1. Physiological Studies of Some Polyamines on Wheat Plants Irrigated with Waste Water. I. Osmolytes in Relation to Osmotic Adjustment and Grain Yield

Aldesuquy, HS (Aldesuquy, H. S.)[1]; Haroun, SA (Haroun, S. A.)[2]; Abo-Hamed, SA (Abo-Hamed, S. A.)[2]; Al-Saied, AA (Al-Saied, A. A.)[2]

[1] Albaha Univ, Fac Sci, Dept Biol, Albaha, Saudi Arabia
[2] Mansoura Univ Egypt, Fac Sci, Dept Bot, Mansoura, Egypt

Abstract:

A pot experiment was conducted to evaluate the beneficial effect of grain pre-soaking in spermine (0.15 mM), spermidine (0.30 mM) and their interaction on tolerance of wheat (Triticum aestivum L. cv Sakha 94) plants irrigated with waste water mostly polluted by heavy metals. Osmotic pressure (OP), some osmolytes concentration and grain yield were determined. Waste water at all examined concentrations caused marked increases in OP, osmolytes [proline, organic acids, chloride and heavy metals (Cd(++), Pb(++), Cu(++), Ni(++) & Zn(++))] content in flag leaves of wheat plants at heading and anthesis stages. On the other hand, waste water stress induced marked decreases in total soluble nitrogen (TSN), total soluble sugars (TSS) and ions (Na(+), K(+) & Ca(++)) as well as grain yield. Exogenous application of polyamines either spermine, spermidine or their interaction mitigated the deleterious effects of waste water on wheat plants. The effect was more pronounced with spermine + spermidine treatment. The applied polyamines increased the osmotic pressure, TSN, TSS, proline, organic acids and ions (Na(+), K(+), & Ca(++)) concentration as well as grain yield. The osmotic pressure appeared to depend mainly on proline, organic acids, chloride and heavy metals content, where there is positive correlations between OP and proline, organic acids, and heavy metals. The economic yield (grain yield) was positively correlated with TSN, TSS and ion contents but negatively correlated with proline, organic acids, chloride, heavy metals and OP

Keywords: Grain yield; wheat; osmotic pressure; osmoprotectants; polyamines; Triticum aestivum; waste water

Published In: PHYTON-ANNALES REI BOTANICAE **Volume:** 50 **Issue:** 2 **Pages:** 263-286 **Published:** FEB 7 2011

References

1. Title: RESPONSE OF OLIVE AND ALMOND ORCHARDS TO PARTIAL IRRIGATION UNDER DRY-FARMING PRACTICES IN SEMI-ARID REGIONS .2. PLANT-SOIL WATER RELATIONS IN OLIVE DURING GROWING SEASON

Author(s): ABDELRAH.AA; ELSHARKA.HM
Source: PLANT AND SOIL Volume: 41 Issue: 1 Pages: 13-31 DOI: 10.1007/BF00017940 Published: 1974

2. Title: Effect of different cadmium concentration on growth, photosynthesis and ion relation of wheat.
Author(s): Abo-Kassem, E. M.; El-Din, A. S.; Mohamed, Y. A. H.; et al.
Source: Egyptian Journal of Physiological Sciences Volume: 21 Issue: 1 Pages: 41-51 Published: 1997

3. Title: [not available]
Author(s): AGHABARATI A
Source: J ENVIRON SCI Volume: 2 Pages: 281 Published: 2008

4. Title: [not available]
Author(s): ALBERTS B
Source: MOL BIOL CELL Pages: 779 Published: 2002

5. Title: Involvement of polyamines in plant response to abiotic stress
Author(s): Alcazar, Ruben; Marco, Francisco; Cuevas, Juan C.; et al.
Source: BIOTECHNOLOGY LETTERS Volume: 28 Issue: 23 Pages: 1867-1876 DOI: 10.1007/s10529-006-9179-3 Published: DEC 2006

6. Title: Ameliorating effect of kinetin on pigments, photosynthetic characteristics, carbohydrate contents and productivity of cadmium treated Sorghum bicolor plants
Author(s): Aldesuquy, H. S.; Haroun, S. A.; Abo-Hamed, S. A.; et al.
Source: Acta Botanica Hungarica Volume: 46 Issue: 1-2 Pages: 1-21 DOI: 10.1556/ABot.46.2004.1-2.1 Published: 2004

7. Title: Effect of glycine betaine and salicylic acid on growth and productivity of droughted wheat cultivars: 1-Osmolytes in relation to osmotic adjustment and grain yield
Author(s): Aldesuquy, HS; Abo-Hamed, SA; Abbas, MA; et al; Elhakem, AH.
Source: J Environ Sci Mans Univ Volume: 37 Pages: 13-33 Published: 2009

8. Title: Roles of glycine betaine and proline in improving plant abiotic stress resistance
Author(s): Ashraf, M.; Foolad, M. R.
Source: ENVIRONMENTAL AND EXPERIMENTAL BOTANY Volume: 59 Issue: 2 Pages: 206-216 DOI: 10.1016/j.envexpbot.2005.12.006 Published: MAR 2007

9. Title: [not available]
Author(s): ASLAM M
Source: PLANT PHYSIOL Volume: 5 Pages: 623 Published: 1984

10. Title: Polyamines in relation to ammonium-inhibited growth in suspension-cultured rice cells
Author(s): Chen, SJ; Kao, CH
Source: BOTANICAL BULLETIN OF ACADEMIA SINICA Volume: 37 Issue: 3 Pages: 197-200 Published: JUL 1996

11. Title: Enhancement of tolerance of abiotic stress by metabolic engineering of betaines and other compatible solutes
Author(s): Chen, THH; Murata, N
Source: CURRENT OPINION IN PLANT BIOLOGY Volume: 5 Issue: 3 Pages: 250-257 DOI: 10.1016/S1369-5266(02)00255-8 Published: JUN 2002

12. Title: [not available]
Author(s): CLESCREI LS
Source: STANDARD METHODS EX Published: 1998
Times Cited: 1 (from All Databases)

13. Title: Distribution of cadmium in leaves of Thiaspi caerulescens
Author(s): Cosio, C; DeSantis, L; Frey, B; et al.
Source: JOURNAL OF EXPERIMENTAL BOTANY Volume: 56 Issue: 412 Pages: 765-775 DOI: 10.1093/jxb/eri062 Published: FEB 2005

14. Title: PUTRESCINE EXTENDS EFFECTIVE POLLINATION PERIOD IN COMICE PEAR (PYRUS-COMMUNIS L) IRRESPECTIVE OF POSTANTHESIS ETHYLENE LEVELS
Author(s): CRISOSTO, CH; LOMBARD, PB; RICHARDSON, DG; et al.
Source: SCIENTIA HORTICULTURAE Volume: 49 Issue: 3-4 Pages: 211-221 DOI: 10.1016/0304-4238(92)90158-9 Published: MAR 1992

15. Title: [not available]
Author(s): DAVID ES
Source: PLANT PHYSIOL Volume: 109 Pages: 1427 Published: 1995

16. Title: Response to cadmium in higher plants
Author(s): di Toppi, L. Sanita; Gabbrielli, R.
Source: Environ. Exp. Bot. Volume: 41 Pages: 105-130 DOI: 10.1016/S0098-8472(98)00058-6 Published: 1999

17. Title: Changes in antioxidant enzyme activities in soybean under cadmium stress
Author(s): Ferreira, RR; Fornazier, RF; Vitoria, AP; et al.
Source: JOURNAL OF PLANT NUTRITION Volume: 25 Issue: 2 Pages: 327-342 DOI: 10.1081/PLN-100108839 Published: 2002

18. Title: DIFFERENTIAL-EFFECTS OF DROUGHT AND LIGHT LEVELS ON ACCUMULATION OF CITRIC AND MALIC-ACIDS DURING CAM IN CLUSIA
Author(s): FRANCO, AC; BALL, E; LUTTGE, U
Source: PLANT CELL AND ENVIRONMENT Volume: 15 Issue: 7 Pages: 821-829 DOI: 10.1111/j.1365-3040.1992.tb02149.x Published: SEP 1992

19. Title: Pyruvic acid II. The determination of keto acids in blood and urine
Author(s): Friedemann, TE; Haugen, GE
Source: JOURNAL OF BIOLOGICAL CHEMISTRY Volume: 147 Issue: 2 Pages: 415-442 Published: FEB 1943

20. Title: [not available]
Author(s): GALSTON AW
Source: LECT COURSE POLYAMIN Volume: 27 Published: 1991

21. Title: [not available]
Author(s): GARDEY L
Source: BUENOS AIRES ARGENTI Volume: 956 Pages: 1113 Published: 2003

22. Title: Comparison of uptake and distribution of cadmium in different cultivars of bread and durum wheat
Author(s): Greger, M; Lofstedt, M
Source: CROP SCIENCE Volume: 44 Issue: 2 Pages: 501-507 Published: MAR-APR 2003

23. Title: [not available]
Author(s): GROPPA D
Source: PLANT SCI Volume: 164 Pages: 293 Published: 2003

24. Title: [not available]
Author(s): HANSEN EM
Source: PLANT SOIL Volume: 6 Pages: 101 Published: 1988

25. Title: Kinetin-induced modification in growth criteria, ion contents and water relations of sorghum plants treated with cadmium chloride.
Author(s): Haroun, S. A.; Aldesuquy, H. S.; Abo-Hamed, S. A.; et al.

