the work was to establish a method of collecting a representative sample material of poppy plants to research the alkaloid content. In this work we focused on the content of the main poppy alkaloid – morphine.

Research material was composed of poppy plants binding a few capsule levels. As a comparison, capsules binding 3 levels: A — main stem, B and C — respective lateral stems, were used. The research described in this work showed significant differentiation in morphine content in capsules bound on subsequent levels of the same plant. Therefore, morphine content estimation based on single capsule analysis is not truly objective. These results show that appropriate poppy genotype selection for morphine content should be based on morphine content of a mean sample selected from at least 2–3 capsules of a single plant or from a capsule from stem B, as high correlation of the researched trait with the plant mean was observed.

Weed-Control

BADOWSKI M., KUCHARSKI M. 2004 – **Influence of the time of graminicides application on residues level and efficacy of weed control in winter rape crop** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 151-158.

The aim of investigations was to understand the effect of herbicides term of application (autumn and spring) on residues level in soil and seeds of winter rape and efficacy of *Elymus repens* control. Field experiments were carried out during 2000–2002 on arable field near Wrocław. Herbicides to *Elymus repens* control in winter rape (containing active ingredients as: quizalofop-P-ethyl, fluazifop-P-buthyl, haloxyfop-P-R and quizalofop-P-tefuryl) were applied at recommended dose post emergence in autumn and comparatively in spring. In experiments efficacy of *Elymus repens* control – percent of weed control was evaluated and yield from each plot was calculated. Samples of soil and seeds of winter rape were taken at the day of harvest. All samples were analysed (herbicide residues) using the high-performance liquid chromatography (HPLC) with UV-detection. At the harvest time, in soil and seeds of winter rape samples residues all of herbicide active ingredients were detected. Residues of herbicides active ingredient in seeds of winter rape amount: autumn application — 0.002–0.021 mg kg^{-1}, spring application 0.009–0.037 mg kg^{-1}. For soil samples, the residues amount respectively: 0.006–0.032 and 0.013–0.072 mg kg^{-1}. Residues all active ingredient of herbicide, after spring application, detected in soil and seeds of winter rape, were higher than determined after autumn application. The residues of active ingredient of herbicides determined in seeds of winter rape did not exceed acceptable amounts displayed in EU standards. The phytotoxic effects of all used herbicides on winter rape were not observed. Graminicides used in autumn controlled *Elymus repens* in 90–98% and applied in spring in 96–100%. The yield assembled from the herbicide objects (autumn and spring applications) was similar.

KUCHARSKI M., BADOWSKI M. 2004 – **Residues of selected herbicides in soil and seeds of winter rape** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 159-166.

The aim of investigations was to understand the effect of herbicides application on residues in soil and seeds of winter rape. Field experiments were carried out during five-year-period (1998-2002) on arable field near Wrocław. Herbicides to weed control in winter rape (containing active ingredients as: clopyralid, clomazone, alachlor, benazoline, quizalofop-P-ethyl and fluazifop-P-buthyl) were applied at recommended dose. Samples of soil and seeds of winter rape were taken to analyses at the day of harvest. Determination of residues consists of three elementary processes: extraction of active ingredients from samples, chemical cleaning of extract (and esterification if needed) and quantitative determination. All samples were determined (herbicide residues) using the high-performance liquid chromatography (HPLC) with UV-detection or gas liquid chromatography (GLC) with ECD and NPD detection. At the harvest time, in soil and seeds of winter rape samples residues all of herbicide active ingredients were detected. The level of residues was depend on the kind and dosage of herbicide and weather condition in individual vegetation seasons. Residues all active ingredient of herbicide detected in soil were higher than in seeds of winter rape. The residues of active ingredient of herbicides determined in seeds of winter rape did not exceed acceptable amounts displayed in EU standards. At the harvest time, about 82% of soil and 54% of seeds winter rape samples contained detectable residues all of herbicide active ingredients.

JAKUBIAK S., STACHECKI S. 2004 – **Residual effects of clomazone and metazachlore used alone and in mixture after deleted crop of winter oilseed rape** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 167-176.

Clomazone and metazachlor are characterised by a long time of persistence in soil. This attribute determines the choice of the relevant following crops for re-sowing after damaged winter oilseed rape plantation. The aim of the research was to assess the residual effect of clomazone, metazachlor and their mixtures on re-sowing crops. The field experiments were carried out in the years 1997–2000 on the leached brown soil. Two-factor experiments were established in four replications for each following crop. The first factor was the herbicide and the second one- the method of pre-sowing soil tillage (pre-sowing ploughing or reduced soil tillage). In autumn, after winter oilseed rape sowing Command 480 EC

(clomazone) was applied to soil at dose 0,2 l/ha (96 g a.i./ha) alone and as a mixture with herbicide Butisan 400 SC (metazachlor) at dose 2,5 l/ha (1000 g a.i./ha). Butisan 400 SC was used twice at doses 1,5 l/ha (600 g a.i./ha) with split application method in the cotyledon stage of weeds. The following crops were re-sown in spring: spring barley, spring wheat, oat, pea and sugar beet. The weather conditions during the time of experiments and in the state of repose balanced from strong, long-lasting frost, through the soft winter to the alternately appearing frosts and thaws. The frosty winter caused that residual effects of herbicides on the re-sown crops were much stronger. The injuries were much more visible and the yields of re-sown crops were decreased. Generally the reduced tillage presowed harrowing with disc harrow did not affect the phytotoxicity level of the assessment herbicides. Oat has the same susceptibility to tested herbicides as other spring cereals. Data received from the research (on average) cannot indicate the negative effect of clomazone and metazachlor applied alone and as a mixture to the re-sowing crops (spring wheat, spring barley, oat, field pea, sugar beet). However, data obtained from each year of experiment show that we should be aware of the possibility of crop damages which can lead to yield decrease, especially in frosty and long lasting winter.

ADAMCZEWSKI K., PARADOWSKI A. 2004 – **Subsequent effect of propoxycarbazone sodium and propoxycarbazone sodium + tribenuron methyl on winter and spring oilseed rape** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 293-306.

The aim of the experiments carried out in field and in greenhouse conditions was to determine subsequent effect of herbicides Attribut 70 WG (propoxycarbazone sodium) and Attribut Star 57 WG (propoxycarbazone sodium + tribenuron methyl) on winter and spring oilseed rape. Attribut 70 WG and Attribut Star 57 WG were used in field experiments in spring in the middle of April on winter wheat. Winter oilseed rape was drilled in the end of August after the harvest of wheat and soil cultivation. The seed germination of rape was normal but about 10 days later the injury of rape plants occurred. All plants of winter rape have been destroyed in twenty days. Spring oilseed rape was sown on the same field after shallow soil cultivation in the next spring. Strong injuries were also found on spring rape plants. The greenhouse experiment was done in two-factor design. The following combinations were used in the experiments: first factor – 30% and 70% soil moisture and second factor – three doses of herbicides Attribut 70 WG and Attribut Star 57 WG. The soil in the pots was sprayed with herbicides four months before the sowing of winter rape. Two levels of soil moisture in the pots were maintained during four months after herbicide applications. Next, the equal seed number of winter rape was sown to all pots. The plant number per pot and the green matter of plants were lower at 70% soil moisture than at 30%. Also plant number and green matter of plants were lower when higher rates of herbicides were used. The same seed number of spring rape was sown to the same pots one week after winter rape harvest. The subsequent effects of herbicides on spring rape were the same as previous on winter rape.

Murawa D., Pykało I., Banaszkiewicz T. 2004 – **The complex estimation of herbicidal activity of some chemicals applied in white musta**rd (*Sinapis alba* L.) II. Effectiveness of applied herbicides in white mustard (*Sinapis alba* L.) and their influence on yield of seeds – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 521-532.

In the paper results of field experiment conducted in 1998–2000 on the effectiveness of two white mustard cultivars (Nakielska, Borowska) are presented. The following herbicides were used: Triflurotox 250 EC (trifluralin) as standard compound in dose of 3,0 $dm^3 \cdot ha^{-1}$, Alatrif 380 EC (alachlor + trifluralin) — 4,0 $dm^3 \cdot ha^{-1}$, Butisan 400 SC (metazachlor) — 3,0 $dm^3 \cdot ha^{-1}$ alone and with Lontrel 300 SL (chlopyralid) — 0,3 $dm^3 \cdot ha^{-1}$, Comodor 72 EC (tebutam) — 4,0 $dm^3 \cdot ha^{-1}$. Similar, relatively weak effectiveness of all herbicides was noted in 1998, metazachlor and tebutam gave better results than trifluralin in 1999 and supremacy of standard herbicide was seen in 2000, which was characterized by rainfall deficiency. Higher yield of seeds was obtained in the case of Nakielska cv. The yield of white mustard was positively influenced by trifluralin treatment in the first and third year of experiment.

Murawa D., Pykało I., Banaszkiewicz T. 2004 – **The complex estimation of herbicidal activity of some chemicals applied in white mustard (*Sinapis alba* L.). II. Phytotoxic effect and morphological changes in white mustard (*Sinapis alba* L.) treated with herbicides** – Rośliny Oleiste – Oilseed Crops n^{o}XXV (2), p. 533-548.

In three year field experiment conducted in 1998–2000 two white mustard cultivars i.e. Borowska and Nakielska, were treated with the following herbicides: Triflurotox 250 EC (trifluralin) in dose of 3 $dm^3 \cdot ha^{-1}$ as standard compound, Alatrif 380 EC (alachlor + trifluralin) — 4,0 $dm^3 \cdot ha^{-1}$, Butisan 400 SC (metazachlor) — 3 $dm^3 \cdot ha^{-1}$ alone and with herbicide Lontrel 300 SL (chlopyralid) — 0,3 $dm^3 \cdot ha^{-1}$ and Comodor 72 EC (tebutam) — 4,0 $dm^3 \cdot ha^{-1}$. The investigations concerned hight of plants, stem base diameters, number of first and second order branches, number of siliques on the main stem, number of seeds per silique and mass of 1000 seeds. Symptoms of metazachlor phytotoxicity noted in every year of experiment were insignificant for white mustard yielding. Great differentiation in the effects of herbicides on studied morphological features was found. The most active were trifluralin and metazachlor alone or with chlopyraid.

BADOWSKI M., KUCHARSKI M. 2005. **Chemical weed control in white mustard (*Sinapis alba*) crop**. Rośliny Oleiste – Oilseed Crops, XXVI (1): 193-198.

The aim of the research was to evaluate the efficacy of selected herbicides used to weed control in mustard crop.

