ECONOMIC, SOCIAL, AND ENVIRONMENTAL BENEFITS ASSOCIATED WITH U.S. ORGANIC AGRICULTURE

Luanne Lohr

Department of Agricultural and Applied Economics, University of Georgia, Athens, GA 30602-7509, U.S.A.

e-mail: llohr@agecon.uga.edu, tel: +1-706-542-0847

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Abstract

This case study reviews the economic, social, and environmental benefits associated with organic agriculture in the United States. Measurable impacts are quantified by comparing indicators of benefits in counties with organic farms and counties without. Statistical differences across counties with and without organic farms provide preliminary evidence that organic farms may generate a variety of direct and indirect benefits. Of 36 indicators tested across a range of economic, social, and environmental benefits, 26 favor organic systems, three favor conventional systems, and seven are neutral. Even though organic farmers are not a large percentage of the total number of U.S. farmers, they may be influencing mainstream agriculture to shift toward greater sustainability.

Introduction/Problem

Consumers believe that organic foods are safer, healthier, and better for the environment and that they are safer for farmers to produce (HealthFocus, 1999). Farmers cite both personal and business reasons for organic farming, including a belief that organic is better for the land, a concern that conventional farming may cause negative environmental and health impacts, a sense of satisfaction in solving the challenges of organic systems in innovative ways, and an ability to make positive net returns on small scale, intensively managed farms (Duram, 1999). Most of the farm benefits usually cited – improved soil quality, greater diversity of soil organisms, insects, wildlife, and plants, greater net return, reduced income risk, better drought resistance, higher cumulative energy efficiency, and safer on-farm environment - are outcomes of the methods required for organic farming (Mahoney *et al*., 2004; Rigby *et al*., 2001; Stolze *et al.*, 2000). Beyond the farm, benefits claimed from organic farming include enhanced biodiversity and habitat, cleaner groundwater and surface water, and reduced greenhouse gas emissions. Greater certainty about expected benefits of organic foods encourages consumers to pay the price premiums that internalize these benefits and encourages producers to incur the costs of converting farms to organic production. Government policy to support the organic industry is likely only if evidence of comprehensive beneficial effects is presented. Most studies of organic benefits in the United States have been localized in nature. To evaluate benefits for the entire country, indirect statistical measures must be used.

Methodology

Statistical comparison of organic farms with conventional farms would ideally be conducted at the farm level, with data collected on each individual operation relating farm practices to observable benefits. In the absence of such data sets, county level data, the next highest geographic level of analysis, were used. Counties are geopolitical units that may encompass several towns or cities, and thus multiple zip codes, but are subordinate to state governments. Data on the number of organic farmers per county were collected for 1997 from the Organic Farming Research Foundation and from certifiers throughout the U.S. Only one major certifier, accounting for about 200 farmers, refused to participate in the data collection, so the sample is nearly the entire population of organic farmers at that time.

Using the unique five-digit state-and-county identifiers, called FIPS (Federal Information Processing Standards) codes used by the U.S. Census Bureau, all counties in the U.S. were classified as either "with" or "without" organic farms, "with" being defined as having at least one organic farm located interior to the county boundary. Of 3,078 counties in the United States, 39.2% had at least one organic farm at the time of the analysis, with a weighted average of 3.3 organic farms in these 1,208 counties. The mean values of selected indicators from the U.S. Agricultural Census (USDA, 1997) were calculated for counties "with" and "without" organic farms. The counties were compared using a t-test for equality of the means under the assumption that as the sample size increases, the t distribution approaches the standard normal distribution (Kmenta, 1986). For statistically different means, either the organic or conventional system was declared "best performance." Higher means were preferred for positively valued attributes, such as hired worker payroll, and lower means for negatively valued attributes, such as pesticide use.