Source: Acta Botanica Hungarica Volume: 45 Issue: 1-2 Pages: 113-126 Published: 2003

26. Title: Plant cellular and molecular responses to high salinity
Author(s): Hasegawa, PM; Bressan, RA; Zhu, JK; et al.
Source: ANNUAL REVIEW OF PLANT PHYSIOLOGY AND PLANT MOLECULAR BIOLOGY Volume: 51 Pages: 463-499 DOI: 10.1146/annurev.arplant.51.1.463 Published: 2000

27. Title: Alterations in the mineral nutrition of pea seedlings exposed to cadmium
Author(s): Hernandez, LE; CarpenaRuiz, R; Garate, A
Source: JOURNAL OF PLANT NUTRITION Volume: 19 Issue: 12 Pages: 1581-1598 DOI: 10.1080/01904169609365223 Published: 1996

28. Title: [not available]
Author(s): HIRAM C
Source: THESIS U TEXAS EL PA Published: 2005

29. Title: [not available]
Author(s): IAZI A
Source: EXP BOT Volume: 36 Pages: 1716 Published: 1985

30. Title: [not available]
Author(s): IBRAHEEM FI
Source: THESIS FAC SCI U MAN Published: 1999

31. Title: Glycine betaine and shikimic acid - Induced modification in growth criteria, water relation and productivity of droughted Sorghum bicolor plants.
Author(s): Ibrahim, AH; Aldesuquy, HS
Source: PHYTON-ANNALES REI BOTANICAE Volume: 43 Issue: 2 Pages: 351-363 Published: 2003

32. Title: [not available]
Author(s): JIHONG L
Source: PLANT BIOTECHNOLOGY Volume: 24 Pages: 117 Published: 2007

33. Title: Proline accumulation in two bean cultivars under salt stress and the effect of polyamines and ornithine
Author(s): Jimenez-Bremont, JF; Becerra-Flora, A; Hernandez-Lucero, E; et al.
Source: BIOLOGIA PLANTARUM Volume: 50 Issue: 4 Pages: 763-766 DOI: 10.1007/s10535-006-0126-x Published: DEC 2006

34. Title: [not available]

Author(s): JONATHAN J
Source: NEW PHYTOL Volume: 172 Pages: 261 Published: 2006

35. Title: [not available]
Author(s): JUWARKER AS
Source: PLANT BIOTECHNOL Volume: 24 Pages: 117 Published: 1986

36. Title: Polyamines and plant morphogenesis
Author(s): Kakkar, RK; Nagar, PK; Ahuja, PS; et al.
Source: BIOLOGIA PLANTARUM Volume: 43 Issue: 1 Pages: 1-11 DOI: 10.1023/A:1026582308902 Published: 2000

37. Title: Polyamines and senescence of maintenance foliage of tea, Camellia sinensis L
Author(s): Kakkar, RK; Nagar, PK
Source: BIOLOGIA PLANTARUM Volume: 38 Issue: 1 Pages: 153-157 DOI: 10.1007/BF02879652 Published: 1996

38. Title: RELATION OF POLYAMINE SYNTHESIS AND TITER TO AGING AND SENESCENCE IN OAT LEAVES (View record in MEDLINE)
Author(s): KAURSAWHNEY, R; SHIH, LM; FLORES, HE; et al.
Source: PLANT PHYSIOLOGY Volume: 69 Issue: 2 Pages: 405-410 DOI: 10.1104/pp.69.2.405 Published: 1982

39. Title: Stress responses of tobacco cells to high temperature and salinity. Proline accumulation and phosphorylation of polypeptides
Author(s): Kuznetsov, VV; Shevyakova, NI
Source: PHYSIOLOGIA PLANTARUM Volume: 100 Issue: 2 Pages: 320-326 DOI: 10.1034/j.1399-3054.1997.1000214.x Published: JUN 1997

40. Title: [not available]
Author(s): LEE DW
Source: PLANT BIOLOGY Volume: 37 Pages: 195 Published: 1994

41. Title: [not available]
Author(s): LEE VG
Source: ENVIRON EXP BOT Volume: 63 Pages: 19 Published: 2008

42. Title: [not available]
Author(s): LIN W
Source: J HAZARDOUS MAR Volume: 154 Pages: 818 Published: 2008

43. Title: Relationship between ATPase activity and conjugated polyamines in mitochondrial membrane from wheat seedling roots under osmotic stress
Author(s): Liu, HP; Liu, J; Zhang, YY; et al.
Source: JOURNAL OF ENVIRONMENTAL SCIENCES-CHINA Volume: 16 Issue: 5 Pages: 712-716 Article Number: 1001-0742(2004)16:5<712:RBAAAC>2.0.TX;2-H Published: 2004

44. Title: Effect of osmotic stress on the activity of H+-ATPase and the levels of covalently and noncovalently conjugated polyamines in plasma membrane preparation from wheat seedling roots
Author(s): Liu, HP; Yu, BJ; Zhang, WH; et al.
Source: PLANT SCIENCE Volume: 168 Issue: 6 Pages: 1599-1607 DOI: 10.1016/j.plantsci.2005.01.024 Published: JUN 2005

45. Title: [not available]
Author(s): MALLAN HI
Source: SEED SCI RES Volume: 8 Pages: 445 Published: 1998

46. Title: [not available]
Author(s): MARUTHI BBS
Source: ENVIRON EXP BOT Volume: 54 Pages: 131 Published: 2005

47. Title: Accumulation of four metals in tissues of Corchorus olitorius and possible mechanisms of their tolerance
Author(s): Mazen, AMA
Source: BIOLOGIA PLANTARUM Volume: 48 Issue: 2 Pages: 267-272 DOI: 10.1023/B:BIOP.0000033455.11107.97 Published: 2004

48. Title: [not available]
Author(s): MOINUDDIN S
Source: ENV AGRON J Volume: 97 Pages: 1062 Published: 2005

49. Title: [not available]
Author(s): NASSER AH
Source: THESIS U AIN SHAMS C Published: 1997

50. Title: [not available]
Author(s): NASSER LE
Source: J BIOL Volume: 3 Pages: 107 Published: 2001

51. Title: [not available]
Author(s): NIKOLAOS EI

Source: BIOCHIM BIOPHYS ACTA Volume: 1767 Pages: 1372 Published: 2007

52. Title: Effect of Cd on plasma membrane ATPase from plant roots differing in tolerance to Cd

Author(s): Obata, H; Inoue, N; Umebayashi, M

Source: SOIL SCIENCE AND PLANT NUTRITION Volume: 42 Issue: 2 Pages: 361-366 Published: JUN 1996

53. Title: STIMULATION OF GROWTH AND NITRATE ASSIMILATION IN LEUCAENA-LEUCOCEPHALA SEEDLINGS IN RESPONSE TO SPERMIDINE SUPPLY

Author(s): PANDEY, S; SRIVASTAVA, HS

Source: BIOLOGIA PLANTARUM Volume: 37 Issue: 1 Pages: 153-157 DOI: 10.1007/BF02913012 Published: 1995

54. Title: [not available]

Author(s): PINE NW

Source: MODERM METHODS PLANT Pages: 23 Published: 1955

55. Title: Biochemical responses of the aquatic moss Fontinalis antipyretica to Cd, Cu, Pb and Zn determined by chlorophyll fluorescence and protein levels

Author(s): Rau, S.; Miersch, J.; Neumann, D.; et al.

Source: ENVIRONMENTAL AND EXPERIMENTAL BOTANY Volume: 59 Issue: 3 Pages: 299-306 DOI: 10.1016/j.envexpbot.2006.03.001 Published: APR 2007

56. Title: [not available]

Author(s): RAUL SL

Source: SOIL TILL RES Volume: 62 Pages: 55 Published: 2001

57. Title: Direct evaluation of the Ca2+-displacement hypothesis for Al toxicity

Author(s): Ryan, PR; Reid, RJ; Smith, FA

Source: PLANT PHYSIOLOGY Volume: 113 Issue: 4 Pages: 1351-1357 Published: APR 1997

58. Title: Accumulation of Zn, Cu, Ni and Pb in soil and leaf of Pinus eldarica Medw. Following irrigation with municipal effluent. Author(s): Salehi, A.; Tabari, M.

Source: Research Journal of Environmental Sciences Volume: 2 Issue: 4 Pages: 291-297 Published: 2008

59. Title: Cadmium-induced changes in the growth and oxidative metabolism of pea plants

Author(s): Sandalio, LM; Dalurzo, HC; Gomez, M; et al.
Source: JOURNAL OF EXPERIMENTAL BOTANY Volume: 52 Issue: 364 Pages: 2115-2126 Published: NOV 2001

60. Title: Drought-induced biochemical modifications and proline metabolism in Abelmoschus esculentus (L.) Moench.
Author(s): Sankar, Beemarao; Jaleel, Cheruth A.; Manivannan, Paramasivam; et al.
Source: Acta Botanica Croatica Volume: 66 Issue: 1 Pages: 43-56 Published: 2007

61. Title: [not available]
Author(s): SCHAT H
Source: ECOLOGY ULTRAMAFIC S Pages: 337 Published: 1992

62. Title: [not available]
Author(s): SHANTI SS
Source: PHYTOCHEMSTRY Volume: 49 Pages: 1531 Published: 1998

63. Title: [not available]
Author(s): SHARIF AS
Source: AGR WATER MANAGE Volume: 82 Pages: 177 Published: 2006
Times Cited: 2 (from All Databases)

64. Title: Heavy metal contamination of soil and vegetables in suburban areas of Varanasi, India
Author(s): Sharma, Rajesh Kumar; Agrawal, Madhoolika; Marshall, Fiona
Source: ECOTOXICOLOGY AND ENVIRONMENTAL SAFETY Volume: 66 Issue: 2 Pages: 258-266 DOI: 10.1016/j.ecoenv.2005.11.007 Published: FEB 2007

65. Title: Effects of sewage sludge amendment on heavy metal accumulation and consequent responses of Beta vulgaris plants
Author(s): Singh, R. P.; Agrawal, M.
Source: CHEMOSPHERE Volume: 67 Issue: 11 Pages: 2229-2240 DOI: 10.1016/j.chemosphere.2006.12.019 Published: MAY 2007

66. Title: CHROMIUM UPTAKE AND TRANSPORT IN BARLEY SEEDLINGS (HORDEUM-VULGARE-L)
Author(s): SKEFFINGTON, RA; SHEWRY, PR; PETERSON, PJ
Source: PLANTA Volume: 132 Issue: 3 Pages: 209-214 DOI: 10.1007/BF00399719 Published: 1976

67. Title: THE PHYSIOLOGY AND BIOCHEMISTRY OF POLYAMINES IN PLANTS (View record in MEDLINE)

Author(s): SLOCUM, RD; KAURSAWHNEY, R; GALSTON, AW
Source: ARCHIVES OF BIOCHEMISTRY AND BIOPHYSICS Volume: 235 Issue: 2 Pages: 283-303 DOI: 10.1016/0003-9861(84)90201-7 Published: 1984

68. Title: Chloride increases cadmium uptake in Swiss chard in a resin-buffered nutrient solution
Author(s): Smolders, E; McLaughlin, MJ
Source: SOIL SCIENCE SOCIETY OF AMERICA JOURNAL Volume: 60 Issue: 5 Pages: 1443-1447 Published: SEP-OCT 1996

69. Title: [not available]
Author(s): Snedecor, G. W.; Cochran, W. G.
Source: Statistical methods Published: 1976
Publisher: The Iowa State University Press, Ames, Iowa, USA

70. Title: [not available]
Author(s): SNELL FD
Source: COLOURIMETRIC METHOD Volume: 4 Published: 1954

71. Title: [not available]
Author(s): SNELL FD
Source: COLOURIMETRIC METHOD Volume: 3 Published: 1949

72. Title: [not available]
Author(s): STADELMANN FX
Source: VERB DTSCH LANDWIRTS Volume: 15 Pages: 575 Published: 1986

73. Title: Osmotic adjustment, water relations and carbohydrate remobilization in pigeonpea under water deficits
Author(s): Subbarao, GV; Nam, NH; Chauhan, YS; et al.
Source: JOURNAL OF PLANT PHYSIOLOGY Volume: 157 Issue: 6 Pages: 651-659 Published: DEC 2000

