Certified Organic Field Crop Profitability

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Abstract

Most research about the economics of organic field crop production evaluates variable costs using data from long-term experimental trial results, while little information is available about the relative economic costs and returns of organic production on commercial farms. This study uses data from targeted surveys of organic corn, wheat, and soybean production in an observational analysis of cost-of-production differences between conventional and organic cropping systems. Findings of this research suggest that significant economic returns are possible from organic crop production. Unlike long-term experimental trials—where returns are often the result of obtaining similar conventional and organic yields with lower organic production cost—this study finds the main reason for higher per-bushel returns to organic production to be the price premiums received for organic crops. Despite potentially higher returns, adoption of organic field crop production has been slow and challenging because of such factors as achieving effective weed control and acceptable yields, and organic certification costs and procedures.

Introduction

U.S. crop acres under USDA certified organic systems have grown rapidly since the National Organic Program (NOP) was implemented in 2002. Organic crop acreage increased from about 1.3 million to almost 3.1 million acres between 2002 and 2011 (USDA, Economic Research Service 2014). While acreage for some major field crops increased substantially, growth was modest for others. Among three major field crops—corn, soybeans, and wheat—certified organic production of corn increased the most. Certified organic wheat acres were the highest, but declined after 2009. Organic soybean acreage has been flat since peaking in 2001. Recent USDA survey data show corn acreage up 24 percent, soybean acreage up 3 percent, but wheat acreage down 3 percent between 2011 and 2014. These trends suggest that organic corn was most profitable during this period, but that the profitability of organic wheat and soybeans is uncertain.

Despite the interest and support of organic crop production in the U.S, overall adoption of organic corn, soybeans, and wheat remains low, standing at less than one-percent of the total acreage of each crop in 2011 (USDA, Economic Research Service and National Agricultural Statistics Service 2014). Low organic adoption among U.S. field crop producers may be affected by the dearth of information about the relative costs and returns of organic and conventional production systems on commercial farms in the U.S. and the performance of farms that are choosing the organic approach. Several researchers (Delate et al. 2003.; Mahoney et al. 2001; Hanson et al. 1997; Pimentel et al. 2005; Smith et al. 2004) have examined organic crop production in a long-term experimental setting, but little has been reported about the commercial production of organic field crops (McBride and Greene 2009; Nordquist et al. 2012). This study utilizes observational data obtained in samples of U.S. field crop producers from USDA's Agricultural Resource Management Survey (ARMS) in a comparison of the profitability of conventional and organic systems.

Objectives

The objectives of this study are twofold: 1) to estimate the difference in economic production costs that can be attributed to producing certified organic field crops, and 2) to examine how this difference in production costs compares with the price premiums received for organic field crops during 2011-14.

The views expressed are those of the authors and should not be attributed to ERS or USDA.

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These results should provide a context for the organic field crop acreage changes observed over the study period.

Data and Methods

Data from samples of U.S. corn, wheat, and soybean producers, including targeted samples of certified organic producers of each crop as part of USDA's 2010, 2009, and 2006 Agricultural Resource Management Survey (ARMS), respectively, support the research in this study. Each version targeted producers in States that totaled over 90 percent of U.S. planted acreage of the commodity in each year. After accounting for out of business operations, survey refusals, and questionnaires with incomplete data, 1,087 conventional corn farms and 243 organic corn farms from IL, IN, IA, KS, MI, MN, MO, NE, NY, ND, OH, PA, SD, and WI were used in this study. For wheat, 1,339 conventional farms and 182 organic farms from CO, ID, IL, KS, MI, MN, MO, NE, ND, OH, OK, OR, SD, TX, and WA were used. Production costs were compared among conventional and organic soybean producers in IL, IN, IA, KS, MI, MN, MO, NE, ND, OH, SD, and WI including 1,425 conventional and 237 organic producers.

