# The effect of sowing date and seeding rate on the development and yield of different winter oilseed rape (*Brassica napus* L.) cultivars


## SUMMARY

This study investigated the response of open-pollinated (SY Ilona), long-stem hybrid (Advocat), and semi-dwarf hybrid (PX131) cultivars of winter oilseed rape to different sowing dates (20 August, 27 August, 3 September) and seeding rates (30, 50, 70, 90 seeds $m^{-2}$). A small-area field experiment was conducted during three growing seasons (2020/2021, 2021/2022, 2022/2023) in the Agricultural Experiment Station in Bałcyny (53°35'46.4'' N, 19°51'19.5'' E) owned by the University of Warmia and Mazury in Olsztyn, located in north-eastern Poland. The experiment had a split-split-plot design with three replications. The effect of different sowing strategies on the fall growth and development, overwintering success, stand architecture, yield components, seed yield, and straw yield of different winter oilseed rape morphotypes was determined in the study. The results of laboratory analyses of seeds, oil, and fat-free seed residues were also analyzed.

The open-pollinated cultivar was characterized by higher fresh and dry weight of rosette leaves than conventional and semi-dwarf hybrid cultivars. The semi-dwarf cultivar had leaf rosettes with short epicotyls and relatively large root collar diameters. The fall development of the analyzed winter oilseed rape cultivars was determined by environmental and climatic conditions. The leaf rosettes of the open-pollinated and conventional hybrid cultivars had a more desirable habit before winter dormancy in years with more favorable weather conditions in October. The growth rate of leaf rosettes in the semi-dwarf hybrid cultivar was not affected by weather conditions during the summer-fall growing season. The optimal sowing date of winter oilseed rape contributed to rosette development. Delayed sowing induced a decrease in the values of all morphometric parameters of leaf rosettes (the greater the delay in sowing, the weaker the rosette habit at the end of the fall growing season). A low seeding rate (30 seeds $m^2$) contributed to the development of rosettes with the highest number of leaves, the thickest root collars, and taproots with the highest fresh and dry weight. The root collar diameter decreased when the seeding rate was increased to 50 seeds $m^{-2}$. The weights of aerial leaf rosettes and taproots decreased when the seeding rate was increased to 70 seeds $m^{-2}$. In turn, the number of rosette leaves decreased only in response to the seeding rate of 90 seeds $m^{-2}$.

The long-stem hybrid cultivar was characterized by the highest seed yield. The seed yields of the open-pollinated and the semi-dwarf hybrid cultivars were lower by 4–5%. The seed yields of the studied winter oilseed morphotypes were strongly differentiated by environmental and climatic conditions. In years characterized by very wet March and April and dry June, seed yield was highest in the long-stem hybrid cultivar. In years characterized by favorable weather conditions during the spring-summer growing season, the seed yields of the hybrid cultivars were higher than that of the open-pollinated cultivar. Conversely, in years characterized by dry spells in early spring (May), seed yield was highest in the open-pollinated cultivar. Seed yields were lowest when winter oilseed rape was sown on the date recommended for the Ostróda Lakeland (20 August). Sowing delayed by 7 days contributed to a 3% increase in seed yield. A further delay in sowing (early September) did not reduce seed yield relative to sowing in late August and was still more productive than sowing on the optimal date. The response of winter oilseed rape to the sowing date was not influenced by cultivar or weather conditions across years of the study. In winter oilseed rape cultivation, the yield-forming effect of seeding rate was significantly determined by environmental and climatic conditions. High seed yields were obtained at seeding rates of 50 to 90 seeds $m^{-2}$. However, only the seeding rate of 70 seeds $m^{-2}$ contributed to the highest seed yield in all years of the experiment. No interaction was found between seeding rate and winter oilseed cultivar, which implies than the seeding rate of 70 seeds $m^{-2}$ was optimal for both open-pollinated and hybrid cultivars, regardless of morphotype (semi-dwarf, conventional). The open-pollinated and semi-dwarf hybrid cultivars of winter oilseed rape were characterized by higher values of the harvest index than the conventional hybrid cultivar. Sowing delayed by 7 and 14 days had a beneficial influence on the proportion of seeds in the harvested biomass of winter oilseed rape, regardless of cultivar. Seeding rate had no significant effect on the harvest index.

Seeds of the semi-dwarf hybrid cultivar had the highest crude fat content. The oil content of seeds was 3-5% lower in long-stem hybrid and open-pollinated cultivars. Oil extracted from seeds of the semi-dwarf hybrid cultivar had the highest content of monounsaturated fatty acids, mainly due to increased biosynthesis of oleic acid. The sowing strategy (sowing date and seeding rate) had no significant effect on the crude fat and total protein content of winter oilseed rape seeds. Seeds of the semi-dwarf hybrid cultivar were characterized by the highest concentrations of total glucosinolates. In turn, the concentrations of alkenyl glucosinolates were highest in seeds of the open-pollinated cultivar, mainly due to increased biosynthesis of progoitrin. Delayed sowing exerted a beneficial influence on the feed value of seeds by reducing the accumulation of alkenyl glucosinolates (sowing in late August) and total glucosinolates (sowing in early September). Seeding rate had no significant effect on the glucosinolate content of winter oilseed rape seeds.



**Keywords**: winter oilseed rape, cultivar, sowing strategy, seed yield, seed quality.