1- Effects of water stress on growth, pigments and (CO2)-C-14 assimilation in three sorghum cultivars

Younis, ME (Younis, ME); El-Shahaby, OA (El-Shahaby, OA); Abo-Hamed, SA (Abo-Hamed, SA); Ibrahim, AH (Ibrahim, AH)

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

Abstract

The effects of drought on growth, pigments and (CO2)-C-14 assimilation were studied in three sorghum cultivars. Water stress applied either at the vegetative or at the reproductive stage was found to reduce relative growth and net assimilation rates. Root growth was less affected by water stress and in certain cases it was increased; consequently, the root/shoot ratio was improved. The sensitivity to drought stress was greater at the reproductive than at the vegetative stage. Dorado was the most drought-tolerant and Giza 15 the least drought-tolerant cultivar, as determined by calculation of the drought susceptibility index for total green leaf area and shoot dry weight. Short-term water stress in the vegetative phase (7 days) improved the chlorophyll content in leaves, and long-term stress in the vegetative and reproductive phases reduced chlorophyll content. Carotenoid content, in general, was not changed by drought stress. (CO2)-C-14 photoassimilation indicated that soluble, insoluble and consequently total photosynthates were reduced at the end of the stress period at both stages. Drought plus defoliation appeared to increase both chlorophyll content and (CO2)-C-14 photoassimilation, to a certain extent, as compared with drought alone.

KeyWords: defoliation; drought; pigments; sorghum; (CO2)-C-14 assimilation

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References

1. Title: EFFECT OF WATER-STRESS ON TOTAL PHENOLS, PEROXIDASE-ACTIVITY AND CHLOROPHYLL CONTENT IN WHEAT (TRITICUM-AESTIVUM L (

   Author(s): ASHRAF, MY; AZMI, AR; KHAN, AH; et al.
   Source: ACTA PHYSIOLOGIAE PLANTARUM Volume: 16 Issue: 3 Pages: 185-191 Published: 1994

2. Title: CHARACTERIZATION OF CAROTENOID ACYL ESTERS PRODUCED IN DROUGHT-STRESSED BARLEY SEEDLINGS
   Author(s): BARRY, P; EVERSHED, RP; YOUNG, A; et al.
   Source: PHYTOCHEMISTRY Volume: 31 Issue: 9 Pages: 3163-3168 DOI: 10.1016/0031-9422(92)83467-D Published: SEP 1992

3. 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**

4. Title: WATER DEFICIT AND ABSCISIC-ACID CAUSE DIFFERENTIAL INHIBITION OF SHOOT VERSUS ROOT-GROWTH IN SOYBEAN SEEDLINGS - ANALYSIS OF GROWTH, SUGAR ACCUMULATION, AND GENE-EXPRESSION
   Author(s): CREELMAN, RA; MASON, HS; BENSEN, RJ; et al.
   Source: PLANT PHYSIOLOGY Volume: 92 Issue: 1 Pages: 205-214 DOI: 10.1104/pp.92.1.205 Published: JAN 1990

5. Title: Response of photosynthetic pigments to drought and salt stress in some desert species
   Author(s): Elhaak, M. A.; Migahid, M. M.; Wegmann, K.
   Source: Feddes Repertorium Volume: 103 Issue: 7-8 Pages: 573-577 Published: 1992

6. 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

7. Title: DROUGHT RESISTANCE IN SPRING WHEAT CULTIVARS .1.

GRAIN-YIELD RESPONSES
Author(s): FISCHER, RA; MAURER, R
Source: AUSTRALIAN JOURNAL OF AGRICULTURAL RESEARCH Volume: 29 Issue: 5 Pages: 897-912 DOI: 10.1071/AR9780897 Published: 1978

8. 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

9. Title: [not available[
Author(s): Hulse, J. H.; Laing, E. M.; Pearson, O. E.
Source: Sorghum and the Millets: Their Composition and Nutritional Value Published: 1980
Publisher: Academic Press, New York

10. Title: Reaction and resistance of grain sorghum to heat and drought .
Author(s): Jordan, W. R.; Sullivan, C. Y.
Conference: Sorghum in the eighties: proceedings of the international symposium on sorghum, 2-7 November 1981, ICRISAT Center, Patancheru, A.P., India .
Source: Sorghum in the eighties: proceedings of the international symposium on sorghum, 2-7 November 1981, ICRISAT Center, Patancheru, A.P., India. Pages: 131-142 Published: 1982

