Understanding the Issues Faced by Tennessee Farmers in Adopting Organic Practices

Kumuditha D Hikkaduwa Epa Liyanage

Graduate Student,

Department of Agricultural and Environmental Sciences

Tennessee State University

3500 John A. Merritt Blvd, Nashville, TN 37209

Email: kchandra@my.tnstate.edu,

Phone: (615) 649-1502

Dr. Hiren Bhavsar (Corresponding author)

Assistant Professor,

Department of Agricultural and Environmental Sciences

Tennessee State University

3500 John A. Merritt Blvd, Nashville, TN 37209

Email: hbhavsar@tnstate.edu

Tel: (615) 963-1498

Selected Paper prepared for presentation at the Southern Agricultural Economics Association's 2018 Annual Meeting, Jacksonville, Florida, February 2 - February 6, 2018

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Abstract

The demand for the organic food has increased over the last few years in the USA but organic crop production is not increasing proportionally. In Tennessee numbers of certified organic farms are very low. This study attempts to identify and analyze fruit and vegetable farmers' perceptions towards organic farming in Tennessee. Two hundred and fifty conventional and organic farmers were randomly selected from the Pick Tennessee products database. From the responses of 116 farmers revealed that 65% of respondents are following organic farming practices. Also, all the eight variables selected as farmers' perceptions towards organic farming were affected growing practices. There were significant relationships ($p \leq 0.05$) between some growing practices and perceptions. Most of the organic farmers have identified high cost, labor intensity, pest and disease problems and certification process as challenges to continue organic farming. Conventional farmers have identified high cost of production, time consuming as some of major barriers to enter organic farming. Factors such as producing vegetables, farming experience, hours work per week on farm, gender, annual cash farm income contributed significantly to the adoption of organic farming.

Introduction

The term “organic farming” first came into use in the U.S. in the 1940s, but organic crop production did not begin and developed as an industry until the 1970s. In the previous decades, increased environmental consciousness and consumer demand powered the growth of the organic production. At the beginning, even though there were general settlement on philosophical methodologies, no standards or regulations existed to explain organic agriculture. With the introduction of Organic Foods Production Act in 1990 and the application of certification requirements in 2002 this situation changed in the organic industry. The uniform standard was planned to benefit both organic growers and consumers to adopt to organic farming.

Organic farming has developed into one of the fastest growing systems of agriculture, in the United States. According to an organic survey of United States Department of Agriculture (USDA) Census of Agriculture in 2015, the United States had 12,818 certified organic farms producing and selling $6.2 billion in organic products. California and Wisconsin states had more than 1,000 organic farms while Washington, Iowa and several northeastern states had only more than 500 organic farms. States across the south, except Arkansas, Florida and Texas had relatively few certified organic farms. In general, southeast region has less certified organic farmland than other regions.

Certified organic farms operated 4.4 million acres of certified land in 2015, it’s a 20 % increase from 2014. Slightly more than half the land (55 %) was used to produce organic crops and the rest of the land was used for pasture and rangeland. About half of the certified acres were owned by those who operated the farm and the rest of the land was rented from others. Certified

farms were transitioning 151,000 additional acres of land into organic production in 2015, primarily to grow crops (NASS-USDA, 2015).

Over the past 30 years, public interest in organic food and organic farming has been increasing in the United States. This fact is proved by the increases observed in consumer demand for organically produced food and the number of publicly funded research and policy projects relating to organic food production. In the United States Consumer demand for organic products has shown exceptional growth. Since 1990, organic food has averaged 20% sales growth per annum and this growth is outstanding considering that, over the same period total food sales averaged about 3% growth [Organic trade association (OTA), 2008].

In different parts of the world researchers have compared the farming methods, barriers to enter organic farming, attitudes and demographic characteristics of conventional and organic farmers in their research work in recent years. It is important to determine differences among farmers' perceptions and motivations in converting to organic production for several reasons. The most considerable reasons among these narrate to effective organic agricultural policy development and implementation.

