МІНІСТЕРСТВО ОСВІТИ І НАУКИ УКРАЇНИ

ПОЛТАВСЬКИЙ ДЕРЖАВНИЙ АГРАРНИЙ УНІВЕРСИТЕТ

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СХІДНОЄВРОПЕЙСЬКИЙ ЦЕНТР ФУНДАМЕНТАЛЬНИХ ДОСЛІДЖЕНЬ

«Аграрний бізнес: технології вирощування, зберігання, переробки зернових і олійних культур»

І Міжнародна науково-практична конференція

22 квітня 2025 року

м. Полтава

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Матеріали
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До збірника матеріалів міжнародної науково-практичної конференції ввійшли результати досліджень щодо актуальних проблем технології вирощування, зберігання, переробки зернових і олійних культу та аграрного бізнесу. Матеріали надруковані в авторській редакції.

Редакційна колегія може не розділяти поглядів авторів. Відповідальність за зміст матеріалів, точність наведених фактів, цитат, посилань на джерела, достовірність іншої інформації та за додержання норм авторського права несуть автори.

Аграрний бізнес: технології вирощування, зберігання, переробки зернових і олійних культу»: матеріали І міжнародної науково-практичної конференції, 22 квітня 2025 р. Полтава : ПДАУ, 2025. 126 с.

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water, which play a key role in agriculture, especially in the face of climate change and increasingly frequent droughts.

The research was conducted in 2016-2018 based on two-factor field experiments established in a randomized subblock design (split-block), in 4 replications. The first research factor was the superabsorbent dose (SAP) (0, 20, 30 kg·ha^{-1}), and the second – the faba bean variety (Granit and Bobas).

The yield of faba bean seeds was largely shaped by weather conditions in the years of the study. Regardless of the applied superabsorbent dose and variety, faba bean yielded the best in 2018, worse in 2016, and the weakest in 2017 (yield lower by 23.4 and 38.3%, respectively, compared to 2018). In all years of the study, the yield level depended significantly on the hydrogel dose. The application of superabsorbent at a dose of 20 kg·ha^{-1} (SAP20) increased faba bean yield in the following years by 11.5%, 32.8% and 12.8%, respectively, compared to the control object, where the soil amendment was not applied (SAP0). Further increase of the hydrogel dose to 30 kg·ha^{-1} (SAP30) did not significantly increase faba bean yield. The variety factor did not statistically differentiate seed yield in any year of the experiments. No interactions of the experimental factors with the achieved yield were also demonstrated.

The dose of the superabsorbent used did not significantly affect the total protein content in faba bean seeds in any year of the study or in the average values. The genetic factor differentiated the content of this component in the seeds. In all years of the study, the Bobas variety of faba bean was characterized by a higher average total protein content in seeds compared to Granit, with significant differences being shown in 2016 and 2018 (by 12.3% and 4.7%, respectively). The tested experimental factors did not significantly differentiate the fat content in faba bean seeds.

In summary, the use of superabsorbent significantly increased the yield of faba bean and the most effective dose was 20 kg·ha^{-1}, at which the yield of faba bean seeds increased by an average of 16.6%. The chemical composition of seeds, however, was different only depending on the variety factor.

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SOYBEAN RESPONSE TO COLD STRESS DURING THE FLOWERING BASED ON PHYSIOLOGICAL INDICATORS

Interest in soybean cultivation in Poland, as well as in Europe, continues to grow due to several factors, that favor the expansion of this crop's cultivation area. The most important of these include climate warming and biological progress, which has made available early-maturing varieties well adapted to cultivation under temperate climate conditions (Kusano et al. 2015). Soybean is sensitive to low temperatures, particularly during emergence and flowering stages. Therefore, tolerance to temperature stress is a key factor for the successful cultivation of this species in Poland (Staniak et al. 2021 a,b). The aim of the study was to compare the sensitivity of 16 soybean cultivars to cold stress during the flowering stage based on physiological indicators.

