Factors Affecting Okra Productivity in Suphan Buri Province, Thailand

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Abstract The study has been conducted to identify the factors affecting okra productivity by using multiple regression analysis in Suphan Buri Province, Thailand. Structure questionnaires were conducted to gather data from 82 okra growers in Suphan Buri Province. Descriptive statistics were use to describe socio-economic variables of the respondents as presented. Besides, multiple regression analysis was employed in determining the factors influencing farmers' productivity. The results revealed that the variables found to be highly significant and which influenced farmers' productivity include gender ($p<.05$), age ($p<.01$), experience in okra production ($p<.01$), okra farm size ($p<.01$), and quantity of chemical fertilizer ($p<.01$), respectively, with the adjusted R^2 was 89.80.

Keywords: Okra, okra productivity, okra growers, regression model.

Introduction

Okra (*Abelmoschus esculentus* L. Moench) is believed to have originated from Africa and is being grown in most sub-tropical and tropical regions of the world (CBI Market Intelligence, 2016), which has been one of the important export vegetables cultivated in Thailand for decade, especially in the central region of Thailand. Almost all okra farmers in Thailand are contract farmers for the export companies (FAO Vegetable IPM 2004), which is more than 95 percent of fresh pod was exported to Japan in 2002.

Thailand's export of fresh okra to Japan in 2007 decreased sharply from 2006 (Thai Custom, 2019). Therefore, the objectives of this study are 1) to investigate the socio-economic characteristics okra growers who are the members of the okra farming network for export in Suphan Buri Province, Thailand, and 2) identify factors that lead to okra productivity

Literature Review

Regression analysis is a related technique to assess the relationship between an outcome variable and one or more risk factors or confounding variables which the dependent variable is denoted "y" and the independent variables are denoted by "x", which is widely used for prediction and forecasting, also used to understand which among the independent variables are related to the dependent variable, and to explore the forms of these relationships. In restricted circumstances, regression analysis can be used to infer causal relationships between the independent and dependent variables.

A review of previous research found that several studies have used regression analysis to determine plant productivity such as Nosiru *et al.* (2012) used regression analysis to improved Productivity of Okra (Abelmoschus esculentus) by Farmers in Lowland Areas of Ogun State, Nigeria. Jelena *et al.* (2011) used regression analysis to analyze external and internal factors influencing the growth and biomass production of short rotation woods genus Salix and perennial grass Miscanthus.

Materials and methods

1. The study area

U Thong and Song Phi Nong District of Suphan Buri Province located in Central Thailand (Fig.1), and is the most productive area of okra production for export (DOAE, 2016).

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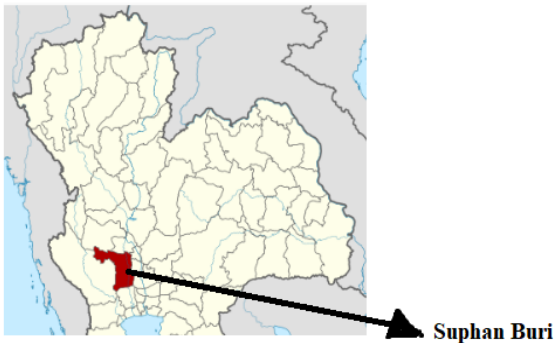

Fig.1 Map of Suphan Buri Province, Thailand

2. Data collection procedure

A total of 440 okra growers were cultivating okra commercially by referred the data from Department of Agricultural Extension: DOAE (2016) for January-December, 2016; a sample of 82 okra growers were selected randomly by referred a list of farmers in the okra sell center by using probability proportionality size following a simplified formula provided by Yamane (1967).

The required sample size at 90% confidence level with degree of variability of 10% will be used to obtain a sample size required which represents a true population as follow:

$$n = \frac{N}{1 + N(e^2)} \quad (1)$$

Where; n is Sample size, N is Population size and e is Allowable error ($e = 0.10$).

An estimated of n as follows equation (1) based on the intensity of okra production in Suphan Buri Province is equal 82.

Primary data was collected by using a structured questionnaire adapted from a baseline survey Export Okra Production in Thailand conducted by the FAO Vegetable IPM. (2004)

3. Method of data analysis

The study was based on primary data and was confined to Suphan Buri Province. Farm size in okra production in rai (1,600 square meters) was used to standardize of the inputs in terms of the quantities per rai.

The data included information on okra production such as: amount of work hours in production, quantity of inputs (seed, chemical fertilizer), number of plowing, and okra farm size.

For estimating the impact of various factors on okra productivity, regression analysis was carried out. Various inputs and agricultural practices were considered as independent variables and the okra productivity as dependent variable, following the multiple regression equation was used and presented below to identify factors affecting okra productivity in Suphan Buri Province, Thailand.