74. Title: SUCROSE-STARVATION-INDUCED CHANGES IN POLYAMINE AND ABSCISIC-ACID LEVELS OF SUSPENSION-CULTURED RICE CELLS
Author(s): SUNG, HI; LIU, LF; LUR, HS; et al.
Source: BOTANICAL BULLETIN OF ACADEMIA SINICA Volume: 36 Issue: 1 Pages: 47-51 Published: JAN 1995

75. Title: [not available]
Author(s): SUTAPA B
Source: CHEMOSPHERE Volume: 70 Pages: 1264 Published: 2008

76. Title: Effects of heavy metals on the nitrogen metabolism of the aquatic moss Fontinalis antipyretica L. ex hedw.
Author(s): Sutter, K; Jung, K; Krauss, GJ
Source: ENVIRONMENTAL SCIENCE AND POLLUTION RESEARCH Volume: 9 Issue: 6 Pages: 417-421 DOI: 10.1065/espr2001.12.102 Published: 2002

77. Title: Zinc and copper uptake by plants under two transpiration rates. Part II. Buckwheat (Fagopyrum esculentum L.)
Author(s): Tani, FH; Barrington, S
Source: ENVIRONMENTAL POLLUTION Volume: 138 Issue: 3 Pages: 548-558 DOI: 10.1016/j.envpol.2004.06.004 Published: DEC 2005

78. Title: Transpiration, a prerequisite for long-distance transport of minerals in plants?
Author(s): Tanner, W; Beevers, H
Source: PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA Volume: 98 Issue: 16 Pages: 9443-9447 DOI: 10.1073/pnas.161279898 Published: JUL 31 2001

79. Title: Effect of exogenous polyamines on alpha-amylase activity during seed germination under salt stress
Author(s): Tipirdamaz, Rukiye; Durusoy, Mubeccel; Bozcuk, Suna
Source: Turkish Journal of Botany Volume: 19 Issue: 4 Pages: 411-416 Published: 1995

80. Title: [not available]
Author(s): VALERIA S
Source: CHEMOSPHERE Volume: 64 Pages: 1695 Published: 2006

81. Title: [not available]
Author(s): VALERIE P
Source: ANN BOT Volume: 96 Pages: 425 Published: 2005

82. Title: [not available]
Author(s): VALERIE P
Source: ENVIRON EXP BOT Volume: 58 Pages: 269 Published: 2006

83. Title: EFFECTS OF METALS ON ENZYME-ACTIVITY IN PLANTS
Author(s): VANASSCHE, F; CLIJSTERS, H

Source: PLANT CELL AND ENVIRONMENT Volume: 13 Issue: 3 Pages: 195-206 Published: APR 1990

84. Title: ORGANIC-ACIDS AS SOURCES FOR DROUGHT-INDUCED PROLINE SYNTHESIS IN FIELD BEAN-PLANTS, VICIA-FABA L

Author(s): VENEKAMP, JH; LAMPE, JEM; KOOT, JTM

Source: JOURNAL OF PLANT PHYSIOLOGY Volume: 133 Issue: 6 Pages: 654-659 Published: JAN 1989

85. Title: [not available]

Author(s): WALTER H

Source: GUNDLAGEN FLAZEN VER Published: 1949

86. Title: Metal tolerance aspects of plant cell wall and vacuole

Author(s): Wang, J; Evangelou, VP.

Editor(s): Pessarakli, M.

Source: HDB PLANT CROP PHYSL Pages: 695-717 Published: 1995

Publisher: Marcel Dekker Inc., New York, NY, USA

87. Title: Exogenous polyamnines enhance copper tolerance of Nymphoides peltatum

Author(s): Wang, Xue; Shi, Guoxin; Xu, Qinsong; et al.

Source: JOURNAL OF PLANT PHYSIOLOGY Volume: 164 Issue: 8 Pages: 1062-1070 DOI: 10.1016/j.jplph.2006.06.003 Published: AUG 2007

88. Title: DIFFERENCES BETWEEN 2 GRAIN-SORGHUM GENOTYPES IN ADAPTATION TO DROUGHT STRESS .3. PHYSIOLOGICAL-RESPONSES

Author(s): WRIGHT, GC; SMITH, RCG; MORGAN, JM

Source: AUSTRALIAN JOURNAL OF AGRICULTURAL RESEARCH Volume: 34 Issue: 6 Pages: 637-651 DOI: 10.1071/AR9830637 Published: 1983

89. Title: LIVING WITH WATER-STRESS - EVOLUTION OF OSMOLYTE SYSTEMS (View record in MEDLINE)

Author(s): YANCEY, PH; CLARK, ME; HAND, SC; et al.

Source: SCIENCE Volume: 217 Issue: 4566 Pages: 1214-1222 DOI: 10.1126/science.7112124 Published: 1982

90. Title: [not available]

Author(s): YANTIANG MH

Source: PLANT NUTR Volume: 18 Pages: 2691 Published: 1995

91. Title: PLANT-GROWTH METABOLISM AND ADAPTION IN RELATION TO STRESS CONDITIONS .16. SALINITY AND HORMONE INTERACTIONS IN AFFECTING GROWTH, TRANSPIRATION AND IONIC RELATIONS OF PHASEOLUS-VULGARIS

Author(s): YOUNIS, ME; ABBAS, MA; SHUKRY, WM

Source: BIOLOGIA PLANTARUM Volume: 36 Issue: 1 Pages: 83-89 DOI: 10.1007/BF02921274 Published: 1994

92. Title: [not available]

Author(s): ZUITING X

Source: ECOTOX ENVIRON SAFE Volume: 64 Pages: 273 Published: 2006

Times Cited: 1 (from All Databases)

2. Glycine betaine and shikimic acid - Induced modification in growth criteria, water relation and productivity of droughted Sorghum bicolor plants.

Ibrahim, IAH (Ibrahim, IAH); Aldesuquy, HS (Aldesuquy, H. S.)

[1] Suez Canal Univ, Fac Educ El Arish, Dept Biol Sci, N Sina, Egypt

[2] Mansoura Univ, Fac Sci, Dept Bot, Mansoura, Egypt

E-mail Addresses: Ibrahim@mans.edu.eg

Abstract:

To evaluate the beneficial role of glycine betaine and shikimic acid and their combination on Sorghum bicolor plants under water deficit conditions, the plants were grown under greenhouse conditions and subjected to withholding water at days 40 from sowing. Analysis of growth, photosynthetic pigments, some solutes concentration, water relations and yield were carried out. Water stress markedly reduced S. bicolor growth, chl a, chl b, carotenoids concentrations, RWC, transpiration rate and total leaf conductance at both lower and upper leaf side as well as yield components. On the other hand, total soluble sugars increased and proline accumulated in S. bicolor plants grown under drought conditions. The applied chemicals mitigated the effect of water stress on S. bicolor growth and yield. The effect was more pronounced with glycine betaine + shikimic acid treatment. Used chemicals increased the formation of photosynthetic pigments as well as soluble sugars concentrations, and lowered proline concentration and transpiration rate of S. bicolor plants under the stress conditions as compared with untreated droughted plants. The economic yield (grain yield) was found to be strongly positively correlated with shoot fresh and dry weights, leaf area, chlorophyll a concentration, transpiration rate, RWC and the biomass of developing grains. On the other hand, the economic yield was strongly negatively correlated with proline concentration of S. bicolor leaves.

Keywords: Arbuscular mycorrhiza; electrolyte leakage; salinity; spermine; wheat; yield

Published in: PHYTON-ANNALES REI BOTANICAE **Volume:** 43 **Issue:** 2 **Pages:** 351-363 **Published:** 2003

References

1. Title: An evaluation of the effect of exogenous glycinebetaine on the growth and yield of soybean: Timing of application, watering regimes and cultivars
Author(s): Agboma, PC; Sinclair, TR; Jokinen, K; et al.
Source: FIELD CROPS RESEARCH Volume: 54 Issue: 1 Pages: 51-64 DOI: 10.1016/S0378-4290(97)00040-3 Published: AUG 1997

2. Title: The role of shikimic acid in regulation of growth, transpiration, pigmentation, photosynthetic activity and productivity of Vigna sinensis plants
Author(s): Aldesuquy, HS; Ibraghim, AHA
Source: PHYTON-ANNALES REI BOTANICAE Volume: 40 Issue: 2 Pages: 277-292 Published: 2000

3. Title: Physiological principles of dryland crop production.
Author(s): Arnon, I.; Gupta, U. S.
Editor(s): Gupta, U. S.
Source: Production and improvement of crops for drylands. Pages: 1-165 Published: 1995

4. Title: [not available]
Author(s): ARTECA RN
Source: PLANT GROWTH SUBSTAN Pages: 87 Published: 1996

5. Title: AMINO ACID AND PROTEIN METABOLISM IN BERMUDA GRASS DURING WATER STRESS (View record in MEDLINE)
Author(s): BARNETT, NM; NAYLOR, AW
Source: PLANT PHYSIOLOGY Volume: 41 Issue: 7 Pages: 1222-& DOI: 10.1104/pp.41.7.1222 Published: 1966

6. Title: RAPID DETERMINATION OF FREE PROLINE FOR WATER-STRESS STUDIES
Author(s): BATES, LS; WALDREN, RP; TEARE, ID
Source: PLANT AND SOIL Volume: 39 Issue: 1 Pages: 205-207 DOI: 10.1007/BF00018060 Published: 1973

7. Title: Growth analysis
Author(s): Beadle, C. L.
Book Editor(s): Hall, D. O.; Scurlock, J. M. O.; Bolhar-Nordenkampf, H. R.; et al.
Source: Photosynthesis and production in a changing environment: A field and laboratory manual Pages: 36-46 Published: 1993

8. Title: EVIDENCE FOR A FERREDOXIN-DEPENDENT CHOLINE MONOOXYGENASE FROM SPINACH CHLOROPLAST STROMA
Author(s): BROUQUISSE, R; WEIGEL, P; RHODES, D; et al.
Source: PLANT PHYSIOLOGY Volume: 90 Issue: 1 Pages: 322-329 DOI: 10.1104/pp.90.1.322 Published: MAY 1989

9. Title: Genotypic variation in osmoregulants and their relationship with bioproductivity and grain yield in wheat.
Author(s): Chetti, M. B.; Hattalli, S. R.; Konda, C. R.
Source: Annals of Plant Physiology Volume: 10 Issue: 2 Pages: 118-123 Published: 1996

