Georgia Farmers' Perceptions of Production Barrier in Organic Vegetable and Fruit Agriculture

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Abstract

Profit maximizing farm producers attempt to minimize risk in their business by utilizing available cost effective methods and information. This research attempts to identify production barriers to vegetable and fruit producers adopting organic methods of production and determine which of these barriers to organic production influence adoption most. The data for this study is from a 2014 state wide telephone survey of Georgia's vegetable and fruit producers. Producers were segregated into five groups; those using 100 percent conventional methods, more conventional than organic, those using about 50 percent organic and 50 percent conventional, more organic than conventional, and 100 percent organic method. Results are based on logit analysis of producers' perceptions of barriers, farm and socioeconomic characteristics. A number of factors including producers' evaluation of production barriers are shown to influence adoption of organic production methods. Among perception factors and characteristics influencing adoption are organic certification costs, reluctance to adopt new production methods, lower organic yields, liability of organic producers is higher, labor costs, producer age, educational attainment, years of organic farming experience and farm size (measured as gross annual farm sales).

Introduction

In recent years, average annual growth of U. S. sales of organic food and beverages have been reported in the range of 12 to 21 percent and has outpaced those of conventional produced agricultural food products (Organic Trade Association, 2011). Annual sales of organics have grown from about $1 billion in 1990 to an estimated $28.4 billion in 2012, slightly more than 4 percent of at-home food sales (Organic Trade Association; Catherine Green). It is estimated that organic food and beverage sales will grow to $35 billion in 2014 (Nutrition Business Journal). The results of a Hartman group (2008) survey showed that about 69 percent of U.S. consumers purchase organics. The increase in the portion of the U. S. population purchasing organics and organic sales has been enhanced by consumer concerns about health issues, repeated food safety scares, the environment, and animal welfare (Chan, Caldwell and Rickard, 2010). The Food Marketing Institute (2011) estimated that about 40 percent of consumers believed that significant health risks are posed by pesticide residues on produce, despite contrary scientific evidence. There are also findings that suggest a sizable and growing percentage of households that frequently purchase produce, purchase organics and tend to consume the larger amount of produce (Cook 2011).

USDA's regulatory program defines organic agriculture as an ecological production system that is established "to respond to site-specific conditions by integrating cultural, biological, and mechanical practices that foster cycling of resources, promoting ecological balance, and conserving biodiversity" (Greene, Slattery and McBride). There are indications

that production under these guidelines adds more costs on producers transitioning to certified organics. However, since USDA established national standards for organic production and processing, sales in organic products has increased in double digits almost continuously, suggesting the possibility that these standards may have influenced consumer safety assurance of organics and impacted demand (Kiesel and Villas-Boas, 2007; Kiesel, 2007; Kiesel 2012).

Consumers show a willing to pay a price premium for organic products (Batte, Van Buren, Hu, Woods and Ernst, 2010; Catherine Green, 2013; Stevens-Garmon, Huang and Lin, 2007; Smith, Huang, and Lin, 2009; Volpe, Richard J., III, 2006; Klonsky and Greene, 2005). For example, ERS used 2005 produce purchase data for 18 fruits and 19 vegetables and found organic price premiums of about 30 percent of corresponding conventional products for about 67 percent of the products. Organic milk price premiums for a one-half gallon container ranged from 60 to 109 percent for private-labeled organic versus conventional branded and branded organic versus private-labeled conventional milk, respectively. Fruits and vegetables and organic dairy have traditionally been and continue to be the two top selling categories of organics. Vegetables and fruits account for about 43 percent of organic sales and dairy is responsible for 15 percent of sales (Catherine Green, 2013; Klonsky and Greene, 2005).

