**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**
**І Міжнародної науково-практичної конференції**

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***Відповідальні за випуск:***

***Марія ІЛЬЧЕНКО* –** доцент кафедри біології продуктивності тварин імені академіка О.В. Квасницького, кандидат сільськогосподарських наук, старший дослідник.

***Іван ЖЕЛІЗНЯК* –** завідувач навчально – наукової лабораторії біотехнології відтворення сільськогосподарських тварин імені академіка В.Ф. Коваленка.

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.

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 be delayed in most regions of Poland, which shortens the growing season and limits the cultivation of later-maturing, higher-yielding varieties (Staniak et al. 2021).

The aim of the conducted study was to assess the response of 12 soybean varieties to a 9-day cold stress during the seed germination stage and its impact on physiological indicators in subsequent growth stages.

The two-year study was conducted in the vegetation hall of the Institute of Soil Science and Plant Cultivation – State Research Institute in Puławy (51°24′59″N 21°58′09″E) using a completely randomized design with four replications. The study included 12 soybean varieties, divided into three groups: early and very early, medium-early, and late and very late. The initial stage of the experiment was carried out in MICRO-CLIMA phytotrons (SNIJDERS LABS). The cold stress treatment (11/6°C day/night) was applied for 9 days after sowing, followed by a shift to optimal temperatures (20/15°C day/night). The control treatment was maintained at optimal temperature conditions throughout. In both phytotrons, air humidity was 50%, with a 16/8 h day/night photoperiod and optimal watering.

During vegetation, phenological observations were conducted, along with measurements of leaf gas exchange (net photosynthesis, transpiration) and chlorophyll *a* fluorescence (indicators Fv/Fm, Pi) in four plant growth stages: beginning/full flowering (BBCH 60-65), end of flowering/beginning of pod and seed development (BBCH 67-74), pod and seed development (BBCH 75-79), and pod and seed ripening (BBCH 80-84). Photosynthesis and transpiration rates were measured using a Ciras-2 gas analyzer (Portable Photosynthesis Systems Company, WB, USA) under constant parameters: 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 was measured using a HandyPEA portable fluorometer (Hansatech, WB, UK) after 20 minutes of dark adaptation.

The study showed that soybeans subjected to cold stress at early developmental stages exhibited significantly higher net photosynthesis rate than the control treatment, while in later stages the response was either lower or absent. Significant interactions between the experimental factors were recorded, depending on the plant developmental stage. A similar trend was observed for the transpiration rate. Significantly higher transpiration rate was recorded in cold-stressed soybean plants during BBCH 60-65, while in later stages, differences were generally not statistically confirmed. In all years and growth stages, interactions between the experimental factors were observed.

In both years of the study, cold stress significantly affected the maximum quantum efficiency of photosystem II (Fv/Fm) in almost all growth stages. Post-stress soybean plants generally showed significantly lower Fv/Fm values compared to the control. Cold stress also significantly affected the performance index (PI), which reflects the functioning of photosystems I and II. Soybeans subjected to stress exhibited significantly lower PI values than control plants. In both study years, significant interactions between the experimental factors were observed for both chlorophyll fluorescence indicators.

In conclusion, it was shown, that the photosynthetic efficiency of soybean leaves, regardless of the variety, was initially higher, which was related to increased plant vigor after cold stress. However, in subsequent developmental stages, these differences were no longer statistically confirmed. The slight decreases in maximum quantum efficiency of PSII and reduced PI values indicate minor disturbances in photosystem function caused by cold stress.


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## THE EFFECTS OF CULTIVATION SYSTEM ON WATER USE EFFICIENCY AND YIELD IN MAIZE (*ZEA MAYS* L.)

Maize (Zea mays L.) plays a fundamental role in global agriculture. Statistical data from 2023 indicate that this species, with a cultivated area exceeding 208,23 million ha, ranks second after wheat, surpassing rice. Globally, in 2023, over 1,241,56 million tons of maize grain were produced, with the United States of America, China and Brazil leading in this production (FAOSTAT 2025), which in many regions is the basis of the human and animal diet. The versatile use of corn covers practically all branches of industry. In addition to direct consumption, it is used as energy and bulk feed, as well as a raw material for the production of biofuels, cellulose and adhesives.