



## Assessment of socio-economic factors affecting production of African nightshades vegetable for enhanced livelihoods in Siaya county, Kenya

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### Abstract

African nightshades (*Solanum*-related species) are important African leafy vegetables consumed by rural communities in most parts of Kenya. They are easy to grow, rich in vitamins, minerals, have medicinal properties, contributes to poverty alleviation and nutritional security. However, the current data show that their production is low. Integration of this crop into mainstream horticulture has been very slow due to low yields that are considered uneconomical compared to other high-value horticultural crops. Farmers of African nightshades obtain yields of about 3.0 tons ha<sup>-1</sup> compared to potential yields of about 30 tons ha<sup>-1</sup>. The purpose of this study was to investigate socio-economic characteristics affecting production. A household survey on 205 African nightshades growing farmers was conducted using structured questionnaires. The collected data was analyzed using descriptive statistics, binomial regression analysis and Chi-square test for inferential statistics at the 5% level of significance. The results on socio-economic factors were statistically significant and positively influenced African nightshades production. These were age, location, education, household, title deeds and income. The study concluded that production of nightshades was influenced by farmers' socio-economic factors. The study recommended that the Government and other stakeholders in African nightshades production should put more effort towards improving small-scale farmers' socio-economic factors to achieve the economic pillar of Vision 2030 and Sustainable Development Goals.

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## Introduction

Smallholder agriculture is a key source of food, livelihoods and employment for many rural households in Kenya. However, agricultural production in Kenya has declined in recent years recording a low performance of 2.9 percent in 2013 (ROK, 2014).

Kenya's smallholder farmers play an important role in agricultural production accounting for 75 percent of total output and 70 percent of the marketed produce (ROK, 2010). (MOA, 2004). FAO (1999) stipulated that poverty afflicts 56% of the Kenyan population and that Kenya is among other countries in Africa whose percentage of undernourished persons is greater than 35%. According to Ruthuku (2007), agriculture contributes 53% of Gross Domestic Product (GDP) directly and indirectly through crop development, linkages with manufacturing, distribution and other service related sectors. It also provides 59% of total export earnings and employment to over 70% of the country's population.

Appropriate strategies and interventions are required to improve agricultural production and productivity, food security and nutrition to meet food needs for the increasing population (ROK, 2010). Introduction and use of improved agricultural technologies is one way of enhancing agricultural productivity in the country (Olwande *et al.*, 2009).

African leafy vegetables, nightshades inclusive, can be defined as those vegetables whose primary center of origin is known to be in Africa (Schippers, 2000). They are outstanding sources of micronutrients in the world. This makes them helpful in alleviating micronutrient deficiencies common in Sub Saharan Africa (Abukutsa Onyango, 2010).

Among the micronutrients these vegetables have include Vitamin A, calcium, manganese, magnesium and iron (Keding *et al.*, 2009). In Kenya, the area under African nightshades was 2,687 Ha in 2013 with a production of 1, 9624 MT of which 36% was produced in Nyamira and Kisii Counties. The total value was KES 609 million.

The major challenge in production of the crop is inadequate supply of certified seeds and poor post harvest handling processes in terms of packaging, transportation and distribution. (HCDA, 2013). According to the Kenya Integrated Household and Budget Survey (2005/2006), 22.79 per cent of the children in the Siaya County below 5 years are stunted, 12.6 per cent of the children in the same category are underweight.

Farming households have differences in their socio-economic characteristics such as location, education level, age, farm size, income, gender and household size among others. A survey on socio-economic factors influencing smallholder pumpkin production, consumption and marketing in Eastern and Central Kenya regions found that proximity of the study areas to markets and permanent water sources gave a comparative advantage in production over other growing regions (Ndegwa, 2016).

Risk and uncertainty largely influence farmers' actions in the use of productive resources. Agricultural productivity can therefore be improved by assuring farmers of improved income and livelihood opportunities. Farmers' production systems are highly diversified with strong interactions among crops, livestock and off-farm activities (IFPRI, 2005). A study in Nigeria found that older people are the majority of producers of indigenous vegetables because they recognize them for their health properties and ability to prevent diseases (Oladele, 2010). Young people on the other hand prefer consuming "modern foods" and do not identify with indigenous and traditional foods (Matenge *et al.*, 2012).