The two-year experiment was carried out in the vegetation hall of the Institute of Soil Science and Plant Cultivation in Puławy (51°24′59″N 21°58′09″E), using a completely randomized design with four replications. The experiment included 15 soybean cultivars: 5 early and very early, 5 medium-early, and 5 late and very late. At the beginning of flowering (BBCH 62), the plants were subjected to cold stress for 7 days in a phytotron (17/13°C day/night). The control plants were maintained under optimal conditions (25/20°C day/night). After the stress period, measurements were taken of leaf gas exchange (net photosynthesis, transpiration) and chlorophyll *a* fluorescence (Fv/Fm and PI indices). Photosynthesis and transpiration measurements were conducted using a Ciras-2 gas analyzer (Portable Photosynthesis Systems Company, WB, USA) under constant conditions: PAR radiation intensity – 1000 μmol CO_2 m^{-2} s^{-1}, CO_2 – 390 ppm (μmol CO_2 mol^{-1} air), and leaf chamber temperature of 20°C. Chlorophyll fluorescence measurements were taken using a HandyPEA portable fluorometer (Hansatech, WB, UK) after 20 minutes of dark adaptation. The study was conducted at three time points: one day after stress (BBCH 63-65), two weeks after stress (BBCH 70-75), and four weeks after stress (BBCH 80-85).

The results showed that cold stress significantly affected photosynthesis rate. In both years, plants exposed to cold during flowering exhibited significantly lower photosynthesis rates at BBCH 63-65 and BBCH 70-75 compared to control plants. At BBCH 80-85, in the first year, stressed plants assimilated CO_2 significantly more than the control, while in the second year, the values were similar (no statistically significant differences). In both years and across all growth stages, significant interactions were observed, indicating cultivar-specific responses to cold stress. Based on average values, a significant reduction in photosynthesis rate was observed in all early and medium-early cultivars, while late cultivars showed only a non-significant trend.

In both years, directly after cold stress (BBCH 63-65), leaf transpiration rate was lower in stressed plants, with significant differences recorded only in the second year. At BBCH 70-75, however, transpiration was significantly higher in stressed plants compared to the control. Significant interactions between experimental factors were noted in both years.

Cold stress significantly affected the maximum quantum yield of photosystem II (Fv/Fm). On average, the stressed plants during flowering showed significantly higher Fv/Fm values than the control. Significant differences were observed at BBCH 63-65 and 70-75 in the first year, and at BBCH 80-85 in the second year. Additionally, early cultivars exhibited higher PSII efficiency compared to medium-early and late cultivars, but only at BBCH 63-65 and 70-75. A significant interaction between the tested factors was noted in the second year.

Regarding the performance index (PI), reflecting the function of PSI and PSII, cold stress generally caused a significant decrease in its value. Significant differences were recorded at BBCH 80-85 in the first year and at BBCH 70-75 and 80-85 in the second year. However, in the first year at BBCH 63-65, cold stress significantly increased the PI value.

In conclusion, the photosynthetic efficiency of soybean leaves was significantly lower in cold-stressed plants compared to those grown under optimal temperature conditions, both immediately and two weeks after stress (BBCH 63-65 and 70-75), regardless of cultivar. Stress conditions also affected chlorophyll fluorescence parameters. After cold exposure during flowering, soybean plants demonstrated significantly higher maximum quantum efficiency of PSII and, in general, higher values of the performance index reflecting the functioning of PSI and PSII.

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PHYSIOLOGICAL RESPONSE OF SOYBEAN TO COLD STRESS DURING THE GERMINATION STAGE

Soybean is one of the most important crops in the world. Due to its versatile use, it ranks fourth globally in terms of cultivated area (after wheat, rice and maize), and it holds first place among leguminous plants. Soybeans are mainly cultivated for seeds used in oil production, while soybean meal remaining after oil extraction is a valuable feed for animals (Bellaloui et al. 2015). In addition to providing food and feed, soybean is also a valuable raw material for the chemical, pharmaceutical and cosmetic industries. As a legume species, it also brings additional economic and ecological benefits through biological fixation in symbiosis with nodule-forming bacteria (Martyniuk 2012). The introduction of thermophilic crops such as soybean into cultivation in Poland is associated with recent climate warming and the lengthening of the growing season in our geographical zone. Also important is the significant progress in breeding, which has enabled the cultivation of new soybean varieties at higher latitudes, significantly expanding the northern range of this species. However, the high sensitivity of soybean to cold in its early developmental stages means, that sowing must