11. Title: STOMATAL AND NONSTOMATAL LIMITATIONS TO PHOTOSYNTHESIS IN 2 WHEAT CULTIVARS SUBJECTED TO WATER-STRESS
Author(s): KICHEVA, MI; TSONEV, TD; POPOVA, LP
Source: PHOTOSYNTHETICA Volume: 30 Issue: 1 Pages: 107-116 Published: 1994

12. Title: Soybean physiology, regrowth, and senescence in response to defoliation
Author(s): Klubertanz, TH; Pedigo, LP; Carlson, RE
Source: AGRONOMY JOURNAL Volume: 88 Issue: 4 Pages: 577-582 Published: JUL-AUG 1996

13. Title: [not available[
Author(s): Kramer, P.J.
Source: Water Relations of Plants Published: 1983
Publisher: Academic Press, New York

14. Title: Diurnal fluctuations of carbon exchange rate, proline content, and osmotic potential in two water-stressed potato hybrids

Author(s): Martinez, Carlos A.; Guerrero, Cesar; Moreno, Ulises
Source: Revista Brasileira de Fisiologia Vegetal Volume: 7 Issue: 1 Pages: 27-33 Published: 1995

15. Title: RESPONSE OF 4 SORGHUM LINES TO MID-SEASON DROUGHT .1. GROWTH, WATER-USE AND YIELD
Author(s): MATTHEWS, RB; REDDY, DM; RANI, AU; et al.
Source: FIELD CROPS RESEARCH Volume: 25 Issue: 3-4 Pages: 279-296 DOI: 10.1016/0378-4290(90)90010-9 Published: DEC 1990

16. 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

17. Title: Effect of water restriction on carbohydrate metabolism and photosynthesis in mature maize leaves
Author(s): Pelleschi, S; Rocher, JP; Prioul, JL
Source: PLANT CELL AND ENVIRONMENT Volume: 20 Issue: 4 Pages: 493-503 DOI: 10.1046/j.1365-3040.1997.d01-89.x Published: APR 1997

18. Title: Photosynthetic rate control in cotton : photorespiration .
Author(s): Perry, S W; Krieg, D R; Hutmacher, R B
Source: Plant physiology Volume: 73 Issue: 3 Pages: 662-5 DOI: 10.1104/pp.73.3.662 Published: 1983-Nov

19. Title: A COMPARATIVE-STUDY OF PLASTICITY IN SEEDLING ROOTING DEPTH IN DRYING SOIL
Author(s): READER, RJ; JALILI, A; GRIME, JP; et al.
Source: JOURNAL OF ECOLOGY Volume: 81 Issue: 3 Pages: 543-550 DOI: 10.2307/2261532 Published: SEP 1993

20. 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

21. Title: DEFOLIATION AND REGROWTH IN GRAMINACEOUS PLANT - ROLE OF CURRENT ASSIMILATE
Author(s): RYLE, GJA; POWELL, CE
Source: ANNALS OF BOTANY Volume: 39 Issue: 160 Pages: 297-310

Published: 1975

22. Title: [not available[
Author(s): SHADDAD MA
Source: THESIS ASSUIT U EGYP Published: 1979

23. Title: [not available[
Author(s): SOLIMAN AI
Source: THESIS MANSOURA U EG Published: 1984
Times Cited: 2 (from All Databases (

24. Title: Effects of manipulations of source and sink on the carbon exchange rate and some enzymes of sucrose metabolism in leaves of soybean [Glycine max (L) Merr [
Author(s): Suwignyo, RA; Nose, A; Kawamitsu, Y; et al.
Source: PLANT AND CELL PHYSIOLOGY Volume: 36 Issue: 8 Pages: 1439-1446 Published: DEC 1995

25. Title: Physiological response of sunflower plants to drought
Author(s): Terbea, M; Vranceanu, AV; Petcu, E; et al; Craiciu, DS; Micut, G.
Source: Romanian Agricultural Research Volume: 3 Pages: 61-67 Published: 1995

26. Title: Stomatal Behavior and Water Status of Maize, Sorghum, and Tobacco under Field Conditions: II. At Low Soil Water Potential .
Author(s): Turner, N C
Source: Plant physiology Volume: 53 Issue: 3 Pages: 360-5 DOI: 10.1104/pp.53.3.360 Published: 1974-Mar