The food security situation in Kenya is worsening due to declining agricultural production and productivity. In Siaya County, the level of production and nutritional benefits of nightshades is low. Integration of these crops into mainstream horticulture has been very slow, due to low yields that are considered uneconomical compared to other high yielding high-value horticultural crops.

Farmers of African nightshade obtain yields of about 3.0 tons ha<sup>-1</sup> which compares dismally to potential yields of about 30 tons ha<sup>-1</sup> according to Ojiewo *et al.*, (2009). Other challenges associated with low production of African nightshades vegetable are socio-economic characteristics such as location, education level, gender; income, age; farm size and household size determine the success and development of an enterprise. Low production of nightshades has been attributed to the perception that the vegetables are for the poor, their erratic availability, and poor presentation at the markets. Production and supply of nightshades in Siaya County remains at small scale and mostly lacks a business and marketing orientation. However, the crop has not been given much attention in research nor promoted as a viable enterprise in Siaya County. Siaya is a net importer of African nightshades during dry season. It has a potential of producing 110 tons per year of African nightshades vegetables but only 28 tons are achieved annually with an annual consumption of 67 tons which is imported from outside the County (ROK, 2014).

The objective of the study was to investigate socio-economic factors that can potentially improve production of African nightshades in Siaya County. Improved sustainable production of African nightshades vegetables will result into improved livelihoods in terms of food and nutritional security due to growing malnutrition caused by unhealthy and imbalanced diets, income generation, biodiversity conservation, improved production, employment creation along the value chain. The recommended interventions once implemented would go a long way in enhancing the capacity of smallholder farmers in African nightshades farming to improve their food security, incomes and agro-biodiversity conservation. In addition the information generated in this study feed into the necessary policy interventions for improved African nightshades production in the County.

## Materials and methods

### *The Location of the Study*

The study was conducted in Siaya County which is one of the six counties in the former Nyanza region. The surface area of Siaya County is 2,530km<sup>2</sup>.

It is boarded by Busia County to the North, Vihiga and Kakamega counties to the North East, Kisumu County to the South East and Homa Bay County across the Winam Gulf to the South. To the West is Lake Victoria. It lies between latitude 0°26' South to 0°18' North and longitude 33°58' and 34°33' east.

### *Population of the Study, Sampling Procedures and Sample size*

The population of Siaya County is 885,762 persons (per 2009 census) with a growth rate of 1.7 percent per annum. It has an average population density of 354.6 persons per square kilometer (CIDP, 2013). The target population is 420 ALVs producers from the County. A simple random sampling using stratified sampling was used to select the respondents from each Sub county. Selection of households was done using stratified random sampling. A simple random sampling was used to select the respondents.

### *Sample Size Calculation*

Purposive sampling was used to select Siaya County. The formulae provided by Israel 2013 as shown below to draw sample size. The formula used for generating samples was by Israel (2009) the sample size was calculated as follows:  $n = \frac{N}{1 + N(e)^2}$

Where:

- n = desired sample size
- N = Population size of the total households involved in the study
- e = desired level of statistical precision. (±5 margin of error the precision level is 0.05)

Using this formula the sample size was the generated as below:

$$n = \frac{420}{1 + 420(0.05)^2} = 204.878 \text{ which is approximately } 205 \text{ to the next integer.}$$

### *Data Collection*

Questionnaires were used to collect data. Secondary data was collected from desk review. Household survey was conducted to collect data on status of African nightshades vegetable production in the study area.

### *Data Analysis*

The data was analyzed by the use of Statistical Package for Social Science (SPSS) version 20. During data analysis; results were summarized using descriptive statistics. Chi-square test was used to assess association between categorical variables. P-value  $\leq 0.05$  was considered statistically significant results. The Chi-Square statistics is commonly used for testing relationships on categorical variables. Binomial logistic regression analysis was used to establish the relationship between independent variables to measure the magnitude of association. Odds Ratio and 95% confidence intervals (CI) were reported. P-value  $\leq 0.05$  was considered statistically significant results.

## **Results and discussions**

### *Introduction*

The socio-economic factors affecting the production of African nightshades were considered. These were gender, occupation, education level, location, land ownership type, size of land owned by the farmer, household size and income.