Rational

Organic sales are more distributed geographically than number of organic farms. Ten states accounted for 78 % of all certified organic sales, including crops, livestock and livestock products. California, with $2.4 billion in sales, accounted for 40 % of the total value of U.S. certified organic sales. In 2015, $6.2 billion organic commodities were sold and among that $3.5 billion or 57 % came from organic crops, $1.9 billion (31 %) from organic livestock and poultry products (primarily milk and eggs) and $0.7 billion (12 %) from organic livestock and poultry (NASS-USDA, 2015).

Organic food and non-food products controlled an 11.3% increase in sales between 2013 and 2014, while organic sales are currently nearly 5 % share of the US total food market (OTA 2015). Fruits and vegetables are the top selling produce in this category, accounting for 43% of total organic sales in 2012 (Greene 2014). Simultaneously, organic farming continues to be a growing portion of US agriculture and certified organic crop land is accounted for about 0.7% of US cropland in 2011 (Greene 2013). However, shortage of organic food supplies is a major challenge for the industry with organic farms struggling to keep up with growing demands (Dimitri and Oberholtzer 2009; OTA 2015) and producers in some regions facing unique challenges.

Tennessee ranked tenth, among all states with low certified acreage of organic lands. According to the USDA organic survey report, certified and exempt organic farms totaled 54 in 2014. In the same year total acreage of organic production was 3,667 acres and $4.0 million in total value of organic products sold. According to the 54 organic farms identified Organic survey in Tennessee in 2014 among them 30 farms were certified organic and 24 farms were exempt from certification as their gross annual organic income was less than $5,000. There were 18 farms with 100 % total value of sales from certified organic production, compared to 2 farms with 75 to 99 %, 2 farms with 50 to 74 %, 4 farms with 25 to 49 % and 4 farms with less than 25 %. Organic operations and land area percentages of Tennessee are even lower than the national numbers. In 2014 both certified organic agricultural land and number of agricultural operations in Tennessee were less than 0.1% (NASS-USDA, 2014).

This study focused on how farmers' perceptions and attitudes affect conversion to organic agriculture for fruit and vegetable farmers. This examination of the connection between farmers' motives and perceptions regarding organic conversion may lead to an enriched

understanding of farmers' motivation in adopting organic farming practices, which may in turn lead to improved effectiveness in establishing policies and programs directed toward organic farmers. It is therefore important to identify the attitudes of fruit and vegetable farmers to convert to organic farming, challenges to continue organic farming and the barriers that prevent the conversion into organic fruit and vegetable production in Tennessee.

Methodology and Data Collection

The data were collected from 116 farmers in Tennessee during June to November 2016. Farmers were randomly selected from the Pick Tennessee products organization database. The list was including all those individuals who were farm owners and/or farm operators in Tennessee according to the counties and these were considered to be "organic" and "conventional" in their farming practices. The sample in this study was a convenience sample given according to the time limitations. All together 262 farmers were taken into the study. Farmers selected for the study were given an opportunity to decline or accept participation in this study before answer the questionnaire.

The questionnaires were hand delivered to farmers with the help of county extension agents. Hard copies of the survey were given to all extension agents and were requested to distribute copies of survey to farmers of their counties and collect them back and resubmit via mail. Also, the survey link was given to extension agents to be sent to farmers in their counties through email.

The questionnaire was designed to collect basic information on farmers' socio-demographic characteristics such as farm size, age, gender, experience and education. Also, to understand farmers' decision making, farmers were further asked about their challenges and

barriers to convert to organic farming. Farmers' attitudes and perceptions, challenges and barriers towards organic farming were evaluated through a series of statements which farmers were asked to check on a Likert scale from strongly disagree (1) to strongly agree (5). The approval to use questionnaire to collect data was received from Institutional Review Board (IRB) of Tennessee State University.

The developed questionnaire consisting of 20 questions was adapted from past research studies such as Egri, 1999; Fairweather et al., 2001; Midmore et al., 2001; Niemeyer and Lombard, 2003; and Schneeberger et al., 2002. A 5-point Likert-type scale was used in the study creating of three items measured attitudes toward organic farming methods and attitudes toward conventional farming methods (Ajzen, 2002). The questionnaire asked farmers what barriers impacted their decision to not adopt organic farming practices. This study compared Tennessee fruit and vegetable farmers' attitudes toward organic and conventional farming with their demographic characteristics; gender (Beus & Dunlap, 1994; Egri, 1999), family farming, age (Fairweather et al., 2001; McCann et al., 1997; Niemeyer & Lombard, 2003), education (Duram, 1999; Fairweather et al., 2001; McCann et al., 1997), marital status and gross annual farm sales. The completed questionnaires were checked for the completeness and accuracy. The data was entered for analysis using Microsoft excel and was analyzed using Statistical Package for Social Sciences (SPSS) 21.0 software.