27. Title: EFFECTS OF PARTIAL DEFOLIATION, CHANGES OF IRRADIANCE DURING GROWTH, SHORT-TERM WATER-STRESS AND GROWTH AT ENHANCED P(CO2) ON THE PHOTOSYNTHETIC CAPACITY OF LEAVES OF PHASEOLUS-VULGARIS L
Author(s): VONCAEMMERER, S; FARQUHAR, GD
Source: PLANTA Volume: 160 Issue: 4 Pages: 320-329 Published: 1984

28. Title: DIFFERENCES BETWEEN 2 GRAIN-SORGHUM GENOTYPES IN ADAPTATION TO DROUGHT STRESS .1. CROP GROWTH AND YIELD RESPONSES
Author(s): WRIGHT, GC; SMITH, RCG; MCWILLIAM, JR
Source: AUSTRALIAN JOURNAL OF AGRICULTURAL RESEARCH Volume: 34 Issue: 6 Pages: 615-626 DOI: 10.1071/AR9830615 Published: 1983

29. Title: PLANT-GROWTH, METABOLISM AND ADAPTATION IN RELATION TO STRESS CONDITIONS .17. INFLUENCE OF DIFFERENT WATER TREATMENTS ON STOMATAL APPARATUS, PIGMENTS AND PHOTOSYNTHETIC CAPACITY IN VICIA-FABA
Author(s): YOUNIS, ME; ELSHAHABY, OA; HASANEEN, MNA; et al.
Source: JOURNAL OF ARID ENVIRONMENTS Volume: 25 Issue: 2 Pages: 221-232 DOI: 10.1006/jare.1993.1057 Published: AUG 1993

2- Kinetin alleviates the influence of waterlogging and salinity on growth and affects the production of plant growth regulators in *Vigna sinensis* and *Zea mays*

Younis, ME (Younis, ME); **El-Shahaby, OA (El-Shahaby, OA)**; Alla, MMN (Alla, MMN); El-Bastawisy, ZM (El-Bastawisy, ZM)

Mansoura Univ, Fac Sci Damietta, Dept Bot, Dumyat, Egypt

E-mail Address: mamnamatalla@mum.mans.edu.eg

Abstract

Growth criteria (shoot height, root length and dry weight) of 14-d-old Vigna sinensis and Zea mays were mostly suppressed by waterlogging or salinization using artificial seawater mixture during the subsequent 3 weeks; the water level in pots was, respectively, kept at 120% or 60% of water field capacity. The suppression in growth induced by salinization was greater than that obtained by waterlogging. The pattern of changes in growth appeared similar to chlorophyll a and b as well as activity of delta-aminolevulinic acid dehydratase (ALA-D). On the other hand, waterlogging significantly increased indole-acetic acid (IAA) in shoots of both species but salinity had a decreasing effect. Both treatments decreased gibberellic acid (GA(3)) levels in shoots of Vigna sinensis and Zea mays as well as zeatin in shoots of Zea mays. Meanwhile, abscisic acid (ABA) was greatly accumulated in shoots of the stressed plants. Foliar application of 50 ppm kinetin counteracted the resulting reduction in growth and in chlorophylls of both species but partially lowered the inhibition in ALA-D activity. Moreover, kinetin increased IAA, GA(3) and zeatin in the stressed plants to mostly reach control levels, but markedly reduced ABA. These findings indicate that relief of the damage and restoration of normal conditions was maintained either partially or completely by application of kinetin. This recovery may be a consequence of several roles played by such hormones, which can cause triggering of the internal cellular metabolism and also induce alterations in the ratios of growth regulators.

