What contribution can *Miscanthus giganteus* make to bioenergy requirements associated with IPCC climate projections ?

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Abstract

As a bioenergy crop, *Miscanthus giganteus* is an obvious choice for growers. It thrives on poor soils, requiring little or no farm operations except annual harvest, efficiently recycles nutrients into the rhizome at senescence to be reused the following season and has a high water efficiency compared to other arable crops. As such, it can thrive on waste land, or poor agricultural soils that cannot give sufficient economic returns for food crops in many areas of the world.

We present work to better understand the global potential for *M giganteus* as a bioenergy crop grown in the 21st century under IPCC climate RCP 2.6 and social development pathway SSP2 bioenergy land use projections. Vaughan et al (2018) investigated the BECCS assumptions relating to low emission scenarios, including biomass resources and land use and reports that half of the projected biomass has to be derived from dedicated bioenergy crops grown on abandoned agricultural land. MiscanFor (Hastings et al, 2009) is a bioenergy crop growth and environmental system model that can be tailored to various crops, including Miscanthus giganteus. It is a mechanistic simulation with a daily time step requiring soil and climate databases, and outputs average annual values on a grid point basis. The scale of the grid is dependent on the databases used and can range from 5 arc minutes when used globally to 30 arc seconds used regionally or nationally. MiscanFor has been modified to better reflect the climate and crop water potential of its new databases. It has been used to simulate miscanthus growth under the SSP2 bioenergy land use mask, provided by the IMAGE (Stehfest et al., 2014) integrated assessment model.

We report projections of aggregated global crop yield, power generation and soil carbon sequestration, with CO_2 emissions under the projections for dynamic bioenergy land use. The countries with the greatest aggregated bioenergy potential are Brazil, and China, and later in the century The United States, taking into account land area, energy generation and potential soil carbon change. *M giganteus* could provide just over 20% of the bioenergy requirement by the 2090s to satisfy the RCP 2.6 SSP2 climate scenario constrained by pre-determined land area projections. In reality, multiple varieties of miscanthus will be grown and multiple bioenergy resources will be used, best suited to regional conditions, further increasing the mean bioenergy yield and energy production. Nevertheless our projections indicate that *M giganteus* can make an important contribution.

References

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