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THE CONSERVATION RESERVE PROGRAM AS A MEANS TO SUBSIDIZE BIOENERGY CROP PRICES

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ABSTRACT

The Conservation Reserve Program (CRP), enacted in the 1985 Farm Bill, removes environmentally sensitive cropland from production in exchange for annual rental payments from the federal government. To reduce the cost of the program, economic use of CRP acres in exchange for reduced rental payments were proposed, but not implemented in the 1995 Farm Bill. This paper examines the potential impact an economic use policy would have on the market prices of bioenergy crops if they were permitted to be harvested from CRP acres. The analysis shows that at average yields of 11.25 dry Mg/ha/yr (5 dry tons/ac/yr) and total production of 9.1 million dry Mg (10 million dry tons) subsidized farmgate prices of as low as $16.5/dry Mg ($15/dry ton) for switchgrass and $24.2/dry Mg ($22/dry ton) for short-rotation woody crops can be achieved. Furthermore, the government can reduce the cost of the CRP resulting in a potential win-win situation.

Keywords: bioenergy crops, conservation reserve program

INTRODUCTION

The Conservation Reserve Program (CRP), enacted in the 1985 Farm Bill, removes environmentally sensitive cropland from production. While enrolled in the program, CRP acres must be maintained in conservation uses and not harvested. In return, farmers receive an annual rental payment from the government. While effective at maintaining environmental quality, the program is also expensive (approximately $1.8 billion annually) and during the 1995 Farm Bill debates, Congress explored ways of reducing its cost (Osborn 1994). Amendments (e.g., S 1407, HR 67), which were ultimately not included in the final Farm Bill, proposed allowing economic use of CRP acres. Among the uses discussed was the potential to produce and harvest bioenergy crops in exchange for a reduced rental rate. While the intent of the proposed changes was to reduce the cost of the CRP program to the federal government, an additional implication of such a policy is that the CRP rental rates can serve as a defacto subsidy for the production of bioenergy crops. This subsidy can in turn reduce the market price of energy crops and improve their economic competitiveness relative to fossil fuels. This paper analyzes the potential to use the CRP as a means to reduce the market prices of switchgrass, hybrid poplar, and hybrid willow. The paper begins with a brief description of the methods and data used to estimate the potential supplies and prices of bioenergy crops produced on CRP acres. The estimated results are presented next. The paper closes with a discussion of the implications the analysis has for the competitiveness of bioenergy crops.

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METHODS AND DATA

The potential bioenergy crop prices and quantities that can be produced on suitable CRP acres are first estimated. For the purpose of the analysis, suitable CRP acres are assumed to be all CRP acres from the mid-Plains states eastward in land capability classes (LCCs) 1 through 4. Acres in the western Plains States are excluded because they are too dry to support the production of hybrid poplars and willows without irrigation, and data regarding the production of switchgrass in these areas are lacking. The total CRP lands assumed suitable for switchgrass and short-rotation woody crops (SRWC) (i.e., hybrid poplar and willow) production are 7.0 and 5.7 million hectares respectively (17.4 and 14.2 million acres) (Walsh and Graham 1995). All estimates are based on planting all suitable acreage to switchgrass or all to SRWC.

The potential bioenergy crop supplies and prices can be estimated by using the CRP rental rate as the opportunity cost of the land in other uses. The analysis assumes that farmers will be unwilling to plant bioenergy crops on CRP acres unless they receive an expected income earned from producing bioenergy crops that is at least as high as the current CRP rental rate. That is, the income farmers receive from bioenergy crop production on CRP lands must be comparable to the rental rate farmers are currently receiving. The analysis uses the twelfth signup CRP rental rate distributions. Over the course of the CRP, the environmental criteria and the bid process have been continuously revised; the twelfth signup was felt to be a reasonable approximation of future rental rate distributions. The CRP rental rate distributions were generously provided by Erik Lichtenberg of the University of Maryland.

The price and supply estimates also require bioenergy crop yield distributions by LCC that correspond to the rental rates, and bioenergy crop production costs. The yield distributions by LCC are based on expert opinion and data from field plots (Walsh and Graham 1995). Full economic production costs (i.e., variable cash, fixed cash, and opportunity costs of owned resources) are used (Walsh 1994, 1995). Hybrid willow production costs are courtesy of Dan Robison of the State University of New York, Syracuse.

Given the rental rate, bioenergy crop yield, and production cost distributions, the potential minimum bioenergy crop price needed to ensure that a farmer would be willing to produce bioenergy crops can be estimated by solving for BP in Equation (1).

$$R = BP \times Y - C \qquad (1)$$

where:
R = CRP rental rate.
BP = bioenergy crop price.
Y = bioenergy crop yield.
C = bioenergy crop production cost.

From the CRP rental rate distribution, each bioenergy crop price and the corresponding acreage derived from each rental rate in the distribution is used to derive the total quantity of bioenergy crops that can potentially be produced at a given market price.