Investigations were carried out during 2002–2004 on plantations of white mustard (4 replications). Herbicides: Galera 334 SL (a.i. picloram – 67 g/l + clopyralid – 267 g/l) and Lontrel 300 SL (clopyralid – 300 g/l) in the rate of 0.35 l/ha, Butisan 400 SC (metazachlor – 400 g/l) in the rate of 3 l/ha and mixture of Butisan 400 SC + Galera 334 SL in the rate of 2 + 0,35 l/ha, to control*Chenopodium album*, *Viola arvensis*, *Anthemis arvensis*, *Geranium pusillum*, *Thlaspi arvense* and *Stellaria media* were applied in spring, in the stage of 2–4 leaves of white mustard.

In experiments phytotoxicity, efficacy of weeds control and yield of white mustard were evaluated.
Herbicides Lontrel 300 SL and Butisan 400 SC were selected for mustard plants. Herbicide Galera 334 SL caused some phytotoxic effect, which was temporary and did not influence yield. Galera 334 SL effectively controlled *Anthemis arvensis* and *Thlaspi arvense*. Weeds such as: *Chenopodium album*, *Viola arvensis* and *Stellaria media* were semi sensitive and *Geranium pusillum* was resistant. Lontrel 300 SL eliminated only *Anthemis arvensis*. Butisan 400 SC controlled well majority of weed species. Only *Geranium pusillum* was weakly eliminated.
The best efficacy of weed control and the highest yield of white mustard seeds were obtained from objects where the mixture of Butisan 400 SC + Galera 334 SL was applied.

ADOMAS B., MURAWA D. 2005. **Plant morphology and yielding of spring rape cultivars depending on applied herbicides.** Rośliny Oleiste – Oilseed Crops, XXVI (2): 369-386.

Field experiment with spring rape (*Brassica napus* var. *oleifera* f. *annua*) cv. Lisonne and Star was conducted in northern part of Poland in 1995–1999. The aim of the study was to determine the effect of herbicides applied to spring rape c.v. Star and Lisonne on plant morphology and yielding of seeds. The following herbicides were used:

* before spring rape sowing: Triflurotox 250 SC (trifluralin) at dose of 3.5 $dm^3 \cdot ha^{-1}$ that is 1.82 kg a. i.$\cdot ha^{-1}$and Alatrif 380 EC (alachlor + trifluralin) at dose of 4.0 $dm^3 \cdot ha^{-1}$ that is 1.82 kg a. i.$\cdot ha^{-1}$;
* after sowing: Alanex 480 EC (alachlor) at dose of 3.5 $dm^3 \cdot ha^{-1}$ that is 1.68 kg a. i.$\cdot ha^{-1}$ and Butisan 400 SC (metazachlor) at dose 3.0 $dm^3 \cdot ha^{-1}$ that is 1.2 kg a. i.$\cdot ha^{-1}$;
* at 4–6 leafs stage: Lontrel 300 SL (clopyralid) at dose of 0.3 $dm^3 \cdot ha^{-1}$ that is 0.09 kg a. i.$\cdot ha^{-1}$.

The influence of applied herbicides on investigated characteristics was various in different experimental years. The obtained results showed significant influence of examined herbicides only on stem base thickness of both rape cultivars. The thickness of stem bases after application of herbicide Butisan 400 SC was 6.15 mm for cultivar Star and 6.65 mm for Lisonne. The investigated cultivars differed significantly in plant height, height to first productive branch, number of productive branches and number of siliques per plant, seed yield and 1000 seeds weight. Whereas cultivar Lisonne was characterised throughout the whole experiment by higher plants (123.4 cm), higher number of productive branches (6.61) higher siliques per plant (86.7), higher number of seeds in the siliques (24) and higher first productive branch (50.8 cm).
The analyses of the obtained results showed varying influence of applied herbicides on seeds yielding of both rape cultivars. A favorable influence of Butisan 400 SC, Alanex 480 EC and Lontrel 300 SL on the yield of spring rape was noted in 1995 and 1996. The cultivar Star was characterized by higher seed yield and weight of 1000 seeds in comparison with Lisonne cv.
Weather conditions in significant way affected plant morphology, 1000 seeds weight and yielding of seeds of both cultivars of spring rape.
It was concluded that herbicides — except for stem base thickness — did not modify most of the morphological features of spring rape plants. Application of the herbicides resulted also in a significant increase of seed yield.

Insects – Pests

KELM M., FOSTIAK I., KACZMARZYK M., KLUKOWSKI Z. 2004 – **Occurrence of bumblebees (*Bombus* spp.) on winter oilseed rape – implications for crop protection** – Rośliny Oleiste – Oilseed Crops n^o XXV (1), p. 187-194.

Bumblebees (*Bombus* spp.), beside honey bee (*Apis mellifera* L.), are the most important group of pollinators and all of them are under the law protection. The aim of this study, conducted in 2000–2001 on fields in Pawłowice near Wrocław, during the spring-summer vegetation period of winter oilseed rape, was to recognize species composition, phenology and spatial distribution of bumblebees guild on winter oilseed rape crop. The analysis was based on catching in yellow water traps. Total amount of 477 bumblebee individuals were caught. The dominants were *Bombus terrestris* L. and *B. lapidarius* L. (93.2% of all). As the subdominants *B. pascuorum* L. and *B. lucorum* L. were recognized (2.95% of all). Bumblebees appeared at winter oilseed rape plantations at the beginning of April. The highest number of individuals in yellow water traps was found in mid-April. They were the most numerous before flowering (53.1% of all catches). During the flowering 10.8% and after this period 36.1% of bumblebees were caught. Spatial distribution of bumblebees before and after flowering was patchy (dispersion coefficient 1.56–2.95), during flowering they occurred more evenly (d = 0.9). Bumblebees are present on winter oilseed rape during the whole early-spring vegetation of oilseed rape and not only during flowering of this crop. It points out that there is a necessity to improve prevention programs for protection of these pollinators.

KOZŁOWSKI J., KAŁUSKI T. 2004 – **Susceptibility of winter oilseed rape cultivars to damages caused by Arion lusitanicus Mabille (Gastropoda: Pulmonata: Arionidae)** – Rośliny Oleiste – Oilseed Crops n^o XXV (1), p. 177-186.

Young growth stages of oilseed rape are attacked, in Poland, by numerous pests. Among them on peculiar attention merit slugs, which cause severe damages in crops of winter oilseed rape in some regions. The most dangerous slug species, which damage oilseed rape plants, are *Deroceras reticulatum* (Müller) and *Arion lusitanicus* Mabille. This last species, in margin parts of fields, may damage up to 100% of oilseed rape plants. Among many factors determine numbers of this slug and damage degree of winter oilseed rape plants, the cultivar of plant is very important agent. Some literature data show, that cropping at present, oilseed rape cultivars with low glucosinolate concentration are more

susceptible on feeding of slugs than olden cultivars. The aim of conducted studies was determine of susceptibility degree of selected cultivars of oilseed rape (*Brassica napus* var. o*leifera*) on feeding of *Arion lusitanicus* slugs. In controlled conditions tests with multiple choices were made with 12 winter oilseed rape *B. napus* cultivars and 1 cultivar of agrimony *B. campestris* on seedlings in cotyledon growth stage and on plants in 2 – 3 leaves growth stage. Once a day, for next few days, damage degree of plants by slugs was observed. The obtained results showed strong differentiation of palatability and susceptibility of tested cultivars of oilseed rape plants for *Arion lusitanicus* slugs. The most injured were plants of Contact and Lirajet cultivar, and the less damaged were plants of Carina and Kana cultivars.

DOBOSZ R. 2005. **How does the oilseed rape cultivation change the density of sugar beet nematode population in soil?** Rośliny Oleiste – Oilseed Crops, XXVI (1): 277-280.

The development of *Heterodera schachtii* Schm. in oilseed rape cultivation has become the object of investigations since white females of the nematode were observed on roots of oilseed rape for the first time. It was considered that in oilseed rape cultivation sugar beet nematode density increased and that the oilseed rape cultivation with rotation with sugar beet may create the problem for the latter. Both spring and winter oilseed rape are cultivated in Poland, therefore the object of the experiment was to observe how cultivation of spring as well as winter oilseed rape change *Heterodera schachtii* population density in soil. The influence of winter as well as spring oilseed rape on the change of sugar beet nematode population density was investigated in the microplot experiments in 2003–2004. The control experiment was the population of nematode in soil without plants. The nematode population density was estimated twice: before sowing — initial population density — P_i and after harvest — P_f. Factor of population development P (P_f / P_i) was estimated.

The experiments showed that spring oilseed rape (cv. Licosmos) caused the increase of sugar beet nematode population (P av. = 1.4) in contrast to winter oilseed rape (cv. Bor) where the population distinctly decreased and an average value of P factor was 0.55. In the control experiment, on a fallow, population of nematode also decreased (P av. = 0.55). No statistically important differences between winter oilseed rape and fallow were observed.

Diseases

Jędryczka M., Matysiak R., Bandurowski R., Rybacki D. 2004 – **SPEC – the decision support system against stem canker of oilseed rape in Poland** Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 637-644.

The paper contains a detailed description of the System for Forecasting Disease Epidemics (System Prognozowania Epidemii Chorób – SPEC) operating in Poland since 1 September 2004, which is a joint initiative of the Institute of Plant Genetics PAS and DuPont-Poland. SPEC is a system of disease forecasting in oilseed rape and currently the system allows us to monitor the presence and concentration of ascospores of *Leptosphaeria maculans* and *Leptosphaeria biglobosa* in air samples. In Poland both fungal species usually occur simultaneously, and are responsible for stem canker of crucifers, a serious disease of oilseed rape. Monitoring is done using seven-day volumetric spore traps and a cyclone sampler (Burkard Manufacturing Ltd., UK) located in five main oilseed rape growing areas of Poland (Lower Silesia, Pomerania, West Pomerania, Great Poland and the area encompassing Opole Region and Upper Silesia). Monitoring is accompanied by two field experiments located in regions with different weather conditions (an experiment field of the IPG PAS in Cerekwica near Szamotuły and an experimental field of the Institute of Plant Protection in Sośnicowice near Gliwice). The aim of this experiment is to improve the efficacy of fungicide treatments with respect to application timing based on spore sampling data. The data on numbers of *L. maculans* and *L. biglobosa* ascospores in the air are updated on the websites of both IPG PAS (www.igr.poznan.pl) and DuPont (www.dupont.pl). Warnings about the first and mass ascospore releases are also sent as SMS text messages and emails to persons who have registered an interest in the scheme. SPEC is directed at oilseed rape farmers, associated farm service personnel, commercial company representatives and also students and research personnel with an interest in plant pathology and plant protection. Information is distributed free of charge. The paper also contains a short overview of decision support systems (DSS) operating in oilseed rape worldwide, with reference to insect and disease control.

