Adoption of Conservation Initiatives on Midwest Farms: Farm Size Matters

Department of Agricultural Economics

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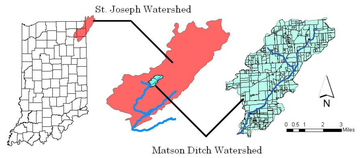
Introduction

This study examines the incentives of farm firms in the Matson Ditch Watershed to change tillage practices and adopt buffers on their farms. Matson Ditch, a 10,700 acre sub-section of the St. Joseph Watershed, is located in DeKalb County, Indiana. Farm level economic and environmental modeling was conducted to examine the trade-offs the farmer must make when changing tillage practices and establishing buffer areas.



Research Objectives

1) Determine how changing tillage systems and utilizing buffers affect the economics of the farm firm.
2) Examine how changes in tillage practices and buffer utilization affect the amount of sediment reaching water resources.
3) Identify possible improvements in agricultural policy that would encourage producers to adopt conservation tillage systems and buffers.

Farm Firm Level Modeling

Nine different representative farms were modeled for the Matson Ditch Watershed. Three farm sizes; small (500 acres), medium (1000 acres), and large (2500 acres) were examined under three different tillage systems; conventional, reduced, and no-till. Production costs for corn and soybean rotations were established using local input prices and machinery complements. Three different buffer widths were established; 20 feet, 35 feet, and 120 feet, utilizing four different vegetative options; alfalfa, all grass, half grass and half trees, and two-thirds grass one-third trees.

Economic Model

Information was gathered from local producers, input dealers, and natural resource agencies to develop representative farms. These farms where then analyzed with the Purdue Crop and Livestock Linear Programming Model (PCLP) to better understand how scarce farm resources, such as labor and machinery, can be allocated in the most optimal way. The model estimates the expected returns to the farm when utilizing different production systems. Prices, yields, subsidies, machinery complements, and input costs are based on 2005 data for Matson Ditch.

Environmental Model

The Water Erosion Prediction Project (WEPP) model was utilized to better understand the environmental implications of changing land uses in the Matson Ditch watershed. The model was used to predict yearly sediment yields from the watershed, which is subdivided into 456 hillslopes, based on DEM data. WEPP uses the same tillage systems and crop rotations as the economic model. Model output estimates annual sediment yields over a 30 year period based on rain fall amount and intensity, soil properties, slope, crop growth and decomposition, and production practices.

Profitability

A

Profit per Acre from Operations with Subsidy Payments	Conventional	Reduced	No-Till
Large	$ 73.90	$ 69.32	$ 66.24
Medium	49.71	44.66	41.91
Small	33.92	36.43	33.94

B

Profit per Acre from Operations without Subsidy Payments	Conventional	Reduced	No-Till
Large	$ 22.05	$ 17.48	$ 15.42
Medium	(2.14)	(7.19)	(8.91)
Small	(17.93)	(15.41)	(16.88)

C

Returns to Labor and Management per Hour	Conventional	Reduced	No-Till
Large	$ 78.40	$ 77.42	$ 83.32
Medium	48.92	46.68	50.78
Small	35.81	41.22	41.38

D

Growth Potential (Acres)	Conventional	Reduced	No-Till
Large	228.5	214.2	1130.3
Medium	501	291.8	785.6
Small	0	2.8	162.4

The PCLP model indicates that larger farms are more profitable per acre than smaller farms (A), but all profits are heavily dependant on government subsidies (B) such as direct, counter-cyclical, and loan deficiency payments. Small farms lose money without these payments. Reducing the amount of tillage reduces the amount of time spent on field operations, so no-till farms have higher returns to full time labor and management (C). This additional time can also lead to greater farm expansion potential (D) using the same machinery compliment. It is important to compare returns that buffers generate in comparison to the crop production that must be given up. Corn production can be profitable on marginal lands, but soybean production is only profitable on large farms (E). Alfalfa buffers are the most profitable over the life of the practice, grass and grass tree mixes lead to fairly comparable returns (F).

E

Profits per Acre on Marginal Lands

Corn	Small	Medium	Large
Conventional	$ 28.62	$ 45.71	$ 69.08
Reduced	22.34	37.04	60.46
No-Till	32.14	41.26	63.64

Soybeans	Small	Medium	Large
Conventional	$ (7.64)	$ 0.71	$ 9.53
Reduced	(2.37)	3.47	21.57
No-Till	(2.93)	(2.82)	16.78

F

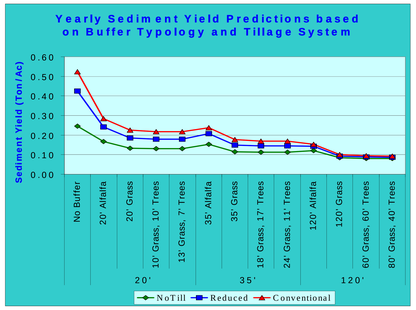
Expected Profits per Acre from Buffer Areas

Buffer Type	Establishment Year	Second Year	Third Year and Beyond	Yearly Average Over Life of Practice
Grass	$102.40	$5.05	$5.05	$14.79
Alfalfa	(178.44)	69.02	69.02	19.53
1/2 Grass, 1/2 Trees	87.80	0.02	11.17	15.53
2/3 Grass, 1/3 Trees	101.63	1.67	9.16	14.82

Sediment Yield

WEPP modeling (G) indicates that switching to a reduce tillage system decreases sediment yields by 19% in comparison to conventional system. Utilizing a no-till system reduces sediment yields 53%. Adding a 20' buffer to a conventional system can be as beneficial in reducing sediment yield as switching to a no-till practice in the short run. The first 20' of buffer area has the greatest impact on reducing sediment yields; expanding the buffer to 35' or 120' continues to reduce sediment delivery but to a lower extent than the initial 20'. Adding buffer areas does not decrease soil loss that is occurring uphill or the runoff from those areas. As buffer sizes are increased the tillage system has less impact on the amount of sediment delivered to water resources. No-till systems always show the lowest estimated sediment yields.

G



Conclusions

Different sized farms have different incentives when choosing to adopt conservation tillage or buffer areas. Large farms can produce profitably on marginal lands and may be less likely than small farms to take these lands out of production.

Farm profitability is highly tied to production subsidies. Switching to a No-Till cropping system allows for greater returns per production hour as well as greater flexibility for future farm expansion.

The first 20' of buffers provides the greatest decrease in sediment yields. Alfalfa buffers can be a financially feasible alternative to producers, but decrease sediment yields less than traditional grass or grass/tree buffers and returns are less certain due to weather and markets.

Recommendations

Producers on smaller farms are more likely to see financial benefit in establishing buffer areas than larger producers. On larger farms changing to no-till can be a profitable alternative which greatly reduces sediment yields. This research highlights the importance of production subsidies on producer income. Tying these subsidies to conservation initiatives rather than traditional payment methods could greatly benefit environmental quality while maintaining farm income. Providing producers with incentives to establish 20' buffers near water resources should lead to large decreases in the amount of sediment entering water resources. Future studies should be extended to other CEAP watersheds and should expand the environmental parameters by utilizing an AGNPS or SWAT model.

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