Adoption of organic fruit and vegetable farming developed as a dichotomous or binary dependent variable, with the 'adoption' or 'non-adoption' options. Logistic regression was considered to be the convenient analytical tool to estimate the factors influencing adoption of organic farming by fruit and vegetable farmers in Tennessee. In order to investigate the factors affecting farmers' decision in adoption studies Logit model have been widely used (Feder et al.,

1985; Vandeveer et al., 2001; Ullah et al., 2015). In order to facilitate analysis of the data, a value of 1 was assigned to the adoption to organic farming and 0 to the non- adoption to organic farming. The parameters of the model were measured with the maximum likelihood estimation technique. The logit specification then provides a model of observing the probability of a farmer adopting organic farming.

The model was specified explicitly as follows and the following model was used

$$P(Y) = \frac{e^{b0+b1x1+b2x2+\ldots\ldots\ldots+bnxn}}{1 + e^{b0+b1x1+b2x2+\ldots. + bnxn}}$$

P: Probability of Y

e: Natural logarithm base

b0: Interception at y-axis

b1: Line gradient

bn: Regression coefficient of Xn

X1: Predictor variable

X1 predicts the probability of Y

Results and Discussion

Total responses of 116 farmers were collected during June to November 2016 for this study. Table 1 provides descriptive statistics for the sample. According to the sample, majority (about 69%) of farmers have less than 50 acres. Additionally, 12.9% of the farmers had between 50-100 acres and 10.3% were operating farms with the size of 100-250 acres. About 2.6% of the farmers had 251-500 acres and the remaining 5.2% operated land over 500 acres. Majority of respondents or their members of family have worked full time other than farming. 43.1% worked full time, 24.1% worked part time while 32.8% of the participant farmers relied completely on their farm income.

Respondents were also asked to mention how long they have been farming. Nearly 27.6% said they have been farming for five years or less, 22.4% had stated that they have been farming between 5- 10 years. About 16.4% of respondents have been farming 10 to 20 years, 9.5% between 20 -30 years and 24.1% of respondents have been farming more than 30 years. 42.2% of farmers have been producing livestock or field crops except fruit and vegetables and 57.7% did not produce livestock or other field crops and only do fruits and vegetable farming. Approximately 84.5 % of the framers were owners of their own farms. In addition, 6% were leasing and 9.5% renting the land from other owners or mixture of rented and owned lands. Majority of farmers produce both fruits and vegetables (56%). 24.1% of the respondents grow vegetables and 19.9% grow only fruits. According to the hours work in a week on farm, majority of farmers work over 40 hours (35.3%) and 24.1% of framers work 1 to 15 hours. In addition, 20.7% of respondents work 15 to 20 hours and 19.8% of farmers work 30 to 40 hours work in a week on farm.

Initial results show that farmers' practices can be divided to four categories. Out of 116, 61 farmers were organic practices- not certified (52.6%) followed by 41 conventional farmers (35.4%), 7 organically certified farmers (6%) and 7 certified naturally grown farmers (6%). All together 65% of farmers were following organic practices. According to the results, 31% farmers are having more than 2 years' experience organic farming and 27.6 % have 2 -5 years' experience. There are 27.6% of farmers have experience in organic farming more than 10 years. The remaining 12.8% have 2 to 5 years organic farming experience. Majority of respondents (n=49, 50%) earned gross farm sales from $1,000 to $10,000 in the last year, while the next group (n=22, 22.4%) earned from $10,000 to $50,000. Twelve respondents (12.2%) earned from $50,000 to $100,000 gross farm sales, and 10 respondents (10.2%) earned greater than $100,000.

Only five respondents (5.1%) earned between $25,000 and $50,000 gross farm sales. Majority of respondents were male (65.1%) and the rest were female (34.9%). According to the respondent's age majority were in age group 51-65 (39.4%) followed by 24.8%, in age group 36-50, 23.8%, in age group older than 65 and 11.9%, in age group 18-35.