The costs of organic and conventional production were contrasted by two commonly used distinct empirical procedures to evaluate relationships in observational data. Both procedures used a treatment-effect analysis where the treatment is organic production and its effect is examined on economic production costs. First, a matched sample of organic and conventional producers—based on farm, operator, and production characteristics—was generated in order to account for differences between conventional and organic farms in measuring the organic treatment-effect on production costs. Such a method is referred to as "propensity-score matching". Second, a "regression with endogenous treatment-effects" was conducted to account for observable differences between organic and conventional crop producers and potential unobservable differences resulting from selection-bias in the assignment of organic production among producers in the population. These statistical procedures, in contrast with the simple mean difference, attempt to measure the cost difference between organic and conventional corn, wheat, and soybean production from farm survey data as if they were from an experimental setting.

The average treatment-effect of producing organic is measured using each technique on unit (per bushel) total economic production costs. Economic production costs include operating and allocated overhead costs. Operating costs are costs for seed; fertilizer; chemicals; custom operations; fuel, lubrication, and electricity; repairs; purchased irrigation water; hired labor; and operating interest. Capital costs are part of allocated overhead and include the annualized cost of maintaining the capital, including economic depreciation and interest, used in production, estimated using the capital recovery approach, and costs for non-real estate property taxes and insurance. Total economic costs are the sum of operating and capital costs, plus opportunity costs for land and unpaid labor, and allocated costs for general farm overhead items. Costs of organic and conventional production are computed according to procedures used by USDA (USDA, Economic Research Service 2012). Estimates of the annualized cost of organic transition and annual certification costs were then added to the cost difference measured from each technique. Further detail about the data and methods used in this study can be found in McBride et al. 2015.

Results and Discussion

Data from long-term cropping system experiments in Iowa, Pennsylvania, and other States suggest that organic field crop production can generate significant returns. These data often show similar conventional and organic yields and lower organic production costs. However, farm data from USDA producer surveys show organic crop yields to be much lower than those of conventional production. The yield differences estimated from ARMS data are similar to those estimated by comparing USDA's 2011 Certified Organic Production Survey with USDA's 2011 Crop Production Report. These data show organic corn yields to average 41 bushels per acre less than conventional yields, organic wheat yields to average 9 bushels per acre less, and organic soybean yields to average 12 bushels per acre less.

The mean difference in total economic costs per acre was not significant for any of the field crops, but the composition of costs varied significantly between conventional and organic producers. On average, conventional growers had significantly higher seed, fertilizer, and chemical costs than organic growers, but lower costs for fuel, repairs, capital, and labor, as organic systems substituted manure and field operations for fertilizers and chemicals. Organic producers had higher fuel, capital, and labor costs because they used more field operations, particularly for tillage and weed control. Despite similar economic costs per acre, mean total economic costs per bushel were significantly higher for organic producers due to lower crop yields.

The estimated average treatment-effect on total economic costs was statistically significant using the propensity score and regression estimators for each field crop. Both estimators yielded values that were greater than the mean difference in total economic costs, suggesting that not adjusting for the influence of covariates and self-selection would have contributed to an underestimation of the treatment-effect. An annualized estimate of organic transition costs and annual certification costs were added to each estimator. Using the propensity score estimator economic costs of organic corn, wheat, and soybean production were $1.92, $3.90, and $6.62 per bushel, respectively, higher than conventional costs. These costs were $2.27, $4.46, and $7.81 per bushel, respectively, with the regression with endogenous treatment effects estimator (table 1).

Comparing the additional costs of organic production with historic price premiums (the difference between organic and conventional crop prices) provides an indication of the returns associated with organic field crop production. Organic corn prices averaged $7.98 (food-grade) and $6.82 (feed-grade) more than conventional corn prices during 2011-14 (fig. 1), while the economic cost difference was $1.92 to $2.27 higher, indicating significant profit potential from organic corn. Likewise, organic soybean prices averaged $12.82 (food-grade) and $10.86 (feed-grade) higher than conventional soybeans during the same period, creating price premiums high enough to cover the additional economic costs of $6.62 to $7.81 per bushel of organic soybean production.