10. Title: CHLOROPHYLL - OCCURRENCE, FUNCTIONS, MECHANISM OF ACTION, EFFECTS OF EXTERNAL AND INTERNAL FACTORS
Author(s): DRAZKIEWICZ, M
Source: PHOTOSYNTHETICA Volume: 30 Issue: 3 Pages: 321-331 Published: 1994

11. Title: Physiological response of two soybean cultivars grown under water stress conditions as affected by CCC treatment.
Author(s): El-Kheir, M. S. A. A.; Kandil, S. A.; Mekki, B. B.
Source: Egyptian Journal of Physiological Sciences Volume: 18 Issue: 1 Pages: 179-200 Published: 1994

12. Title: FORMATION OF LONG-LIVED HYDROXYL FREE-RADICAL ADDUCTS OF PROLINE AND HYDROXYPROLINE IN A FENTON REACTION (View record in MEDLINE)
Author(s): FLOYD, RA; ZSNAGY, I
Source: BIOCHIMICA ET BIOPHYSICA ACTA Volume: 790 Issue: 1 Pages: 94-97 DOI: 10.1016/0167-4838(84)90337-6 Published: 1984

13. Title: Glycinebetaine is a major nitrogen-containing solute in the malvaceae
Author(s): Gorham, J

Source: PHYTOCHEMISTRY Volume: 43 Issue: 2 Pages: 367-369 DOI: 10.1016/0031-9422(96)00312-3 Published: SEP 1996

14. Title: PHYSIOLOGICAL-RESPONSES OF DROUGHT TOLERANT AND DROUGHT SUSCEPTIBLE DURUM-WHEAT GENOTYPES
Author(s): GUMMULURU, S; HOBBS, SLA; JANA, S
Source: PHOTOSYNTHETICA Volume: 23 Issue: 4 Pages: 479-485 Published: 1989

15. Title: [not available]
Author(s): Hale, M.G.; Orcutt, D.M.
Source: The Physiology of Plants Under Stress Published: 1987
Publisher: John Wiley & Sons, New York

16. Title: Exogenous glycinebetaine accumulation and increased salt-tolerance in rice seedlings
Author(s): Harinasut, P; Tsutsui, K; Takabe, T; et al.
Source: BIOSCIENCE BIOTECHNOLOGY AND BIOCHEMISTRY Volume: 60 Issue: 2 Pages: 366-368 Published: FEB 1996

17. Title: New routes for lignin biosynthesis defined by biochemical characterization of recombinant ferulate 5-hydroxylase, a multifunctional cytochrome P450-dependent monooxygenase
Author(s): Humphreys, JM; Hemm, MR; Chapple, C
Source: PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES OF THE UNITED STATES OF AMERICA Volume: 96 Issue: 18 Pages: 10045-10050 DOI: 10.1073/pnas.96.18.10045 Published: AUG 31 1999

18. Title: [not available]
Author(s): IBRAHIM AH
Source: THESIS MANSOURA U EG Published: 1999

19. Title: EFFECT OF SALICYLIC-ACID ON NITRATE REDUCTASE-ACTIVITY IN MAIZE SEEDLINGS
Author(s): JAIN, A; SRIVASTAVA, HS
Source: PHYSIOLOGIA PLANTARUM Volume: 51 Issue: 4 Pages: 339-342 DOI: 10.1111/j.1399-3054.1981.tb05565.x Published: 1981

20. Title: [not available]
Author(s): JONES RGW
Source: AUST J PL PHYSL Volume: 5 Pages: 817 Published: 1978

21. Title: [not available]
Author(s): LARTHER F
Source: PLANT SCI LIMERICK Volume: 113 Pages: 21 Published: 1996

22. Title: Systemic acquired resistance in Arabidopsis requires salicylic acid but not ethylene
Author(s): Lawton, K; Weymann, K; Friedrich, L; et al.
Source: MOLECULAR PLANT-MICROBE INTERACTIONS Volume: 8 Issue: 6 Pages: 863-870 DOI: 10.1094/MPMI-8-0863 Published: NOV-DEC 1995

23. Title: PROLINE ACCUMULATION AS A SYMPTOM OF DROUGHT STRESS IN MAIZE - A TISSUE DIFFERENTIATION REQUIREMENT
Author(s): IBARRACABALLERO, J; VILLANUEVAVERDUZCO, C; MOLINAGALAN, J; et al.
Source: JOURNAL OF EXPERIMENTAL BOTANY Volume: 39 Issue: 204 Pages: 889-897 DOI: 10.1093/jxb/39.7.889 Published: JUL 1988

24. Title: CHLOROPHYLLS AND CAROTENOIDS - PIGMENTS OF PHOTOSYNTHETIC BIOMEMBRANES
Author(s): LICHTENTHALER, HK
Source: METHODS IN ENZYMOLOGY Volume: 148 Pages: 350-382 Published: 1987

25. Title: Uptake and translocation of foliar-applied glycinebetaine in crop plants
Author(s): Makela, P; PeltonenSainio, P; Jokinen, K; et al.
Source: PLANT SCIENCE Volume: 121 Issue: 2 Pages: 221-230 DOI: 10.1016/S0168-9452(96)04527-X Published: DEC 20 1996

26. Title: THE DIMENSIONS OF DROUGHT
Author(s): MCWILLIAM, JR
Book Editor(s): BAKER, FWG
Conference: SYMP ON DROUGHT RESISTANCE IN CEREALS Location: CAIRO, EGYPT Date: NOV 28-30, 1988
Sponsor(s): INT COUNCIL SCI UNIONS, COMMISS APPLICAT SCI AGR FORESTRY & AQUACULTURE; AUST CTR INT AGR RES; INT BIOSCI NETWORKS
Source: DROUGHT RESISTANCE IN CEREALS Pages: 1-11 Published: 1989

27. Title: Pigment content and methyl chavicol production in Agastache foeniculum Kuntze cultured in vitro. Author(s): Menghini, A.; Capuccella, M.; Pagiotti, R.; et al.
Source: Journal of Essential Oil Research Volume: 4 Issue: 5 Pages: 483-486 Published: 1992

28. Title: INVOLVEMENT OF ABSCISIC-ACID IN REGULATING WATER STATUS IN PHASEOLUS-VULGARIS L DURING CHILLING
Author(s): PARDOSSI, A; VERNIERI, P; TOGNONI, F
Source: PLANT PHYSIOLOGY Volume: 100 Issue: 3 Pages: 1243-1250 DOI: 10.1104/pp.100.3.1243 Published: NOV 1992

29. Title: PHOTOSYNTHETIC RATE CONTROL IN COTTON - PHOTO-RESPIRATION (View record in MEDLINE)
Author(s): PERRY, SW; KRIEG, DR; HUTMACHER, RB
Source: PLANT PHYSIOLOGY Volume: 73 Issue: 3 Pages: 662-665 DOI: 10.1104/pp.73.3.662 Published: 1983

30. Title: Leaf water relations and solute accumulation in two grain sorghum lines exhibiting contrasting drought tolerance
Author(s): Premachandra, GS; Hahn, DT; Rhodes, D; et al.
Source: JOURNAL OF EXPERIMENTAL BOTANY Volume: 46 Issue: 293 Pages: 1833-1841 DOI: 10.1093/jxb/46.12.1833 Published: DEC 1995

31. Title: QUATERNARY AMMONIUM AND TERTIARY SULFONIUM COMPOUNDS IN HIGHER-PLANTS
Author(s): RHODES, D; HANSON, AD
Source: ANNUAL REVIEW OF PLANT PHYSIOLOGY AND PLANT MOLECULAR BIOLOGY Volume: 44 Pages: 357-384 DOI: 10.1146/annurev.pp.44.060193.002041 Published: 1993

32. Title: WATER-STRESS INDUCED CHANGES IN CONCENTRATIONS OF PROLINE AND OTHER SOLUTES IN GROWING REGIONS OF YOUNG BARLEY LEAVES
Author(s): RIAZI, A; MATSUDA, K; ARSLAN, A
Source: JOURNAL OF EXPERIMENTAL BOTANY Volume: 36 Issue: 172 Pages: 1716-1725 DOI: 10.1093/jxb/36.11.1716 Published: 1985

33. Title: EFFECT OF KINETIN ON PROTEIN CONTENT AND SURVIVAL OF DETACHED XANTHIUM LEAVES

Author(s): RICHMOND, AE; LANG, A
Source: SCIENCE Volume: 125 Issue: 3249 Pages: 650-651 DOI: 10.1126/science.125.3249.650-a Published: 1957

34. Title: LEAF WATER-CONTENT AND GAS-EXCHANGE PARAMETERS OF 2 WHEAT GENOTYPES DIFFERING IN DROUGHT RESISTANCE
Author(s): RITCHIE, SW; NGUYEN, HT; HOLADAY, AS
Source: CROP SCIENCE Volume: 30 Issue: 1 Pages: 105-111 Published: JAN-FEB 1990

35. Title: UNUSUAL SOLUTION PROPERTIES OF PROLINE AND ITS INTERACTION WITH PROTEINS (View record in MEDLINE)
Author(s): SCHOBERT, B; TSCHESCHE, H
Source: BIOCHIMICA ET BIOPHYSICA ACTA Volume: 541 Issue: 2 Pages: 270-277 DOI: 10.1016/0304-4165(78)90400-2 Published: 1978

36. Title: [not available]
Author(s): SHIELDS LM
Source: BIOECOLOGY ARID SEMI Pages: 15 Published: 1958

37. Title: Physiological response of sunflower plants to drought.
Author(s): Terbea, M.; Vranceanu, A. V.; Petcu, E.; et al.
Source: Romanian Agricultural Research Issue: 3 Pages: 61-67 Published: 1995

38. Title: STOMATAL BEHAVIOR AND WATER STATUS OF MAIZE, SORGHUM, AND TOBACCO UNDER FIELD CONDITIONS .2. LOW SOIL-WATER POTENTIAL (View record in MEDLINE)
Author(s): TURNER, NC
Source: PLANT PHYSIOLOGY Volume: 53 Issue: 3 Pages: 360-365 DOI: 10.1104/pp.53.3.360 Published: 1974

39. Title: BETAINE ALDEHYDE OXIDATION BY SPINACH-CHLOROPLASTS (View record in MEDLINE)
Author(s): WEIGEL, P; WERETILNYK, EA; HANSON, AD
Source: PLANT PHYSIOLOGY Volume: 82 Issue: 3 Pages: 753-759 DOI: 10.1104/pp.82.3.753 Published: NOV 1986

40. Title: Characterization and expression of dehydrins in water-stressed Sorghum bicolor
Author(s): Wood, AJ; Goldsbrough, PB

Source: PHYSIOLOGIA PLANTARUM Volume: 99 Issue: 1 Pages: 144-152 DOI: 10.1034/j.1399-3054.1997.990120.x Published: JAN 1997

41. Title: Betaine aldehyde dehydrogenase in sorghum - Molecular cloning and expression of two related genes

Author(s): Wood, AJ; Saneoka, H; Rhodes, D; et al.