Respondents were asked to indicate their marital status. From all the respondents 88 farmers (82.2%) were married followed by 15 farmers (14%) were single and 3 farmers (2.8%) were widowed and only one respondent (1%) was divorced. Respondents were asked to indicate their level of education. Majority of the respondents (34.6%) had completed undergraduate degree followed by (26.2%) of those who had completed high school and advanced degree, and the remaining (13%) had an associate or technical school education. Majority of farmers (31.1%) sell their produce in other methods such as pick your own, online, road side stands, for own consumption and in community supported agriculture method followed by 30.5% sell in Famers market. 22.6% of farmers sell in retail sales and 15.8% of farmers sell whole sale.

Table 1 Descriptive Statistics of Sample

Farm Size	Percentage	**Organic farming experience of the Farmers**	Percentage
Less than 50 acres	69.0	Less than 2 years	31.0
51-100 acres	12.9	2-5 years	13.8
101-250 acres	10.3	5-10 years	27.6
251-500 acres	2.6	More than 10 years	27.6
Over 500 acres	5.2		
Farmer or member of household work off-farm		**Annual farm income from gross sales**	
Full-time	43.1	$1000-10000	50.0
Part-time	24.1	$10000-50000	22.4
Don't work	32.8	$25000-50000	5.1
		$50000-100000	12.2
		Over $100000	10.2

Farming Experience of the Farmers		**Distribution of the respondents by the Gender**	
Less than 5 years	27.6	Male	65.1
5-10 years	22.4	Female	34.9
10-20 years	16.4		
20-30 years	9.5		
More than 30 years	24.1		
Do Farmers' Produce live stock or field crops except fruits and vegetables?		**Distribution of Respondents by their Age**	
Yes	42.2	18-35	11.9
No	57.8	36-50	24.8
		51-65	39.4
		65+	23.9
Type of land used for farming		**Marital status of the farmers**	
Own	84.5	Single	14.0
Lease	6.0	Married	82.2
Other	9.5	Divorced	1.0
		Widowed	2.8
Type of Produce grown in the farm		**Level of Education of the farmers**	
Fruits	19.9	High school graduate/GED	26.2
Vegetables	24.1	Associate/tech. school degree	13.1
Both	56.0	Undergraduate degree	34.6
		Advanced or professional degree	26.2
Number of hours work in a week on farm		**Methods used for selling Farm products**	
1-15 hours	24.1	Sell Whole sale	15.8
15-30 hours	20.7	Sell Retail	22.6
30-40 hours	19.8	Sell Farmers market	30.5
Over 40 hours	35.3	Sell Other	31.1
Method of growing practices			
Organically certified	6.0		
Organic practices-not certified	52.6		
Certified naturally grown	6.0		
Conventional	35.4		

Attitudes toward challenges for organic farmers were directly measured with five items using a 5-point Likert scale. A high overall mean (3.5-5) represents a positive attitude, and a low overall mean (1-2.5) represents a negative attitude. Results in Table 2 indicated that Tennessee fruit and vegetable farmers had high and positive means for the Labor intensive and Certification process challenges toward organic farming practices. Farmers held slightly positive attitudes towards, Difficult to control pests & diseases and High cost of production using organic farming practices. Farmers considered negative attitude toward high market competition in practicing organic farming.

Table 2 Challenges to continue Organic Farming

Variable	N	Mean	Std. Deviation
High cost of production	67	3.84	1.07
Labor intensive	67	4.18	0.89
Difficult to control pests & diseases	67	3.94	0.92
Market competition is high	67	3.42	0.99
Certification process is difficult	67	4.10	0.94

The results showed in Table 3, the mean of farmers' attitude toward Organic farming is better for the environment was 4.13. Farmers felt slightly positive that for Organic farming gives good use of skills. Tennessee fruit and vegetable farmers showed neutral attitudes towards can't control weeds, pests & diseases, more profitable than conventional farming, Profits of organic products are high, Organic farming popular among local farmers, Organic standards are too restrictive to be practical and changing to organic farming is an exciting new challenge on their farms.

