

## CO<sub>2</sub> ENRICHMENT AND GRAIN YIELDS IN SOYBEANS, WHEAT AND CORN

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### ABSTRACT

It is well accepted that C<sub>3</sub> crops have increased growth, biomass, and yield under enriched CO<sub>2</sub> environment. However, only small responses to CO<sub>2</sub> enrichment are observed for C<sub>4</sub> crops. The magnitude of the effect of CO<sub>2</sub> enrichment on crops is not well known yet due to experimental differences among the various CO<sub>2</sub> enrichment studies. So far, only few studies were carried out under field conditions with full season CO<sub>2</sub> exposure. In order to better estimate the impact of future atmospheric CO<sub>2</sub> increases, on grain yields, on C<sub>3</sub> and C<sub>4</sub> crops, field studies were conducted using open-top chambers to mimic atmospheric CO<sub>2</sub> concentrations that are predicted to occur during the first half of the coming century (500 ppm CO<sub>2</sub>). The experiments were conducted at USDA Beltsville Agricultural Research Center with soybeans (*Glycine Max*; C<sub>3</sub> crop) during 1989 and 1990, with wheat (*Triticum aestivum*; C<sub>3</sub> crop) during 1991 and 1992; and with corn (*Zea mays*; C<sub>4</sub> crop) during 1991. Crops were grown under CO<sub>2</sub> concentrations of ambient (350 ppm CO<sub>2</sub>) or +150 ppm CO<sub>2</sub>, during 12 h day<sup>-1</sup>, from early growth until physiological maturity. The impact of CO<sub>2</sub> enrichment on soybeans grain yield was not significant in either 1989 (~+10%,  $p=0.42$ ) or 1990 (~+8%,  $p=0.37$ ). However, CO<sub>2</sub> enrichment had a significant impact on wheat grain, increasing grain yield by ~12% ( $p<0.05$ ) when combined over years. Corn grain yield was unchanged under CO<sub>2</sub> enrichment. The results indicated that CO<sub>2</sub> enrichment had a physiological beneficial effect in wheat and soybeans (C<sub>3</sub> crops) but not in corn (C<sub>4</sub> crop), however, future changes in atmospheric CO<sub>2</sub> concentrations may be escorted by other factors such as rising temperature, air pollution, and diseases, that are likely to have a negative impact on agricultural production.