Source: PLANT PHYSIOLOGY Volume: 110 Issue: 4 Pages: 1301-1308 DOI: 10.1104/pp.110.4.1301 Published: APR 1996

42. Title: Phytochemical aspects of osmotic adaptation

Author(s): Wyn Jones, RG.

Source: Rec Adv Phytochem Volume: 18 Pages: 55-78 Published: 1984

3. Water relations, abscisic acid and yield of wheat plants in relation to the interactive effect of seawater and growth bioregulators

Aldesuquy, HS (Aldesuquy, H. S.), Ibrahim, IAH (Ibrahim, IAH);

[1] Mansoura Univ, Fac Sci, Dept Bot, Mansoura, Egypt

[2] Suez Canal Univ, Fac Educ, Dept Biol Sci, Al Arish, N Sinai, Egypt

ABSTRACT

Irrigation of wheat plants with seawater (10% and 25%) led to significant increase in free and bound ABA in leaves, especially at 25%. The relative water content (RWC) particularly at 25%, and water use efficiency of the seawater irrigated plants were lower than the control. Grain presoaking in either GA(3), IAA or ABA were able to reduce the levels of accumulated ABA (free and bound) resulting from seawater irrigation. The stress imposed by seawater generally reduced yield and yield components of wheat plants and the effect was more pronounced at the higher level of seawater (25%). Furthermore, seawater treatments decreased carbohydrate content and increased protein content of the developing grains. The effect of seawater treatments on ions concentration in the developing grains was not consistent. The application of growth bioregulators appeared to mitigate the effect of seawater salinity stress on wheat productivity. Gibberellic acid was the best used hormone for this target. The economic yield (grain yield) had a strong positive correlation with relative water content (RWC), water use efficiency for grain yield (WUEG), water use efficiency for biomass (WUEB) plant height, shoot fresh and dry weight, grain number/main spike, kernel weight, and harvest index.

Keywords: SALT TOLERANCE; SALINITY; METABOLISM; TRANSPORT; SORGHUM; LEAF

Published in: AGROCHIMICA **Volume:** 46 **Issue:** 5 **Pages:** 190-201

Published: SEP-OCT 2002

References

1. Title: INTERACTIVE EFFECTS OF IAA AND SALINITY ON THE GERMINATION AND GROWTH OF SOYBEAN SEEDLING

Author(s): ABDEL-AZIZ I M; MAHMOUD M H; ASHOUB M A

Source: Annals of Agricultural Science (Cairo) Volume: 30 Issue: 2 Pages: 1093-1108 Published: 1985

2. Title: PLANT-GROWTH, METABOLISM AND ADAPTATION IN RELATION TO STRESS CONDITIONS .9. ENDOGENOUS LEVELS OF HORMONES, MINERALS AND ORGANIC SOLUTES IN PISUM-SATIVUM PLANTS AS AFFECTED BY SALINITY

Author(s): ABOHAMED, SA; YOUNIS, ME; ELSHAHABY, OA; et al.

Source: PHYTON-ANNALES REI BOTANICAE Volume: 30 Issue: 1 Pages: 187-199 Published: 1990

3. Title: EFFECT OF GROWTH-REGULATORS ON VICIA-FABA PLANTS IRRIGATED BY SEA-WATER - LEAF-AREA, PIGMENT CONTENT AND PHOTOSYNTHETIC ACTIVITY

Author(s): ALDESUQUY, HS; GABER, AM

Source: BIOLOGIA PLANTARUM Volume: 35 Issue: 4 Pages: 519-527 DOI: 10.1007/BF02928026 Published: 1993

4. Title: GROWTH AND PIGMENT CONTENT OF WHEAT AS INFLUENCED BY THE COMBINED EFFECTS OF SALINITY AND GROWTH-REGULATORS

Author(s): ALDESUQUY, HS

Source: BIOLOGIA PLANTARUM Volume: 34 Issue: 3-4 Pages: 275-283 DOI: 10.1007/BF02925883 Published: 1992

5. Title: Effect of indol-3-yl acetic acid on photosynthetic characteristics of wheat flag leaf during grain filling

Author(s): Aldesuquy, HS

Source: PHOTOSYNTHETICA Volume: 38 Issue: 1 Pages: 135-141 DOI: 10.1023/A:1026712428094 Published: 2000

6. Title: [not available]

Author(s): BALL HC

Source: PLANT PHYSIOL Volume: 41 Pages: 1222 Published: 1984

7. Title: WATER RELATIONS AND GROWTH OF THE FLACCA TOMATO MUTANT IN RELATION TO ABSCISIC-ACID (View record in MEDLINE)

Author(s): BRADFORD, KJ

Source: PLANT PHYSIOLOGY Volume: 72 Issue: 1 Pages: 251-255 DOI: 10.1104/pp.72.1.251 Published: 1983

8. Title: Hormones as chemical signals involved in root to shoot communication of etThets of changes in the soil environment

Author(s): Davies, W.J.; Metcalfe, J.C.; Schurr, U.; et al; Taylor, G.; Zhang, J.

Editor(s): Hoad, CV; Lemon, J.R.; Jackson, M. B.; et al; Atkin, R. K.

Source: Hormone action in plant development. A critical appraisal Pages: 201-216 Published: 1987

Publisher: Butter-worths, London, UK

9. Title: METABOLISM AND TRANSPORT OF ABSCISIC-ACID DURING GRAIN FILL IN WHEAT

Author(s): DEWDNEY, SJ; MCWHA, JA

Source: JOURNAL OF EXPERIMENTAL BOTANY Volume: 29 Issue: 113 Pages: 1299-1308 DOI: 10.1093/jxb/29.6.1299 Published: 1978

10. Title: [not available]

Author(s): Dorgham, EA.

Source: Effect of water stress, irradiation and nitrogen fertilization on grain filling, yield and quality of certain wheat cultivars Published: 1991

Publisher: Ain Shams University of Cairo, Egypt

11. Title: SALINITY EFFECTS ON SEED YIELD, GROWTH, AND GERMINATION OF GRAIN-SORGHUM

Author(s): FRANCOIS, LE; DONOVAN, T; MAAS, EV

Source: AGRONOMY JOURNAL Volume: 76 Issue: 5 Pages: 741-744 Published: 1984

12. Title: INCREASE IN FREE AND BOUND ABSCISIC ACID DURING NATURAL AND ETHYLENE-INDUCED SENESCENCE OF CITRUS FRUIT PEEL (View record in MEDLINE)

Author(s): GOLDSCHM.EE; GOREN, R; EVENCHEN, Z; et al.

Source: PLANT PHYSIOLOGY Volume: 51 Issue: 5 Pages: 879-882 DOI: 10.1104/pp.51.5.879 Published: 1973

13. Title: ABSCISIC-ACID METABOLISM IN WATER-STRESSED BEAN-LEAVES (View record in MEDLINE)

Author(s): HARRISON, MA; WALTON, DC

14. Title: EFFECT OF WATER STRESS ON TRANSPORT OF [2-C-14]ABSCISIC ACID IN INTACT PLANTS OF PHASEOLUS-COCCINEUS-L

Author(s): HARTUNG, W

Source: OECOLOGIA Volume: 26 Issue: 2 Pages: 177-183 DOI: 10.1007/BF00582895 Published: 1976

15. Title: Effects of different levels of N, P, K and growth regulators on the morphological characters and yield components of wheat

Author(s): Ibrahim, A.A.; Khafaga, E.R.

Source: J. Agric. Sci. Volume: 11 Pages: 1051-1056 Published: 1986

16. Title: [not available]

Author(s): IBRAHIM AH

Source: THESIS FS MANSOURA U Published: 1999

17. Title: [not available]

Author(s): Jones, H G.

Source: Plants and Microclimate: a Quantitative Approach to Environmental Plant Physiology Published: 1992

Publisher: Cambridge University Press, Cambridge, UK

18. Title: Salinity Stress and Enzymatic Activities During Seeds Germination

Author(s): Kord, Maymona A.; Khalil, Mary S.

Source: Egyptian Journal of Physiological Sciences Volume: 19 Issue: 1-2 Pages: 255-265 Published: 1995

19. Title: TRANSLOCATION OF PHOTOSYNTHATES IN TALL AND DWARF VARIETIES OF PEA, PISUM-SATIVUM

Author(s): LOVELL, PH

Source: PHYSIOLOGIA PLANTARUM Volume: 25 Issue: 3 Pages: 382-& DOI: 10.1111/j.1399-3054.1971.tb01460.x Published: 1971

20. Title: ABSCISIC-ACID AND WATER TRANSPORT IN SUNFLOWERS

Author(s): LUDEWIG, M; DORFFLING, K; SEIFERT, H

Source: PLANTA Volume: 175 Issue: 3 Pages: 325-333 DOI: 10.1007/BF00396337 Published: SEP 1988

21. Title: Crop salt tolerance - current assessment.

Author(s): Maas, E. V.; Hoffman, G. J.

Source: Journal of the Irrigation and Drainage Division, American Society of Civil Engineers Volume: 103 Issue: IR2 Pages: 115-134 Published: 1977

22. Title: [not available]

Author(s): MILBORROW BV

Source: PHYTOCHEMISTRY Volume: 13 Pages: 131 Published: 1987

23. Title: EFFECT OF SALINITY ON TOMATO FRUIT RIPENING (View record in MEDLINE)

Author(s): MIZRAHI, Y

Source: PLANT PHYSIOLOGY Volume: 69 Issue: 4 Pages: 966-970 DOI: 10.1104/pp.69.4.966 Published: 1982

24. Title: GENOTYPIC DIFFERENCES IN LEAF WATER POTENTIAL, ABSCISIC-ACID AND PROLINE CONCENTRATIONS IN SPRING WHEAT DURING DROUGHT STRESS

Author(s): QUARRIE, SA

Source: ANNALS OF BOTANY Volume: 46 Issue: 4 Pages: 383-394 Published: 1980

25. Title: EFFECT OF SALINITY AND MOISTURE-CONTENT OF SOIL ON GROWTH, NUTRIENT-UPTAKE AND YIELD OF WHEAT PLANT

Author(s): RABIE, RK; MATTER, MK; KHAMIS, AEA; et al.