Table 3 Perceptions and attitudes towards Organic Farming

Variable	N	Mean	Std. Deviation
Organic farming is better for the environment	111	4.13	1.10
Can't control weeds, pests & diseases	110	3.38	1.34
More profitable than conventional farming	109	2.83	1.11
Profits of organic products are high	108	2.76	1.05
Organic farming popular among local farmers	108	2.64	1.12
Organic standards are too restrictive to be practical	108	3.00	1.13
Changing to organic is an exciting new challenge	108	3.40	1.10
Organic farming gives good use of skills	108	3.56	1.07

Also results indicated that farmers held neutral attitudes towards taste, price, nutrition, free of chemicals, freshness and consumer demand of organic fruits and vegetables. Farmers indicated barriers to adopt organic farming, which could explain their attitude toward the barriers to continue organic farming methods on their farms. As shown in Table 4, the Labor consuming was the highest barrier. The second highest barrier was the time consuming, followed by high cost of production. Lack of organic knowledge, No benefits, and Lower yields also showed as positive barriers toward adoption. Fruit and vegetable farmers mentioned that Market competition is high and Government supports are neutral barriers to adopt organic farming in Tennessee.

Table 4 Barriers affecting adoption of Organic Farming

Variable	N	Mean	Std. Deviation
Production cost is high	66	4.14	0.76
Time consuming	66	4.17	1.00
Labor consuming	66	4.20	0.96
Lack of organic knowledge	66	3.80	1.07
No benefits	66	3.30	1.18
Market competition is high	66	3.14	1.08
Lower yields	65	3.62	1.14
Government support	64	3.08	1.13

Cross tabulations were used to indicate the relationship between method of growing practices and the characteristics of the farmers. All the variables tested, size of the farm and annual farm income from gross sales of farmers had statistically significant relationships with the growing practices of the farmers. However, there were no significant relationship between method of growing practices and work off-farm, farming experience, hours work in a week on farm, produce live stock or other field crops, gender, age, marital status and level of education of the participated farmers respectively.

Table 5 Results of the Chi-Square test for relationship between farmer characteristics and growing practices

Farmer Characteristics	Chi-square value	Df	P Value (2-sided)
Size of the farm	29.878	12	0.003
Annual farm income from gross sales	21.191	12	0.048
Farmer or family member work off-farm	7.692	6	0.262
Farming experience	14.145	12	0.490
Hours work in a week	8.449	9	0.490
Produce live stock or other field crops	3.491	3	0.322
Gender	3.516	3	0.319
Age	5.688	9	0.771
Marital status	8.510	9	0.484
Level of formal education	9.528	9	0.390

Cross tabulations were used to indicate the relationship between method of growing practices and the challenges to continue organic farming. All the variables tested, high market competition and certification process is difficult had statistically significant relationships with the growing practices of the farmers. However, other challenges did not indicate any significant relationship to the method of growing practices using by farmers. Table 6 illustrates the results of Pearson Chi-Square test for the relationship between method of growing practices and High cost of production, Labor intensive and difficult to control pests & diseases.

Specifically, the relationship between method of growing practices and High cost of production was not significant as the p value of the Pearson Chi Square statistic ($p = 0.235$) was higher than $p = 0.05$ at 12 degrees of freedom as illustrated in table 6. The relationship between method of growing practices and Labor intensive was also not statistically significant because the p value was 0.917, which was higher that $p = 0.05$ on which significant relationship was pegged, as indicated in table 6. The relationship between method of growing practices and difficult to control pests & diseases was not significant as the p value of the Pearson Chi Square statistic ($p = 0.614$) was higher than $p = 0.05$ at 9 degrees of freedom as illustrated in table 6.

Table 6 Results of the Chi-Square test for relationship between challenges and growing practices

Variable	Chi-square value	Df	P Value (2-sided)
High market competition	22.364	12	0.034
Certification process is difficult	32.568	12	0.001
High cost of production	15.119	12	0.235
Labor intensive	3.911	9	0.917
Difficult to control pests & diseases	7.220	9	0.614

All the eight variables selected as respondents' perceptions towards organic farming affect growing practices. There were significant relationships ($p \leq 0.05$) between growing practices and perceptions better for the environment, weeds, pests & diseases problem, more profitable than conventional farming, profits are high, popular among local farmers, standards are too restrictive, an exciting new challenge and make good use of skills.