Despite the double digit growth in the value of organic sales, production of organics has not kept pace with demand, resulting in a supply shortage in the U. S., and some of the surplus demand has been filled by imports. ERS-USDA statistics show that in 2010 imports accounted for more than 24 percent and 32 percent of U.S. fresh vegetables and fruits consumption, respectively. As fruits and vegetables demand increases, less seasonal imports are becoming more important because of the U.S.'s inability to produce year round (Cook, 2011). According to USDA-ERS estimates, there were 12,880 U. S. farms with certified organic pasture and cropland acres in 2011. These farms had 3,084,989 cropland acres and 2,298,130 pasture and rangeland acres, a national total of 5,383,119 certified acres. Organic cropland, however, accounted for only about 1 percent of U. S. total cropland. The U.S. Census show that in 2007 there were 20,437 organic farms with 2,577,000 acres and less than 23 percent of these farms had sales of $50,000 or more and accounted for more than 93 of organic sales. Certified organic farmland grew by about 171 percent between 2000 and 2008. Organic cropland acres grew by 288 percent during this period but started with and acreage base of slightly more than one-half million acres.

The 2012 Census of Agriculture State Data shows that Georgia had 1562 vegetable farms and 213 of these farms were responsible for 75 percent of the sales. Further, according to USDA-ERS, Georgia had 75 certified organic pasture and cropland farms in 2011. These farms had 3310 cropland acres and 2173 pasture and rangeland acres or about 0.09 percent of Georgia harvested cropland and 0.14 pastureland, respectively. Six of these farms were

responsible for 75 percent of organic farm sales. These statistics show that a few large farms are responsible for the majority of vegetables and organic sales in the state. In 2012 Georgia had 3256 farms producing fruits, tree nuts and berries and 255 of these farms were responsible for 75 percent of farm sales (2012 Census of Agriculture). Sales of peaches and pecans dominated farm sales among this category.

The inadequate domestic supply of organic products to meet consistent increases in demand is hampered by the slow transition to organic production from conventional methods. There are indications that transition to organic production is impacted by producer perceptions of falling yields, particularly during the transitioning period, increased cost of production, marketing and product quality risk, the cost of certification, price premiums, imports, inadequate supply of organic inputs, lack of consistent consumer demand, large industrial farm operations, and competition from differently labeled products such as locally grown, small farm and family farm designation (Oliver, 2006; Yeager, 2006; Wolf, 2006; Batte, Van Buren, Hu, Woods and Ernst, 2010). Johnson (2010) found in a survey of New York state farmers that disease related production losses (57%), the high cost of organic inputs (49%) and lack of organic pest-related control barriers (38%) were the most severe obstacles to expansion of organic production. Competition with non-organics (29%) and uncertainty about price premiums (28%) were the two marketing factors perceived as the most severe obstacles to increasing organic acreage. Perceptions by organic producers about the severity of both production and marketing barriers were not as large as the general sample but the importance of the ranking of the barriers did not change.

A 2007 Census of Agriculture/USDA/NASS survey of primary production challenges for certified and exempt organic farms show that producers listed regulatory problems and production problems most frequently, at 35.1 and 19.7 percent, respectively in the U.S. Georgia producers, our study area, listed production problems, management issues and regulatory problems most frequent at 25.3, 23.2 and 20.2 percent, respectively. Price issues and market access were cited by the least percentage of U.S. (10.3 and 9.9 percent) and Georgia producers, respectively (6.1 and 9.1 percent). Martinez, Binge and Conner (2009) surveyed 115 Great Lake States (GLS) handlers of fresh and organic produce to identify perceptions of constraints in purchasing from GLS producers. The principal limitations were concerns about inadequate and year round supply, the inability to supply consistent sized products and increased cost above current suppliers.