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} \quad (3)$$

Where:

Y = Okra productivity of each okra growers in Suphan Buri (KG./Rai)
β_0 = Intercept
$\beta_1 - \beta_8$ = Regression coefficients of the respective input variables
X_1 = Gender of respondent (Male = 1, Female = 0)
X_2 = Age of respondent (Years)
X_3 = No. of schooling year (Years)
X_4 = Marital status (Married = 1, single = 0)
X_5 = Experience in okra production (Year)
X_6 = Family members for okra production (Person/household)
X_7 = Okra farm size (Rai/household)
X_8 = Quantity of okra seed (KG./Rai)
X_9 = Quantity of chemical fertilizer (KG./Rai)
X_{10} = Farm Type (garden grove = 1, ridge tillage = 0)

X_{11} = Number of plowing (Time/Rai/Household)
X_{12} = Sum total of work hours in okra production (Hour/Rai)

Results

Socio-economic characteristics of okra growers

The socio-economic characteristics of okra growers in the study area consist gender, age, years of schooling, marital status, number of family member, and experience in okra production were analyzed by using descriptive statistics which the result is presented in Table 1.

Table 1. Socio-economic Characteristics of okra growers in Suphan Buri Province

Characteristics	%	Mean	Minimum	Maximum
Gender				
Male	48.80	n.a.	n.a.	n.a.
Female	51.20	n.a.	n.a.	n.a.
	100.00%	**0**	**0**	**0**
Age (Year)				
30 - 39	34.10	n.a.	n.a.	n.a.
40 - 49	30.50	n.a.	n.a.	n.a.
50 - 59	22.00	n.a.	n.a.	n.a.
> 60	13.40	n.a.	n.a.	n.a.
	100.00%	**0**	**0**	**0**
No. of schooling year (Year)				
0 - 6	72.00	n.a.	n.a.	n.a.
7 - 9	13.40	n.a.	n.a.	n.a.
10 - 12	12.20	n.a.	n.a.	n.a.
14	2.40	n.a.	n.a.	n.a.
	100.00%	**0**	**0**	**0**
Marital status				
Single	17.10	n.a.	n.a.	n.a.
Married	82.90	n.a.	n.a.	n.a.
	100.00%	**0**	**0**	**0**
Experience in okra production (Year)				
1 - 5	57.30	n.a.	n.a.	n.a.
6 - 10	19.50	n.a.	n.a.	n.a.
11 - 15	17.10	n.a.	n.a.	n.a.
> 15	6.10	n.a.	n.a.	n.a.
	100.00%	**0**	**0**	**0**
Farm Type				
Garden grove	34.10	n.a.	n.a.	n.a.
Ridge tillage	65.90	n.a.	n.a.	n.a.
	100.00%	**0**	**0**	**0**
Family members (Person/household)	n.a.	3.98	2.00	7.00
Okra farm size (Rai/household)	n.a.	1.52	0.25	8.00
Quantity of okra seed (KG./Rai)	n.a.	0.76	0.13	4.00
Quantity of chemical fertilizer (KG./Rai)	n.a.	137.03	22.50	720.00
Number of plowing (Time/Rai)	n.a.	2.05	1.00	3.00
Sum total of work hours (Hour/Rai)	n.a.	13.55	10.38	17.16
Sum total of okra product (KG. /Rai)	n.a.	2,708.78	970.00	4,500.00

From gender perspective, about 48.80% were found to be male for okra production in Suphan Buri Province while 51.20% were found to be female.

On age classification, 64.60% were found to be within the age bracket of 40 – 49 years. While 13.40% of the respondents is older than 60 years. Contrary to findings of past studies which reported the farming population to be ageing (Idowu, 1989), the present study shows a young farming population.

Number of schooling years of okra growers, from this study reveals that 72.00% of the respondents have 6-year schooling while about 12.20% are okra grower who have 12-year schooling. Thus, over than 60% of the respondents have had one form of formal education. Evidence indicates that the okra growers in Suphan Buri Province is an educated one similarly with Gabriel *et al.* (2006).

On experience in okra production, 57.30% were revealed to be the respondents have 1-5 years experience in okra production while 6.10% were revealed to be respondents have more than 15 years experience in okra production.

The total productivity of each okra grower household as revealed in the Table 1, an average productivity is 2,807.93 KG./Rai/Crop. While the minimum productivity and maximum productivity is 1,350.00 KG./Rai/Crop and 4,500.00 KG./Rai/Crop respectively. It is clear that okra production in Suphan Buri Province is highly productivity.

Estimation of factors affecting okra productivity in Suphan Buri Province.

In table 2, the coefficient of determination (R^2) was 89.80 which states that given independent variables; explain 89.80 percent variation in the okra productivity. The Durbin Watson statistics (1.887) was also normal showing absence of autocorrelation in the data series.

Table 2. Enter Regression Analysis Results of Factors Affecting[1] on the Okra productivity in Suphan Buri Province, Thailand.