Table 7 Growing practices vs Perceptions and attitudes towards Organic Farming

Variable	Chi-square value	Df	P Value (2-sided)
Organic farming is better for the environment	45.292	12	0.000
Can't control weeds, pests & diseases	38.252	12	0.000
More profitable than conventional farming	26.097	12	0.010
Profits on organic products are high	30.672	12	0.002
Organic farming is popular among local farmers	27.427	12	0.007
Organic standards are too restrictive to be practical	27.555	12	0.006
Changing to organic farming is an exciting new challenge	25.563	12	0.012
Organic farming gives a chance to make good use of skills	28.826	12	0.004

Cross tabulations were used to indicate the relationship between method of growing practices and the barriers to adopt organic farming. According to the findings, of all the variables tested, only lower yields had statistically significant relationship with the growing practices of the farmers. However, all other variables did not indicate any significant relationship to the method of growing practices using by farmers. Table 8 illustrates the results of Pearson Chi-Square test for the relationship between method of growing practices and Production cost is high, Time consuming, Labor consuming, Lack of organic knowledge, No benefits, Market competition is high and Government support for the participated farmers respectively.

Table 8 Results of the Chi-Square test for relationship between barriers and growing practices

Variable	Chi-square value	Df	P Value (2-sided)
Lower yields	23.175	12	0.026
Production cost is high	7.152	9	0.621
Time consuming	9.198	12	0.686
Labor consuming	8.511	12	0.744
Lack of organic knowledge	8.868	12	0.714
No benefits	13.249	12	0.351
Market competition is high	16.124	12	0.186
Government support	8.987	12	0.704

A logistic regression analysis was conducted to predict adapt to organic farming for 116 organic and conventional farmers using 10 predictors. Table 9 shows the test of the full model against a constant only model was statistically significant, indicating that the predictors as a set reliably distinguished between acceptors and decliners of the adoption (chi square = 48.381, $p < 0.05$ with df = 27).

Table 9 Results of the tests of Model Coefficients

		Chi-square value	Df	Sig.
Step 1	Step	48.381	27	0.007
	Block	48.381	27	0.007
	Model	48.381	27	0.007

In these results, the statistics for the Step, Model and Block are the same because it has not used stepwise logistic regression or blocking. The probability of obtaining the chi-square statistic (48.381) is 0.007 and there is no effect of the independent variables, taken together, on the dependent variable.

Table 10 Results of the Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	79.573	0.393	0.536

Nagelkerke's R^2 of 0.536 indicated a moderate relationship between prediction and grouping. Here it is indicating that 39.3% of the variation in the dependent variable is explained by the logistic model. The –2log likelihood value from the Model Summary table is 79.573 (Table 10). According to the Hosmer and Lemeshow Test, H-L statistic has a significance of .595 which means that it is not statistically significant and therefore our model is quite a good fit.

Table 11 Classification Table of observed and predicted values

Observed			Predicted		
			Adopt to Organic farming or not		Percentage Correct
			Conventional	Organic	
Step 1	Adopt to Organic farming or not	Conventional	26	10	72.2
		Organic	7	54	88.5
	Overall Percentage				82.5

Prediction success overall was 82.5% (88.5% for decline and 72.2% for accept) as illustrated in Table 11.

Table 12 Results of the Variables in the equation

Variable		B	S.E.	Wald	df	Sig.	Exp(B)
Farm size	Over 500 acres	Reference		.339	4	.987	
	Less than 50 acres	-.538	1.626	.109	1	.741	.584
	50-100 acres	.025	1.926	.000	1	.990	1.026
	101-250 acres	-.093	1.722	.003	1	.957	.911
	251-500 acres	.518	2.826	.000	1	.999	2.527
Work off farm	Don't work	Reference		.533	2	.766	
	Full Time	-.580	.795	.533	1	.465	.560
	Part Time	-.290	.908	.102	1	.749	.748
Type of produce	Both	Reference		5.791	2	.055	
	Fruits	.785	1.117	.494	1	.482	2.192
	Vegetables	2.461	1.029	5.714	1	.017	11.713
Farming Experience	More than 30 years	Reference		6.517	4	.164	
	Less than 5 years	1.365	1.099	1.541	1	.214	3.915
	5-10 years	1.797	1.136	2.503	1	.114	6.030
	10-20 years	3.069	1.293	5.635	1	.018	21.523
	20-30 years	-.325	1.289	.064	1	.801	.723
Hours work in a week on farm	Over 40 hours	Reference		13.272	3	.004	
	1-15 hours	-4.791	1.394	11.805	1	.001	.018
	15-30 hours	-1.534	1.102	1.937	1	.164	.216
	30-40 hours	-.007	.952	.000	1	.994	.993
Produce live stock or field crops	No	.163	.753	.047	1	.828	1.178
Gender	Male	-2.039	.859	5.632	1	.018	.130