### *Location of respondents*

Data was obtained in an extensive field survey that covered six Sub-Counties of Siaya County (Table 1). Amongst farmers with low production (less than 40bags per acre), 23.1% were from Rarieda compared to majority 64.1% from Ugenya. The difference was statistically significant [OR; 5.95; 95% CI= (1.94-18.29) P=0.002]. Other Sub Counties; Gem 46.9%, Bondo 71.9%, Alego 69.4%, Ugunja 69.6% were not statistically significant. Farmers in Ugenya were 5.95 more likely to get low yields than farmers in Rarieda Sub-County. This result indicated that highest number of farmers from Ugenya got low yields compared to farmers in Rarieda. Therefore Rarieda had better yields than Ugenya.

This was probably due to proximity to Lake Victoria where irrigation was practiced. This concurred with a survey done by Ndegwa, (2016) on socio-economic factors influencing smallholder pumpkin production, consumption and marketing in Eastern and Central Kenya regions that

proximity of the study areas to markets and permanent water sources gave a comparative advantage in production over other growing regions.

### *Gender of respondents*

A total of 103 males and 102 females responded to the questionnaires (Table 1). This gives a percentage of 61.2% and 53.9% respectively. This reflects a high percentage of males in the sample compared to females. Gender of respondents was not statistically significant. [OR 0.74; 95% CI= (0.43-1.30) P=0.295].

### *Age of respondents*

Age was important to understand inclusivity along different categories. Amongst the respondents interviewed, the majority age group between 21-30 years had 70.7% compared to age group above 50 years with 47.95% (Table 1). The difference was statistically significant [OR; 0.38; 95% CI= (0.16-0.92) P=0.031]. Low production was more likely amongst the younger farmers (age group of 21-30 years) compared to older farmers above 50 years old. This was probably because the youth were not owners of productive resources like land and most of them do not access extension service. Age of the farmer had significant and positive influence on nightshade production as indicated in the study. This implied that older farmers were more likely to be involved in nightshades vegetable production than the youth. A study in Nigeria found that older people are the majority of producers of indigenous vegetables because they recognize them for their health properties and ability to prevent diseases (Oladele, 2010). Young people on the other hand prefer consuming "modern foods" and do not identify with indigenous and traditional foods (Matenge *et al.*, 2012).

### *Occupation*

To understand livelihood options, the respondents were asked to indicate livelihood activities they engaged in to earn a living (Table 1). Occupation of majority, 84% of the respondents had other occupations compared to 52.3% who were farmers. The difference was statistically significant [OR; 0.21; 95% CI= (0.07-0.63) P=0.005].

Those who were not farmers were 0.21 times more likely to produce low yields (less than 40 bags per acre) compared to farmers who produced higher yields. The study found that farmers' engagement in other occupation had significant and positive influence on nightshade production. This implied that farmers engaged in other occupation were low producers. The findings indicated that engagement in other activities would likely limit time available to engage in on-farm activities.

In addition, engagement in other occupation sometimes contributed to rural urban migration which limited access to farm land thereby limiting farming activities. The findings agreed with a study by IFPRI (2005) that showed that there was high diversification and strong interactions among agricultural activities and off-farm activities in smallholder farmers' production systems.

Non-farm activities enable households to obtain additional income, empower themselves financially and diversify their agricultural production. In a study on analysis of occupational diversification among rural women in Nigeria, Ajani & Igbokwe (2012) established that diversification of occupations assured households of food security, additional incomes, poverty reduction and enabled them cope with seasonality of farming activities.

#### *Household size*

In an African society, dependency is a common phenomenon (Table 1). Amongst farmers with low production (less than 40bags per acre), 22% had 0-2 dependents compared to 45.8 % who had above 8 dependents. The difference was statistically significant [OR; 6.50; 95% CI= (1.94-21.74) P=0.002].

In an African society, dependency is a common phenomenon. Farmers with 0-2 dependents were 2.75 times more likely to realize low yields compared to farmers with over 8 dependents. This was probably due to the demand of food required by the household and labor availability. Household size had significant and positive influence on nightshade production. This meant that as household size increased the more the households were involved in nightshade production.

This was consistent with a study by Vorster & Rensburg (2005) which found that households with many members tended to be more reliant on traditional vegetables. Farmers depend on the family as an immediate source of labor. The larger the family the more the available labor force and consequently more productivity was expected to meet their food needs.

In a study of market participation decisions of cassava producing households in Nigeria, Enete & Igbokwe (2009) established that the larger the household size the higher were the domestic consumption needs. Family size was an important factor in determining the level of production and productivity of smallholder farmers. As found by Sani *et al.*, (2014) and Shadiadeh *et al.* (2012), household size was one of the factors that influenced adoption of technologies and practices in crop production.