In 2012 Georgia had 1562 vegetable farms producing on 99,492 acres and 51 of these farms were USDA certified organic, 70 were USDA certification exempt and 50 were transitioning into the USDA national organic program. These organic operations produce on 3310 acres which is about 3 percent of vegetable farm acreage. About 14 percent of Georgia

vegetable farms accounted for 75 percent of sales and less than 5 percent of organic farms accounted for 75 percent of organic sales. The state also has about 2173 organic acres of pasture and rangeland (2012 Census of Agriculture – State Data). USDA – NASS conducted a national survey in 2008 to determine the primary production challenges for certified and exempt organic farms. More than 20 percent of Georgia farmers listed regulatory problems as primary production challenges, 6.1 percent said price issues, 25.3 percent listed production problems, 9.1 percent said market access, 23.2 percent listed management issues and over 16 percent indicated other issues. In our survey of Georgia fruit and vegetable producers, these challenge areas were disaggregated to get a better understanding of the specific problems that hamper adoption and/or expansion of organic production. Several of the important management decisions that must be made by an agricultural producer are the selection of the production and marketing management practices. The production practice of concern is the decision to produce using organic or conventional methods and the unique marketing requirements of organics as they move through the supply chain, such as segregating the products. These choices will be made subject to an attempt to optimize some objective function. Producers may have multifaceted objective functions but the literature supports the idea that the paramount objective function, in most cases, is maximization of profits over some pre-determined planning horizon (Peterson, Narkley, Chacion-Casconte and Kartens, 2012; Walker and Lin, 1978**).** Therefore, with the objective function of profit maximization in mind, we developed a pre-identified list of barriers, as suggested by a literature review, to farmers producing organic and non-organic vegetables and/or fruits and sought their perceptions of the severity of the barriers on the decision to use organic production methods. The objectives of the study were pursued recognizing that certain socioeconomic characteristics and farm characteristics may influence perception of barriers and may influence acreage allocation devoted to organic. Therefore, the producers' age, education attainment, farm size (measured in gross sales), and farming experience are included in the analysis. Further, it was surmised that the barrier ratings would influence whether to produce 100 percent conventional or some level of organic production. Therefore, models for each of these possibilities were estimated on the perception of production barriers to entering and expanding organic production.

Population and Sample

According to the 2012 Census of Agriculture, Georgia had 4818 vegetables and fruits farm; 1562 of which were vegetables, melons, potatoes and sweet potatoes farms (vegetables)and 3256 were fruits, tree nuts and berries farms (fruits). Our sample was drawn from a population of 4065 vegetables and fruits farms. The population was made of a composite list of farmers provided by Georgia Organics and a purchased data set from a vendor of both vegetable and fruit farmers in the state. A maximum of seven attempts were made to contact all 4065 farmers by telephone and 1661 were unusable (691 were no longer farming, 334 did not

produce vegetables or fruits, 347 numbers were disconnected, there were 128 wrong numbers, 99 were fax numbers, 50 rented out all their land and 12 were removed for other miscellaneous reasons). Off the remaining 2404 potential farmers, 387 refused to participate, 95 stopped completing the questionnaire before it was completed, 1522 were disposed of because of no answers, busy signals, answering machines and no return calls in response to messages left. Therefore, 400 usable surveys were completed resulting in a completion rate as a percentage of potential farmers that were able to be contacted of 45.3 percent (400/882). The telephone survey was completed in early April 2014 by The Burruss Institute at Kennesaw State University, Georgia. In hind sight, conducting the survey in April no doubt adversely impacted the number of farmers contacted and the number refusing to participate because April is the prime preparation and planting season, particularly for farmers in Middle and South Georgia.