Age	65+	Reference		.186	3	.980	
	18-35 years	.098	1.401	.005	1	.944	1.103
	36-50 years	-.390	1.192	.107	1	.743	.677
	51-65 years	-.208	.986	.045	1	.833	.812
Annual cash farm income from gross sales	Over $100000	Reference		8.386	4	.078	
	$1000-10000	4.123	1.548	7.095	1	.008	61.722
	$10000-25000	3.778	1.573	5.770	1	.016	43.735
	$25000-50000	3.095	2.085	2.202	1	.138	22.085
	$50000-100000	2.038	1.472	1.916	1	.166	7.675
Level of education	Professional degree	Reference		4.322	3	.229	
	High school degree	-1.423	.931	2.334	1	.127	.241
	Tech. school degree	.732	1.240	.349	1	.555	2.079
	Undergraduate degree	-1.014	.927	1.196	1	.274	.363
	Constant	-.340	2.220	.023	1	.878	.712

Log likelihood ratio = 79.573, LR Chi^2 = 48.381, Pseudo R^2 = 0.593, No. of observations = 97

According to the results of the table 13, producing vegetables (p = .017), 10-20 years in farming experience (p = .018), 1-15 hours work per week on farm (p = .001), male farmers (p = .018), $1000-10000 in annual cash farm income (p = .008) and $10000-25000 in annual cash farm income (p = .016) contributed significantly to the prediction. All other variables did not contribute significantly to the prediction.

The pseudo R^2 value of the model was 0.593. Thus, the explanatory variables used in the model are collectively able to predict nearly 59 % of the factors influencing adoption of organic farming among the fruit and vegetable farmers in Tennessee.

According to the results showed in the Table 13, the coefficients of farm sizes were not significant at the 5% level. Coefficients of Less than 50 acres and 101-250 acres were negative and coefficients of 50-100 acres and 251-500 acres were positive compared to over 500 acres reference category. The coefficients of work off farm were negative compared to don't work. But not statistically significant. Coefficients of type of produce was positive and fruits produce not

significant and vegetables produce significant at the five percent level. The coefficients of Farming Experience were positive except 20-30 years and statistically not significant at the five percent level except 10-20 years compared to reference category. Not producing livestock or field crops compared to producing, was positive and not statistically significant. Gender of farmer male compared to female was significant and negative at the five percent level. Coefficients of age of farmer were not significant and positive at 18-35 years and negative at 36-50 and 51-65 years compared to 65+ years at the five percent level. The coefficients of annual cash farm income were positive and statistically significant in $1000-10000 and $10000-25000 at the five percent level. Coefficients of level of education of the farmer's high school and undergraduate degrees were negative and technical school degree was positive compared to professional degree and coefficients were not statistically significant at the five percent level.

Farmers who were producing vegetables 11.713 times more likely to adapt to organic farming than farmers who were producing both fruits and vegetables. Farmers who have 10-20 years' experience in farming, 21.523 times more likely to adapt to organic farming than farmers who have experience more than 30 years in farming. The odds ratios of farmer who work 1-15 hours per week on farm adapting to organic farming in comparison to farmer who work more than 40 hours per week, are lot lower for farmer who work 1-15 hours per week on farm. Farmers who work more than 40 hours per week 55.5 times more likely to adapt to organic farming than farmers who work 1-15 hours per week on farm. Female farmers were 7.69 times more likely to adapt to organic farming than male farmers.