The CRP rental rate payments can serve as a defacto subsidy for the production of bioenergy crops and reduce the price of these crops. Using an approach similar to that described above, the potential price reduction was estimated for two administrative options: (a) a program similar to deficiency payments in that the rental rate is established and the government pays the difference between the profits earned from bioenergy crops and the rental rate and (b) a predetermined percent reduction in rental payments with participation of producers whose combined income from bioenergy crop profits and the reduced rental payment exceed the nonreduced rental payment.

For the deficiency payment option, farmers are assumed to participate in an economic use program only if the combined value of the government rental payments and bioenergy crop profits at least equals the full CRP rental payment. Under this option, the government pays the difference between the bioenergy crop profit and the CRP rental payment. Under such an option, the cost to the government of the program could potentially increase if producers earn negative profits from the production of bioenergy crops. However, since a principle driver of the proposals to allow economic use of CRP land was the potential to reduce government payments by reducing rental rates, it is unlikely that the government will increase rental payments beyond those that currently exist. Using the current CRP payments as the maximum subsidy possible, the reduction in the price of bioenergy crops can be approximated by estimating supply curves in the cases where bioenergy crop profits exceed zero.

Under the predetermined percent reduction option, the amount by which bioenergy crop prices can be reduced depends on the percent reduction of the rental rate. For a given percent reduction, bioenergy crop supply curves can be constructed by estimating the curves for which the combined income from bioenergy crop production and the new, lower rental rate is equal to or greater than the old rental rate.

EMPIRICAL RESULTS AND DISCUSSION

Table 1 presents the estimated nonsubsidized farm prices for three national yield levels and two total quantity levels. Transportation costs from the farm to user facility are not in- cluded in these prices; inclusion of transportation costs is expected to add \$5.50–\$11/dry Mg (\$5–\$10/dry ton) depending on transportation distance. A maximum of 121 km (75 miles) is assumed. Current expected national yields are 6.7–9.0 dry Mg/ha/yr (3–4 dry ton/ac/yr) for SRWC and 9.0–11.2 dry Mg/ha/yr (4–5 dry ton/ac/yr) for switchgrass. Since SRWC and switchgrass are relatively undomesticated species, the potential to increase yields by 4.5–6.7 dry Mg/ha/yr (2–3 dry ton/ac/yr) is high.

Tables 1 and 2 present the impact of using the CRP to subsidize bioenergy crop prices. Table 1 compares the nonsubsidized price, the deficiency payment price, and the percent reduction price assuming a rental rate reduction of 40%. Table 2 compares the price effects of the predetermined rental rate reduction option under two percent reduction levels. Under both administrative options, bioenergy crop prices are reduced with the deficiency payment option potentially reducing prices more than the predetermined percent reduction option.

Table 1. Estimated Farmgate Prices ($/Mg) For Selected Total Production and Yields.

	9.1 Million Mg			45.5 Million Mg		
	Non - Subsidize d	Subsidize ddeficienc y payment	Subsidized 40% rental rate reduction	Non - Subsidize d	Subsidize d deficiency payments	Subsidized 40% rental rate reduction
SRWC						
6.7 Mg/ha/yr	66	39	51	NP[a]	NP[a]	NP[a]
11.2Mg/ha/yr	43	24	34	56	30	41
15.7 Mg/ha/yr	32	15	28	39	24	30
Switchgrass						
9.0 Mg/ha/yr	36	20	26	47	25	34
11.2 Mg/ha/yr	30	17	24	45	23	31
13.5 Mg/ha/yr	28	13	23	37	22	28

[a] NP = not possible to produce this quantity given expected yields and suitable acres.
[b] Prices rounded to nearest dollar.
[c] Yields are weighted national average yields rounded to nearest tenth.

Table 2. Estimated Farmgate Prices ($/Mg) Under Two Percent Rental Rate Reduction Levels—Selected Yields and Production Levels.

Crop	Switchgrass						Short Rotation Woody Crops					
Reduction Rate	20 Percent			40 Percent			20 Percent			40 Percent		
Yield (Mg/ha)/ Supply	9.0	11. 2	13. 5	9.0	11. 2	13. 5	6.7	11. 2	15. 7	6.7	11. 2	15. 7
9.1M Mg	24	22	21	26	24	23	45	32	25	51	34	28
45.5 M Mg	30	28	24	34	31	28	NP[a]	36	28	NP[a]	41	30

[a] NP = not possible to produce this quantity given expected yields and suitable acres.
[b] Prices rounded to nearest dollar.
[c] Yields are weighted national average yields rounded to nearest tenth.