Starzycka E., Starzycki M., Cichy H., Cicha A., Budzianowski G., Szachnowska H. 2004 – **Resistance of some winter rapeseed (*Brassica napus* L.) cultivars to *Sclerotinia sclerotiorum* (Lib.) de Bary infection –** Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 645-654.

The main goal of resistance breeding of winter rapeseed is the development of new cultivars resistant to pathogens, as well as with high and stable yield. Fungal diseases have very high influence on cultivars performance. The knowledge of resistance level of initial materials (e.g. varieties) is essential for applied crossing scheme in any breeding program. In this paper three-year (2001–2003) results of testing the resistance level of rapeseed cultivars to white mould *Sclerotinia sclerotiorum* (Lib.) de Bary are presented. The research was conducted in field conditions in Małyszyn Department of Plant Breeding Company Strzelce. Artificial infection was performed at full flowering stage of rapeseed plants with rye kernels overgrown by pathogen mycelium. 40 rapeseed plants of each tested variety were inoculated with mid-aggressive pathotype Ss-3. The results of infection were estimated three weeks after inoculation according to three mark scale: 1 — resistant, 2 — medium resistant, 3 — not resistant. Three-year investigations showed that the most resistant to *S. sclerotiorum* were BOH 2600, Bermuda, Capio, Mohican. Otherwise Rasmus, Lirajet, Wotan and Lisek showed low level of resistance.

PODLEŚNA A., JĘDRYCZKA M., LENARTOWSKA E. 2005. **The occurrence of fungal diseases on winter oilseed rape in the conditions of differentiated sulphur and nitrogen fertilization.** Rośliny Oleiste – Oilseed Crops, XXVI (1): 173-184.

In pro-ecological system of farming there is still a big problem of protection against diseases, especially in a situation of monoculture and increase of cultivated area. The use of fungicides is to-day a basis for protection system. In the literature we can find some information about the possibility to increase natural plant resistance by proper supply with sulphur and other mineral nutrients. The problem of sulphur deficit has been known in Poland for some years in connection with a considerable decrease of gaseous pollutants which in post-war period were the main source of sulphur for cultivated plants. The application of sulphur fertilizer can have a positive effect on their nutritive requirements and on the increase of plant resistance. The aim of field experiments was to evaluate the influence of nitrogen-sulphur fertilizers on healthiness of winter oilseed rape. The first experimental factor was differentiated sulphur fertilization (-S, +S) and the second — 6 levels of nitrogen fertilization. During vegetation fungicides were used also for the objects with and without sulphur. The observations of plant healthiness were performed just before oilseed rape harvest. In the period of three years of experiment it was found that the occurrence of fungal diseases on oilseed rape was dependent mainly on weather course as well as sulphur and nitrogen fertilization. The oilseed rape sprayed with fungicides and fertilized with sulphur showed lower fungal disease infection than plants from control objects where plants were protected only by fungicides. It was found that sulphur fertilizers used in experiments did not fully protect oilseed rape against fungal diseases but significantly decreased the infection size of the following pathogens: *Pyrenopeziza brassicae, Phoma lingam, Perenospora parasitica, Erysiphe cruciferarum, Alternaria*. However there was a 2001/2002 season in Baborówko where higher infection was found in objects with mineral sulphur than at control ones. Greater nitrogen doses promoted in general the disease infection because of longer duration of green leaves and greater vegetative mass of plants. Stem cancer caused by *Leptosphaeria maculans/ Phoma lingam* was a disease which occurred in all years of the research.

ANDRUSZEWSKA A., BYCZYŃSKA M. 2005. **Resistance of linseed cultivars from the Institute of Natural Fibres collection to Fusarium wilt.** Rośliny Oleiste – Oilseed Crops, XXVI (1): 185-192.

Research on resistance to *Fusarium* wilt of flax has been carried out on cultivars from collection at the Institute of Natural Fibres in Poznan for many years. 560 cultivars, including 91 cultivars of linseed have been evaluated so far. The results of research on linseed resistance, among which 19 cultivars derived from Cultivars' Catalogue registered in the European Union, are presented in current version, that is, in comparison to the control, which is the average percentage of healthy plants of very resistant and resistant cultivars. During the study the cultivars were tested in provocative field in a three-year cycle, where the field (horizontal) resistance was evaluated. The experiments were performed using the random block method in 4 repetitions. Health condition of tested varieties was assessed during 3 stages of flax growth. The highest severity of disease was usually observed in the 'fir tree' and pre-flowering stage. It was the typical *Fusarium* wilt, which finally caused drying of whole plants. *Fusarium oxysporum f. sp. lini* was reisolated from affected plants. The ultimate criterion of cultivar resistance evaluation was the average percentage of healthy plants in green seed capsule stage from all tests in comparison with the control.

On the basis of the study, 22 resistant cultivars of linseed were selected. Among them, the cultivars: AC Emerson, Koto, Atalante, Symphonia, Łucz, Astorga L-391, Gold Merchant, Summit, Taraqui and Mikael can be regarded as very resistant.

Molecular markers

MIKOŁAJCZYK K., SPASIBIONEK S., BARTKOWIAK-BRODA I. 2004 – **Analysis of the low-linolenic mutant genotypes of winter oilseed rape (*Brassica napus* L.) with the use of DNA markers** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 243-250.

Oil obtained from rapeseed (*Brassica napus* L.) is used not only for human nutrition but also as a row material in industry and technology for biofuel production. Differentiated fatty acids composition is required due to the means of rapeseed oil application. In Plant Breeding and Acclimatization Institute in Poznań, attempts to obtain low-linolenic winter oilseed rape genotypes have beeen successfully undertaken for several years. However, the breeding process is complicated by the fact that the trait has complex genetic inheritance being highly influenced by the environment. DNA markers appear as an accurate and environment independent tool to be used while selection. The aim of this work is to develop DNA markers for the low linolenic acid content trait. Genomic DNA was isolated from young leaves of oilseed rape plants: from a double-low winter line PN 1775/02 (about 10% of linolenic acid), an inbred line PN 1712/02 of mutant M-681 which was obtained from PN 1775/02 throughout chemical mutagenesis (about 2% of linolenic acid) and from a summer oilseed rape cultivar Apollo (about 2% of linolenic acid). In order to investigate DNA regions specific for the low linolenic acid trait, RAPD method was applied. Polymorphic bands, which enabled the distinction between plants of the low (mutant type) and double-low linolenic acid content were obtained with the use of five Operon Technologies primers: OPK-01, OPL-13, OPP-05, OPP-08 and D-25. These results make a background for further research in order to analyze DNA regions characteristic for the low-linolenic acid trait as well as to develop the specific DNA markers.

ALEKSANDRZAK Ł., BRODA Z. 2004 – **„Rapeseed-like weeds" polymorphism detected with RAPD markers** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 61-66.

The occurrence of plants whose morphological appearance is different from the typical morphotype of plants cultivated on a given field has been recently observed in oilseed rape plantations. They show a higher amount of erucic acid, which causes devaluation of material delivered for oil industry. For this reason some molecular analyses were undertaken. The research was performed with RAPD method using 25 primers selected earlier. This study allowed for the division of plants into a few groups of different genetic variability levels. This division was consistent with plants origin. Genetical similarity of analysed plants was different and ranged from 40 to 90%. On the basis of the analyses made so far we may suspect that a part of analysed accesions is probably a turnip-like rape, and a part belongs to varieties of oilseed rape earlier than this cultivated on a field which they came from.

Nowakowska J., Mikołajczyk K., Krótka K., Bartkowiak-Broda I. 2004 – **Assessment of genetic distance in parental lines of F_1 winter rapeseed hybrids (*Brassica napus* L.) using RAPD method** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 353-370.

The proper selection of both parental components of hybrid cultivar is required in order to obtain F_1 hybrid generation characterized by a high yield of seeds. The aim of this work was to estimate genetic distance among parental lines and to establish a correlation between seed yield of obtained hybrids and the genetic distance values between particular parental line pairs. The objects of research were: five CMS *ogura* lines and six homozygotic restorer lines — the components of eighteen restored F_1 hybrids. The genetic distance values, estimated using 150 RAPD markers, ranged from 0.0339 to 0.8362. Seed yield of the obtained hybrids were investigated in the field trials and ranged from 56.2 to 69.2 dt/ha. High yielding hybrids were obtained as a result of combinations of parents characterized by a high genetic distance value. Positive correlations were obtained between genetic distance values and seed yield and oil content in the seeds. Obtained results are the background for further investigations, which require several years of field observations.

Analyses

MICHALSKI K. 2004 – **Measurement of protein content in oilseed rape seeds – comparison of reflectance and transmittance methods –** Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 195-202.

In breeding works on rapeseed there is a need for fast seed analysis of different chemical compounds, including protein content. Wet analysis of protein is a time consuming and expensive procedure, an alternative method can be an instrumental analysis by NIR/NIT method. There are two versions of near infrared analysis: measurement of transmittance or reflectance. An attempt to compare both methods was made. Samples were measured on reflectance machine NIRS 6500 and on transmittance machine Infratec 1255. Calibration set consists of 170 seed samples (reflectance) and 264 seed samples (transmittance), validation set consists of 45 seed samples. Protein range was 17–26% of mass. Obtained results show, that calibration method for transmittance gave slightly worse results (SEP = 0,628) than subsequent calibration for reflectance method (SEP = 0,609), but both methods were able to estimate protein content with similar accuracy although the calibration sets were different. For a bigger sample, better representative results were obtained by transmission method due to cuvette construction 5 independent subsamples in one measurement cycle). Both methods can be used for research purposes, although in reflectance method protein measurement can be joined with glucosinolate calibration, and therefore this method is better suited for breeders' expectations.

SIGER A., NOGALA-KAŁUCKA M., LAMPART-SZCZAPA E., HOFFMANN A. 2004 – **Phenolic compound contents in new rape varieties** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 263-274.