The profitability of organic and conventional wheat varied by type of wheat and year during the 2011-14 period. During 2011-12, average price premiums for organic food- and feed-grade wheat, at $2.75 and $4.44 (fig. 3), respectively, were at or below the economic cost difference of $3.90 to $4.46 per bushel. During 2013-14 average organic wheat price premiums increased to $10.55 (food-grade) and $5.76 (feed-grade) per bushel, well above the estimated cost difference, particularly for food-grade wheat.

The yield, price, and cost differences were used to estimate average per acre returns to organic versus conventional production for each crop. Average additional economic costs of $83 to $98 per acre for corn, $55 to $62 per acre for wheat, and $106 to $125 per acre for soybeans were incurred from organic production. These cost estimates are based on the farm survey yield and cost data. Estimates of the average difference in net returns per acre for organic versus conventional production were positive and highest for corn ($51 to $66 per acre), followed by soybeans ($22 to $41 per acre), but negative for wheat (-$9 to -$2 per acre).

Conclusions

The main reason that organic returns were higher than conventional returns was the price premiums paid for organic crops. Price premiums received for organic crops were generally above the estimated additional economic costs of organic production for most crops during 2011-14. Estimates of the difference in net returns per acre for organic versus conventional production showed positive economic profit for organic corn and soybeans relative to conventional crops, consistent with expanded organic acreage of those two crops during 2011-14. Estimates of an economic loss per acre for organic versus conventional wheat is consistent with the decline in organic wheat acreage during this period. The relative economic profit was highest for organic corn, consistent with the 25 percent increase in organic corn acreage, much greater than for the other field crops.

Despite these potentially higher returns from organic production, adoption of the organic approach among U.S. field crop producers remains low. One possible reason is the ease of producing for the conventional market. Seed and chemicals are readily available from local seed and chemical company dealers and conventional products can be sold at the local elevator. In contrast, organic farmers have to secure organic seed; learn to manage soil fertility, weeds, and other pests through natural methods; and find their own markets to sell crops, which may require storage on the farm until pickup. Thus organic farming requires more on-farm management.

The low level of U.S. organic crop adoption may also be due to spatial variation in climatic and market conditions. Organic production is more attractive where crop pests are fewer, such as in northern States. Also, a market for the more expensive organic food or feed crops is required, such as the demand for organic feed ingredients from the expanding organic dairy industry in States of the upper Midwest and Northeast. These factors may limit the area where organic systems are potentially profitable. Surveyed organic producers rated controlling weeds, achieving yields, and certification paperwork as the most difficult aspects of organic field crop production.

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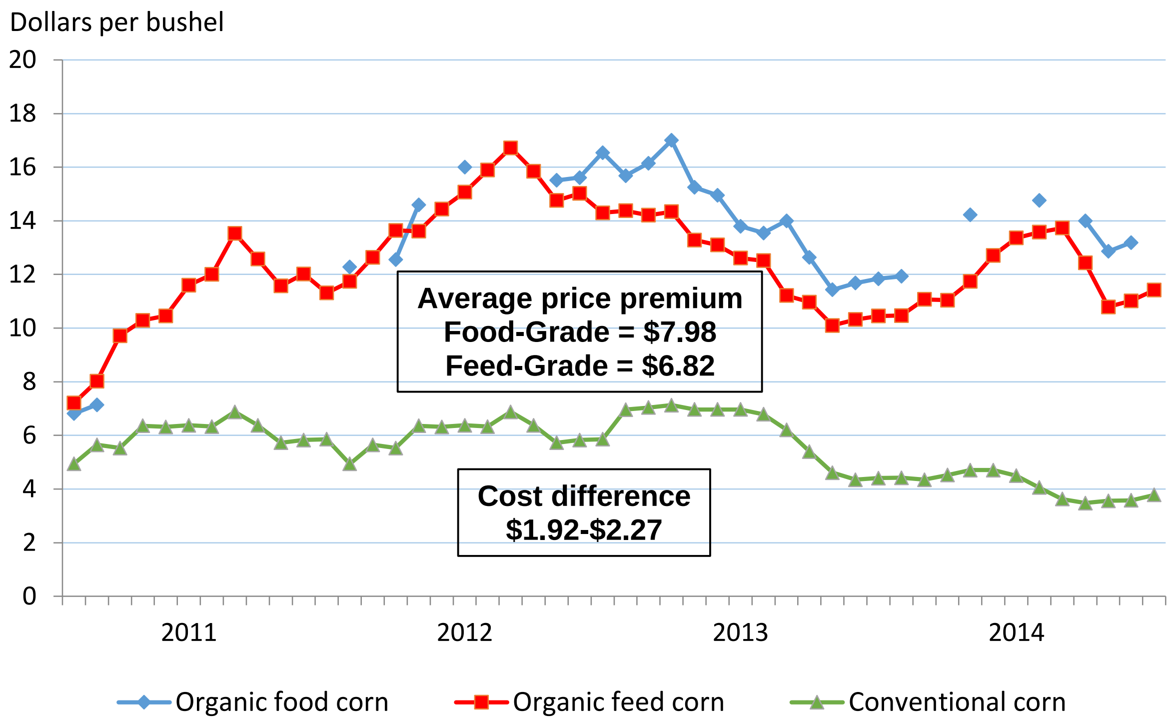
Table 1. The Difference Between Organic and Conventional Production Costs per Bushel for U.S. Corn, Wheat, and Soybean Production using Various Estimators, Plus Organic Transition and Certification Cost Estimates