A similar process was conducted to evaluate watershed indicators. FIPS for the counties with and without organic farms were matched to eight-digit watershed identifiers known as HUCS (Hydrologic Unit Code System) used by the U.S. Geological Survey. It is common for several counties to overlap a watershed yet not be contained within it, since a watershed is a physical unit delineating surface water flows rather than a political boundary. The condition was set that all counties making up the watershed had to have at least one organic farm. Means for watersheds "with" and "without" organic farms were constructed from U.S. Environmental Protection Agency data on watershed indicators.

There are advantages in aggregating the data into two groups – counties with and counties without organic farms. First, the method is consistent with the theory that organic farmers influence other farmers' behavior and county economies by their presence and contributions to the management information set within the county. Even a single organic farmer can stimulate change by requests to county extension agents, applications for government programs, participation in field demonstrations, and other activities that raise the awareness of both farmers and information providers. Second, this approach prevents the results from being skewed by states having many counties with large numbers of organic farmers, such as California. For example, confounding factors such as stricter pesticide laws in California do not influence the findings of benefits because California is not disproportionately represented in the sample, as it would be if the aggregation unit was the number of organic farmers.

The method used relies on correlations to document organic farm influence. Causality is not established, as might be possible with regression analysis, so it cannot be definitively stated that the presence of organic farms is the cause of the benefits indicated. Theoretically, there may be other commonalities in counties with organic farms that account for observed differences, although the geographic distribution and physical diversity of the farms are such that obvious factors such as proximity to cities or crop selection by region may be ruled out. Aggregation to counties allows statistical tests for the influence of organic farms, even if the relationship cannot be precisely quantified. Observing statistically significant results across multiple indicators suggests that the presence of organic farmers is strongly associated with the benefits.

Results and Brief Discussion

Table 1 shows the 36 indicators compared for counties with and without organic farms. Best performance is assessed for the system with the higher mean if the indicator has a (+), and the lower mean if the indicator has a (-). If the category heading has one of these signs, means for all the indicators in the category should be higher (+) or lower (-) to be best, with exceptions marked. If the difference of the means is not statistically significant at $\forall$=0.05, then neither system exhibits the best performance. This test is not a definitive indicator of the superiority of organic or conventional systems; rather, it indicates that counties with organic farms perform statistically differently than counties without.

The results suggest the dominance of counties and watersheds with organic farmers over those without. From Table 1, several direct conclusions may be made. First, counties with organic farms have stronger farm economies and contribute more to local economies through total sales, net revenue, farm value, taxes paid, payroll, and purchases of fertilizer, seed, and repair and maintenance services. Second, counties with organic farms have more committed farmers and better support rural development with higher percentages of resident full-time farmers, greater direct-to-consumer sales, more workers hired, and higher worker pay. Third, counties with organic farms provide more bird and wildlife habitat and have lower insecticide and nematicide use. Fourth, watersheds with organic farms have less agricultural impact and lower runoff risk from nitrogen and sediment.

