**Assessing the impact of increasing carbon dioxide and temperature oncrop-weed interactions for tomato and a C3 and C4 weed species**

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Climate models project increased drought in the 21st century over most of Southern Europe. Severe drought conditions can profoundly impact agriculture, water resources, ecosystems, weed aggressiveness and competition. Within the Mediterranean basin, climate change models forecast a decrease in mean annual precipitation and more extreme events (i.e., less rainy days and longer drought periods between events), along with seasonal changes. As climate change imposes potential new limits to water availability, it is likely that crop-weed interactions, and crop losses from weeds will be affected. Therefore, a broader understanding of the potential interactions between crops and weeds in the context of climatic change, particularly $CO_2$, high temperature and drought, is essential to evaluating the vulnerability of crop production in the Mediterranean region. Based on the carboxylation kinetics of the C3 and C4 photosynthetic pathway, it is anticipated that C3 crops may be favored over C4 weeds as atmospheric $CO_2$ increases. In the current study, tomato (Lycopersicon esculentum), a C3 crop species, was grown at ambient ( 400 µmol mol−1) and enhanced carbon dioxide (800 µmol mol−1) with and without two common weeds, lambsquarters (*Chenopodium album*), a C3 weed, and redroot pigweed (*Amaranthus retroflexus*), a C4 weed, from seedling emergence until mutual shading of crop-weed leaves. Because growth temperature is also likely to change in concert with rising $CO_2$, the experiment was repeated at day/night temperatures of 21/12 and 26/18◦C. To examine the impacted of climate changes on crop-weed interactions we used climate-controlled growth chambers, since they are a power tool to investigate these topics. For both day/night temperatures, elevated CO2 exacerbated weed competition from both the C3 and C4 weed species. A model based on relative leaf area following emergence was used to calculate potential crop losses from weeds. This analysis indicated that potential crop losses increased from 33 to 55% and from 32 to 61% at the 21/12 and 26/18˚C day/night temperatures, for ambient and elevated $CO_2$, respectively. For the current study, reductions in biomass and projected yield of tomato appeared independent of the photo-synthetic pathway of the competing weed species. This may be due to inherent variation and overlap in the growth response of C3 and C4 species, whether weeds or crops, to increasing $CO_2$ concentration. Overall, the current data, while preliminary, suggest that in addition to photosynthetic pathway per se, other phenological and developmental aspects will deserve additional scrutiny in the context of understanding and predicting the impact of increasing atmospheric carbon dioxide on crop-weed interactions. In the end in the Mediterranean region, knowledge of these potential interactions may be crucial in estimating production losses in irrigated agriculture, and devising new management methods to limit pest impacts.

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