Description of Sample

Table 1 provides selected descriptive statistics for the sample. The survey results show that about 40.3 and 30.3 percent of the sample produced using 100 percent conventional and 100 percent organic practices, respectively. About 7.3 percent used both conventional and organic methods with more conventional methods, about 12.5 and 9.8 percent use about half and half conventional and organic practices and more organic than conventional methods, respectively. Therefore, the sample should be representative of certified, USDA certification exempt and transitioning producers. Fruits and vegetables are the primary farm products of more than 78 percent of the producers and about 54 percent rated their organic skills as very good or excellent. About sixty percent of the farmers were producing some of their product using organic methods with slightly more than 30 percent producing using only organic methods. Of the farmers using organic methods, 31 percent had six or more years' experience producing with organic methods. Over 73 percent of the farmers indicated that the most important selling outlets for products are directly to consumers and the remaining 27 percent most important marketing outlets are middlemen. Those farmers selling directly to consumers list direct sales to consumer (37%) and farmers' markets (31%) as most important and roadside stands (6.0 %) was not a very important marketing option. The most important middlemen were wholesalers (10.3%), processors (8.5%) and grocery stores (4.2%). While the statistics are not directly comparable, the 2008 OPS-certified and exempt data (USDA-NASS) show that direct sales to consumers were less important as a percent of total sales by Georgia organic producers. Direct sales to consumer accounted for about nineteen percent of farm sales and farmers' markets were most important with about 9 percent of the total sales directly to consumers. Direct sales to consumers were the most cited method of sales. Sales to middlemen accounted for the largest percent of sales, with sales to conventional supermarket chains (26.9%) and wholesalers, brokers and re-packers (28.3%) being the most important

middlemen. A small number of farmers reported sales to middlemen and accounted for the largest percentage of total sales.

About 49 percent of the farmers were 61 years old or older and 15 percent of this group was over seventy years old. Only fifteen of the sample was 40 years old and younger and the age category of 51 – 60 (more than 29%) years old contained the most producers. The educational attainment level of the sample is higher than the general farmer population in Georgia. About 70 percent of the sample had some college or more and 48 percent held college degrees. Only fifteen percent of the sample had less than a high school diploma. However, over sixty percent of the sample did not work off-farm and more than 62 percent indicated their gross farm sales were less than $50,000. About 20 percent of producers indicated that annual gross farm sales exceeded $100,000. The 2012 Census of Agriculture statistics show that less than 7 or about 14 percent of Georgia's organic farms were responsible for 75 percent of organic sales and these few farms average sales was about $600,000. Thus, these finding suggest that the survey sample is representative of Georgia's organic farming population. Additional descriptive statistics for the sample are provided in table 1.

Producer perception of barriers to expanding or entering organic production was measured as a qualitative response to questions regarding barriers to organic production. Specifically, producers were asked to rate production barriers after they were read the following statement: "I would like to read you a list of potential barriers to organic vegetables and fruit production in Georgia, and have you tell me if you think each item is (a) not a barrier, (b) a minor barrier, or (c) a major barrier". Jones, Batte and Schnitley (1990) suggested that producers responses to such questions are likely influenced by both the quantity and quality of their knowledge and that producers apply their own performance standards in their evaluations. They further suggest, however, that if producers use different measures of rigor in their evaluations, it is just such individual evaluations that form the basis of decisions made and eventual outcomes.

Two of the important management decisions that must be made by an agricultural producer are the selection of the production and marketing management practices. The production practice of concern is the decision to produce using organic or conventional methods. These choices will be made subject to an attempt to optimize some objective function. Producers may have multifaceted objective functions but the literature supports the idea that the paramount objective function, in most cases, is maximization of profits over some pre-determined planning horizon (Peterson, Narkley, Chacion-Casconte and Kartens, 2012; Walker and Lin, 1978**).** Therefore, with this objective function in mind, we developed a pre-identified list of production barriers, as suggested by a literature review, to farmers producing organics and non-organic vegetables and/or fruits and sought their perceptions of the severity

of the barriers on the decision to use organic production methods. The objectives of the study were pursued by recognizing that certain farm and producers characteristics may influence the perception of the severity ratings of barriers. Therefore, the producers' age, education attainment, farm size (measured in gross sales), farming experience in years and currently whether producing 100 percent conventional or organic or some level of organic production.

Thus, the major objective of this research is to further our understanding of producer perceptions of barriers to transitioning to and/or expansion of organic farming in Georgia. Five logit models were estimated to assess producer's perceptions of barriers to organic fruits and vegetables production. The models are: (1) producers currently use 100 percent conventional methods, (2) more conventional than organic, (3) farms where practices are about 50 percent organic and 50 percent conventional, (4) more organic than conventional, and (5) 100% organic practices.