Table 1. Indicators Tested for Counties With and Without Organic Farms

				Best Performance		
Indicator	Units	Mean With Organic	Mean Without Organic	With Organic	Neither	With Conventional
Farm Economy (+)						
Total farm sales	dollars per farm	111,696	99,075	X		
Total farm expenses **(-)**	dollars per farm	85,358	76,748			X
Net return to agricultural sales	dollars per farm	25,813	22,226	X		
Market value of land and buildings	dollars per farm valued	511,250	474,740	X		
Local Economy (+)						
Property taxes paid	dollars per farm paying	95,000	84,479	X		
Hired worker payroll	dollars per farm hiring	24,145	16,685	X		
Fertilizer purchased	dollars per farm buying	8,681	7,770	X		
Agricultural chemicals purchased	dollars per farm buying	7,306	7,340		X	
Livestock and poultry purchased	dollars per farm buying	38,232	40,733		X	
Commercially mixed feed purchased	dollars per farm buying	26,763	36,201			X
Seed, bulbs, and trees purchased	dollars per farm buying	6,976	5,215	X		
Custom work, machinery rented	dollars per farm renting	5,110	4,758		X	
Repair and maintenance purchased	dollars per farm buying	6,268	5,365	X		
Farm Ownership (+)						
Sole proprietorship	percent of all farms	84.2	85.2			X
Family held corporation	percent of all farms	5.2	4.4	X		
Female farmer	percent of all farms	9.3	8.9	X		
Renting some or all land **(-)**	percent of all farms	41.5	48.1		X	
Operator Characteristics (+)						
Operator lives on farm	percent of all farms	72.1	68.0	X		
Farming principal occupation	percent of all farms	53.4	48.7	X		
Full-time farming	percent of all farms	65.4	62.7	X		
Years operating present farm	average years	20.5	20.1	X		
Rural Development (+)						
Direct-to-consumer sales	dollars per farm	5,247	3,489	X		
Worker pay	dollars per worker	4,122	3,675	X		
Workers hired	workers per farm	5.1	4.0	X		
Farms with net losses **(-)**	percent of all farms	47.8	50.2	X		
Bird and Wildlife Habitat (+)						
Idle or in permanent cover crops	acres of cropland	14,476	9,790	X		
Idle, cover cropped, or woodland	acres of farmland	27,487	24,019	X		
Land under CRP/WRP	acres	13,297	9,230	X		
Chemical Use (-)						
Fertilizer use	acres per farm using	204.94	200.70	X		
Insecticide use	acres per farm using	153.67	183.15X			
Herbicide use	acres per farm using	240.09	240.27	X		
Nematicide use	acres per farm using	20.22	37.48X			
Runoff Risk (-)						
Agricultural impact index	weighted index	0.85	1.03X			
Nitrogen runoff index	weighted index	0.79	1.03X			
Pesticide runoff index	weighted index	0.94	1.01	X		
Sediment runoff index	weighted index	0.86	1.02X			

The measurable benefits of organic agriculture suggest other indirect gains to society. Higher average net farm revenues and higher values of land and buildings are important measures of financial stability for farmers, since the value of the farm represents both collateral for loans and retirement capital. Local rural economies benefit as well. In many states, property taxes pay for public schools, hospitals, and other infrastructure. Higher tax payments can translate to significant benefits to non-farmers. Adding payroll to the local economy is important not only for the multiplier effect in the retail and service sectors, but because it provides another avenue for recruitment of farmers young people are hired and trained in farming. If sales of more expensive organic inputs are generated, agribusinesses may survive on fewer sales, which could keep more firms in business.

Concern over the industrialization of agriculture has led to scrutiny of farm transition among families. Counties with organic farms have higher percentages of family held corporations and female farmers, as well as farms where the operator lives on farm, farming is the operator's principal occupation, and the operator is a full-time farmer. These factors contribute to a desirable rural sociology by stabilizing the agricultural sector and maintaining local information and social networks. Direct to consumer sales are an important means of linking farmers and consumers. Farmers in counties with organic farms obtain nearly 50% more revenue from direct sales than in counties without. Farm workers need to earn a living wage to contribute to the rural economy and maintain a reasonable standard of living. More workers are hired per farm in counties with organic farmers and pay per worker is higher. Agricultural habitat for birds and wildlife was defined in several ways that relate to contiguity of habitat, measured by total acres. Habitat is statistically higher in all three categories for counties with organic farms. Less use of insecticide and nematicide and lower indexes of agricultural impact, nitrogen runoff, and sediment runoff result in fewer incidents of chemical exposures affecting worker productivity, less water quality degradation, and fewer fish consumption advisories.

Conclusions

This case study documents the statistical difference between U.S. counties with organic farms and those without. Counties with organic farms perform better on 26 of 36 economic, social, and environmental indicators. The findings suggest that even in small numbers, organic farmers are influencing mainstream agriculture to shift toward greater sustainability.

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