KeyWords: plant growth regulators; salinity; Vigna sinensis; waterlogging; Zea mays

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References

1.Title: [not available]
Author(s): ALLA MMN
Source: AGR MED Volume: 4 Pages: 218 Published: 1994

2. Title: Interactive effects of nitrate and long-term waterlogging on growth, water relations, and gaseous exchange properties of maize (Zea mays L.)
Author(s): Ashraf, M; Habib-ur-Rehman
Source: PLANT SCIENCE Volume: 144 Issue: 1 Pages: 35-43 DOI: 10.1016/S0168-9452(99)00055-2 Published: JUN 14 1999

3. Title: Induction of abscisic acid in excised maize roots by osmotic and salt stress.
Author(s): Baker, D. A.; Lachno, D. R.
Editor(s): Loughman, B.C.; Gasparikova, O.; Kolek, J.
Conference: Structural and functional aspects of transport in roots. Third international symposium on structure and function of roots, Nitra, Czechoslovakia, 3-7 Aug. 1987.
Source: Structural and functional aspects of transport in roots. Third international symposium on structure and function of roots, Nitra, Czechoslovakia, 3-7 Aug. 1987. Pages: 241-246 Published: 1989

4. Title: [not available]
Author(s): BROZENKOVA RH
Source: FIELD CROP ABSTR Volume: 32 Pages: 24 Published: 1976

5. Title: Effects of flooding the root system of sunflower plants on the cytokin in content in the xylem sap.
Author(s): Burrows, W J; Carr, D J
Source: Physiologia plantarum Volume: 22 Issue: 6 Pages: 1105-12 DOI: 10.1111/j.1399-3054.1969.tb09098.x Published: 1969

6. Title: Role of phytohormones in the reversal of stress-induced alteration in growth turgidity and proline accumulation in mungbean (Vigna radiate L. Wilczek) plants
Author(s): Das Gupta, P.; Das, D.; Mukherji, S.
Source: Indian Biol Volume: 26 Pages: 343-348 Published: 1994

7. Title: Effect of water and salt stresses on the growth, gas exchange and water relations in Argyranthemum coronopifolium plants
Author(s): De Herralde, F; Biel, C; Save, R; et al.

Source: PLANT SCIENCE Volume: 139 Issue: 1 Pages: 9-17 DOI: 10.1016/S0168-9452(98)00174-5 Published: DEC 11 1998

8. Title: Carbohydrate metabolism in leaves and assimilate partitioning in fruits of tomato (Lycopersicon esculentum L.) as affected by salinity
Author(s): Gao, ZF; Sagi, M; Lips, SH
Source: PLANT SCIENCE Volume: 135 Issue: 2 Pages: 149-159 DOI: 10.1016/S0168-9452(98)00085-5 Published: JUL 10 1998

9. Title: EFFECT OF SALINITY ON GROWTH, ION CONTENT AND CO2 ASSIMILATION RATE IN LEMON VARIETIES ON DIFFERENT ROOTSTOCKS
Author(s): GARCIALEGAZ, MF; ORTIZ, JM; GARCIALIDON, A; et al.
Source: PHYSIOLOGIA PLANTARUM Volume: 89 Issue: 3 Pages: 427-432 DOI: 10.1034/j.1399-3054.1993.890303.x Published: NOV 1993

10. Title: Cytokinin and inhibitor activities in the avocado fruit mesocarp.
Author(s): Gazit, S; Blumenfeld, A
Source: Plant physiology Volume: 46 Issue: 2 Pages: 334-6 DOI: 10.1104/pp.46.2.334 Published: 1970-Aug

11. Title: [not available]
Author(s): GHAZI SM
Source: THESIS AIN SHAMS U E Published: 1976

12. Title: ROLE OF ETHYLENE IN RESPONSE OF PLANTS TO STRESS
Author(s): HALL, MA; KAPUYA, JA; SIVAKUMARAN, S; et al.
Source: PESTICIDE SCIENCE Volume: 8 Issue: 3 Pages: 217-223 DOI: 10.1002/ps.2780080307 Published: 1977

13. Title: FLOODING-INDUCED SOIL AND PLANT ETHYLENE ACCUMULATION AND WATER STATUS RESPONSE OF FIELD-GROWN TOBACCO
Author(s): HUNT, PG; CAMPBELL, RB; SOJKA, RE; et al.
Source: PLANT AND SOIL Volume: 59 Issue: 3 Pages: 427-439 DOI: 10.1007/BF02184547 Published: 1981

14. Title: Cytokinin Activity in Water-stressed Shoots.
Author(s): Itai, C; Vaadia, Y
Source: Plant physiology Volume: 47 Issue: 1 Pages: 87-90 DOI: 10.1104/pp.47.1.87 Published: 1971-Jan