Source: SOIL SCIENCE AND PLANT NUTRITION Volume: 31 Issue: 4 Pages: 537-545 Published: DEC 1985

26. Title: EFFECTS OF PLANT-GROWTH REGULATORS ON GRAIN-FILLING AND YIELD OF RICE

Author(s): RAY, S; CHOUDHURI, MA

Source: ANNALS OF BOTANY Volume: 47 Issue: 6 Pages: 755-758 Published: 1981

27. Title: CARBON BALANCE AND WATER RELATIONS OF SORGHUM EXPOSED TO SALT AND WATER-STRESS (View record in MEDLINE)

Author(s): RICHARDSON, SG; MCCREE, KJ

Source: PLANT PHYSIOLOGY Volume: 79 Issue: 4 Pages: 1015-1020 DOI: 10.1104/pp.79.4.1015 Published: DEC 1985

28. Title: Effect of GA 3, NAA and 2,4-D on growth and yield of cowpea (Vigna unguiculata (L) Walf) variety Arka Garima. Author(s): Singh, D. B.; Sharma, T. V. R. S.

Source: Flora and Fauna (Jhansi) Volume: 2 Issue: 1 Pages: 5-6 Published: 1996

29. Title: EFFECT OF SALINITY ON NODULE FORMATION BY SOYBEAN (View record in MEDLINE)

Author(s): SINGLETON, PW; BOHLOOL, BB

Source: PLANT PHYSIOLOGY Volume: 74 Issue: 1 Pages: 72-76 DOI: 10.1104/pp.74.1.72 Published: 1984

30. Title: WATER-USE EFFICIENCY

Author(s): STANHILL, G

Source: ADVANCES IN AGRONOMY Volume: 39 Pages: 53-85 DOI: 10.1016/S0065-2113(08)60465-4 Published: 1986

Title: [not available]

Author(s): VARNER JE

Source: HORMONAL CONTROL ENZ Pages: 83 Published: 1977

32. Title: Studies in the water relations of the cotton plant. 1. The field measurement of water deficits in leaves

Author(s): WEATHERLEY, P. E.

Source: NEW PHYTOL Volume: 49 Issue: (1) Pages: 81-97 DOI: 10.1111/j.1469-8137.1950.tb05146.x Published: 1950

33. Title: AN INCREASE IN INHIBITOR-BETA CONTENT OF DETACHED WHEAT LEAVES FOLLOWING A PERIOD OF WILTING

Author(s): WRIGHT, STC

Source: PLANTA Volume: 86 Issue: 1 Pages: 10-& DOI: 10.1007/BF00385299 Published: 1969

34. Title: Molecular biology of salt tolerance in the context of whole-plant physiology

Author(s): Yeo, A

Source: JOURNAL OF EXPERIMENTAL BOTANY Volume: 49 Issue: 323 Pages: 915-929 DOI: 10.1093/jexbot/49.323.915 Published: JUN 1998

Times Cited: 252 (from All Databases)

[View abstract] [Hide abstract]

35. Title: PLANT GROWTH METABOLISM AND ADAPTATION IN RELATION TO STRESS CONDITIONS XI. MODIFICATION OF OSMOTIC STRESS-INDUCED METABOLIC EFFECTS BY GA-3 OR IAA IN PISUM-SATIVUM L. PLANTS

Author(s): YOUNIS M E; EL-SHAHABY O A; ABO-HAMED S A; et al.

Source: Acta Agronomica Hungarica Volume: 40 Issue: 3-4 Pages: 367-375 Published: 1991

4. Interactive effect of seawater and growth bioregulators on water relations, abscisic acid concentration and yield of wheat plants

Aldesuquy, HS (Aldesuquy, H. S.), Ibrahim, IAH (Ibrahim, IAH);

[1] Mansoura Univ, Fac Sci, Dept Bot, Mansoura, Egypt

[2] Suez Canal Univ, Fac Educ, Dept Biol Sci, Al Arish, N Sinai, Egypt

Abstract

Irrigation of wheat plants with seawater (10 and 25 %) led to a significant increase in free and bound ABA in leaves, especially at 25 %. The relative water content (RWC), particularly at 25 %, and water use efficiency of the seawater-irrigated plants were lower than those of the control. Grain pre-soaking in GA(3), IAA or ABA reduced the levels of accumulated ABA (free and bound) resulting from seawater irrigation. The stress imposed by seawater generally reduced yield and yield components of wheat plants, and the effect was more pronounced at the higher level of seawater (25 %). Furthermore, seawater treatments decreased the carbohydrate content and increased the protein content of the developing grains. The effect of seawater treatments on ion concentration in the developing grains was not consistent. The application of growth bioregulators appeared to mitigate the effect of seawater salinity stress on wheat productivity. Gibberellic acid gave the best effect. The economic yield (grain yield) had a strong positive correlation with RWC, water use efficiency for grain yield, water use efficiency for biomass, plant height, shoot fresh and dry weights, grain number/main spike, kernel weight and harvest index.

Keywords: abscisic acid; efficiency; growth bioregulators; relative water content; seawater; wheat; yield

Published in: JOURNAL OF AGRONOMY AND CROP SCIENCE **Volume:** 187 **Issue:** 3 **Pages:** 185-193 **DOI:** 10.1046/j.1439-037x.2001.00522.x **Published:** NOV 2001

References

1. Title: INTERACTIVE EFFECTS OF IAA AND SALINITY ON THE GERMINATION AND GROWTH OF SOYBEAN SEEDLING
Author(s): ABDEL-AZIZ I M; MAHMOUD M H; ASHOUB M A
Source: Annals of Agricultural Science (Cairo) Volume: 30 Issue: 2 Pages: 1093-1108 Published: 1985

2. Title: PLANT-GROWTH, METABOLISM AND ADAPTATION IN RELATION TO STRESS CONDITIONS .9. ENDOGENOUS LEVELS OF HORMONES, MINERALS AND ORGANIC SOLUTES IN PISUM-SATIVUM PLANTS AS AFFECTED BY SALINITY
Author(s): ABOHAMED, SA; YOUNIS, ME; ELSHAHABY, OA; et al.
Source: PHYTON-ANNALES REI BOTANICAE Volume: 30 Issue: 1 Pages: 187-199 Published: 1990

3. Title: EFFECT OF GROWTH-REGULATORS ON VICIA-FABA PLANTS IRRIGATED BY SEA-WATER - LEAF-AREA, PIGMENT CONTENT AND PHOTOSYNTHETIC ACTIVITY
Author(s): ALDESUQUY, HS; GABER, AM
Source: BIOLOGIA PLANTARUM Volume: 35 Issue: 4 Pages: 519-527 DOI: 10.1007/BF02928026 Published: 1993

4. Title: GROWTH AND PIGMENT CONTENT OF WHEAT AS INFLUENCED BY THE COMBINED EFFECTS OF SALINITY AND GROWTH-REGULATORS
Author(s): ALDESUQUY, HS
Source: BIOLOGIA PLANTARUM Volume: 34 Issue: 3-4 Pages: 275-283 DOI: 10.1007/BF02925883 Published: 1992

5. Title: Effect of indol-3-yl acetic acid on photosynthetic characteristics of wheat flag leaf during grain filling
Author(s): Aldesuquy, HS
Source: PHOTOSYNTHETICA Volume: 38 Issue: 1 Pages: 135-141 DOI: 10.1023/A:1026712428094 Published: 2000

6. Title: [not available]
Author(s): BALL HC
Source: PLANT PHYSIOL Volume: 41 Pages: 1222 Published: 1984

7. Title: WATER RELATIONS AND GROWTH OF THE FLACCA TOMATO MUTANT IN RELATION TO ABSCISIC-ACID (View record in MEDLINE)
Author(s): BRADFORD, KJ
Source: PLANT PHYSIOLOGY Volume: 72 Issue: 1 Pages: 251-255 DOI: 10.1104/pp.72.1.251 Published: 1983

8. Title: Hormones as chemical signals involved in root to shoot communication of etThets of changes in the soil environment
Author(s): Davies, W.J.; Metcalfe, J.C.; Schurr, U.; et al; Taylor, G.; Zhang, J.
Editor(s): Hoad, CV; Lemon, J.R.; Jackson, M. B.; et al; Atkin, R. K.
Source: Hormone action in plant development. A critical appraisal Pages: 201-216 Published: 1987
Publisher: Butter-worths, London, UK

9. Title: METABOLISM AND TRANSPORT OF ABSCISIC-ACID DURING GRAIN FILL IN WHEAT
Author(s): DEWDNEY, SJ; MCWHA, JA
Source: JOURNAL OF EXPERIMENTAL BOTANY Volume: 29 Issue: 113 Pages: 1299-1308 DOI: 10.1093/jxb/29.6.1299 Published: 1978

10. Title: [not available]
Author(s): Dorgham, EA.
Source: Effect of water stress, irradiation and nitrogen fertilization on grain filling, yield and quality of certain wheat cultivars Published: 1991
Publisher: Ain Shams University of Cairo, Egypt

11. Title: SALINITY EFFECTS ON SEED YIELD, GROWTH, AND GERMINATION OF GRAIN-SORGHUM
Author(s): FRANCOIS, LE; DONOVAN, T; MAAS, EV
Source: AGRONOMY JOURNAL Volume: 76 Issue: 5 Pages: 741-744 Published: 1984

12. Title: INCREASE IN FREE AND BOUND ABSCISIC ACID DURING NATURAL AND ETHYLENE-INDUCED SENESCENCE OF CITRUS FRUIT PEEL (View record in MEDLINE)
Author(s): GOLDSCHM.EE; GOREN, R; EVENCHEN, Z; et al.
Source: PLANT PHYSIOLOGY Volume: 51 Issue: 5 Pages: 879-882 DOI: 10.1104/pp.51.5.879 Published: 1973

13. Title: ABSCISIC-ACID METABOLISM IN WATER-STRESSED BEAN-LEAVES (View record in MEDLINE)
Author(s): HARRISON, MA; WALTON, DC
Source: PLANT PHYSIOLOGY Volume: 56 Issue: 2 Pages: 250-254 DOI: 10.1104/pp.56.2.250 Published: 1975

14. Title: EFFECT OF WATER STRESS ON TRANSPORT OF [2-C-14]ABSCISIC ACID IN INTACT PLANTS OF PHASEOLUS-COCCINEUS-L
Author(s): HARTUNG, W
Source: OECOLOGIA Volume: 26 Issue: 2 Pages: 177-183 DOI: 10.1007/BF00582895 Published: 1976

15. Title: Effects of different levels of N, P, K and growth regulators on the morphological characters and yield components of wheat
Author(s): Ibrahim, A.A.; Khafaga, E.R.
Source: J. Agric. Sci. Volume: 11 Pages: 1051-1056 Published: 1986