Farmers who earned annual cash farm income $1,000-10,000 were 61.72 times more likely to adapt to organic farming than farmers who earned annual cash farm income more than $100000. Farmers who earned annual cash farm income $10,000-25,000 were 43.73 times more

likely to adapt to organic farming than farmers who were earned annual cash farm income more than $100,000.

The average Tennessee farm size is 160 acres in 2012 and it was increased up to 162 acres in 2016. Total farm land area was 68,050 acres in 2012 and it was reduced down to 66,600 acres in 2016. Farm size for the sample showed that the farm size of the sample contained an overall larger number of small size farms that are less than 50 acres. 39% of actual farms in the U.S. were below 50 acres in 2012; while in Tennessee around 45% of the farms were having less than 50 acres, according to the observations of this current study majority of the farmers are having less than 50 acres and this shows an increment in the small farms in Tennessee. According to the 2012 USDA data, the annual gross income between $1000-10000 from farm production was 28% while in Tennessee 41% of farms fell in that category. According to the results of the current study 50% of farmers were earning between $1000-10000 and there is an increment in less income category since 2012.

Conclusion and Summary

The main objective of this study is to explore fruit and vegetable farmers' attitudes towards organic farming in Tennessee. Specific research objectives are to analyze awareness and attitudes of fruit and vegetable farmers in Tennessee towards organic farming; to analyze factors affecting the adoption of organic farming in Tennessee; to find the challenges faced by current organic farmers in Tennessee. Based on the data collected, 53% of farmers responded that they were following organic practices but not certified, 6% organically certified farmers and 6% were certified naturally grown farmers. 35% of farmers were not following any organic practices. All together 65% of farmers were following organic practices.

The findings of this study showed that majority of farmers were male and 82% were married. 39 % of the farmers were within the age group of 51-65 years, with 35% had completed an undergraduate degree.

Most of the organic farmers have identified high cost of production, labor intensity, pest and disease problem and certification process as challenges to continue their farming practices. All organic and conventional farmers have positive opinion towards attitudes Organic farming is better for the environment and Organic farming gives good use of skills. According to the results, responded the organic and conventional farmers have neutral attitudes towards Taste, Price, Nutrition, Chemicals free, Freshness and Consumer demand of organic fruits and vegetables

Conventional farmers have identified high cost of production, time consuming, labor consuming, lack of organic knowledge and lower yields as major barriers to enter organic farming. Furthermore, there was a direct correlation between the size of the farm and growing practices of farmers. Out of the respondents, 69% of farmers operated farms less than 50 acres. There is a relationship between annual farm income from gross sales and farming practices as well. However, it was found that size of the farm directly relates to the farmers annual farm income.

When consider relationships between growing practices and challenges faced by farmers to continue organic farming, high market competition and certification process is difficult directly relate to farming practices. All selected farmers' perceptions and attitudes towards organic farming for this study affect in adopting organic practices. According to the findings, of all the variables tested, only lower yields had direct relationship with the growing practices of the farmers.

Moreover, the chances of fruit and vegetable farmers adopt to organic farming practices will increase with producing vegetables, the years of experience in farming, hours work per week on farm, female farmers and annual income on gross sales.

The results of the study show that there is a future for organic farming in Tennessee. Most farmers agreed organic agriculture is better for environment. Conventional farmers will show their interest in adoption of organic farming if they get solutions for time consuming, labor consuming and lack of organic knowledge barriers.

The main limitation to this study was the finding farmers and collecting data. A total of 116 participants were involved, and it would have been more efficient to get a larger sample size in order to gain different perspectives and to have a clearer understanding of the research subject. Many county agents were contacted to help with distribution and collection of questionnaires, but the help was not anticipating. Furthermore, a larger number of participants would enable future researchers to apply this study in further research on whole organic farming industry and the importance of organic farming to the society.

In addition to that, it was difficult get responses to those who were sent the survey link via email and has an issue who responded to the questionnaire because not asking the personal information of the respondent. There was also limited time to effectively hand deliver the questionnaires to a larger number of farmers and collect data and the season that collected data for the research.

Future study should consider strategies to involve more farmers to conduct advance statistical analysis. These findings can be used by Extension agents to overcome some challenges in improving organic fruit and vegetable production in Tennessee.

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