NCR-101 Report for 2000

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Research Projects

1. Effects of atmospheric ethylene on growth and development

We are continuing studies to establish dose/response curves for ethylene effects on wheat, rice, and lettuce. An ethylene concentration of only 0.05 ppm caused a 20% reduction in seed set in both wheat and rice, and 0.75 ppm caused complete sterility.

2. Failure analysis of biological systems in controlled environments

We have examined the effect of prolonged darkness on lettuce and soybeans. When the plants are kept at 10 C, plants tolerated up to 16 days of continuous darkness with only a 2 day period for full recovery.

3. Effect of high levels of ammonium on plant growth

Dawn Muhlestein is examining ammonium effects on the growth of wheat. Her data indicate that supplying 85% of the N as NH_4^+ did not decrease plant biomass, or yield. compared to controls with a 70/30% NO_3_ /NH_4^+ ratio. The key to using high levels of NH_4^+ is to maintain a stable pH and to supply high levels of calcium and potassium in the root-zone.

4. Modeling Carbon Use Efficiency using continuous canopy gas exchange

Jonathan Frantz is beginning studies to determine the factors controlling carbon use efficiency in crop plants. Preliminary data indicate that carbohydrate supply is far more important than night temperature in determining night time respiration rates.

Publications in Refereed Journals 1998-2000 (continued on back)

Orchard, B.J., W.J. Doucette, J.K. Chard and **B. Bugbee**. 2000a. A novel laboratory system for determining the fate of trichloroethylene in plants. Environmental Toxicology and Chemistry. *In Press*.

Orchard, B.J., W.J. Doucette, J.K. Chard and **B. Bugbee**. 2000b. Uptake of trichloroethylene by hybrid poplar trees grown hydroponically in high rate, flow-through plant growth chambers. Environmental Toxicology and Chemistry *In Press*

J. Cavazzoni, T. Volk, **B. Bugbee**, and T. Dougher 2000 Phasic temperature and photoperiod control for soybean using a modified Cropgro model. Life Support and Biosphere Science. *In Press*.

Bugbee, B. 1999. Engineering Plants for Spaceflight Environments. American Soc. for Gravitational and Space Biology Bulletin. 12:67-74.

Stahl, R., P. Grossl, And **B. Bugbee**. 1999. Effect of 2(N-Morpholino)ethane sulfonic Acid (MES) on the Growth and Tissue Composition of Cucumber. Jour. Plant Nutrition 22:315-330.

Bugbee, B., M. Droter, O. Monje, and B. Tanner. 1999. Evaluation and Modification of Commercial Infra-red transducers for leaf Temperature measurement. Adv. In Space Res. 22:1425-1434.

Dougher, Tracy and **B. Bugbee**. 1998. Is Blue Light Good or Bad for Plants? Life Support and Biosphere Science. 5:129-136.

Bishop, Debbie and **B. Bugbee**. 1998. Photosynthetic Capacity and Dry Mass Partitioning in Dwarf and Semi-dwarf Wheat. Jour. Plant Physiology 153:558-565.

Smart, D., K. Ritchie, A. Bloom, and **B. Bugbee**. 1998. Nitrogen balance for wheat canopies grown under elevated and ambient CO_2 concentrations. Plant, Cell, and Environment 21:753-763.

Dougher, T. and **B. Bugbee**. 1998. Effect of Lamp Type and Temperature on Development, Carbon Partitioning, and Yield of soybean. Adv. Space Res. 5:129-136.

Grotenhuis, T., J. Reuveni, and **B. Bugbee**. 1998. Super-optimal CO_2 Reduces Yield in Growth Chamber and Greenhouse Environments. Adv. Space Res. 20:1901-1904.

Monje, O. and **B. Bugbee**. 1998. Adaptation to high CO_2 concentration in an optimal environment: radiation capture, canopy quantum yield, and carbon use efficiency. Plant, Cell, and Environment 21:315-324.

Jurgonski, L., D. Smart, **B. Bugbee**, and S. Nielsen. 1998. Controlled Environments Alter Nutrient Content of Soybeans. Adv. Space Research 20:1979-1988.