We examined the content of phenolic compounds of twelve varieties cultivated in Wielkopolska region in the years 2000–2003 regarding to. After a thorough grinding, rape seeds were extracted in water solution of methanol (80%) and total phenolic compounds were determined**.** The cleaning on SPE columns was applied to isolate the fraction of phenolic acids which was then identified qualitatively and quantitatively on HPLC. The NovaPak®C18 column and gradient solvent elution were used. Detecting of extracted compounds was made with UV – VIS detector at the wavelength 250 and 320 nm. After the determination of phenolic compounds in all rape seed varieties (Lisek, Liropa, Silvia, Marita, Bermuda, Lirajet, Buffalo, Kaszub, Wotan, Kronos, Rafaela and Rasmus), it was confirmed that their largest quantity was observed in the Kronos variety (2659,7 mg/100 g), and the smallest in Sylvia (about 1505,5 mg/100 g). The total content of free phenolic acids varied from 76 to 154/100 g. Regardless of the variety and the year of crop, the quantity of sinapic acid and its derivative was the largest. It was observed that the content of this acid differed between individual years and also statistically differed in the same varieties in different crop year. Other phenolic acids occurred in considerably smaller quantities.

Michalski K. 2004 – **HPLC qualitative analysis of morphine, codeine and thebaine in poppy capsules for breeding *purposes*** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 621-626.

Modern poppy seed breeding target is obtaining new varieties with low alkaloid content (below 0.05% morphine) and varieties with high content of some alkaloids (morphine, thebaine) for medical purposes as well. Colorimetric method used until now allows only morphine estimation, without other existing alkaloids. One of the main targets of contemporary poppy seed breeding is development of the varieties with high thebaine yield. HPLC method was adopted for alkaloid analysis. Samples were extracted with the method developed for colorimetrical analysis of morphine content and extract was injected into HPLC column C18 BDH. Alkaloids were eluted by gradient acetonitrile : phosphate buffer (pH = 3.8). Signal from diode array detector was measured at 230 nm. During method development alkalic elution (Gomez-Serranillos) and acidic elution (Singh) were examined as well. Due to the problems with columns stability the acidic method was selected and optimized. Analysis by acidic method is comparatively cheaper and faster. The resolution is good. The calibration coefficients against pholcodine were calculated and applied for estimation of alkaloid composition. The method is environmentally safe. The developed method provides plant breeders with a tool for selection of new varieties with desired alkaloid content and composition.

MICHALSKI K. 2005. **Measurement of fat content in oilseed rape seeds – comparison of NMR and NIR reflectance and transmittance methods.** Rośliny Oleiste – Oilseed Crops, XXVI (1): 65-74.

Breeding works on rapeseed demand fast seed analysis for different chemical compounds, including fat content, which is a basic parameter for new lines selection. Soxhlet wet analysis of fat content is a time consuming and expensive procedure. Alternatively, instrumental analysis by NIR/NIT (near infrared reflectance/transmittance) or NMR (nuclear magnetic resonance) method can be applied. NMR method is commonly used in breeding works, although allows only the measurements of fat and moisture content (pulse NMR).

NIR analysis can be conducted in the transmittance or reflectance mode. An attempt to compare both methods was made. Samples of seeds were measured on reflectance machine NIRS 6500, transmittance machine Infratec 1255 and pulse NMR Oxford MQA 7005 with rapeseed calibration.

For comparison the seed sample set of 46 breeding lines and varieties was used. Obtained results show that the lowest error against Soxhlet reference method was attained by NIT method and NMR (NIT, commercial ANN equation, SEP 0.59, correlation coeff. 0.843, NMR SEP 0.67, correlation coefficient 0,800). The worst results were obtained by NIR (in house equation, error about 1.0). The NIR calibration needs further work to enhance the results quality.

RATUSZ K., KOWALSKI B., BEKAS W., WIRKOWSKA M. 2005. **Monitoring of rapeseed and sunflower oils autoxidation.** Rośliny Oleiste – Oilseed Crops, XXVI (1): 211-220.

Autoxidation of fats is a well-known phenomenon and its monitoring is a commonly accepted practice in food control systems. The experimental designs are based on organoleptic, analytical or instrumental methods. Some of the methods are based on the determinations of induction periods. The oven, shelf and pressure differential calorimetry (PDSC) tests belong to such group.

It was the purpose of this paper to compare the results of the above mentioned tests for the samples of model vegetable oils. As model fats the rapeseed and sunflower oils were used and they were obtained directly from the factory.

The oils were stored in open beakers at room temperature (shelf test) and at 63^{o}C (oven test). Periodically, aliquots were taken and the peroxide values (LN) were determined by iodometric titration. Thermoanalytical (PDSC at 120^{o}C and at 1400 kPa of oxygen) measurements of time to reach the maximum on PDSC exotherm (τ_{max}) were performed at the same time. The 60 couples of (LN and τ_{max}) from the oven and PDSC tests and 48 couples of (LN and τ_{max}) from shelf and PDSC tests were obtained. The measured peroxide values from shelf and oven tests increase with time and their functional dependence versus time are characteristic for oil oxidation showing induction and acceleration periods. Measured by PDSC τ_{max} values decrease with storage time or in another words with increase of LN values of oils. The presented results show that oils with high LN values (beyond acceptable limits) are poorly differentiated by PDSC measurements. The PDSC method can be used only for oils with LN < 30 mmole O_2^{2-}/kg of oil.

Based on the results from oven and shelf tests the dependences LN = f(τ) were obtained and they suggest that the mechanisms of oxidative degradation of oils are similar in these tests. It could be assumed that thermal oxidative degradation of oils at the initial steps of PDSC tests has similar chemistry as in shelf and oven tests. For this reason the experimental dependences of PDSC and traditional results obtained for samples with LN, 30 mmole O_2^{2-}/kg of oil are linear. When the oils have peroxide values high, the autoxidation is very fast and the secondary reactions can change the shape of PDSC exotherm. Such oils cannot be characterized by PDSC tests.

JĘDRUSEK-GOLIŃSKA A., KORCZAK J., BIAŁAS W., HĘŚ M., GRAMZA A. 2005. **Antioxidant activity of protein hydrolysates from defatted rapeseed meal obtained in various conditions of hydrolysis**. Rośliny Oleiste – Oilseed Crops, XXVI (1): 221-234.

The aim of the study was to produce the protein hydrolysates from defatted rapeseed meal by hydrochloric acid hydrolysis in various conditions and to compare the antioxidant activity of the obtained hydrolysates. Various conditions of hydrolysis concern concentration of the used hydrochloric acid (4.5 and 6 M) and the time of the process (6 and 12 h). The temperature of the hydrolysis (105ºC) and the degree of neutralization (pH 5.5) were constant.

The contents of total nitrogen, amino nitrogen, salt, polyphenols, ash, dry matter, monosacharides, and color were determined in the hydrolysates. The antioxidant activity was evaluated by using scavenging effect of DPPH$^{\bullet}$, chelating activity and reducing power methods. The correlations between scavenging effect of DPPH$^{\bullet}$, chelating activity, reducing power and the composition of the hydrolysates were calculated.

The obtained results indicate that the protein hydrolysates from defatted rapeseed meal showed good antioxidant activity in used methods, depending first of all on the time of hydrolysis. Higher antioxidant activity show the products hydrolysed in shorter time (6 h). The antioxidant activities of the protein hydrolysates are correlated with the level of Maillard reactions products ($r = 0.9237$, $p < 0.001$ for scavenging effect of DPPH$^{\bullet}$ and $r = 0.8774$, $p < 0.05$ for reducing power) and polyphenols included in them ($r = 0.9842$, $p < 0.05$ for reducing power). The protein hydrolysates from defatted rapeseed meal could be taken into consideration as natural antioxidants in food production to limit fat oxidation.

JĘDRUSEK-GOLIŃSKA A., KORCZAK J., GLISZCZYŃSKA-ŚWIGŁO A., CZACZYK K., KMIECIK D. 2005. **The protein concentrates from defatted rapeseed meal as a raw material for production of protein hydrolysates.** Rośliny Oleiste – Oilseed Crops, XXVI (1): 249-260.

The aim of the study was to produce rapeseed protein concentrate and to hydrolyze it. Protein concentrate was obtained by extraction of rapeseed meal using 70% ethanol. The concentrate and the defatted rapeseed meal were hydrolyzed (HCl). Preliminary purifying of the defatted rapeseed meal with ethanol caused higher content of protein (42.4 and 35.9%, respectively) and lower content of polyphenols (1.2 and 22.6 mg/g) in the obtained concentrate with reference to the raw material. Obtained results show that protein concentrate and defatted rapeseed meal differed from each other in the content of carbohydrates and fibre, too. The acid hydrolysis of the concentrate yielded a product with good chemical evaluation and high degree of hydrolysis (74.8%). The hydrolysates obtained from protein concentrate and from defatted rapeseed meal differ from each other in the content of the amino nitrogen and monosacharides; other parameters were similar. The hydrolysate of protein concentrate was lighter. Both kinds of hydrolysates had good sensory evaluation without bitterness. The hydrolysate of defatted rapeseed meal had better total sensory evaluation. It seems that the protein hydrolysates obtained from non-purified rapeseed meal are more profitable for consumers. It is necessary to confirm the obtained results by further research on comparing functional properties of both kinds of hydrolysates.

FLACZYK E., KOBUS J., RUDZIŃSKA M., BUSZKA K., GÓRECKA D., SZCZEPANIAK B., KORCZAK J. 2005. **Evaluation of quality and stability of "extra virgin" olive oils available in retail.** Rośliny Oleiste – Oilseed Crops, XXVI (2): 621-630.

The aim of this study was the evaluation of physical and chemical indexes and sensoric quality of fresh "*extra virgin*" olive oils bought in retail. These olive oils came from Italy (four), Spain (three) and Greece (one). Sensory analysis (flavor and odor) and clarity were also determined. An assessment of peroxide value (PV), acidity, anizidine value, the contents of sterols, squalene and phenolic compounds, absorbancy in ultra-violet, refraction of light coefficient and also oxidative stability in Oxidograph and Rancimat methods was carried out.

As the results of investigations it was confirmed that physical and chemical indexes of all examined olive oils were up to European Union standards. These olive oils were characterized by similar refraction of light coefficient, however, other quality indexes were different. The least peroxide values (PV) were observed in Spanish olive oils and the most in two of Italian olive oils.

Olive oils "*extra virgin*" were characterized by good but different sensoric qualities. The most intensive apple and almond odor and flavor were characteristic of two olive oils from Italy and one from Spain. In some olive oils negative descriptors such as grass odor were felt. Total amount of phenolic compounds was negatively correlated with PV and positively with induction period in Rancimat and Oxidograph methods.