#### *Education level of respondents*

Respondents' level of education was one of the variables investigated during the study. Amongst farmers with low production (less than 40bags per acre), 68.1% had gone through secondary education compared to none at 31.8%. The difference was statistically significant [OR; 0.51; 95% CI= (0.51-0.97) P=0.040] (Table 1). Education level of farmers had significant and positive influence on nightshade production.

This implied that as the education level of the farmer increased the less the farmers were likely to be involved in nightshade production. Education level is an indicator of access to knowledge and information as well as ability to synthesize it to usable form. The educational level of the farmer was very important for it enhanced taking up of new ideas and modern techniques in agricultural production. The findings were contrary to a study by Singha *et al.* (2012) that education level was among the factors that influenced adoption of agricultural technologies and practices under a diversified farming system. Similarly, Fashola *et al.*, (2007) established that education level increased the probability of technology adoption by farmers.

**Table 1.** Summary of results on socio-economic factors contributing to production of African nightshades vegetable.

Socio-economic Information	African Nightshade Production			Odds Ratio (95% CI)	Chi P values
	Total	Low n (%)	Moderate n (%)		
Age					
Below 20	1	1 (100.0)	0 (0.0)	0	1.000
Between 21 - 30	41	29 (70.7)	12 (29.3)	0.38(0.16-0.92)	0.31*
Between 31 - 40	64	35 (54.7)	29 (45.3)	0.76(0.36-1.61)	.478
Between 41 - 50	51	30 (58.8)	21 (41.2)	0.64(0.29-1.43)	.278
Above 50	48	23 (47.9)	25 (52.1)	Ref	
Occupation					
Farmer	174	91 (52.3)	83 (47.7)	Ref	
Other	25	21 (84.0)	4 (16.0)	0.21(0.07-0.63)	.005*
Education Level					
Primary	96	50 (52.1)	46 (47.9)	Ref	
Secondary	69	47 (68.1)	22 (31.9)	0.51(0.27-0.97)	.040*
University/College	18	14 (77.8)	4 (22.2)	0.31(0.10-1.01)	.052
None	22	7 (31.8)	15 (68.2)	2.33(0.87-6.22)	.092
Location					
Rarieda	26	6 (23.1)	20 (76.9)	5.95(1.94-18.29)	.002*
Gem	49	23 (46.9)	26 (53.1)	2.02(0.85-4.78)	.110
Bondo	32	23 (71.9)	9 (28.1)	0.70(0.25-1.92)	.487
Alego	36	25 (69.4)	11 (30.6)	0.79(0.30-2.06)	.624
Ugunja	23	16 (69.6)	7 (30.4)	0.78(0.26-2.35)	.661
Ugenya	39	25 (64.1)	14 (35.9)	Ref	
Household Size					
0-2 people	26	22 (84.6)	4 (15.4)	Ref	
3-5 people	80	47 (58.8)	33 (41.3)	3.86(1.22-12.25)	.022
6-8 people	45	23 (51.1)	22 (48.9)	5.26(1.56-17.73)	.007
Above 8 people	48	22 (45.8)	26 (54.2)	6.50(1.94-21.74)	.002*
Not applicable	6	4 (66.7)	2 (33.3)	2.75(0.37-20.40)	.322
Title deed					
No	88	61 (69.3)	27 (30.7)	Ref	
Yes	117	57 (48.7)	60 (51.3)	2.38(1.33-4.248)	.003*
Reasons for growing ALVs income generation	180	95 (52.8)	85 (47.2)	10.29(2.36-44.94)	.002*

\*P- values generated through chi-square test and values in bold are statistically significant at  $p < 0.05$ . Odds ratios were generated through binary logistic regression,  $n$ =Total number of respondents.\*very low production defined as less than 40bags per acre, Moderate production is 40-80 bags per acre.

#### Type of land ownership

The most prevalent land ownership type was ancestral without title deeds (Table 1), constituting 69.3% where a father shares his piece of land to mainly his adult sons (from father to son). There was however 48.7% of respondents who had own title deeds. The difference was statistically significant [OR; 2.83; 95% CI= (1.33-4.25)  $P=0.003$ ].

