Title: Effects of elevated temperature on growth and reproduction of biofuels crops

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Background/Questions/Methods

Cellulosic biofuels crops have considerable potential to reduce our carbon footprint , and to be at least neutral in terms of carbon production. However, their widespread cultivation may result in unintended ecological and health effects. We report here results of a one year study in which switchgrass (*Panicum virgatum*), sorghum (*Sorghum bicolor*), giant miscanthus (*Miscanthus giganteus*), Amur silvergrass (*M. sacchariflorus*), and giant reed (*Arundo donax*) were exposed to ambient or elevated temperatures (ambient + 2C) over one summer growing season. The two temperature treatments were randomly allocated to six large (3.3 m high x 3 m diameter) plastic-covered outdoor sunlit mesocosms, in which plants were grown in three large (1.2 m wide x 0.6 m deep) tubs per mesocosm. *P. virgatum* and *S. bicolor* were planted at rates of 4, 8 or 12 plants/tub to determine if density affected responses. The three plant densities were randomly allocated to the three tubs within each mesocosm. Experimental endpoints (per plant basis) included aboveground biomass (shoots plus panicles if present) for all species, and for *P. virgatum* and *S. bicolor* number of panicles and weight of pollen to indicate effects of temperature on reproductive structures.

Results/Conclusions

Elevated temperature increased aboveground biomass compared to the controls for all species except *A. donax*. However, the increases were statistically significant only for *P. virgatum* (54%, p=0.07) at the 0.10 level of significance, and near significance for other species (*M. sacchariflorus,* 40%, p=0.13; *S. bicolor*, 15%, p=0.15; and *M. giganteus*, 15%, p=0.15). Panicle number also increased for *P. virgatum* (47%) and *S. bicolor* (15%) but only at p = 0.10 and 0.24, respectively. Density also affected these parameters, except for *P. virgatum* biomass, with generally the lowest biomass and fewest panicles at the lowest density. Elevated temperature produced a large increase in pollen weight for *S. bicolor* (44%, p=0.0003), and *P. virgatum* (106%) across densities, however, statistical analysis could not be conducted on the data for *P. virgatum* as samples were pooled across replicate chambers. For *S. bicolor* the ratio of pollen weight to total biomass weight increased, but only at p=0.154. These results suggest that elevated temperature may increase both net productivity and pollen production of some biomass crops. Those factors, in turn, could increase crop adaptability to future climates and possibly negatively impact human health by increasing levels of allergenic grass pollens.