16. Title: [not available]
Author(s): IBRAHIM AH
Source: THESIS MANSOURA U EG Published: 1999

17. Title: [not available]
Author(s): Jones, H G.
Source: Plants and Microclimate: a Quantitative Approach to Environmental Plant Physiology Published: 1992
Publisher: Cambridge University Press, Cambridge, UK
Times Cited: 1,040 (from All Databases)

18. Title: Salinity Stress and Enzymatic Activities During Seeds Germination
Author(s): Kord, Maymona A.; Khalil, Mary S.
Source: Egyptian Journal of Physiological Sciences Volume: 19 Issue: 1-2 Pages: 255-265 Published: 1995
Times Cited: 4 (from All Databases)
[View abstract] [Hide abstract]

19. Title: TRANSLOCATION OF PHOTOSYNTHATES IN TALL AND DWARF VARIETIES OF PEA, PISUM-SATIVUM
Author(s): LOVELL, PH
Source: PHYSIOLOGIA PLANTARUM Volume: 25 Issue: 3 Pages: 382-& DOI: 10.1111/j.1399-3054.1971.tb01460.x Published: 1971

20. Title: ABSCISIC-ACID AND WATER TRANSPORT IN SUNFLOWERS
Author(s): LUDEWIG, M; DORFFLING, K; SEIFERT, H
Source: PLANTA Volume: 175 Issue: 3 Pages: 325-333 DOI: 10.1007/BF00396337 Published: SEP 1988

21. Title: Crop salt tolerance - current assessment.
Author(s): Maas, E. V.; Hoffman, G. J.
Source: Journal of the Irrigation and Drainage Division, American Society of Civil Engineers Volume: 103 Issue: IR2 Pages: 115-134 Published: 1977

22. Title: [not available]
Author(s): MILBORROW BV
Source: PHYTOCHEMISTRY Volume: 13 Pages: 131 Published: 1987

23. Title: EFFECT OF SALINITY ON TOMATO FRUIT RIPENING (View record in MEDLINE)
Author(s): MIZRAHI, Y
Source: PLANT PHYSIOLOGY Volume: 69 Issue: 4 Pages: 966-970 DOI: 10.1104/pp.69.4.966 Published: 1982

24. Title: GENOTYPIC DIFFERENCES IN LEAF WATER POTENTIAL, ABSCISIC-ACID AND PROLINE CONCENTRATIONS IN SPRING WHEAT DURING DROUGHT STRESS
Author(s): QUARRIE, SA
Source: ANNALS OF BOTANY Volume: 46 Issue: 4 Pages: 383-394 Published: 1980

25. Title: EFFECT OF SALINITY AND MOISTURE-CONTENT OF SOIL ON GROWTH, NUTRIENT-UPTAKE AND YIELD OF WHEAT PLANT
Author(s): RABIE, RK; MATTER, MK; KHAMIS, AEA; et al.
Source: SOIL SCIENCE AND PLANT NUTRITION Volume: 31 Issue: 4 Pages: 537-545 Published: DEC 1985

26. Title: EFFECTS OF PLANT-GROWTH REGULATORS ON GRAIN-FILLING AND YIELD OF RICE
Author(s): RAY, S; CHOUDHURI, MA
Source: ANNALS OF BOTANY Volume: 47 Issue: 6 Pages: 755-758 Published: 1981

27. Title: CARBON BALANCE AND WATER RELATIONS OF SORGHUM EXPOSED TO SALT AND WATER-STRESS (View record in MEDLINE)

Author(s): RICHARDSON, SG; MCCREE, KJ
Source: PLANT PHYSIOLOGY Volume: 79 Issue: 4 Pages: 1015-1020 DOI: 10.1104/pp.79.4.1015 Published: DEC 1985

28. Title: Effect of GA 3, NAA and 2,4-D on growth and yield of cowpea (Vigna unguiculata (L) Walf) variety Arka Garima. Author(s): Singh, D. B.; Sharma, T. V. R. S.
Source: Flora and Fauna (Jhansi) Volume: 2 Issue: 1 Pages: 5-6 Published: 1996

29. Title: EFFECT OF SALINITY ON NODULE FORMATION BY SOYBEAN (View record in MEDLINE)
Author(s): SINGLETON, PW; BOHLOOL, BB
Source: PLANT PHYSIOLOGY Volume: 74 Issue: 1 Pages: 72-76 DOI: 10.1104/pp.74.1.72 Published: 1984

30. Title: WATER-USE EFFICIENCY
Author(s): STANHILL, G
Source: ADVANCES IN AGRONOMY Volume: 39 Pages: 53-85 DOI: 10.1016/S0065-2113(08)60465-4 Published: 1986

31. Title: Hormonal control of enzyme activity in higher plants.
Author(s): Varner, J. E.; Ho, D. T.-H.
Editor(s): Smith, H.
Source: Regulation of enzyme synthesis and activity in higher plants. Pages: 83-92 Published: 1977

32. Title: Studies in the water relations of the cotton plant. 1. The field measurement of water deficits in leaves
Author(s): WEATHERLEY, P. E.
Source: NEW PHYTOL Volume: 49 Issue: (1) Pages: 81-97 DOI: 10.1111/j.1469-8137.1950.tb05146.x Published: 1950

33. Title: AN INCREASE IN INHIBITOR-BETA CONTENT OF DETACHED WHEAT LEAVES FOLLOWING A PERIOD OF WILTING
Author(s): WRIGHT, STC
Source: PLANTA Volume: 86 Issue: 1 Pages: 10-& DOI: 10.1007/BF00385299 Published: 1969

34. Title: Molecular biology of salt tolerance in the context of whole-plant physiology
Author(s): Yeo, A

Source: JOURNAL OF EXPERIMENTAL BOTANY Volume: 49 Issue: 323 Pages: 915-929 DOI: 10.1093/jexbot/49.323.915 Published: JUN 1998

35. Title: PLANT GROWTH METABOLISM AND ADAPTATION IN RELATION TO STRESS CONDITIONS XI. MODIFICATION OF OSMOTIC STRESS-INDUCED METABOLIC EFFECTS BY GA-3 OR IAA IN PISUM-SATIVUM L. PLANTS

Author(s): YOUNIS M E; EL-SHAHABY O A; ABO-HAMED S A; et al.

Source: Acta Agronomica Hungarica Volume: 40 Issue: 3-4 Pages: 367-375 Published: 1991

5. Efficacy of indol-3-yl acetic acid on improvement of some biochemical and physiological aspects of wheat flag leaf during grain filling

Aldesuquy, HS (Aldesuquy, HS)

Univ Mansoura, Dept Bot, Fac Sci, Mansoura, Egypt.

Abstract:

Flag leaf area, leaf fresh and dry matter show two phases of development during grain filling in *Triticum aestivum*. The initial large increase in leaf size is mainly due to water intake. Chlorophylls, reducing sugars, sucrose, Hill activity and photosynthetic activity appeared to be stimulated during leaf growth; thereafter, a noticeable decline in these parameters was manifested particularly throughout leaf senescence. The maximum accumulation of polysaccharide and protein occurred at the beginning of grain set followed by continuous decline in these absolute values during grain filling. Grain priming with IAA at 25 ppm stimulated flag leaf growth by increasing its fresh and dry matter as well as its area. Furthermore, the stimulatory effect was mainly due to the increase in pigment production which, in turn, increase the photo synthetic activity of the wheat flag leaf during grain filling. On the other hand, the higher dose of IAA (50 ppm) attenuated the growth and physiological activity of the wheat flag leaf through its inhibitory action on leaf fresh weight, dry weight, leaf area, pigment content, carbohydrate and protein formation as well as its effect on (CO2)-C-14 assimilation.

KeyWords: ABSCISIC-ACID; GAS-EXCHANGE; GROWTH; WATER;LEAVES; SENESCENCE; SALINITY; PROTEIN; PLANTS; STRESS

Published in: AGROCHIMICA **Volume:** 45 **Issue:** 1-2 **Pages:** 1-13 **Published:** JAN-APR 2001

References

1.Title: Effects of Phytohormones on Carbohydrate and Nitrogen Metabolism of Some Drought Stressed Crop Plants

Author(s): AHMED, A. M.; RADI, A. F.; SHADDADU, M. A.; et al; El-TAYEB, M. A.
Source: J. Islamic Acad. Sci. Volume: 2 Issue: 2 Pages: 93 Published: 1989

2. Title: Effect of seawater salinity and gibberellic acid on abscisic acid, amino acids and water-use efficiency by wheat plants
Author(s): Aldesuquy, HS
Source: AGROCHIMICA Volume: 42 Issue: 3-4 Pages: 147-157 Published: MAY-AUG 1998

3. Title: EFFECT OF GROWTH-REGULATORS ON VICIA-FABA PLANTS IRRIGATED BY SEA-WATER - LEAF-AREA, PIGMENT CONTENT AND PHOTOSYNTHETIC ACTIVITY
Author(s): ALDESUQUY, HS; GABER, AM
Source: BIOLOGIA PLANTARUM Volume: 35 Issue: 4 Pages: 519-527 DOI: 10.1007/BF02928026 Published: 1993

4. Title: [not available]
Author(s): ALDESUQUY HS
Source: MANS SCI B Volume: 17 Pages: 135 Published: 1990

5. Title: [not available]
Author(s): ALDESUQUY HS
Source: P 6 EG BOT C CAIR U Volume: 1 Pages: 51 Published: 1998

6. Title: [not available]
Author(s): ARKHANGELSKII NS
Source: IZV TIMIRYAZ SELSKOK Volume: 1 Pages: 67 Published: 1999

7. Title: COPPER ENZYMES IN ISOLATED CHLOROPLASTS - POLYPHENOLOXIDASE IN BETA-VULGARIS (View record in MEDLINE)
Author(s): ARNON, DI
Source: PLANT PHYSIOLOGY Volume: 24 Issue: 1 Pages: 1-15 DOI: 10.1104/pp.24.1.1 Published: 1949

8. Title: EFFECTS OF EAR REMOVAL ON PHOTOSYNTHESIS, CARBOHYDRATE ACCUMULATION AND ON DISTRIBUTION OF ASSIMILATED C-14 IN WHEAT
Author(s): AUSTIN, RB; EDRICH, J
Source: ANNALS OF BOTANY Volume: 39 Issue: 159 Pages: 141-152 Published: 1975

9. Title: CHANGES IN ULTRASTRUCTURE AND HORMONES OF THE FULLY SENESCENT LEAF OF SENECIO-AEGYPTIUS
Author(s): BAKA Z A M; ALDESUQUY H S
Source: Beitraege zur Biologie der Pflanzen Volume: 66 Issue: 2 Pages: 271-281 Published: 1991