Technology and processing

GÓRSKI M. 2004 – **Germination capacity of the flax seeds (*Linum usitatissimum* L.) in the long-term storage** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (1) p. 275-280.

Long-term storage of 30 varieties of flax seeds started in 1985. Seeds of the moisture content of 5–7% were stored in glass containers at vacuum conditions, at the temperature of 0–1^{o}C. The germination capacity of flax seeds was determined shortly before storage and after 3, 12 and 18 years of storage. Seeds of tested flax varieties retained high viability during all investigated times of preservation. After 18 years of storage the highest germination capacity, above 97%, was presented by the following 12 varieties: Blenda, Fibra, Charrua MA, Iduna, Izolda, Łucz, M-3266, Nataja, Olajozan, Pacyfik, Tine Tammes and Vera.

STROBEL W., TYS. J., SUJAK A., GAGOM M., ŻAK W., KOTLARZ A., RYBACKI R. 2005. **Harvesting technique versus the content of chlorophylls and carotenoids in rape seeds, oilcakes and rapeseed oil.** Rośliny Oleiste – Oilseed Crops, XXVI (2): 479-488.

The content and composition of photosynthetic pigments are indicators of the quality of seeds and oil. The applied harvesting technique is one of the factors limiting the crop quality.

The aim of the research was to estimate the pigment content and composition in seeds, oil and rapeseed cake and its concentration in relation to the applied harvesting technologies as well as harvest time. Cultivar Lisek harvested at different stages of maturity was used and two-stage harvest technique was applied. The analysis was conducted on the oil obtained by pressing the seeds in hydraulic press at the temperature of 20°C. The UV-Vis absorption technique was applied as the method of determination of carotenoid pigments and chlorophyll content. The results show that pigments content in seeds, oil and rapeseed cake strongly depended on the harvest time. It was found that the delayed harvest resulted in reduction of the pigment and chlorophyll content in each of examined plant material. It was of notice that the ratio of total concentrations of the pigments remained approximately constant and was independent of harvesting time and maturity stage of rape. The direct combining and two-stage harvesting methods were additionally compared and nearly three-fold decrease in total pigment concentration was found in the case of direct combining harvesting. The chlorophyll contents alterations were observed in a two-stage harvesting method. Summing up, the used harvesting technique as well as the harvesting time were the crucial factors in final seeds quality. The results also show that oil cakes contained much higher pigment concentrations as compared to oil.

SIGER A., NOGALA-KAŁUCKA M., LAMPART-SZCZAPA E., HOFFMAN A. 2005. **Antioxidant activity phenolic compounds of selected cold-pressed and refined plant oils.** Rośliny Oleiste – Oilseed Crops, XXVI (2): 549-560.

The increase of popularity of cold-pressed oils may indirectly influence the consumers' health by providing more native antioxidants such as polyphenolic compounds. In this paper the investigation of the content and properties of antioxidant polar substances extracted from non-polar oils is reported. Rapeseed oil, sunflower oil and soybean oil were investigated. The influence of the refining process on natural phenolic antioxidants content was also examined.

The antiradical activitiy of phenolic extracts from oils were determined using the free radical 1,1-diphenyl-2-picrylhydrazyl (DPPH$^{\bullet}$). The percentage of radicals (DPPH$^{\bullet}$) scavenged by compounds contained in the extracts was determined. Concentration needed to scavenge 50% of radicals (EC_{50}) was also determined. Antiradical power (ARP) was calculated. Rapeseed oil was characterized by the highest quantity of phenolic acids, especially the sinapic acid (236.1 μg/100 g). This extract had the best antioxidant properties. In soybean and sunflower oils phenolic acids were not found after the refining. Correlation between the phenolic acids content and scavenging of free radicals (DPPH$^{\bullet}$) (r = 0.94) was found.

The results obtained confirmed significant influence of the refining process on native polyphenolic compounds content in plant oils.

MURAWA D., WARMIŃSKI K. 2005. **The effects of varied protection of spring rape on the composition and oxidative stability of rapeseed oil. Rośliny Oleiste – Oilseed Crops, XXVI (2): 571-586.**

The objective of the present study was to determine the effects of varied protection of spring rape on the composition and oxidative stability of rapeseed oil. The experimental material comprised spring rape seeds obtained from a three-year field experiment (1999–2001). Experimental factors were varied plant protection (7 treatments) and cultivars (Star and Margo). The following formulas were applied for plant protection in various combinations: Decis 2,5 EC, Ronilan 500 SC, Butisan 400 SC and Roundup Ultra 360 SL. Fatty acid composition, concentrations of tocopherols, chlorophylls and

carotenoids (oil colour), peroxide value PV and anisidine value AnV of fresh oil, and changes in their levels during storage under model conditions (oxidative stability) were determined in oil extracted from rapeseeds.
The results obtained showed that the method of spring rape protection had an insignificant effect on fatty acid composition, tocopherol content of oil and initial levels of AnV and PV. The lack of protection against pests had a highly significant effect on the colour and oxidative stability of oil. Oil colour was affected by the experimental factors to the greatest degree. The high chlorophyll level in oil from rape seeds obtained from unprotected treatments may be related to generative organ damage caused primarily by pollen beetle (*Meligethes aeneus* F.), which resulted in non-uniform seed ripening.
It may be concluded that in order to determine the effects of agricultural practices on rapeseed quality it is necessary not only to analyze the chemical composition of seeds, but also to estimate the oxidative stability of oil in storage tests.

MASZEWSKA M., KRYGIER K. 2005. — **Research on relationship between occurrence of peroxides and of derivative – volatile oxidative products in refined rapeseed and sunflower oils.** Rośliny Oleiste – Oilseed Crops, XXVI (2): 611-620.

The aim of this work was the determination of relationship between the amount of peroxides (Peroxide Value) and derivatives (volatile oxidative products) measured by Rancimat test.
Material for research were samples of fully refined rapeseed oil and sunflower oil which come from nine different batches, taken directly from the industrial line. The subject of the study includes measurements of stability by the Rancimat test, firm Methrom. The following application parameters were used: weight of oil sample — 2.5 g, temperature — 120°C, air flow — 20 l/h, water volume in conductivity vessel — 60 ml. Results were given as induction times in hours.
The induction times of ten batches of refined rapeseed oil and sunflower oil were between 5.76 and 6.73 hours and 3.05 and 3.39 hours in Rancimat test. Peroxide Value (PV) in examined oils and Rancimat test results were increasing simultaneously. The growth of water conductivity of volatile oxidative products (Rancimat) began from PV about 10 meq/kg for rapeseed oil and about 40 meq/kg for sunflower oil and their faster growth was observed from PV about 50 meq/kg for rapeseed oil and sunflower oil.

Oil

PTASZNIK S., JERZEWSKA M., ROPELEWSKA M. 2004 – **Trials on enzymatic interesterification of rapeseed and fish oils mixtures with a diversified level of polyenic fatty acids and examination of obtained products –** Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 203-212.

The studies on the enzymatic restructuring process, with the application of interesterification of the fat mixtures, containing fatty acids of Omega-3 with a differentiated chain length and degree of saturation, were carried out. The investigations were conducted in a model system, in laboratory scale. The Lipozyme® RM IM of Novozymes® A/S company, Denmark, revealing specificity to the *sn*-1,3 triacylglycerol (TAG), was used as a biocatalyst. The research material consisted of rapeseed oil and fish oil with different levels of EPA and DHA acids. The enzymatic processes of interesterification were conducted in batch system with a stirrer and without solvent. The optimal parameters of the process were determined and the analysis of the obtained product was carried out. Regarding to information from literature, process conditions and products it can be considercel that in the case of the reaction of enzymatic esterification with specific biocatalyst Lipozyme® RM IM, the TAGs structure was influenced by migration of the acyl-groups in *sn*-1,3 positions in the TAGs molecules. Enzymatic esterification reaction with specific biocatalyst Lipozyme® RM IM followed together with hydrolysis reaction. As the effect of partially hydrolysis arises at first the DAGs (separation of one acyl group from TAG), then were formed MAG (separation of two acyl groups from *sn*-1 and *sn*-3 positions of TAG). The separated acyl-groups again occupied the *sn*-1,3 positions, but *sn*-2 internal position rest unchangeable. It mat be concluded that over grouping in the external positions could take place during the reaction, however it was not confirmed directly, because the fatty acid composition in individual position *sn*-1 and *sn*-3 were not determined. The slight changes in the *sn*-2 TAG position were observed, although taking into consideration accuracy of applicated analytical method, it was stated that this position rest unchanged. The polar fractions – the DAGs, MAGs as well as free fatty acids and non polar – TAGs were found as the result of the enzymatic esterification process of the rapeseed and fish oils mixtures.

FLACZYK E., RUDZIŃSKA M., GÓRECKA D., SZCZEPANIAK B., KLIMCZAK S., KORCZAK J. 2004 – **Evaluation of selected quality indexes of stored "extra virgin" olives** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 213-224.

The aim of the study was to evaluate influence of temperature and storage conditions of olive "extra virgin" on quality indexes. The olives originated from 6 different producers were subjected to assessment of peroxide value, free fatty acids, TOTOX index, sensory analysis, and also oxidative stability in Oxidograph and Rancimat test. All of examined olives were characterized by good quality directly after purchase. After 6 months of storage at the temperature and exposition to light similar to that in the market, two of them revealed sensoric changes and exceeded peroxide value permitted by quality standard. The change of storage conditions (temperature 16–18^{o}C, without light) of the same olive samples favourably affected quality indexes. Even at the end of the shelf life of olive samples (10 month storage in changeable conditions), values of quality indexes were on the level permissible by quality standard. Furthermore, oxidative stability of olives was improved, compared to reference samples analyzed after 6 months of storage at room

temperatures and light. It was shown, that olives stored for a longer time should be placed in temperature lower than room temperature and without light. In trade conditions the shelf-life should be shortened.

NOGALA-KAŁUCKA M., LAMPART-SZCZAPA E., KORCZAK J., PACYŃSKA K., SIGER A. 2004 – **The study of the antioxidants efficiency and the loss of the tocopherol content in model systems during fat oxidation tests** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 251-262.