Variables	B	Std. Error	Beta	t	P-Value
(Constant)	4,722.329	840.526		5.618	0.000
Gender	119.309	174.037	0.079	0.686	0.034*
Age	-22.511	106.561	-0.031	-0.211	0.003**
No. of schooling year	177.478	113.264	0.187	1.567	0.122
Marital status	-288.785	253.340	-0.144	-1.140	0.258
Experience in okra production	-20.585	110.350	-0.026	-0.187	0.000**
Family members	107.117	72.321	-0.163	-1.481	0.143
Okra farm size	-0.565	0.179	0.156	0.106	0.002**
Quantity of okra seed	-172.411	182.938	-0.110	-0.942	0.349
Quantity of chemical fertilizer	0.219	0.048	0.238	0.073	.000**
Farm type	-355.411	213.794	-0.223	-1.662	0.101
Number of plowing	-60.993	91.018	-0.081	-0.670	0.505
Sum total of work hours in production	-88.759	46.160	-0.221	-1.923	0.059
Multiple R^2 = 0.912	*F = 24.954*				
Adjusted R^2 = 0.898	*Durbin – Watson = 1.887*				

Note: [1] * $p \leq 0.05$, ** $p \leq 0.01$

Table 2 shows that there is 5 out of 12 independent variables in the regression equation were significant. That is ***gender*** (t = 0.686), ***age*** (t = -0.211), ***okra farm size*** (t = 0.106), ***experience in okra production*** (t = -0.187), ***quantity of chemical fertilizer*** (t = 0.073), which all the coefficients were statistically significant at 5%, 1% and 0.1% level, respectively.

Gender (X_1) had a positive sign at the 5% level of probability. By increasing in male okra growers by a unit, the output level will increase by 119.31%. Due to 51.20% were found to be female.

Age (X_2) had a negative sign at the 1% level of probability. By increasing in age by a unit, the output level will decrease by 22.51%. Due to 64.60% were found to be within the age bracket of 40 – 49 years.

Marital status (X_4) had a negative sign. By increasing in married status by a unit, the output level will decrease by 288.79%. According to 82.90% were found to be married.

Experience in okra production (X_5) had a negative sign at the 1% level of probability. By increasing in experience in okra production by a unit, the output level will decrease by 20.59%. Because 57.30% had 1-5 years' experience in okra production.

Okra farm size (X_7) had a negative sign at the 1% level of probability. By increasing in okra farm size by a unit, the output level will decrease by 56.50%. This is because okra plants demand much attention from grower, especially while maintaining and harvesting. If okra farmers can't attend adequately, the productivity will decrease.

Quantity of okra seed (X_8) had a negative sign. By increasing in quantity of okra seed by a unit, the output level will decrease by 172.41%. This is because using more seed will reduce space of okra plants, especially fruit length, which is accordance with Singh (1990)

Quantity of chemical fertilizer (X_9) had a positive sign at the 1% level of probability. By increasing quantity of chemical fertilizer by a unit, the output level will increase by 21.90%. This indicated that the yields can be explained by increasing in chemical fertilizer use. This result is in line with the findings of Rahman *et al.* (2012); Anyiro *et al.* (2013).

Farm type (X_{10}) had a negative sign. By increasing in garden grove farm type by a unit, the output level will decrease by 355.41%. This is because planting by garden grove method has space between okra plant less than ridge tillage method.

Number of plowing (X_{11}) had a negative sign. By increasing in number of plowing by a unit, the output level will decrease by 60.99%. This is because more plowing will kill soil organisms, which is affected by okra productivity.

Sum total of work hours in okra production (X_{12}) had a negative sign. By increasing in sum total of okra operating hour by a unit, the output level will decrease by 88.76%, a finding is similar to Baree *et al.* (2011); Rahman *et al.* (2012), who showed the importance of labor in farming.

Base on all details above, the final equation of multiple regression for determining okra productivity in Suphan Buri Province will be:

$$Y_i = \underset{}{4{,}722.329} + \underset{(5.618)}{119.309X_1} - \underset{(0.686)}{22.511X_2} + \underset{(-0.211)}{177.478X_3} - \underset{(1.567)}{288.785X_4} - \underset{(-1.140)}{20.585X_5} + \underset{(-1.481)}{107.117X_6} - \underset{(0.106)}{0.565X_7} - \underset{(-0.942)}{172.411X_8} + \underset{(0.073)}{0.219X_9} - \underset{(-1.662)}{355.411X_{10}} - \underset{(-0.670)}{60.993X_{11}} - \underset{(-1.923)}{88.759X_{12}}$$

Conclusion

The regression analysis result was used to identify the determinant factors of okra productivity, which the result showed that independent variable such as gender, age, okra farm size, experience in okra production, and quantity of chemical were statistically significant variables that affected the okra productivity, especially experience and quantity of chemical fertilizer these parameters could be observed to be most significantly contributing to improving productivity of okra growers.

Moreover, this study found that okra growers in Suphan Buri Province should be encouraged to increase quantity of chemical fertilizer. While should decrease quantity of okra seed, number of plowing and sum total of okra operating hour in okra production for increasing their productivity.

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