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Špoljarević, Marija

Source / Izvornik: **Poljoprivreda, 2016, 22, 54 - 54**

Journal article, Published version

Rad u časopisu, Objavljena verzija rada (izdavačev PDF)

<https://doi.org/10.18047/poljo.22.1.9>

Permanent link / Trajna poveznica: <https://um.nsk.hr/um:nbn:hr:151:882953>

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Download date / Datum preuzimanja: **2024-12-03**



Sveučilište Josipa Jurja
Strossmayera u Osijeku

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The physiological response of soybean cultivars to abiotic stress

Marija Špoljarević

Poljoprivreda/Agriculture

ISSN: 1848-8080 (Online)

ISSN: 1330-7142 (Print)

<http://dx.doi.org/10.18047/poljo.22.1.9>



Poljoprivredni fakultet u Osijeku, Poljoprivredni institut Osijek
Faculty of Agriculture in Osijek, Agricultural Institute Osijek

ISSN 1330-7142

UDK: 633.34:632.1 (043)

DOI: 10.18047/poljo.22.1.9

FIZIOLOŠKI ODGOVOR KULTIVARA SOJE NA ABIOTSKI STRES

Marija Špoljarević, prof. biologije i kemije ⁽¹⁾

Disertacija ⁽²⁾

Među različitim vrstama abiotskoga stresa u proizvodnji soje ističu se sušni, temperaturni i solni stres. Cilj ove disertacije bio je istražiti fiziološke mehanizame reakcije soje na navedene vrste stresa. Istraživanja su provedena sa šest kultivara soje u fazi klijanje - nicanje te dva kultivara u fazi cvatnje. U prvome je pokusu sjeme soje naklijavano u papirnim ručnicima natopljenim vodom ili otopinom određenoga osmotskoga potencijala. Tijekom 7 dana uz kontrolu (20°C, voda) primijenjene su po dvije razine sušnoga (otopina PEG 5% i 10%), solnoga (otopina NaCl 50 i 100 mM) i temperaturnoga stresa (10°C i 30°C, voda). Osim % klijavosti i morfoloških svojstava, analizirani su enzimski i neenzimski pokazatelji stresa u hipokotilu. Najjači stresni učinak imali su viša razina sušnoga stresa te niska temperatura. Visoka je temperatura djelovala povoljno na razvoj klijanaca, a blagi sušni stres imao je primirajući efekt i povećao klijavost. Odabrana dva kultivara u drugome su eksperimentu uzgojena u posudama s tlom na otvorenom do faze cvatnje, nakon čega su izložene različitoj temperaturi (30°C, 10°C i 20°C kao kontrola) tijekom 3 dana u klima komori. Analizirani su pokazatelji učinkovitosti fotosinteze te, kao i u prvom eksperimentu, pokazatelji reakcije biljke na stres u tkivu troliske. Vrlo značajan utjecaj tretmana u obje razvojne faze soje potvrđuje da su primijenjeni tretmani izazvali oksidacijski stres i obrambene reakcije soje.

Ključne riječi: soja, sortna specifičnost, abiotski stres, osmotski stres, sušni stres, solni stres, temperaturni stres

THE PHYSIOLOGICAL RESPONSE OF SOYBEAN CULTIVARS TO ABIOTIC STRESS

Doctoral thesis ⁽²⁾

Drought, temperature and salt stress are the most prominent among different types of abiotic stress in soybean production. This PhD dissertation aimed to investigate the physiological mechanisms of soybean response to the above mentioned stresses.

The research was performed with 6 cultivars in the germination - emergence stage and two cultivars in the flowering stage. In the first experiment, soybean seed was germinated in paper towels soaked in water or the solution with given osmotic pressure. Two levels of drought (5% and 10% PEG solutions), salt (50 and 100 mM NaCl solutions) and temperature stress (10°C and 30°C), as well as a control treatment (20°C, water) were applied through a 7 day germination period. Seed germinability (%) and morphological traits were analysed, as well as enzymatic and non-enzymatic parameters in hypocotyls. The most effective were higher level of drought stress and low temperature. High temperature stimulated seedling development and mild drought stress had a priming effect and increased germination rate. In the second experiment, two cultivars were grown in pots filled with soil and kept in the open until flowering, and afterwards exposed to different temperature degrees (30°C, 10°C and 20°C as control) during 3 days in a climate chamber. The photosynthesis efficiency parameters and, like in first experiment, physiological indicators of plant stress response were determined in the leaf tissue. Highly significant treatment influence on the analysed parameters in the both growth stages, confirms that the applied treatments invoked the oxidative stress and defence reactions in soybean.

Key-words: soybean, varietal specificity, abiotic stress, osmotic stress, drought stress, salt stress, temperature stress

⁽¹⁾ Sveučilište Josipa Jurja Strossmayera u Osijeku, Poljoprivredni fakultet u Osijeku/Josip Juraj Strossmayer University of Osijek, Faculty of Agriculture in Osijek, Kralja P. Svačića 1d, 31000, Osijek, Hrvatska/Croatia (marija.spoljarevic@pfos.hr)

⁽²⁾ Disertacija je obranjena na Sveučilištu Josipa Jurja Strossmayera u Osijeku, Poljoprivrednom fakultetu u Osijeku 15. ožujka 2016. godine pod mentorstvom prof. dr. sc. Tihane Teklić/Doctoral thesis was defended at Josip Juraj Strossmayer University of Osijek, Faculty of Agriculture in Osijek March 15th, 2016 tutored by Prof. Dr. Tihana Teklić