1-Certain Growth and Metabolic Indices of Stress induced by Visible Light and UV Radiation in Broad Bean Seedlings

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Abstract

Certain growth and metabolic indices of stress induced by visible light and UV radiation in broad bean seedlings. Phyton.(Horn, Austria) 52 (2): 203-218. The effects of either visible light or UV-radiation on growth and metabolism of broad bean (Vicia faba) seedlings were investigated. Exposure of seedlings to low and high visible light and UV-radiation, either alone or in combination, induced variable significant decreases in the levels of growth parameters throughout the experimental period, as compared with values of control seedlings grown in darkness or ambient visible light. In addition, induced pronounced significant changes in the total amount and in the relative composition of pigment fraction contents, associated with significant variable decreases in photosystem II (PSII) activity were observed. In relation to controls, direct exposure of broad bean seedlings to visible light and UV-radiation, induced significant variable changes in the total amount and in the relative composition of the carbohydrate pool. Concurrently with carbohydrate changes, significant variable increases in the activities of both invertase and a-amylase of broad bean seedlings were maintained throughout the entire period of the experiment.

Keywords: Vicia faba; growth parameters; photosynthetic pigments; PSII; carbohydrates; invertase; alpha-amylase

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2-Exogenously applied ascorbic acid ameliorates detrimental effects of NaCl and mannitol stress in *Vicia faba* seedlings

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Abstract

The adverse effects of either NaCl or mannitol on growth, nitrogen content, and antioxidant system in Vicia faba seedlings were investigated. The role of exogenous ascorbic acid in increasing resistance to these stressors was also evaluated. Thus, with an increase in concentration of either NaCl or mannitol in culture media, a progressively greater significant decrease in percentage germination, in growth parameters, and in nitrogen constituents of the germinating beans, was observed. On the other hand, amide-, nitrate-, and total soluble-N contents appeared to show a progressive significant increase. Exogenous addition of ascorbic acid (4 mM) to the stressful media induced a pronounced significantly increased percentage germination and the growth attributes, whereas nitrogen constituents were variably changed in relation to values maintained in beans treated with either NaCl or mannitol. Furthermore, exogenous addition of ascorbic acid to NaCl or mannitol media induced a significant increase in the contents of ascorbate and glutathione and enzymatic antioxidant activities, in particular, in beans treated with the three highest concentrations of NaCl or mannitol, throughout the period of the experiments (12 days). Thus, ascorbic acid ameliorates the adverse effects of the stressful media; the magnitude of amelioration being a function of the type and the concentration of the stressful agent as well as of the duration of treatment. The importance of the above-mentioned changes in growth and metabolism to stress tolerance in broad bean is discussed.

Keywords: Vicia faba; NaCl; Mannitol; Ascorbic acid; Growth; Nitrogen constituents; Antioxidant system

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3-Salinity-biofertility interactive effects on nitrogen and phosphorus metabolites and enzyme activities in *Lactuca sativa*

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Abstract

In contrast with a progressively greater significant increase in NO (3)(-)-N and total soluble-N (TSN) as well as in phospholipid-P contents. an opposite pattern of changes in NH(4)(+)-N, protein-N and total-N (TN) as well as in inorganic-, organic-and total-P contents was obtained with an increase in concentration of NaCl used, in relation to water control levels. Although a significant increase in NH(4)(+)-N, protein-N and TN contents was obtained concurrently with a significant greater decrease in NO(3)(-)-N and TSN contents of the salinized plants fortified with phosphorein, yet addition of nitrobein to the saline culture media induced an additive increase in the contents of all N fractions determined, in relation to respective saline control levels. Furthermore, either an additive significant increase or significant decrease in all P fractions determined was obtained in response to treatment with phosphorein or nitrobein, respectively. The activities of nitrate reductase (NR), asparaginase (AS), glutamine synthetase (GS) and acid phosphatase showed, in general, significant variable increases in response to treatment with phosphorein, as compared with the activities in salinized lettuce plants. On the other hand, these enzyme activities in lettuce plants treated with NaCl in combination with nitrobein biofertilizer, showed additive significant decreases, throughout the entire period of the experiment. The present results with lettuce plants are discussed in relation to applicability of two biofertilizers to sodic salty soils in Egypt.

Keywords: Enzyme activities; lettuce; nitrobein; phosphorein; salinity

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4-Plant growth, metabolism and adaptation in relation to stress conditions.