Table 1: Selected Descriptive Statistics of Sample

	Percent		Percent
Farming Methods		**Do you think Demand for Organics will?**	
Conventional	40.3	Increase	68.8
Conventional > organic	7.3	Stay about the same	21.3
About 50/50	12.4	Decrease	2.7
Organic than conventional	9.7	**Age Range**	
100% organic	30.3	30 or younger	5.9
Organic Farming Experience		31 to 40	8.4
None	40.8	41 to 50	17.3
1 to 5 years	27.5	51 to 60	28.5
6 to 10 years	11.9	61 to 70	23
More than 10 years	18.8	Over 70	14.6
Primary Products: Fruits and Vegetables		**Plan to Farm**	
No	21.8	0 to 5 years	10.1
Yes	78	6 to 11 years	10.1
Do you know of at least one organic farm market		12 or more years	73.5
No	40.8	**Educational Attainment**	
Yes	59.2	Less than high school	3.2
Most Important Markets		H.S. diploma	20.3
Farmers' markets	25	Technical School	6.4
Roadside stands	5	Some college	21.8
Directly to consumers	30.2	College graduate	46.8
Wholesale markets	8.4	**Work Off-farm**	
Processors	6.9	None	59.9
Restaurants	2.5	Yes, Part-Time	13.1
Food stores	3.5	Yes,Full-Time	26.5
Schools	0.5	**Gross Farm Sales**	
		Less than $50,000	61.6
		$50,000-100,000	17.8
		Greater than $100,000	19.3

Empirical Model

Logistic regression is a form of statistical modeling that is appropriate for categorical outcome variables (Stokes et. al 2000). Hence, five logit models were used to analyze if production barriers influences adoption of organic production methods. Setting the result to a

linear function of the explanatory variables, a logit model can be obtained (Allison, 1999). For *k* explanatory variables and i= 1,…….,n ; the model is: *Log (Pi/(1-Pi)) =α +*$\beta_1 \ x_{i1}$ + $\beta_2 \ x_{i2}$+…+$\beta_k \ x_{ik}$

In our study, the five dependent variables based on production methods were: 100% conventional; more conventional than Organic; More organic than conventional; about 50 % each production method; and 100% organic. The dichotomous variables depicting the respondent's production method status took the value of 1 if the respondent had that type of production and 0 if not. The independent variables were the levels of producers' perception of various barriers, farm characteristics and other socio-economic factors.

Hence, our estimated model is shown below :

$$Log\ (Pi/(1\text{-}Pi)) = \beta_0 + \beta_1\ ORGEXP + \beta_2\ CLIMA + \beta_3\ LABOR + \beta_4\ CERT + \beta_5\ SEEDS + \beta_6\ SOLUTION + \beta_7\ RELPROD + \beta_8\ LIABIL + \beta_9\ YEILDS + \beta_{10}\ AGE + \beta_{11}\ FARMEX + \beta_{12} EDU + \beta_{13}\ OFFWORK + \beta_{14}\ GSALES$$

Where *Pi*= Probability of having specific acreage allocation

Odd ratios were estimated to compare and analyze variables. The odds ratio $e^{\beta i}$is the ratio of odds for a one unit change in Xi , since the slope coefficient βi is associated with an explanatory variable Xi that represents the change in log odds for an increase of one unit in Xi (SAS Institute Inc. 1995).