Efficiency of natural antioxidants – tocopherols and rosemary leaf extract – was investigated in the present study. Substrates in our model systems were triacylglycerols isolated from the rapeseed oil deprived of any antioxidant substances that are present in the rapeseed oil. Samples of individual antioxidants alpha-, gamma-, and delta-tocopherols and the mixture of these homologues and butylated hydroxytoluene (BHT) were added to the substrate as 0.01% w/w. Ethanolic extract of rosemary leaves was added in the quantity of 0.05% w/w. Samples were stored at the temperature of 4, 20 and 60^{O}C on Petri dishes in darkness. Before and during the test Lea number (PN-ISO3960), tocopherol contents, using high performance liquid chromatography (HPLC), and scavenging of 1,1-diphenyl-2-picryhydrazyl ($DPPH^{+}$) free radicals were measured. It was stated that antioxidant activity in model systems depended on the type of the antioxidant and the temperature of the tested samples. The highest antioxidation efficiency was demonstrated by triacylglycerols with 0.05% addition of the rosemary leaf extract. Decomposition of tocopherols depended on the added tocopherol homologue. Majority of the added tocopherols decomposed at 60°C, and the smallest loss was noted at 4°C, with the Lea number being the same. In the biggest amount and the fastest to decay was alpha-tocopherol and the smallest and the slowest decomposition was observed for delta-tocopherol. It was observed that during autoxidation the homologous tocopherols displayed various activity in guenching the DPPH free radicals depending on the temperature at which the test was being carried out. At 4^{0}C gamma-T was more efficient than delta-T and tocopherol mixture, at 20^{0}C the activity of gamma-T was equal to that of delta-T, and at 60^{0}C gamma-T, delta-T and their mixture were quenching about the same amount of the $DPPH^{+}$ radicals. The least efficient homologue was alpha-T. Synthetic BHT used for the sake of the comparison was a less efficient antioxidant than the rosemary leaf extract added to the rapeseed triacylglycerols, but its capacity of quenching the free radicals was greater than that of tested tocopherols.

Kupczyk B., Gogolewski M., Nogala-Kałucka M. 2004 – **The time course of degradation of native tocopherols in plant oils supplemented with menadione (vit. K_3) after exposure to gamma radiation** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 549-560.

The objective of this study was to determine the effect of menadione (vit. K_3) and gamma-radiation on changes in tocopherols content in plant oils. In the present work the influence of the tested parameters on the lipid oxidation was also studied. The rapeseed and soybean oils with addition of menadione with equal molar concentration (0.05 mM of menadione / 0.05 mM of tocopherols) were used in this investigation. The samples of all oils were irradiated with 2.5 to 20 kGy doses, using Co^{60} as the radiation source and were stored at the temperature of 4°C. After 4 and 8 weeks of storage the samples of oils were taken for peroxide value, tocopherols and fatty acids determination. The tocopherols content was determined by HPLC, the fatty acids compositions were measured with GC. The oxidation of all oils was determined by measurement of peroxide value. The results obtained in these studies indicate that ionizing radiation and menadione had significant influence on the dissolution of native tocopherols in tested oils. The decomposition of natural antioxidants in tested oils was varied, but it depended on homologous form and increased in statistically significant way together with the increase of the radiation doses and storage time. The degradation of vitamin E (homologous tocopherol) in tested oils caused decreasing of their nutritive value. The results obtained showed that ionizing radiation and menadione had influence on the lipid oxidation. The autoxidation was different in each oils. During storage, oxidation of oils was accelerated because radiation causes gradual decrease of the content of natural antioxidants. No dimerization of tocopherols was observed under the applied experimental conditions. Gamma radiation did not significantly affect decomposition of unsaturated fatty acids in oils chosen for this experiment.

KANIA M., MICHALAK M., GOGOLEWSKI M. 2005. **Effect of biologically active substances on antioxidant activity in rapeseed oil tested in accelerated oxidative process.** Rośliny Oleiste – Oilseed Crops, XXVI (1): 281-291.

In the study rapeseed oil was enriched with such substances as: β-carotene, coenzyme Q_{10}, menadione K_3 and quercetin. Addition of these substances to rapeseed oil may increase its stability and healthy properties.

The influence of mentioned above additives was analyzed in rapeseed oil which was exposed to accelerated oxidation process in temperature 60^{o}C. Process of autoxidation was monitored by determination of peroxide value. Decomposition of tocopherols and scavenging of free radicals $DPPH^{\bullet}$ were examined by evaluation of antiradical efficiency coefficient (AE).

Substances added to rapeseed oil improved antiradical efficiency (AE). Addition of biologically active substances restrained alpha-tocopherol decomposition. Similarly quercetin influenced gamma- and delta-tocopherols. Other additives restrained tocopherols decomposition after 24 hours of study. Autoxidation process of rapeseed oil was only by quercetin.

NOGALA-KAŁUCKA M., MUŚNICKI CZ., KUPCZYK B., JASIŃSKA-STĘPNIAK A., BARTKOWIAK-FLUDRA E., SIGER A. 2005. **Preliminary studies of tocochromanol content in seeds of open pollinated and hybrids varieties of winter rapeseed.** Rośliny Oleiste – Oilseed Crops, XXVI (2): 561-570.

The objective of this study was determination of natural antioxidants, such as tocochromanols, in seeds of fifteen varieties of winter rape registered by COORU in the years 2002–2003. There were open pollinated varieties: Polish –

Batory and Bazyl and foreign – Rasmus, Digger, Capio, Cazek, Californium and Spencer NL as well as Polish composite hybrids Kaszub and Mazur and foreign restored hybrids Kronos, Baldur, Extrem and Titan. Materials from the first reproduction – K_1 – were supplied by seed producing company OBROL. All studied rapeseeds came from the crop of 2004. Tocochromanol composition of new varieties was compared to that of varieties already cultivated – Kana, Lirajet, Lisek and Buffalo, which had already been studied earlier and results were published in 2003. The material under investigation included also the seeds of winter turnip rape (*B. rapa*) Lufowy variety and winter false flax *Camelina sativa* Przybrodzka II variety harvested in 2003.

The qualitative identification and quantitative determination of homologous tocopherols were carried out by HPLC after saponification of samples and extraction of unsaponifiable substances. Tocopherol separation was performed with the use of Waters HPLC system equipment with LiChrosorb Si 60 column. The mobile phase was *n*-hexane and *1,4* dioxane. Tocopherols were monitored by a fluorimetric detector (295, 330 nm). Contents of individual tocopherol homologues were calculated on the basis of calibration curves for pure forms of these compounds.

Results obtained in this study indicated that total tocochromanol content in the majority of rapeseed varieties was above 300 mg/kg d.m of seeds. The greatest tocopherols content was determined in two rapeseed varieties – restored hybrids Kronos and Titan (above 400 mg/kg d.m). Each of four homologous tocopherols was identified in all investigated winter rapeseed varieties. α- and γ-tocopherols occurred in greatest quantities. The calculated ratio of α- to γ-tocopherol content ranged from 0.8 to 1.10 for open pollinated varieties of rapeseed, and it was higher for the restored hybrids (1.32). Among the open pollinated varieties of winter rapeseed the seeds of Lisek variety were richest in tocopherols (383 mg/kg d.m.). Tocopherol content was also higher when compared to the 2000–2003 crops of this variety.

Feeding

Migdał W., Barowicz T., Borowiec F., Koczanowski J., Pieszka M., Wojtysiak D., Paściak P., Živković B. 2004 – **Positive and negative aspects of supplementing pig feeds with plant oils –** Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 561-572.

Plant fats used in diets for pigs are not the only source of energy but they also improve feed palatability and conversion and provide fat-soluble vitamins and exogenous unsaturated fatty acids. The latter are necessary for animals to grow and develop normally. The special role of exogenous unsaturated fatty acids results from the fact that they are a starting material for biosynthesis of prostaglandings, leukotrienes and tromboxanes. In addition, these acids are involved in cholesterol transport and synthesis. Meals from full-fat oil seeds and plant oils can be used to modify fatty acid profile of porcine fat according to consumer demand by enriching it with exogenous fatty acids such as $C_{22:6}$n-3 (DHA), $C_{20:5}$n-3 (EPA), $C_{22:5}$n-3 (DPA) or CLA. Fatty acid profile can be correlated with eating quality of pork, especially its palatability, which is positively correlated with the content of saturated and monounsaturated fatty acids, and negatively with the content of polyunsaturated fatty acids.(PUFA). Excessive levels of PUFA in animal fat adversely affect the sensory characteristics of meat and its storage capacity. The affected carcass is characterized by slimy backfat, unfavourable colour, reduced keeping quality, susceptibility to oxidation and, as a result, rancid aroma of fat. Plant oils show varying effects on the content and diameter of muscle fibres, which may influence meat juiciness, tenderness, colour and technological suitability (better susceptibility to ham massaging). A dietary supplement of plant oil increases the costs of feeding while shortening the use-by date of the feed. It is therefore appropriate to determine the optimum time for application of such a feed in pig nutrition. The final effect of using plant oils or full-fat oil seed meals is determined by a number of factors that have to be taken into account. The results of daily gains, feed intake, meatiness, muscle fibre content and diameter, intermuscular fat content, fatty acid profile, cholesterol level in muscles, storage time of meat enriched in unsaturated fatty acids, susceptibility to oxidation, and sensory properties of meat have to be considered together. It is only then that we can find out whether pigs may be given plant oils or full-fat oil seed meals to the benefit of animals and consumers.

PIESZKA M., MIGDAŁ W., BAROWICZ T. 2004 – **The effect of the addition of isomers of conjugated linoleic acid (CLA) to feed rations for sows on their reproduction and performance of reared piglets** –Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 225-232.

The aim of this study was to determine the effect of adding CLA isomers for lactation sows on its reproduction and rearing performance of piglets'. The experience was carried out on 20 sows (Polish White × Polish Landrace) being in 3–4 reproductive cycles divided randomly into two groups — 10 animals in each group. Control animals obtained from 108 day of pregnancy to 35 day of lactation the 2% addition of sunflower oil, experimental animals in the same period of time got 2% supplement of CLA (Edenor UKD 6010, Henkel) containing 61.3% isomers of CLA. CLA contained following isomers: $C_{18:2}$ tt — 0.8%, $C_{18:2}$ c9 t11 — 9.1%, $C_{18:2}$ t8 c10 — 9.5%, $C_{18:2}$ c11 t13 — 10.5%, $C_{18:2}$ t10 c12 — 10.2%, $C_{18:2}$ cc — 21.2%. Both fatty additions were added to complete mixture and fed in the mornings. 2% CLA addition which has been used for sows feed rations during lactation did not influence the reproductive traits of sows and rearing piglet's traits. Only the tendency for improvement of indicators mentioned above in control group was observed. Piglets reared by experimental sows were heavier at weaning in average for 0.52 kg but differences were not significant. Average daily gain of piglets' body weight in control group was 224 g and in experimental group 244 g. Milk production to 21 day of lactation was in control group – 162.3 kg and in experimental group 175.8 kg. Average amount of milk consumed by piglets during 21 days of their life was respectively 0.82 and 0.93 kg/day/piglet. Barren period was 7.6 and 7.7 days. Lower sows' body weight loss during lactation was observed in group obtaining CLA. Milk consumed by experimental piglets had a positive effect on hemoglobin content ($P<0.01$) and haematocrit level ($P<0.05$) in rearing piglets' blood. Also in blood serum of experimental piglets higher activity of ALP ($P<0.05$) was observed. Any

significant differences in AST, ChT, its fractions HDL and LDL and TAG content were not observed. It is thought that milk from sows obtaining from 108 day of pregnancy to 35 day of lactation the addition of 2% CLA could be the source of mentioned acid for piglets in first weeks of their life which has a positive effect on their growth and development in this period.