XXIV. Salinity-biofertility interactive effects on proline, glycine and various antioxidants in *Lactuca sativa*

Younis, ME (Younis, M. E.)[1]; Hasaneen, MNA (Hasaneen, M. N. A.)[1]; Tourky, SMN (Tourky, S. M. N.)[1]

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Abstract

Proline and glycine contents in lettuce plants appeared to show additional significant increments, in response to treatment with phosphorein biofertilizer, above those increments maintained in response to salinization. Administration of nitrobein biofertilizer to the NaCl media led to significant increases in proline and glycine contents above the water control levels, but the amino acid content of NaCl-treated plants appeared consistently higher than that content in NaCl + nitrobein-treated plants. Supplemental addition of phosphorein to the salinized culture media induced significant increases in the contents of antioxidant compounds, throughout the experimental period. As compared with the saline control values, total ascorbate (ASA + DASA) and total glutathione (GSSG + GSH) contents were found either to decrease (with 4 & 6 mmhos NaCl) or to increase (with 8 & 10 mmhos NaCl) significantly in response to addition of nitrobein to the saline culture media. The activities of superoxide dismutase (SOD), catalase (CAT), ascorbate peroxidase (APO) and glutathione reductase (GR) in the salinized lettuce plants fortified with the recommended dose of phosphorein or nitrobein were, in general, significantly up-regulated above the salinized control levels; the magnitude of up-regulation being dependent on the concentration of NaCl, the stage of growth and on the enzyme under investigation. With lettuce plants, the present results are discussed in relation to applicability of two biofertilizers to sodic salty soils in Egypt.

Keywords: Lettuce; salinity; biofertilizers; amino acids; antioxidant compounds

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5-Plant growth, metabolism and adaptation in relation to stress conditions. XXI. Reversal of harmful NaCl-effects in lettuce plants by foliar application with urea

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Abstract

In relation to water control levels, administration of NaCl at low (3 dSm(-1)), medium (5 dSm(-1)) or high (7 dSm(-1)) concentration, in the growth medium of the lettuce plants, induced significant decreases in growth components as well as in the metabolites and enzymes determined, at vegetative and adult growth stages. On the other hand, significant increases in all growth and photosynthetic components determined, as well as in carbohydrate contents and in the activities of the antioxidant enzymes were obtained, above the water control levels, in response of treatment of lettuce plants with urea fertilizer up to 4 %, above which urea at 5% and 6% induced significant decreases in all the above mentioned components, throughout the entire periods of the experiments. Foliar application of urea up to 5 % to the variously salinized lettuce plants induced significant increases in all growth components as well as in all metabolites determined as compared with values of control-salinized plants. At 6% urea, significant decreases in growth parameters and in metabolites determined for the variously salinized plants were apparent. Thus, foliar application of urea can, at least, partially alleviate the inhibitory effects of salinity on growth and metabolism of lettuce plants; the magnitude of response being most pronounced with 3-4% urea.

Keywords: antioxidant enzymes; carbohydrates; growth; Lactuca sativa; NaCl; photosynthetic efficiency; urea

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6-Plant growth, metabolism and adaptation in relation to stress conditions XXIII. Salinity-biofertility interactive effects on growth, carbohydrates and photosynthetic efficiency of *lactuca sativa*

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Abstract

The interactive effects of different levels of NaCl and two biofertilizers on certain aspects of growth and metabolism of lettuce plants were investigated. The addition of a recommended dose of phosphorein biofertilizer to salinized soil, induced significant increases in all growth and reproductive parameters determined in growing lettuce plants. On the other hand, fertigation of such sodic salty soil with a recommended dose of nitrobein biofertilizer, induced slight decreases in the growth and reproductive parameters. The carbohydrate as well as pigment components and the activity of PS II of the salinized lettuce plants fertigated with phosphorein, were increased throughout the three successive growth stages, above the control levels. On the other hand, nitrobein did slight changes in all the metabolites determined, throughout the entire period of the experiment. The results are discussed in relation to applicability of the biofertilizers to sodic salty soil.

Keywords: lettuce; salinity; biofertilizers; growth; carbohydrates; pigments; PS II activity

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7-Plant growth, metabolism and adaptation in relation to stress conditions. XXVII. Can ascorbic acid modify the adverse effects of NaCl and mannitol on amino acids, nucleic acids and protein patterns in *Vicia faba* seedlings?

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Abstract

The adverse effects of either NaCl or mannitol on amino acids, protein patterns and nucleic acids in Vicia faba seeds were investigated. The exogenous addition of 4 mM ascorbic acid to the stressing media in which the broad bean seeds were germinated in combination with either the ionic (NaCl) or osmotic (mannitol) stressor induced significant protective changes in the total amount and in the relative composition of amino acids in general and in proline, glycine, glutamic, aspartic, alanine and serine in particular. It also induced changes in nucleic acids (RNA and DNA) content. These changes occurred throughout the entire period of the experiments (12 days). Separate administration of NaCl or mannitol enhanced the occurrence of particular novel proteins that were not detected in control bean seeds (water medium). Protein banding patterns of broad bean seedlings treated with NaCl or mannitol in combination with 4 mM ascorbic acid showed different de novo protein bands, with different molecular weights, at different stages of seedlings growth, with lower levels or a nearly complete absence of the major stress proteins. The pattern of changes for amino acids and nucleic acids and the range of protein bands extracted from the variously treated broad bean seedlings indicate a positive role of ascorbic acid in the alleviation of the damage effects induced by NaCl and mannitol. The importance of this role in the stress tolerance of broad beans is discussed.

Keywords: Ascorbic acid; Amino acids; DNA; Mannitol; NaCl; Protein

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