Crop	Statistical Estimator		
	Mean Difference	Propensity-Score Matching	Regression w/ Endogenous Treatment- Effects
	dollars per bushel		
Corn	1.50	1.92	2.27
Wheat	3.53	3.90	4.46
Soybeans	6.13	6.62	7.81

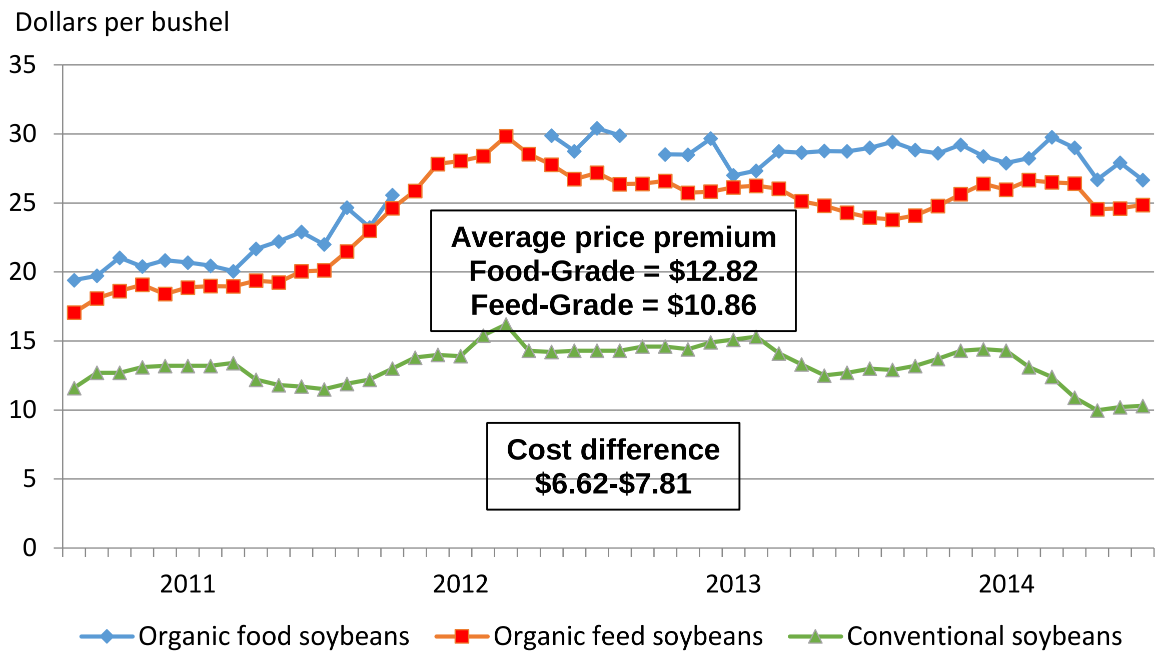
Notes: Estimates show the difference in economic production costs between certified organic producers and conventional producers using each statistical estimator, plus annual transition and certification cost estimates. Further detail about the data and methods used can be found in McBride et al. 2015.
Source: Estimated using data from USDA's Agricultural Resource Management Survey: 2010 for corn, 2009 for wheat, and 2006 for soybeans.