15. Title: [not available]

Author(s): KORD MA
Source: J PHYSL SCI Volume: 19 Pages: 255 Published: 1995

16. Title: The response of plants to salinity: A working hypothesis
Author(s): LERNER, HR; AMZALLAG, GN
Book Editor(s): Cherry, JH
Conference: NATO Advanced Research Workshop on Biochemical and Cellular Mechanisms of Stress Tolerance in Plants Location: MARATEA, ITALY Date: JUN 20-24, 1993
Sponsor(s): NATO; USDA, Washington; Amer Cyanamid Co, Princeton; Ciba Geigy Corp, Ciba Plant Protect, Greensboro; Extended Prod Life, Conshohocken; Pioneer Hi Bred Int Inc, Plant Breeding Div, Johnston; Microglass, Napoli; Delchimica, Napoli; Bioclin Forniture, Napoli; Gamma Sud, Napoli; Farmen Seed Co, Torre del Greco; M Medical, Firenze; Minist Agr & Foreste, Roma; Ctr Miglioramento Genet Ortaggi CRN, Res Ctr Vegetable Breeding Portici; Luigi Esposito, Ina Assitalia
Source: BIOCHEMICAL AND CELLULAR MECHANISMS OF STRESS TOLERANCE IN PLANTS Book Series: NATO ADVANCED SCIENCE INSTITUTES SERIES, SERIES H, CELL BIOLOGY Volume: 86 Pages: 463-476 Published: 1994

17. Title: COMPARISON OF THE ENDOGENOUS GIBBERELLINS IN THE SHOOTS AND ROOTS OF VERNALIZED AND NON-VERNALIZED CHINESE SPRING WHEAT SEEDLINGS
Author(s): LIN, JT; STAFFORD, AE
Source: PHYTOCHEMISTRY Volume: 26 Issue: 9 Pages: 2485-2488 DOI: 10.1016/S0031-9422(00)83859-5 Published: 1987

18. Title: IMPROVEMENTS IN METHODS FOR DETERMINATION OF ABSCISIC-ACID AND INDOLE-3-ACETIC-ACID BY HIGH-PERFORMANCE LIQUID-CHROMATOGRAPHY
Author(s): MAJCHERCZYK, A; RAKOCZY, L; HUTTERMANN, A
Source: JOURNAL OF CHROMATOGRAPHY Volume: 357 Issue: 3 Pages: 399-408 DOI: 10.1016/S0021-9673(01)95844-3 Published: MAY 9 1986

19. Title: The occurrence and determination of delta-amino-levulinic acid and porphobilinogen in urine.
Author(s): MAUZERALL, D; GRANICK, S
Source: The Journal of biological chemistry Volume: 219 Issue: 1 Pages: 435-46 Published: 1956-Mar
Times Cited: 1,606 (from All Databases)

20. 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

21. Title: [not available]
Author(s): MOHAMED HA
Source: THESIS MANSOURA U EG Published: 1993

22. Title: MOLECULAR AND PHYSIOLOGICAL-RESPONSES TO ABSCISIC-ACID AND SALTS IN ROOTS OF SALT-SENSITIVE AND SALT-TOLERANT INDICA RICE VARIETIES
Author(s): MOONS, A; BAUW, G; PRINSEN, E; et al.
Source: PLANT PHYSIOLOGY Volume: 107 Issue: 1 Pages: 177-186 DOI: 10.1104/pp.107.1.177 Published: JAN 1995

23. Title: EFFECTS OF GIBBERELLIC-ACID AND ZEATIN ON THE GROWTH-RESPONSE OF CUCUMBER COTYLEDONS
Author(s): MUIR, RM; CHENG, YJ
Source: JOURNAL OF PLANT GROWTH REGULATION Volume: 7 Issue: 4 Pages: 197-201 DOI: 10.1007/BF02025262 Published: 1988

24. Title: Hormonal regulation of leaf senescence.
Author(s): Osborne, D J
Source: Symposia of the Society for Experimental Biology Volume: 21 Pages: 305-21 Published: 1967

25. Title: [not available]
Author(s): PARTHIER B
Source: PLANT GROWTH SUBSTAN Published: 1986

26. Title: Carbon assimilation and biomass partitioning in Avicennia germinans and Rhizophora mangle seedlings in response to soil redox conditions
Author(s): Pezeshki, SR; DeLaune, RD; Meeder, JF
Source: ENVIRONMENTAL AND EXPERIMENTAL BOTANY Volume: 37 Issue: 2-3 Pages: 161-171 DOI: 10.1016/S0098-8472(96)01051-9 Published: JUN 1997