Table 2: Summary Statistics of the Variables

Variables	Description	Mean	Standard Deviation	Minimum	Maximum
FARM	**Farm acreage allocation: 0= 100% conventional; 1= Majority conventional; 3= Majority organic ; 4= 100% organic**	1.70	1.74	0	4
ORGEXP	Years of organic farming experience: 0= None; 1= 1 to 5 years; 2= 6 to 10 years; 3= > than 10 years	1.09	1.13	0	3
CLIMA	Georgia's climate: 0= Not a barrier at all; 1= A minor barrier; 2= A major barrier	.90	.81	0	2
LABOR	Labor cost : 0= Not a barrier at all; 1= A minor barrier; 2= A major barrier	0.76	.78	0	2
CERT	Cost of organic certification: 0= Not a barrier at all; 1= A minor barrier; 2= A major barrier	1.30	0.81	0	2
SEEDS	Availability of certified organic seeds:0= Not a barrier at all; 1=A minor barrier; 2= A major barrier	0.66	0.76	0	2
SOLUTION	Lack of quick fix solution: :0= Not a barrier at all; 1=A minor barrier; 2= A major barrier	1.07	.86	0	2
RELPROD	I am reluctant to adopt new production methods until I see them working for others:0= Strongly disagree; 1= Disagree; 2=Agree; 3= Strongly agree	1.54	.77	0	3
LIABIL	There is more liability for organic fruits and vegetables producers than conventional producers: 0=Strongly disagree; 0= Strongly disagree 1= Disagree; 2= Agree; 3= Strongly agree	1.58	0.81	0	3
YIELDS	Organic yields are much lower than conventional production yields: 0= Strongly disagree; 1= Disagree; 2=Agree; 3= Strongly agree	1.72	0.85	0	3
AGE	0 = age ≤ 30 years; 1=age 31 - 40 years ;2= age 41 - 50 years; 3= age 51 - 60 years; 4= age 61 - 70 years; 5= age >70 years;	3.00	1.38	0	5
FARMEXP	Years of farming experience: 0= 0 to 5 years; 1= 6 to 11 years; 3= 12 or more years	28.02	19.84	1	76
EDU	Highest level of education: 0= Less than high school; 1= H.S diploma; 2= Technical school; 3= Some college; 4= College graduate.	2.90	1.29	0	4
WORKOFF	Work off farm: 0= No; 1= Yes.	0.4	0.49	0	1
GROSSAL	Gross annual farm sales: 0=sales ≤ $50,000 1= $50,000 ≤ sales ≤ $100,000; 2= sales < $100,000	1.21	0.75	0	2

Empirical Results

The parameter estimates for the five models are presented in table 3. The intercepts for each model is significant at the 10 percent level except for the model representing farmers using both conventional and organic methods with conventional production as the primary production method. The model for 100 percent organic production had eight factors that were statistically significant at the 10 percent level. The production barriers/factors significant at the 10 percent level and higher were; years of organic farming experience, The Georgia Climate, organic certification costs, reluctance to adopt new production methods, liability of organic producers is higher than conventional, producer age and farm size (measured as gross annual farm sales). Three factors were significant at the fifteen percent level and were labor cost, lower organic yields and producer educational attainment.

The 100 percent organic production model includes only farmers using organic farming practices. Thus, years of organic farming experience should have a positive influence on organic production because farmers likely have had sufficient time to seek out solutions or experiment with solutions to problems associated with organic production. The coefficient for years of organic farming is significant and positive for farmers in both 100 percent organic production model and the half organic and half conventional model. The reasoning for this outcome is the same for both farmer groups. The coefficient for farmers in the model that produce using only conventional methods is significant and negative. This outcome is expected because of a lack of experience in organic production and the literature suggests that this has been a perceived barrier to organic transitioning in other studies. The cost of certification is not viewed as a barrier to organic production in the 100 percent organic farming model. This outcome may be viewed in this manner because of several reasons. First, the majority of these farmers may have incurred this cost in the past and/or are smaller farmers that may be certified exempt. The majority of the sample falls within the category of small producers using the USDA definition. Second, these producers may have been made aware of the Environmental Quality Incentive Program organic initiative and/or have used the financial assistance available to farmers through the program for certification and transitioning cost and cost of conservation practices related to organics production (Green, et.al). The outcome for cost of certification of farmers in the more organic than conventional production model is significant and negative at the 5 percent level. This outcome may be attributed to a lack of knowledge and may encompass some of the cost associated with practices that impact yield and quality of produce.