According to the survey results, 48.7% of farmers had title deeds (Table 1). They were 2.38 times more likely to realize low production compared to the majority 69.3% without titles. Most prevalent land ownership type being ancestral where a father shares his piece of land to his adult sons (from father to son). The land tenure system in Kenya was mainly individual ownership with or without title deeds.

It is not common to rent land or to hold land rights as a community. In more than 80% of the cases, men own the title deed, and Mackenzie (1993) illustrated that the land will generally be inherited by sons.

#### Land size

Land size is an important factor in any land-related production enterprise (Table 1). Land size amongst farmers who own 0-2 acres were 58% compared to 70% who own over 6 acres. The difference was not statistically significant [OR=1.69; 95%CI= (0.41-6.92),  $P=0.466$ ].

#### Cultivated vegetables

Majority 80% of farmers cultivated other African leafy vegetable varieties compared to 55% who grew nightshades (Table 1). The difference was not statistically significant [OR=3.27; 95%CI= (0.68-15.81),  $P=0.141$ ].

### *Income of farmer*

Amongst the respondents who were farmers who grew African nightshades, 92% of them grew for home consumption compared to 52.8% for income generation (Table 1). The difference in proportions were statistically significant [OR=10.29; 95% CI=(2.36-44.94), P=0.002]. Majorities, 92% of farmers grew nightshades for home consumption and were 10.29 times more likely to get low yields compared to farmers, 52.8% who grew for income generation (Table1). The results implied that as on-farm income increased the more the households were likely to be involved in nightshades production. As established by Oladele (2010) in Nigeria, indigenous vegetables were a major source of income and nourishment to farmers. Household income determined the availability of working capital to invest in the adoption of technologies and production activities.

African nightshade farmers differed in their socio-economic characteristics (Table 1). As was expected in this study location, age household size, occupation, income, education and income were statistically significant affecting nightshades production. These results were consistent with findings by Nandi *et al.*, (2011) in a study on economic analysis of cassava production in Nigeria which showed that gender, education, capital, farm size, labor, age, experience, income and family size were positively related to cassava output.

### **Conclusions**

The results of this study indicated that nightshade farmers differed in their socio-economic characteristics such as location, age, household size, occupation, income, gender; education and income were positively related to nightshades production. African nightshades vegetable remains a crop with unexploited potential in Siaya County despite its nutritional and medicinal values. African nightshades vegetable production remains the domain of older farmers in the study area. Older persons are more experienced in farming but they may not play a significant role in African nightshades vegetable commercialization because being of low education.

The African nightshades farming households comprised an average of 5 people which indicated there were increased food needs in the family. The households produced slightly more than 200kg of African nightshades in very small portions of land and depended on production and marketing information from informal sources. Farm sizes were relatively small and slightly over half of the households had no title deeds for their land meaning land ownership was a major problem.

It was established that the youth should be targeted; the educated should be targeted to increase production, households with few dependents to be targeted for commercialization and those with high dependents for consumption. Target areas with low production, target farmers with titles to increase acreages, target farmers' involvement in value chain development and improve commercialization. These were statistically significant on African nightshades vegetable production among the farmers in Siaya County. Therefore the hypothesis is true that socio-economic factors significantly influence smallholder African nightshades vegetable production in Siaya County. Majority, 92%, of farmers in the County produced for consumption compared to 8% for income generation from small land portions allocated to African nightshades production. This indicated that African nightshades were grown to meet household food needs and not for commercial purposes.

### **Recommendations**

The findings of this research provide vital information for policy interventions to enhance African nightshades vegetable production in the study area and Kenya in general. The findings have also contributed to the limited body of knowledge on African nightshades vegetable production. Based on the findings of study the following recommendations were made. The Directorate of Agriculture at County level private sector and public benefit organizations should undertake training of farmers targeting youth, women and the educated to equip them with knowledge and skills to enhance African nightshades vegetable production and promote the crop as a viable enterprise.

Capacity building of farmers would also change their eating habits and negative perceptions on African nightshades vegetable. Women and young people should be the main target groups for interventions in increasing production of African nightshades vegetable. They should be facilitated in terms of inputs especially certified seed, as well as market information and access. Capacity development would be an important factor in enhancing farmers' understanding of the medicinal and nutritional benefits of African nightshades vegetable for increased production.

### Consent

Before any interview, respondent's consent was sought.

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### Competing interests

Authors have declared that no competing interests exist.

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