The bioenergy crop prices for the deficiency payment option represent the minimum that could likely be achieved given the rental rates, yields, and production costs assumed. In reality, it is unlikely that these prices can be achieved. The analysis assumes participation in the program by all CRP contractors, but in a voluntary program not all contractors will participate. Also, under this option, farmers are assumed to participate in the program only if they receive an income comparable to the CRP rental rate. In reality, this may provide insufficient incentives for producers to participate since they would be required to use their labor and equipment, as opposed to receiving the same payments for leaving their land idle. Only producers whose expected profits from bioenergy crop production exceed the rental payments may be interested in participating, in which case the bioenergy crop prices would be the same as the prices under the non-subsidized scenario. The bioenergy crop prices under the percent reduction option may be more achievable since it is assumed that farmers would participate in this program only if their expected income from bioenergy crop production exceeds the CRP rental rate. Still, the bioenergy crop prices for the percent reduction program should also be considered a minimum since not all farmers are likely to participate as is assumed.

The nonsubsidized prices can be put in perspective by analyzing their meaning for ethanol production. Technologies currently in the demonstration phase are expected to allow production of at least 416 L ethanol/dry Mg (100 gal/dry ton) of cellulosic material. Thus, depending on yield and crop, 9 million dry Mg (10 million dry tons) and 45 million Mg (50 million tons) of biomass is sufficient to produce from 3.8 billion L (1 billion gal) to 19 billion L (5 billion gal) of ethanol at a delivered (transportation cost included) feedstock price of between \$0.07/L (\$0.25/gal) and \$0.17/L (\$0.65/gal). By-product (e.g., lignin which is burned to provide the energy needed for the conversion process) credits of around \$0.02/L (\$0.07/gal) can be achieved, lowering the feedstock price by this amount (Hohmann and Rendleman 1993). These prices are comparable to net feedstock costs of corn. Since combined capital and operating and maintenance costs of converting cellulosic to ethanol are expected to be similar to those of corn (Hohmann and Rendleman 1993), cellulosic technologies are approaching competitiveness with corn as an ethanol feedstock.

Converting prices to an energy equivalent (Gigajoule, GJ) basis allows comparison of the subsidized bioenergy crop prices with each other and with fossil fuels[2]. At 11.2 dry Mg/ha (5 dry tons/ac) and 9.1 million dry Mg (10 million dry tons) produced, subsidized delivered prices (assuming \$11/Mg transportation costs) are \$1.84/GJ (\$1.94/MBtu) for SRWC and \$1.64/GJ (\$1.73/MBtu) for switchgrass under the deficiency payment option. Under the percent reduction option (and assuming a 40% reduction), subsidized SRWC prices are \$2.35/GJ (\$2.48/MBtu) and switchgrass prices are \$2.09/GJ (\$2.21/MBtu). Current coal and natural gas delivered prices range from \$1.88 to \$2.42/GJ (\$1.99 to \$2.56/MBtu) and \$1.25 to \$1.38/GJ (\$1.32-\$1 to 46/MBtu), respectively (EIA 1996).

The analysis also demonstrates that a strong research program to increase yields can result in a substantial reduction in price of bioenergy crops. Since bioenergy crops are relatively new, the potential to increase yields is high. Other options to reduce production costs also exist, which could increase the relative economic competitiveness of bioenergy crops.

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[2] Woody crops 19.2 GJ/M contain G (16.5 MBTU/dry ton) and switchgrass contains 16.8 GJ/Mg (14.5MBtu/dry ton).

The paper demonstrates that the CRP could potentially be used to subsidize the production of bioenergy crops and reduce their market prices. Because the interest in allowing economic use of CRP acres was to reduce government payments rather than to support a bioenergy crop industry, we also estimated potential government savings under the two administrative options. Under the deficiency payment option, at a delivered price of \$1.75/GJ (\$1.85/MBtu) and an average yield of 11.2 Mg/ha/yr (5dry tons/ac/yr), the government can potentially save up to \$2.2 billion from switchgrass and \$700 million from SRWC production on CRP acres. Under the percent reduction option, assuming the same price and yield and at a 40% predetermined rental rate reduction, the government can potentially save up to \$510 million from switchgrass and \$196 million from SRWC production (Walsh et al., 1996).

It is important to note that as government savings increase, the subsidy provided to bioenergy crops decreases. Thus one cannot achieve maximum savings and minimum prices simultaneously. However, the analysis clearly shows that government saving and subsidy combinations exist such that the production of bioenergy crops on CRP acres can be a win-win situation. Furthermore, if managed appropriately, the harvest of bioenergy crops on CRP acres can maintain most of the environmental benefits of the program.

SUMMARY AND CONCLUSIONS

CRP economic-use amendments were proposed, but not implemented in the 1995 Farm Bill. Thus, the program cannot currently be used as a means to subsidize bioenergy crop prices, although this analysis indicates that the potential exists. However, while it is not USDA policy to routinely allow economic use of CRP acres, the USDA has historically made exceptions to the no-harvest provisions of the program if the situation warranted it. As an example, this summer the USDA is allowing farmers to graze their CRP acres in return for a 5% reduction for the months that grazing occurs (a program similar to the percent reduction option). Given these historical exceptions, some states, on a case-by-case basis, are discussing with the USDA, the possibility of using CRP acres for bioenergy crop production.

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