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## 学 位 論 文 要 旨

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題目: **RECOVERY FROM AUTOTOXICITY IN LISIANTHUS AND STRAWBERRY BY AMINO ACIDS APPLICATION**

( アミノ酸施与によるトルコギキョウおよびイチゴの自家中毒回避 )

Autotoxicity is an intraspecific allelopathy when a plant releases toxic chemical substances into the environment that inhibit germination and growth of same plant species. It has been reported to occur in a wide number of plant species causing serious autotoxic problems. Lisianthus [*Eustoma grandiflorum* (Raf.) Shinn] and strawberry (*Fragaria × ananassa* Duch.) is grown in closed hydroponic culture. Under such conditions plant's roots are able to release allelochemicals mainly benzoic acid causing damage to the root cells, which in turns hamper water and mineral nutrient absorption. As a result, the growth and yield are reduced greatly. Supply of nutrients alternatively other than root uptake, can sustain plant growth during this allelochemical stress. Recently, amino acids have been used as foliar application on many plant species in order to improve the growth and yield during different abiotic and biotic stresses. In this study, foliar application of amino acids was investigated for the recovery of plant growth and yield of lisianthus and strawberry under autotoxicity developed in the closed hydroponic system.

For lisianthus and strawberry, water soluble amino acids were investigated through several experiments. The concentrations of all amino acids were adjusted to nitrogen content of Proline (Pro) at 200 mg L<sup>-1</sup>. In case of lisianthus, twenty three water soluble amino acids were applied on seedlings which grown under controlled environmental condition either in renewed or non-renewed nutrient solution. Compared to the control, Histidine (His) and *Gamma*-aminobutyric acid (GABA) application increased the dry matter contents in renewed nutrient solution. In non-renewed nutrient solution, higher dry matter was produced by the Pro and Glutamine (Gln) treated seedlings, meanwhile

Alanine (Ala) treated seedlings produced the lowest dry matter.

Based on the seedling growth in non-renewed nutrient solution six amino acids Gln, Glycine (Gly), Pro, Methionine (Met), Leucine (Leu) and His were selected for further investigation along with Betaine (Bet) as a new amino acid following seedling grown in horticultural soil. The application of the aforementioned amino acids increased seedling height in horticultural soil. Higher shoot fresh weight and root length were observed in Pro treated seedlings. Amino acids treated seedlings experiment was continued under solution culture with either foliar application of amino acids or water in the greenhouse. Plant height was increased in all amino acids treated plants. Unlike urea, Leu and Bet, continuous application of His did not improve shoot dry weight but earlier flowering of lisianthus was evidenced.

In case of strawberry, a total of twenty two water soluble amino acids were sprayed in greenhouse setting. It was found that, growth and yield of strawberry plants grown in non-renewed nutrient solution was significantly reduced compared to plants that grown in renewed nutrient solution. When plants grown in non-renewed solution and were sprayed with Ala, Cysteine (Cys), Glutamic acid (Glu), Hydroxy-proline (Hyp), Lysine (Lys), Threonine (Thr), Tryptophan (Trp), His and Phenylalanine (Phe), the growth improved whereas, yield were improved by spraying of Ala, Asparagine (Asn), Aspartic acid (Asp), Cys, Glu, Gln, Hyp, Lys, Ornithine (Orn), Thr, Trp, His, Phe and Valine (Val). Regarding to growth and yield performance, Ala, Glu, Hyp, Thr, His and Phe were selected for further investigation along with GABA following Wagner's pot based hydroponic system and also *in vitro* condition. Glu and Hyp sprayed on plants increased over 50% fruit yield compared to control in Wagner's pot based hydroponic system.

Our results confirmed the effects of amino acids on strawberry plant growth during autotoxicity, following *in vitro* culture. Compared to control, leaf dry weight was increased in Hyp treated plantlets and root dry weight of Ala, Glu, Hyp, Thr and GABA treated plants were increased against control.

Considering the growth and yield improvement, foliar application of His on lisianthus and Glu and Hyp on strawberry plants is suggested to recover the decreased growth and yield during autotoxicity in closed hydroponic culture.

※なお、一部図表等を割愛しています。