KOCZANOWSKI J., ORZECHOWSKA B., MIGDAŁ W. 2004 – **Fatty acid composition of backfat as affected by duration of feeding a diet with rapeseed oil** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 307-314.

The experiment was carried out on 32 crossbred fatteners (Polish Landrace × Large White Polish) divided into 4 groups (8 in each group). The fatteners from the 1st (control) group were fed over the whole fattening period (30–100 kg) a feed without fat addition (12.9 MJ, 161.5 g of crude protein), while the fatteners belonging to the 2nd group from 80 kg, 3rd group from 70 kg and 4thgroup from 60 kg of body weight were fed the compound feed with 6% rapeseed oil addition (13.5 MJ, 159.1 g of crude protein). The fatteners were slaughtered at 100 kg of body weight. The samples of backfat were taken from the area over the shoulder to evaluate the fatty acids composition. Proportion of saturated fatty acids in backfat in the respective feeding groups is: I – 41.10%, II – 40.30%, III – 38.97% and IV – 37.50%. The statistically significant difference ($P < 0.05$) was found only between 1st and 4th group. The amount of monounsaturated fatty acids in backfat was similar for all feeding groups and was respectively: 43.60%, 42.98%, 44.61% and 45.48%. However the greater differences among the feeding groups were noted in content of polyunsaturated fatty acids. Together with the lengthened period of fattener feeding with the rapeseed oil supplement, the participation of these acids in backfat increased and was respectively: 13.30%, 14.10%, 15.40% and 16.34%. The statistically significant difference ($P < 0.05$) was found between the 1st group of fatteners, fed a diet without rapeseed oil participation and 3th group of fatteners fed from 70 kg of body weight the compound feed wit 6% content of rapeseed oil. PUFA n-6 : n-3 was respectively: 10.98, 9.76, 7.95 and 7.35. The statistically significant differences ($P < 0.05$) were found between 1st and 4th group. 6% rapeseed oil participation in fatteners' diet used from 60 kg of body weight causes significant ($P < 0,05$) decrease of saturated fatty acids content and significant ($P < 0,05$) increase of polyunsaturated fatty acids concentration in backfat. 6% rapeseed oil supplement to fatteners' feed used from 70 kg of body weight significantly ($P < 0,05$) decreases the ratio of polyunsaturated fatty acids from n-6 : n-3 family.

Banaszkiewicz T. 2004 – **Effect of dehulled of rapeseeds on macroelements content and fatty acids composition of broiler carcass** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 573-584.

The aim of this experiment was to investigate calcium, phosphorus, sodium and potassium content and fatty acids composition of carcass of broilers fed rapeseed cakes. The experiment was conducted on 96 broiler chickens "Hybro" divided into six groups, each of 16 birds. In the first of the fourteen days of life, chickens were fed the same standard mixture "starter". During the experiment (from 14 to 28 days of life) chicken were fed semipurified diets, where as the source of protein rapeseed cakes obtained from raw and dehulled rapeseeds of Bor, Polo and Marita cultivars were used. After biological test four birds from each group were killed and drawn. The carcass with giblets was autoclaved and homogenized. Homogenized carcass was analized for calcium, phosphorus, sodium, and potassium content and fatty acid composition. The use of rapeseed cakes from raw and dehulled rapeseed caused statistcal difference of calcium in broilers carcass. For other macroelements their content in carcass was not significantly differentiated among groups. The carcass of chicken's fed diets with rape cake, from dehulled rapeseeds of Bor and Polo cultivar contained more calcium than from raw seeds, while it was inversely for Marita cultivar. The different effect of rapeseed cultivars on the calcium content in broilers carcass as well rapeseed cakes from natural as dehulled seeds was observed. Significant differentiation between groups concerned palmitic, stearinic, oleic and linolenic fatty acids, as well as total of saturated, nonsaturated, monounsaturated, polyunsaturated, hipo- and hipercholesterolemic. The use of rape cake from dehulled seeds to diets caused increase of oleic acid, total of monounsaturated and polyunsaturated acids, decrease of saturated acids in broiler carcass. Hipercholesterolemic acids content was the lowest in carcass of chickens fed diets containing rape cake from dehulled rapeseeds and hipocholesterolemic were more. It points out to profitable effect of dehulled rape seeds on the composition of fatty acids in broilers carcass.

Banaszkiewicz T. 2004 – **Effect of amino acids supplementation of diets containing rapeseed products on slaughter results, chemical composition and protein and energy retention in broiler carcass** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 585-596.

This experiment was conducted on 96 two- week old broiler chickens "Hybro" divided into eight groups, each of 12 chickens (three replicates per group). In the period from the first to fourteenth day of life, chickens were fed the same standard mixture "starters". During two weeks of the experiment (from 14 to 28 days of life) the chickens were fed wheat mixtures containing one of high protein components: commercial soybean meal, commercial rapeseed meal and rapeseed cakes of Marita cultivar. Shortages of lysine, arginine and methionine were supplemented in compliance with the "Normy Żywienia Drobiu" (Standards of Poultry Nourishment) (1996). Wheat-soya bean diet was supplemented with DL-methionine and wheat-rapeseed diets with L-lysine and L-arginine or only L-lysine. The diets were isoprotein and isoenergetic. At the beginning of the test 6 birds were killed. After the test twenty four chickens (three from each group) were killed and the weight of carcass and giblets was estimated. The carcasses were autoclaved, mixed, homogenized and analysed for energy and basic nutrients content. Supplementation of these diets with amino acids resulted in the decrease of heart mass, particularly in groups fed wheat-soya bean diet supplemented with DL-methionine. Mass of liver was not changed in chickens fed diets supplemented with amino acids, but the lowest mass of liver had chickens fed wheat-soya bean diet supplemented with DL-methionine. The highest protein content in dry matter and the lowest fat content were characteristic for the carcass of chickens fed wheat diets containing rapeseed cakes supplemented with L-lysine. Relevant to the diet containing rapeseed oil meal, this supplementation got considerably lower increase than

rapeseed cakes. The higher of protein content and the least of energy was observed in carcasses of chickens fed diet containing Marita rapeseed cakes supplemented with L-lysine.

Micek P., Borowiec F., Marciński M., Barteczko J., Zając T. 2004 – **Effect of linseed–based diets on fatty acid composition and cholesterol content of sheep meat and milk** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (2), p. 597-610.

The objective of this experiment was to determine the effect of diets supplemented with three linseed cultivars (Opal, Omega and Linola) differing in oil fatty acids composition, on fatty acid profile of fat and cholesterol content of sheep meat and milk. Milk was collected from 32 ewes, each suckling 2 Polish Longwool Sheep lambs that were fed meadow hay, grass haylage, maize silage and concentrate mixture (0.8 kg/head). During suckling, the lambs were additionally fed with concentrate mixtures designed for ewes (0.1–0.3 kg/lamb/day). After weaning lambs were fed meadow hay and concentrates (0.4–0.65 kg/head/day). The control group of ewes and lambs (I_K) received no supplemental linseed, whereas groups II_{OP}, III_{OM} and IV_L received 10% of crushed linseed cultivars Opal, Omega and Linola^{TM}947. After 2 months of fattening, 4 lambs from each group were slaughtered. The linseed supplement in diets for suckling ewes caused statistically significant increase in protein content of milk in group III_{OM} and an increase in total unsaturated fatty acids, including $C_{18:1}$, $C_{18:2}$ and $C_{18:3}$, accompanied by a decrease in milk saturated acids in all experimental groups. In fattened lambs, the use of dietary linseed had a significant effect on the fatty acid composition of meat, the results being dependent on the linseed cultivar.

BANASZKIEWICZ T. 2005. **Effect of rape seeds dehulling process on nutritive value of diets contained rape cakes in broiler chickens feeding.** Rośliny Oleiste – Oilseed Crops, XXVI (2): 499-510.

In this investigation the effects of dehulling process on nutritive protein value of wheat-rapeseed diets containing rape cakes from intact and dehulled seeds of three domestic cultivars Bor, Polo and Marita were estimated. The investigations aimed at estimation of selected physical traits (weight of 1000 seeds, size of seeds and percent of hull in seeds), analyses of chemical composition and bioassays on broiler chickens. Parts of seeds of each cultivar were dehulled and chemical analyses were performed. Next, the intact and dehulled seeds were pressed with the preassure of 400 kG/cm^2. The cakes from intact and dehulled seeds of these cultivars were introduced to semisynthetic wheat diet at the level of 20% of total quantity of crude protein in diets. The source of protein for control group was soybean meal. Total protein content in diets was adjusted to 10%. Bioassay experiment was carried out on 112 two-week old broiler Hybro chickens devided into seven groups of 16 chickens (4 × 4 birds). From 1st to 14th day of life chickens were fed typical commercial broiler starter ration and from 14th to 28th day of life were fed experimental diets. The smallest seeds were characteristic for Marita cultivar and the hull percent was the highest in Polo cultivar. Dehulling caused the increase in protein, fat and phosphorus contents and decrease of crude fibre, ADF and ADL. Dehulled seeds contained more glucosinolates and phytic acid. The chickens from control group had the highest daily body gain. The chickens fed diets containing rape cake from intact and dehulled seeds of Polo cultivar and dehulled seeds of Bor cultivar had essentially lower body gain. The results concerning chickens growth showed that the lowest nutritive value was characteristic for diets containing cakes from seeds of Polo cultivar. Consumption of feed and protein had trends similar to body gain. Chickens from control group had the lowest feed and protein intake, the smallest diet intake was found for diets contained rape cake from dehulled seeds of Bor cultivar and for diets containing rape cakes from intact and dehulled seeds of Polo cultivar. The highest value of protein efficiency ratio was obtained for wheat-soybean diet. Protein efficiency ratio (PER) value of diets containing cakes from intact and dehulled seeds of rape was about 7–9% lower than PER of the control diet, but differences of PER values between examined diets did not differ significantly.