These producers suggest that organic production may be hampered significantly because of the perception that some farmers are reluctant to adopt new production practices until they see the practices work for others. This variable is significant and negative at the 1-percent level for 100 percent organic producers and negative for those using more organic than

conventional. Results for producers in the half organic and half conventional model are positive and significant at the 5-percent level. The producers are giving their personal perceptions based on their observations. According to available USDA statistics, Georgia had only 51 USDA certified organic vegetable farms, 70 farms that were certification exempt and 50 in transitioning to organic. Thus, Georgia has a small organic farming community and probably does not offer a vast opportunity for other farmers to conveniently observe successful organic operations. Research and Cooperative Extension efforts in terms of organic field days and on farm expositions and/or demonstration workshops may be effective in addressing this perceived barrier. Years of farming experience is significant at the one percent level and 5 percent level for the 100 percent organic and one-half organic and one-half conventional producer models. The coefficient for the 100 percent organic model is negative.
The coefficient for the age variable is significant and negative for producer's using100 percent organic practices and the age coefficients for all other levels of organic production is also negative. This finding suggests that as the age of the producers using organic practices increases, they are less likely to expand organic production. Organic farming is more labor intensive because more labor must be used to substitute for the inability to use traditional chemical treatments. Micro and national studies have shown that expansion of organic production results in labor being a major constraint (Curtis 2014; Langley, Heady and Olson). The age variable coefficient is significant and positive for the 100 percent conventional farmer model. The finding for the 100 percent organic producer model is consistent with other recent studies findings (Peterson, Barkley, Chacin-Caseante and Kastens). The coefficient for the barrier that organic yields are much lower than conventional yields is negative and significant at the 15-percent level for the 100 percent organic producers. The coefficients for the one-half organic and one-half conventional production and 100 percent conventional models are positive and significant at the 5 percent and 10 percent levels, respectively with other levels of organic models resulting in negative coefficients. As expected the perception of "more liability in organic production" has a negative impact on 100% organic farms, but interestingly has positive impact on 100% conventional farms.

Working of the farm generally had a negative but insignificant influence on organic production and may be related to the need for more labor to substitute for capital inputs, such as herbicides and insecticides. The off farm work coefficient for the 100-percent conventional model is positive and significant. This result may suggest that having off-farm incomes may afford these producers the luxury to experiment with methods where income may be more risky of not having to rely entirely on farm income. The gross farm sales variable coefficient is negative and significant for the 100-percent organic producers and is generally negative for other levels of organic production. This outcome may suggest that as incomes go up in organic operations management challenges also increase and hampers expansion. This coefficient is positive and significant for 100-percent conventional producers and may suggest higher income

farmers may have more flexibility to take on higher risk operations that carry higher potential rewards. If this is the case, it may suggest that expansion in organics will come from higher income conventional operations transitioning to organics.

The perception of the lack of readily available solutions to problems encountered in organic methods generally has a negative and insignificant impact on expansion in and adoption of organic methods by both organic producers and conventional operations. The coefficient for the readily available solution variable is significant at the 10 – percent level and positive for operations that are primarily conventional with some organic production. The state's climate variable is negative and significant for operations that were about 50 percent organic and 50-percent conventional. The coefficient for 100-percent organic operations is positive and significant. Many successful vegetable operations use irrigation and may be more prevalent on fully organic operations with less variety of crops versus operations that may produce a combination of agronomic crops and vegetables. Increases in educational attainment does not appear to significantly impact the adoption of organic methods but as mention earlier organic farming experience does and may be important because agriculture is more of a vocation.

