



Fear of Losses: Study Shows that Farmers' Loss Aversion Attitude Renders Miscanthus Less Appealing but Switchgrass More Attractive

Ruiqing Miao

Department of Agricultural Economics and Rural Sociology
Auburn University

Madhu Khanna

Department of Agricultural and Consumer Economics
University of Illinois

Mohit Anand

Division of Business and Accounting
Miles College

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Psychologists and economists have gathered a large amount of evidence showing that people's happiness depends on changes in wealth relative to a reference wealth level (i.e., reference point), and that people tend to be more sensitive to losses (i.e., negative change) relative to gains (i.e., positive change). For instance, a person will be sad when she loses \$100 but will be happy when she gains \$100 in a gamble; and the pain of losing \$100 may well surpass the happiness of gaining the same amount of money. These features of human characteristics have been summarized into a theory called prospect theory by Kahneman and Tversky (1979). In the past few decades, this theory has been widely applied in explaining people's economic decisions in areas such as finance, insurance, and labor supply (see Barberis (2013) for a comprehensive review). However, few studies have applied the theory to understanding farmers' crop adoption decisions.

A recent study contributes to this line of research by applying prospect theory to understanding farmers' adoption behavior with respect two bioenergy crops: miscanthus and switchgrass. These two bioenergy crops are of interest because they are viewed as major potential feedstock for cellulosic biofuels and bioproducts (USDOE 2016). Although both crops are promising perennials in providing biomass, they have distinct characteristics. First and foremost, miscanthus requires a large amount of establishment

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cost (about \$1,200/acre) and two or three years to establish whereas the establishment cost of switchgrass is quite modest (about \$100/acre) and the crop can reach full yield potential in the first year. Second, studies show that harsh winter can cause the establishment of miscanthus to fail by killing the rhizomes whereas the failure rate of switchgrass establishment is quite small. Third, after successful establishment, the yield of miscanthus is about twice as high as that of switchgrass.

The study, published in a recent issue of *Agricultural Economics*, examines the impact of loss aversion on farmers' energy crop production decisions. After developing a conceptual framework based on prospect theory with the average return from growing conventional crops as the reference point, the study calibrates the framework and conducts large scale calculations based on data for 1,919 counties in the rainfed U.S. region. Results show that loss averse farmers tend to grow less miscanthus but more switchgrass when compared with loss neutral farmers. This is particularly the case when farmers are credit-constrained and less patient. The reason is that growing miscanthus incurs a large establishment cost and has no revenues in the establishment period, which indicates a "loss" relative to growing conventional crops regardless of biomass prices. However, as long as biomass price is sufficiently high, growing switchgrass does not involve such a "loss." The results also show that when biomass price were to be at \$50 per metric ton and when farmers are credit-constrained, loss averse, and impatient, then there would be almost no miscanthus production in the rainfed U.S. but there would be some switchgrass production outside of the Midwest. If biomass price were to be as high as \$100 per metric ton then miscanthus would outperform switchgrass due to its high yield.

The study further explores the efficacy of two policy instruments that aim to incentivize bioenergy crop adoption: establishment cost subsidy and subsidized energy crop insurance. The former instrument provides support for bioenergy crop establishment at the lower of \$500/acre and 50% of establishment cost. The latter instrument provides a safety net for bioenergy crop yield after the establishment. The study shows that establishment cost subsidy favors miscanthus production whereas subsidized energy crop insurance favors switchgrass production. The reason is that under the establishment subsidy scheme, miscanthus receives substantially more establishment subsidy than switchgrass does. On the other hand, because switchgrass has larger yield risk than miscanthus does, the subsidized energy crop insurance will benefit switchgrass production more than it benefits miscanthus production. The study shows that in most cases the two policy instruments are more efficient (i.e., cause more bioenergy crop production per dollar of policy instrument outlay) when farmers are loss averse than when farmers are loss neutral.

Complete Citation for the Study Discussed Here is:

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