CIEŚLAK A., POTKAŃSKI A., SZUMACHER-STRABEL M., JAJOR M., DĘBIŃSKI D., NOWAKOWSKA A. 2005. **Effect of linseed and rapeseed oils on methane concentration and other rumen parameters in vitro**. Rośliny Oleiste – Oilseed Crops, XXVI (2): 511-518.

One of possible methods to decrease methane production is fat addition to ruminant diets. The objective of this study was to determine the influence of applied oils (rapeseed, linseed) on methane production and on some biochemical parameters in rumen fluid. The experiment was based on in vitro study (*batch culture*) with diets composed of forage feed (60%) containing 4 and 6% of oil in dry matter. In this experiment addition of 4 and 6% of rapeseed oil reduced methane production by 4.80 and 6.62% whereas linseed oil by 5.55 and 7.41%. The obtained results confirmed a hypothesis that oil supplementation to diets can decrease methane production without causing negative effects on fermentation patterns and in vitro dry matter digestibility.

CIEŚLAK A., POTKAŃSKI A., SZUMACHER-STRABEL M., JANICKI M., NOWAKOWSKA A., NOWACKA M., SZYMANKIEWICZ E. 2005. **Biohydrogenation of unsaturated fatty acids in in vitro study during digestion of diet supplemented with plant oils.** Rośliny Oleiste – Oilseed Crops, XXVI (2): 519-526.

Plant oils rich in unsaturated fatty acids, supplemented to ruminants' diet can modify processes occurring in the rumen e. g. biohydrogenation. Level of biohydrogenation depends on diets and type of applied oils. The aim of the study was to assay the biohydrogenation *in vitro* of diets composed mostly of roughage and supplemented with 0, 4 or 6% of linseed and rapeseed oil. The experiment was carried out in in vitro study using *batch culture* system. Level of biohydrogenation of unsaturated fatty acids from C_{18} family was estimated. Extent of biohydrogenation depended on type and quality of fat used. Both rapeseed oil and linseed oil significantly affected the increase of the level of stearic acid in rumen fluid after incubation. Increased level of oleic and linolenic acid in the diets supplemented with rapeseed and linseed oils

respectively, caused the increase of their biohydrogenation in the rumen. The level of dietary oils determines direction of processes occurring in the rumen.

OSEK M., JANOCHA A., MILCZAREK A., KLOCEK B. 2005. **Productive and postslaughter results as well as meat flavour on broiler feed mixtures oiled with different plant oils.** Rośliny Oleiste – Oilseed Crops, XXVI (2): 527-536.

The experiment aimed at comparing the effects of feed mixtures oiled with soybean, rapeseed, sunflower and linseed oil on the productive and postslaughter results and on broiler meat flavour. The study was carried out on ROSS 308 meat type broilers divided into 4 groups of 24 each. The broilers were raised during 42 days. The broilers were fed with Starter mixture (12.53 MJ of ME,217 g of crude protein, 11.7 g of lysine per 1 kg) until the 21st day of life, and then they were fed with Grower mixture (12.96 MJ of ME, 199 g of crude protein, 9.7 g of lysine per 1 kg) from the 22nd to 42nd day of life. The mixtures of S group contained soybean oil, those of R group — rapeseed oil, those of SL group — sunflower oil and those of L group — linseed oil. Significantly higher body weight of broilers from S and R groups (2205 and 2208 g, respectively) at the age of 42 days in comparison with L group (2145 g) was proved. Lower feed conversion ratio (1.66 kg/ kg) in broilers fed with mixtures containing soybean oil in comparison with birds of SL and L groups (1.79 and 1.82 kg) was also found. No influence of the oil type on dressing percentage (75.4–76.4%) and broiler fatness was observed, whereas better shore of muscle ($P \leq 0.05$) in bird groups R (46.8%) and SL (45.9%) in comparison with group S (44.4% of muscles in carcasses) was found. The worst flavour evaluation of meat in broilers fed with mixtures containing linseed oil was proved. The results confirmed that from all of tested oils soybean and rapeseed oils were the most advisable to be used in oil mixtures for broiler chickens.

KUŚNIEREK W., POTKAŃSKI A., KUŚNIEREK S. 2005. **Apparent ileal and total digestibility in pigs of protein and amino acids of rapeseed meal before and after extrusion at 140ºC and 160ºC.** Rośliny Oleiste – Oilseed Crops, XXVI (2): 537-548.

The aim of the experiment was to determine apparent total and ileal digestibility in pigs of rapeseed meal extruded at the temperature of 140 and 160ºC. 16 barrows wbp × pbz × Pietrain of 28 kg mean body weight were divided into 4 experimental groups of 4 animals in each. Animals were cannulated using PTVC method (the Post Valve T-Caecum cannula). Four semisynthetic diets contained soyabean meal (gr. I) or soyabean meal partly replaced with rapeseed meal non-extruded (gr. II), extruded at 140ºC (gr. III) or at 160ºC (gr. IV). Rapeseed meals constituted 28.5% (gr. II), 29.4% (gr. III), 29.1% (gr. IV) of diets. Animals were fed individually. Digestibility experiment, which lasted 14 days, was divided in two periods: initial and experimental of 7 days each. Digestibility coefficients were calculated using the difference method and comparing the results of group I with those obtained for groups II, III, IV.

Extrusion, especially at 160ºC, reduced the total and ileal digestibility of protein and amino acids. The total digestibility of protein and amino acids was higher than the ileal digestibility. The applied extrusion treatment failed to increase digestibility of any of amino acids. Changes in total and ileal digestibility of methionine were higher than of lysine. After extrusion the level of glucosinolates was lower, from 12.70 µM/g to 9.70 µM/g and 7.70 µM/g, after extrusion at 140 and 160ºC, respectively. Extrusion had no effect on the level of crude fiber, but increased NDF fraction from 20.62% in non- extruded rapeseed meal to 24.18% and 26.14% in extruded at 140 and 160ºC, respectively.

MISCELLANEOUS

RUDKO T., HAJNOS M., SOKOŁOWSKA Z. 2004 – **An attempt to apply mercury porosimetry method to investigations of microstructure of rapeseed pods** – Rośliny Oleiste – Oilseed Crops n^{o} XXV (1), p. 77-84.

Both native and cultivated plants are characterized by natural tenacity to preserve species in a given area and occupy new areas. Mature fruits of plants, for example pods are prone to break and shedding of seeds. Among cultivated plants, this phenomena is particularly visible and of economic importance in the case of rape because of yield losses from 3 to 20%. This is influenced by external factors and anatomical structure of the pods. A need of understanding of the internal constitution and porous structure of the pods prompted the authors to conduct this study. Mercury intrusion porosimetry was used to determine microstructure of the rape pods and to recognize the reasons of their breakage. The pods of spring rape, variety Star, taken from plants at full maturity growth stage were used in this study. Before measurements of microporosity, susceptibility of the pods to braaking was estimated using bending test. Two groups of the pods, easily and not easily breakable, were separated. To determine microporosity of the pods, the mercury porosimeter Carlo Erba, Model 2000 with maximum mercury intrusion pressure of 200 MPa was used. It was found that easily breakable compared with more resistant pods have a higher total porosity. The content of micropores in easily breakable pods was 2040 mm^3/g and 1460 mm^3/g in more resistant pods. The method proposed can be useful in estimating susceptibility of pods to breaking.

Askew M.F. 2004 – **Novel trends in investigations of *Brassica napus* protein and its designation for non-food use** – Rośliny Oleiste – Oilseed Crops no XXV (2), p. 319-326.

Though a relatively new crop oilseed rape and associated canola species are now the world's third most important vegetable oil and the only significant temperate oilseed in terms of tonnage. Oil content varies around 40% by weight of seed. Whilst oil is usually extracted by expulsion followed by hexane extraction, alternatives based upon enzymatic processes or upon different solvents offer options and whilst the residue from the seed after oil extraction has a market as a feed, especially for ruminants, technologies exist to exploit metabolites from meal in different market places.

Glucosinolates, sulphur compounds, offer some opportunities whilst proteins offer functionality in adhesives, plastics and other sectors, including potential replacements for methyl bromide. A fundamental prioritisation of true value of rapeseed meal is essential if crop output value and potential is to be maximised.

PAUKSZTA D. 2005. **Composite materials obtained from thermoplastic polymers and lignocellulosic materials from rapeseed straw**. Rośliny Oleiste – Oilseed Crops, XXVI (2): 489-498.

World crops of rape oilseed are estimated over 36 million tons. So far, there have not been known any methods of wide exploitation rape stems as a waste material. In this work we present a new method of use lignocellulosic materials from rape in order to manufacture polymer composites. Expected increase in the crops of rape in the context of biofuel production may supply a new source of cheap and easily renewable materials with the potential for polymer filling.

The research work which we have carried out before, shows that the amount of the wooden substance in rape stem exceeds 80% and the average cellulose content in wooden parts of winter rape stem ranges from 35% to 40%.

This study describes a new method of manufacturing composites from rape and thermoplastic polymers. The first stage of the process aimed to obtain this material involves cutting up rape stems into small pieces and removing parenchyma. The next steps are mercerization and modification with the acetic anhydride. Mercerization changes the structure of the native cellulose I to the polimorphic cellulose II and also removes lignin, pectin, waxy substances and natural oils. The modification process leads to improved adhesion between lignocellulosic material and polymer matrix. The composite material is obtained during extrusion process from mixture of commercial granulate of thermoplastic polymer and modified material from rape stems. The composite obtained in a form of granulate is ready for processing, such as injection moulding or press methods. Our previous investigations on composite rape stem/isotactic polypropylene confirm good mechanical properties of this new composite.

The experimental part of this work presents the mechanical properties of composites isotactic polypropylene/rape containing straw of various varieties of winter rape (Kana, Kaszub, Lubusz, Marita, Mazur and Pomorzanin). The investigations have demonstrated that there were insignificant decreases in mechanical properties of composites containing straw from different varieties of rapeseed. The composites containing 15% of lignocellulosic materials from rape display a higher Young's modulus and lower tensile strength as well as lower impact strength as compare with polypropylene matrix.

Mechanical properties and aesthetic quality of products confirm that composites based on thermoplastic polymers and lignocellulosic materials from rape straw are useful for different applications, for example automotive, furniture and building industry.