Figure 1: Conventional and Organic Food-Grade and Feed-Grade Corn Prices, 2011-2014



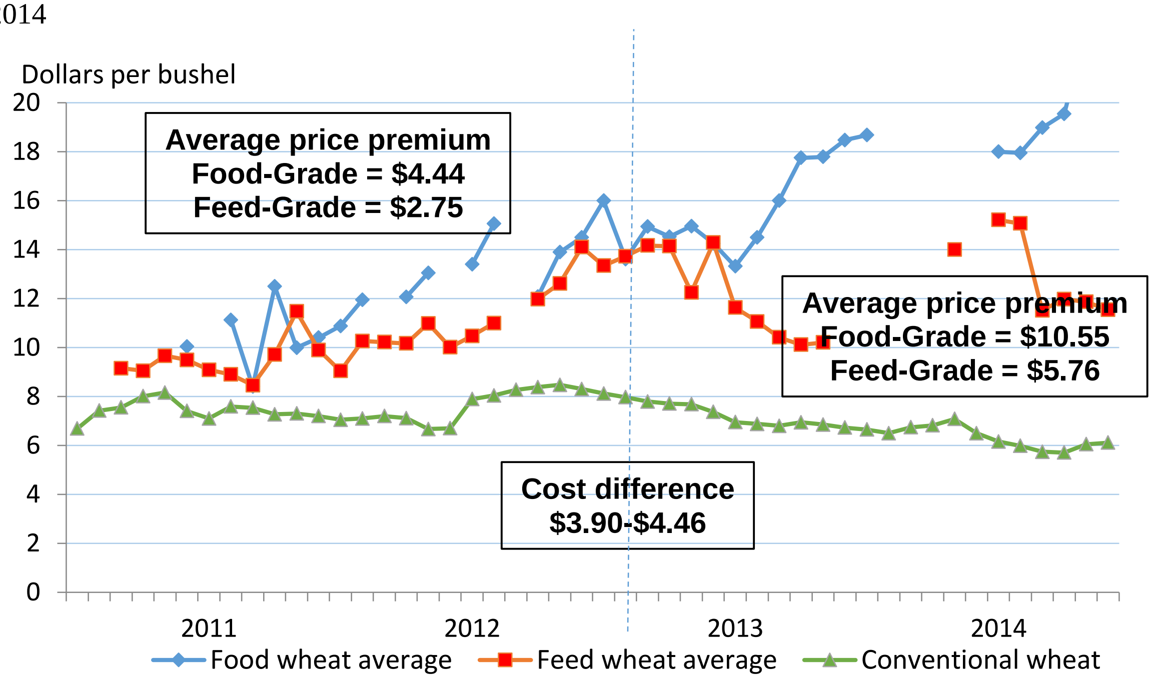
Source: Organic prices are from USDA Agricultural Marketing Service; Conventional prices are from USDA National Agricultural Statistics Service.

Figure 2: Conventional and Organic Food-Grade and Feed-Grade Soybean Prices, 2011-2014



Source: Organic prices are from USDA Agricultural Marketing Service; Conventional prices are from USDA National Agricultural Statistics Service.

Figure 3: Conventional and Organic Food-Grade and Feed-Grade Wheat Prices, 2011-2012 and 2013-2014



Source: Organic prices are from USDA Agricultural Marketing Service; Conventional prices are from USDA National Agricultural Statistics Service.