Impact of O_3 and CO_2 on grain growth and yield of wheat

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Abstract

Spring wheat (*Triticum aestivum* L. cv. Dragon) was exposed to ozone and/or elevated CO_2 in open-top chambers at Östad, 50 km north-east of Göteborg, Sweden, during four growing seasons (1994 – 1997). In 1994 two levels of CO_2 in combination with three levels of ozone were used. In 1995 the plants were exposed to three levels of CO_2 or to the same ozone dose added either before or during and after anthesis. In 1996 elevation of the CO_2 concentration was combined with two levels of irrigation while, in 1997, the plants were exposed to five levels of ozone. In addition, shoots with artificially altered source/sink ratio were included in 1995, 1996 and 1997. It was concluded that the ozone sensitivity in terms of grain yield loss is higher when the grain growth is limited by the source. It was also concluded that the ozone sensitivity is higher during and after anthesis than before anthesis, although source-limited plants may be sensitive also to early ozone exposure. The grain yield was negatively affected by ozone in both ambient and elevated CO_2 and the results of the present thesis do not support the hypothesis that high CO_2 concentrations would substantially reduce the ozone-induced grain yield loss. The increased grain yield due to elevated CO_2 did, however, compensate for the negative ozone effects on grain yield. The grain yield reduction due to ozone exposure was concluded to be related to a senescence-induced shortening of the green leaf area duration, which resulted in a shorter grain filling duration. The grain filling rate was not affected by ozone exposure. It was also concluded that the positive effect of elevated CO_2 on grain yield is larger under relatively warm and dry conditions, when the beneficial effects of a CO_2-induced improved water use efficiency is expressed. The CO_2 effect was not substantially affected by a shift in the source/sink ratio.

Keywords: anthesis, carbon dioxide, grain filling, ozone, source/sink ratio, water availability, wheat, yield

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