10. Title: [not available]
Author(s): BAKER NR

Source: NEW PHYTOL Volume: 75 Pages: 1315 Published: 1975

11. Title: INTERACTIONS BETWEEN NACL AND SOME PHYTOHORMONES ON SOYBEAN GROWTH
Author(s): BEJAOUI, M
Source: JOURNAL OF PLANT PHYSIOLOGY Volume: 120 Issue: 2 Pages: 95-110 Published: 1985

12. Title: [not available]
Author(s): BIDWELL RGS
Source: BIOCH PHYSL PLANT GR Pages: 361 Published: 1968

13. Title: [not available]
Author(s): BUSCHMANN C
Source: THYLAKOID BIOCH PHYS Published: 1979

14. Title: CHANGES IN GAS-EXCHANGE AND IN ACTIVITIES OF PROTEOLYTIC-ENZYMES DURING SENESCENCE OF WHEAT LEAVES (TRITICUM-AESTIVUM L)
Author(s): FELLER, U; ERISMANN, KH
Source: ZEITSCHRIFT FUR PFLANZENPHYSIOLOGIE Volume: 90 Issue: 3 Pages: 235-244 Published: 1978

15. Title: [not available]
Author(s): GABER AM
Source: THESIS MANSOURA U MA Published: 1985

16. Title: Association of plant p40 protein with ribosomes is enhanced when polyribosomes form during periods of active tissue growth
Author(s): GarciaHernandez, M; Davies, E; Baskin, TI; et al.
Source: PLANT PHYSIOLOGY Volume: 111 Issue: 2 Pages: 559-568 Published: JUN 1996

17. Title: Effect of mode of application of some growth regulators on the physiology of tomato plants: II. Effect of IAA on the endogenous hormonal contents
Author(s): Hathout, T. A.; Sheteawi, S. A.; Khallal, S. M.
Source: Egyptian Journal of Physiological Sciences Volume: 17 Issue: 1 Pages: 45-62 Published: 1993

18. Title: RELATION OF SOURCE AND SINK DURING GRAIN FILLING PERIOD IN WHEAT AND SOME ASPECTS OF ITS REGULATION
Author(s): HERZOG, H
Source: PHYSIOLOGIA PLANTARUM Volume: 56 Issue: 2 Pages: 155-160 DOI: 10.1111/j.1399-3054.1982.tb00318.x Published: 1982

19. Title: CHANGES IN CHLOROPHYLL CONTENT AND ORGANIZATION DURING SENESCENCE OF THE PRIMARY LEAVES OF PHASEOLUS-VULGARIS L IN RELATION TO PHOTOSYNTHETIC ELECTRON-TRANSPORT
Author(s): JENKINS, GI; BAKER, NR; WOOLHOUSE, HW
Source: JOURNAL OF EXPERIMENTAL BOTANY Volume: 32 Issue: 130 Pages: 1009-1020 DOI: 10.1093/jxb/32.5.1009 Published: 1981

20. Title: The effect of indoleacetic acid on photosynthetic pigments and oxygen evolution of Chlamydomonas reinhardtii and Anacystis nidulans
Author(s): Kadioglu, Asim
Source: DOGA Turk Botanik Dergisi Volume: 16 Issue: 2 Pages: 187-194 Published: 1992

21. Title: Responses of some Nigerian vegetables of plant growth regulator treatments. (View record in MEDLINE)
Author(s): Kadiri, M; Mukhtar, F; Agboola, D A
Source: Revista de biologia tropical Volume: 44-45 Pages: 23-8 Published: 1997-Mar

22. Title: GAS-EXCHANGE OF BARLEY SEEDLINGS GROWING UNDER SALINITY STRESS
Author(s): KALAJI, H; NALBORCZYK, E
Source: PHOTOSYNTHETICA Volume: 25 Issue: 2 Pages: 197-202 Published: 1991

23. Title: Hormonal control of seed development as related to seed position in the sunflower seedhead.
Author(s): Kholodova, V. P.; Karyagina, T. B.; Zhdanova, L. P.; et al.
Source: Soviet Plant Physiology Volume: 40 Issue: 2 Pages: 250-254 Published: 1993

24. Title: [not available]
Author(s): KISELEVA IS
Source: RUSS J PLANT PHYSL Volume: 45 Pages: 549 Published: 1998

25. Title: SEASONAL AND DIURNAL CHANGES IN ABSCISIC-ACID AND WATER RELATIONS OF APRICOT LEAVES (PRUNUS-ARMENIACA L)
Author(s): LOVEYS, BR; ROBINSON, SP; DOWNTON, WJS
Source: NEW PHYTOLOGIST Volume: 107 Issue: 1 Pages: 15-27 DOI: 10.1111/j.1469-8137.1987.tb04878.x Published: SEP 1987

26. Title: PROTEIN MEASUREMENT WITH THE FOLIN PHENOL REAGENT (View record in MEDLINE)
Author(s): LOWRY, OH; ROSEBROUGH, NJ; FARR, AL; et al.
Source: JOURNAL OF BIOLOGICAL CHEMISTRY Volume: 193 Issue: 1 Pages: 265-275 Published: 1951

27. Title: UNTERSUCHUNGEN ZUR SYNCHRONISIERBARKEIT EINZELNER PIGMENTMANGEL-MUTANTEN VON CHLORELLA
Author(s): METZNER, H; RAU, H; SENGER, H
Source: PLANTA Volume: 65 Issue: 2 Pages: 186-& DOI: 10.1007/BF00384998 Published: 1965

28. Title: [not available]
Author(s): MOKRONOSOV AT
Source: PLASTIDS THEIR CHEM Pages: 789 Published: 1974

29. Title: [not available]
Author(s): NANDA IP
Source: BOTANICA Volume: 3 Pages: 13 Published: 1995

30. Title: [not available]
Author(s): NARWADKAR PR
Source: ACTA HORTIC Volume: 231 Pages: 175 Published: 1989

31. Title: [not available]
Author(s): NOODEN LD
Source: SENESCENCE AGEING PL Pages: 343 Published: 1988

32. Title: Effect of growth regulators on growth and flowering of Lilium longiflorum.
Author(s): Pal, A. K.; Das, S. N.
Source: Orissa Journal of Horticulture Volume: 18 Issue: 1-2 Pages: 18-21 Published: 1990

33. Title: LEAF AREA PARTITIONING AS AN IMPORTANT FACTOR IN GROWTH (View record in MEDLINE)
Author(s): POTTER, JR; JONES, JW
Source: PLANT PHYSIOLOGY Volume: 59 Issue: 1 Pages: 10-14 DOI: 10.1104/pp.59.1.10 Published: 1977

34. Title: GENOTYPIC VARIATION IN LEAF WATER POTENTIAL, STOMATAL CONDUCTANCE AND ABSCISIC-ACID CONCENTRATION IN SPRING WHEAT SUBJECTED TO ARTIFICIAL DROUGHT STRESS
Author(s): QUARRIE, SA; JONES, HG
Source: ANNALS OF BOTANY Volume: 44 Issue: 3 Pages: 323-332 Published: 1979

35. Title: [not available]
Author(s): RAO CN
Source: SCI CULT Volume: 42 Pages: 555 Published: 1976

36. Title: TRANSLOCATION AND REMOBILIZATION OF 14C ASSIMILATED AT DIFFERENT STAGES BY EACH LEAF OF WHEAT PLANT
Author(s): RAWSON, HM; HOFSTRA, G
Source: AUSTRALIAN JOURNAL OF BIOLOGICAL SCIENCES Volume: 22 Issue: 2 Pages: 321-& Published: 1969

37. Title: GRAIN PROTEIN ACCUMULATION AND THE RELATIONSHIP BETWEEN LEAF NITRATE REDUCTASE AND PROTEASE ACTIVITIES DURING GRAIN DEVELOPMENT IN MAIZE (ZEA-MAYS-L) .1. VARIATION BETWEEN GENOTYPES (View record in MEDLINE)
Author(s): REED, AJ; BELOW, FE; HAGEMAN, RH
Source: PLANT PHYSIOLOGY Volume: 66 Issue: 1 Pages: 164-170 DOI: 10.1104/pp.66.1.164 Published: 1980

38. Title: [not available]

Author(s): SAKR MT
Source: THESIS MANSOURA U MA Published: 1985

39. Title: [not available]
Author(s): SHADDAD MA
Source: ACTA AGRON HUNG Volume: 39 Pages: 1 Published: 1990

40. Title: [not available]
Author(s): SMILLIE RM
Source: PLASTIDS THEIR CHEM Pages: 789 Published: 1961

41. Title: [not available]
Author(s): Snedecor, GA; Cochran, WG.
Source: Statistical Method Published: 1976
Publisher: Iowa State Univ, Ames

42. Title: [not available]
Author(s): TAMAS IA
Source: MECH REGULATION PLAN Volume: 12 Pages: 261 Published: 1974

43. Title: [not available]
Author(s): THIANE R
Source: AUST J BIOL SCI Volume: 12 Pages: 349 Published: 1959

44. Title: [not available]
Author(s): THRONE GN
Source: GROWTH CEREALS GRASS Published: 1966

45. Title: Measurement of Hill reactions and photoreduction. (View record in MEDLINE)
Author(s): Trebst, A
Source: Methods in enzymology Volume: 24 Pages: 146-65 Published: 1972

46. Title: [not available]
Author(s): VIANA AM
Source: BERT ANN BOT Volume: 45 Pages: 469 Published: 1980

47. Title: [not available]
Author(s): WENSHAN G
Source: ACTA AGR NUCL SIN Volume: 8 Pages: 216 Published: 1994

48. Title: [not available]
Author(s): WILD A
Source: PHOTOSYNTHESIS Volume: 6 Pages: 339 Published: 1981

49. Title: PARTITIONING AND UTILIZATION OF PHOTOSYNTHATE PRODUCED AT DIFFERENT GROWTH-STAGES AFTER ANTHESIS IN SOYBEAN (GLYCINE-MAX-L MERR) - ANALYSIS BY LONG-TERM C-13-LABELING EXPERIMENTS
Author(s): YAMAGATA, M; KOUCHI, H; YONEYAMA, T

Source: JOURNAL OF EXPERIMENTAL BOTANY Volume: 38 Issue: 193 Pages: 1247-1259 DOI: 10.1093/jxb/38.8.1247 Published: AUG 1987

50. Title: STUDIES ON EFFECT OF CERTAIN ENZYMIC POISONS ON METABOLISM OF STORAGE ORGANS 2 DIFFERENTIAL EFFECTS OF IODOACETATE ON RESPIRATORY METABOLISM AND PERMEABILITY BARRIERS OF RADISH ROOT SLICES
Author(s): YOUNIS, AE; YOUNIS, ME; GABR, MA
Source: PLANT AND CELL PHYSIOLOGY Volume: 10 Issue: 1 Pages: 95-& Published: 1969
Times Cited: 20 (from All Databases)