27. Title: [not available]
Author(s): PHILLIPS ID
Source: ANN BOT Volume: 98 Pages: 17 Published: 1964

28. Title: EFFECTS OF WATERLOGGING ON GIBBERELLIN CONTENT

AND GROWTH OF TOMATO PLANTS
Author(s): REID, DM; CROZIER, A
Source: JOURNAL OF EXPERIMENTAL BOTANY Volume: 22 Issue: 70 Pages: 39-& DOI: 10.1093/jxb/22.1.39 Published: 1971

29. Title: [not available]
Author(s): SAKR MT
Source: J AGR SCI Volume: 21 Pages: 203 Published: 1996

30. Title: Diurnal and seasonal osmotic potential changes in Lotus creticus creticus plants grown under saline stress
Author(s): Sanchez-Blanco, MJ; Morales, MA; Torrecillas, A; et al.
Source: PLANT SCIENCE Volume: 136 Issue: 1 Pages: 1-10 DOI: 10.1016/S0168-9452(98)00072-7 Published: AUG 7 1998

31.Title: [not available]
Author(s): SCHWARTZENBERG K
Source: J PLANT PHYSL Volume: 133 Pages: 529 Published: 1988

32. Title: [not available]
Author(s): Snedecor, W. G.; Cochran, W. G.
Source: Statistical Methods Published: 1980
Publisher: The Iowa State Press, Ames, IA

33. Title: [not available]
Author(s): STROGONOV BP
Source: FISIOLOGITHCHESKIE O Published: 1962

34. Title: Effect of NaCl salinity on photosynthesis and dry matter accumulation in developing rice grains
Author(s): Sultana, N; Ikeda, T; Itoh, R
Source: ENVIRONMENTAL AND EXPERIMENTAL BOTANY Volume: 42 Issue: 3 Pages: 211-220 DOI: 10.1016/S0098-8472(99)00035-0 Published: DEC 1999

35. Title: ROLE OF ENDOGENOUS AUXINS AND ETHYLENE IN THE FORMATION OF ADVENTITIOUS ROOTS AND HYPOCOTYL HYPERTROPHY IN FLOODED SUNFLOWER PLANTS (HELIANTHUS-ANNUUS)
Author(s): WAMPLE, RL; REID, DM
Source: PHYSIOLOGIA PLANTARUM Volume: 45 Issue: 2 Pages: 219-226 DOI: 10.1111/j.1399-3054.1979.tb01691.x Published: 1979

36. Title: [not available]
Author(s): WHITLOW TH
Source: E792 US ARM CROPS EN Published: 1979

37. Title: [not available]
Author(s): WRIGHT STC
Source: CROP PROCESSES CONTR Pages: 349 Published: 1972

38. Title: PLANT-GROWTH, METABOLISM AND ADAPTATION IN RELATION TO STRESS CONDITIONS .4. EFFECTS OF SALINITY ON CERTAIN FACTORS ASSOCIATED WITH THE GERMINATION OF 3 DIFFERENT SEEDS HIGH IN FATS
Author(s): YOUNIS, ME; HASANEEN, MNA; NEMETALLA, MM
Source: ANNALS OF BOTANY Volume: 60 Issue: 3 Pages: 337-344 Published: SEP 1987

39. Title: [not available]
Author(s): YOUNIS ME
Source: P INT C PLANT GROWTH Pages: 245 Published: 1991

40. Title: Drought and salinity differentially influence activities of superoxide dismutases in narrow-leafed lupins
Author(s): Yu, Q; Rengel, Z
Source: PLANT SCIENCE Volume: 142 Issue: 1 Pages: 1-11 DOI: 10.1016/S0168-9452(98)00246-5 Published: MAR 2 1999

41. Title: CAN EARLY WILTING OF OLD LEAVES ACCOUNT FOR MUCH OF THE ABA ACCUMULATION IN FLOODED PEA-PLANTS
Author(s): ZHANG, JH; ZHANG, XP

Source: JOURNAL OF EXPERIMENTAL BOTANY Volume: 45 Issue: 278 Pages: 1335-1342 DOI: 10.1093/jxb/45.9.1335 Published: SEP 1994