

Zachodniopomorski Uniwersytet Technologiczny w Szczecinie

Małgorzata Mikiciuk

**Wpływ preparatów zawierających substancje antystresowe
na cechy fizjologiczne i plonowanie wybranych gliko- i halofitów
w warunkach stresu solnego**

Szczecin 2013

Recenzenci

BARBARA POLITYCKA

STANISŁAW WOCIÓR

Opracowanie redakcyjne

Krystyna Kaźmierowska

WYDANO ZA ZGODĄ

REKTORA ZACHODNIOPOMORSKIEGO UNIWERSYTETU TECHNOLOGICZNEGO W SZCZECINIE

ISBN 978-83-7663-154-7

WYDAWNICTWO UCZELNIANE ZACHODNIOPOMORSKIEGO UNIWERSYTETU TECHNOLOGICZNEGO W SZCZECINIE

70-311 Szczecin, al. Piastów 50, tel. 91 449 47 60, e-mail: wydawnictwo@zut.edu.pl

Druk: PPH „Zapól” Dmochowski, Sobczyk, Sp.j., 71-062 Szczecin, al. Piastów 42, tel. 91 434 10 21

e-mail: zarzad@zapol.com.pl

Spis treści

Wstęp i cel pracy.....	5
1. Przegląd literatury.....	7
2. Materiał, warunki i metody badań.....	19
2.1. Charakterystyka materiału roślinnego.....	19
2.2. Doświadczenie wegetacyjne.....	20
2.3. Charakterystyka preparatów.....	22
2.4. Metody badań fizjologicznych, pomiarów biometrycznych oraz analiz laboratoryjnych.....	23
2.5. Metody statystyczne.....	25
2.6. Warunki meteorologiczne.....	25
3. Wyniki.....	29
3.1. Parametry wymiany gazowej w liściach.....	29
3.1.1. Natężenie asymilacji CO ₂ , intensywność transpiracji oraz efektywność wykorzystania wody w fotosyntezie.....	29
3.1.2. Przewodność szparkowa dla pary wodnej.....	40
3.1.3. Stężenie CO ₂ w przestworach międzykomórkowych liści.....	44
3.2. Zawartość barwników asymilacyjnych w liściach.....	48
3.2.1. Zawartość chlorofilu „a”.....	48
3.2.2. Zawartość chlorofilu „b”.....	51
3.2.3. Stosunek zawartości chlorofilu „a” do zawartości chlorofilu „b”.....	53
3.2.4. Zawartość chlorofilu całkowitego.....	56
3.2.5. Zawartość karotenoidów.....	59
3.3. Względna zawartość wody w liściach.....	61
3.4. Plon.....	64
3.4.1. Plon świeżej masy części nadziemnej.....	64
3.4.2. Plon owoców truskawki.....	67
3.4.3. Masa pojedynczego owocu truskawki.....	69
3.5. Zawartość kwasu askorbinowego w owocach truskawki.....	71
3.6. Zawartość ekstraktu w owocach truskawki.....	71
3.7. Zawartość kwasów organicznych w owocach truskawki.....	72
3.8. Stosunek zawartości ekstraktu do zawartości kwasów organicznych w owocach truskawki – wskaźnik TSS/TA.....	73
3.9. Zawartość suchej masy w części nadziemnej.....	75
3.10. Liczba liści lub źdźbeł.....	79
3.11. Współczynnik tolerancji na zasolenie.....	80
4. Dyskusja.....	83
5. Wnioski.....	103
Piśmiennictwo.....	105
Summary.....	121
Zusammenfassung.....	123

The impact of preparations containing anti-stress substance on physiological features and yield of selected glyco- and halophytes in conditions of salt stress

Summary

The raised salt content of soil, arising from anthropogenic activity and from natural reasons, is currently one of the most important abiotic stressors, limiting the growth and yield of many plant species. Thus, the plants response to salt concentration is one of the most important topics of research in many branches of science, the plant physiology included.

In the recent years, following the development of modern technologies of plant cultivation, the interest grows in various types of compounds which can fulfil anti-stress functions in a plant, consisting in preventing and mitigating the effects of various types of abiotic stressors. The subject of this paper refers to the research on the complex familiarity with the action of anti-stressors on plants which are in the state of salt stress. The experimental part of the research was conducted between 2008 and 2011 in the vegetation hall of the Faculty of Environmental Management and Agriculture of the West Pomeranian University of Technology in Szczecin. Four independent two-factor vase experiments were started in the system of complete randomization in four repetitions.

The first experimental factor in all of them was the concentration level of salt introduced into the substrate, and the other one was the type of anti-stress foliar preparation. The variants of the other experimental factor were determined in the following way: K – without application of any anti-stress preparation (control variant), A – Algex preparation, H – Hergit preparation, P – Pentakeep®super preparation, R – Resistim preparation. The biological material for tests was strawberry (*Fragaria x ananassa* Duch.), cultivar varieties of ‘Elsanta’ and ‘Salsa’ and two species of *Miscanthus x giganteus* Greff and Deu. as well as *Spartina pectinata* Bosc ex Link. Selected physiological, biometric features and some yield parameters of the tested plants were evaluated.

The growing concentration of sodium chloride in the substrate had a crucial impact on the determined physiological and biometric features, both in the case of strawberry (glycophyte) and in the tested grass species (halophiles). In all development stages of the tested strawberry, the sodium chloride caused a reduction in the number of leaves, the efficiency of water consumption in photosynthesis, water vapour stomatal conductance, CO₂ concentration in the intercellular spaces of leaves, the content of total chlorophyll, carotenoids and water in leaves as well as an increase in the dry mass content in the part over the ground. In the case of ‘Salsa’ variety, in all development stages, it reduced the intensity of photosynthesis and transpiration processes.

The application of all anti-stress preparations increased the content of total chlorophyll and carotenoids in the leaves of the plants tested, growing in the substrate of differentiated concentration of sodium chloride. All the preparations applied increased the efficiency of water use in photosynthesis, in the analysed development stages of ‘Elsanta’ variety, growing on a substrate with an addition of salt in smaller doses, and of the ‘Salsa’ variety in conditions of the highest salt content. In the case of *Miscanthus x giganteus* Greff und Deu., growing in the conditions of a smaller salt content, a positive impact on the above features was noted in the case

of Algex, Pentakeep®super and Hergit preparations. All the anti-stress preparations applied increased the water stomatal conductance in the case of strawberries growing in the conditions of the highest salt content.

The fruit yield and the unit mass of fruit of the tested strawberry variety got smaller, following the increase in salt content. Foliar application of anti-stress preparations increased the above-mentioned features of the strawberries, growing in the conditions of salt stress of differentiated intensity.

The coefficient of tolerance to salt content of the strawberry and *miscanthus giganteus* got reduced with the increase in the substrate salt content. In the case of *spartina pectinata*, growing in conditions of salt stress of differentiated intensity, the values of this coefficient were similar.

The preparations applied, in particular those containing in their content the 5-amino-levulinic acid, showed anti-stress action on plants tested, growing in the conditions of raised salt content which is testified by the dependencies proved.