Abstract Example

PERENNIALS OR ANNUAL CROPS FOR BIOENERGY: WHAT MAKES MORE SENSE IN THE NORTHERN GREAT PLAINS, USA?

Marisol T. Berti

North Dakota State University, Fargo, ND

The northern Great Plains (NGP) are dedicated primarily to crops for food and feed production. Most crops grown are annual with the exception of alfalfa (*Medicago sativa* L.) and other perennial grasses used for forage. With the high prices of fossil fuels in the past 10 years, maize (*Zea mays* L.) and soybean (*Glycine max* L. Merr.) started to be utilized as a feedstock for liquid fuel production, causing a raise in grain prices. Soon after ethanol from maize and biodiesel from soybean production started to increase, research in perennial grasses for second generation (2G) biofuels was started aiming to reduce the use of food crops for fuels. Many perennial and annual species and combinations of them in time and space have been evaluated in the past 10 years in the NGP.The most studied perennial bioenergy crops in the NGP include switchgrass (*Panicum virgatum* L.), miscanthus *(Miscanthus x giganteus*), and reed canary grass (*Phalaris canariensis* L.). The selection of these as 'models species' for bioenergy in the USA was not necessarily for scientific reasons, but these are the ones with the most recent research information available. There are many characteristics that a particular energy crop must have to be considered an 'ideal energy crop' candidate, such as, availability of seed/plantlets, yield, germplasm availability, water use efficiency, pest resistance, environmental benefits, amenable to existing farm equipment, invasiveness, feedstock quality, agricultural inputs, and biodiversity. The objective of this research was to compile the existing research information of annual and perennial energy crops comparing the pros and cons of the different cropping systems and their future potential as lignocellulosic feedstocks for energy in the NGP. An extensive database review of the last ten years was conducted searching for energy crops production parameters including seed/plantlet availability, biomass yield, energy balance, C sequestration, and other environmental impact parameters. Only 2G feedstocks (lignocellulosics) were considered in the analysis. The selected crops included switchgrass, miscanthus, and reed canary grass compared with energy sorghum (*Sorghum bicolor* L. Moench.), although a few examples of other annual crops as feedstocks are given. After summarizing the available information and rating each one of the above energy crops in their characteristics as 'ideal energy crop', restricting the analysis to the NGP, it was determined the following: 1) energy sorghum was superior to the perennial crops in availability of seed and germplasm, biomass yield, amenable to existing farm equipment, and feedstock quality, and 2) Perennial crops had high ratings in water use efficiency, pest resistance, environmental benefits (C sequestration), and positive impact in biodiversity, although they were some differences among the three species. In conclusion, annual crops, such as energy sorghum, have greater potential to become a bioenergy crop in the NGP, mainly because of higher biomass yield and easier to adapt to already existing farm equipment, more details on what information backs up this conclusion will be discussed.

Contact: Marisol Berti, Dep. of Plant Sciences, North Dakota State University, NDSU Dep. 7670, P.O.Box 6050, Fargo, ND 58108. Tel: 1 (701)-231-6110. E-mail: marisol.berti@ndsu.edu