Summary and Conclusions

Analysis of state-wide survey data revealed substantial differences in how vegetables and fruit producers view production barriers influence the adoption of organic production methods. One of the important outcomes of this study is an attempt to disaggregate the whole concept of production barriers into its components, thus identifying and aiding the development individual solutions. Eleven barriers were perceived as having significant impacts on the expansion of organic production in Georgia. The reluctance of producers to adopt organic methods before seeing successful operations appear to have a significant negative influence on organic output. This problem is likely heightened because of the relatively small number of organic operations within the state. A possible solution to this problem is to encourage entities servicing agriculture to offer workshops and sponsor one farm demonstrations, and this is an area where leadership could be provided by the land grant system. Further, other outcomes may suggest some challenges to increase organic production as well as some opportunities. The age variable results suggest increases in age have a negative influence on the adoption of organic practices. Table 1 shows 38- percent of farmers are in the range 61 and over 70 years, and an additional 29 percent are 51 to 60 years old. This suggest that about two thirds of the producers are in the age range which negatively influence adoption of organic practices. However, there are several findings that may suggest opportunities for organic production. Higher income conventional producers are more likely to adopt organic methods than others and farmers with off farm income show higher odds to adopt organic methods.

Table 3: Maximum Likelihood Estimates and Odd Ratios of Five Logit Models Representing Georgia Fruits and Vegetable Producers' Farm Acreage Allocation (with 0/1 choices: 100% Conventional, More conventional, Half/half, More organic, and 100% Organic)

	100% Conventional		More conventional		Half/half		More organic		100% Organic	
Parameter	**Estimate**	**Odd ratio estimate**	**Estimate**	**Odd ratio estimate**	**Estimate**	**Odd ratio estimate**	**Estimate**	**Odd ratio estimate**	**Estimate**	**Odd ratio estimate**
Intercept	-3.6648**		-5.6362*		-6.7090***		-2.1494		2.1300**	
ORGEXP	-2.0091***	0.134	-0.3681	0.692	1.2237***	3.400	0.1785	1.195	0.7008***	2.015
CLIMA	0.3600	1.433	-0.1555	0.856	-0.8507**	0.427	-0.0642	0.938	0.4974*	1.644
LABOR	-0.5709	0.565	0.8522	2.345	0.3315	1.393	0.8594**	2.362	-0.4481?	0.639
CERT	0.0817	1.085	0.3003	1.350	-0.2600	0.771	-0.8912**	0.410	0.7206***	2.056
SEEDS	-0.6946?	0.499	0.7004	2.015	-0.3697	0.691	0.3176	1.374	0.2101	1.234
SOLUTION	-0.2529	0.777	2.1682*	8.743	0.1191	1.127	-0.3496	0.705	-0.1514	0.860
RELPROD	0.5327	1.704	-0.0121	0.988	0.8704**	2.388	-0.3000	0.741	-0.6758***	0.509
LIABIL	0.5850*	1.795	0.1899	1.209	0.3024	1.353	0.5098?	1.665	-0.8249***	0.438
YIELDS	0.5793*	1.785	-0.5953	0.551	0.9019**	2.464	-0.3350	0.715	-0.3999?	0.670
AGE	0.5059**	1.658	-0.0594	0.942	-0.1101	0.896	-0.0340	0.967	-0.3160*	0.729
FARMEXP	0.0261?	1.026	-0.0291	0.971	0.0441**	1.045	0.00630	1.006	-0.0452***	0.956
EDU	-0.0233	0.977	-0.0464	0.955	-0.2700	0.763	-0.0754	0.927	0.2848?	1.330
WORKOFF	0.9896*	2.690	-1.2897	0.275	-0.00709	0.993	0.3301	1.391	-0.6204	0.538
GROSSAL	0.6069*	1.835	-0.2213	0.801	-0.2036	0.816	0.2329	1.262	-0.7054*	0.494

Notes [a]*** = significant at α=0.01, **= significant at α=0.05, *= significant at α=0.10, ?= significant at α=0.15.

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