



Organic Spices Farming in West Districts, Zanzibar: It's Contribution to Income of Smallholder Farmers

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Authors' contributions

This work was carried out in collaboration among all authors. Authors EEC, FSS and FAG designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

Aims: In recent years, organic agriculture has been gaining considerable importance. Many farmers today show interest all over the world in organic farming. The concept of organic farming is not new, but it has been scantily studied. Organic spice farming is therefore, requires to be studied widely. Spice production is a popular economic activity in Zanzibar. The purpose of this study was to assess the contribution of organic spice farming to income of the smallholder farmers.

Study Design: The study adopted a cross-sectional research design.

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Place and Duration of Study: The study was conducted in two districts of Zanzibar, the West and Central districts between August 2018 and September 2018.

Methodology: A random sampling procedure was used to obtain 120 households. The households were categorized from three clusters namely: merely organic, certified organic and inorganic spice farming farmers. Data were collected using a household questionnaire survey.

Results: Descriptive statistics were used to analyze the data. Among the three types of spice farming, inorganic spice farming averagely produced 174.3 kg/household, followed by merely organic (86.3 kg/household) and certified organic (70.2 kg/household). However, certified spice farming households earned in average 565 900 TAS higher than others (merely organic (361 170 TAS) and inorganic (350 500 TAS)). Further, certified spices contributed to 26.2% of the total household's income, followed by merely organic (23.1%) and inorganic (19.0%) spices.

Conclusion: The study concludes that spice farming increased income among households. Therefore, there is a need of putting more effort in spice farming improvement, particularly certified organic spice farming as it gives high earnings to the households.

Keywords: Certified spice; organic farming; organic farming by default; smallholder farmers; income.

1. INTRODUCTION

Spice production is a part of horticultural industry which has a significant contribution to income of smallholder farmers in Asia, Latin America and Africa (IFAD, 2009) whereby about 86 types of spices are grown (Panda, 2010; ITC, 2007). Spice farming can be categorized into three types; the certified organic spice farming, merely organic/organic by default and inorganic spice farming. Certification of organic spice came after the registration and adhering to basic organic principles as stipulated by responsible certification body (Firmino, 2010). Spice farmers can practice merely organic/organic by default spice farming but if they are not certified it cannot be considered as organic. The difference between certified and organic by default is only lack of certification to the default organic farming; however, this difference can have a big impact on export market. The organic by default farming system is also known as uncertified organic spice farming (Maurya, 2014). Inorganic spice farming refers to those which use industrial chemicals including fertilizers and pesticides.

According to Research and Markets (2016), increasing demand for organic spices and marketing campaigns are expected to give a major boost to the growth of the global market in the near future. Organic segment accounts for about 10% share of the total spices market and it is expected to grow in the next few years as the preference for organic spice as healthy products have been increasing more than inorganic products in the world market (Panda, 2010). In fact, globalization, varying demographics, and medicinal benefits of spices are among the factors, driving the growth of the global spices

market. Spices play a significant role in the national economies of several spices producing, exporting, and importing countries, hence, the preferences of organic spices promise a fortune in terms of good prices for organic spice farmers than their counterparts.

Organic spice farming has been remarked to bring improvement to livelihood outcomes of grass-root producers in various regions of the world such as Asia, Africa and Latin America (ITC, 2007). In Zanzibar, most farmers practice the traditional form of spice farming, which to certain extent, resembles organic practices that lead the farming to be classified as 'organic by default'. Moreover, many of these 'organic by default' farmers do not practice important organic principles as defined by organic farming organizations partially due to lack of knowledge on economic gain of certified organic spice farming. Nevertheless, these farmers are in a position to step up production of organic spices as per European Commission (EC) organic food standards and fetch a premium price in the international market of up to 20-50% and in some cases 100% (Panda, 2010; Spice Cluster of Sri Lanka, 2002) and fill the gap for international market if they can access adequate scientific support for production and quality improvement (Spice Cluster of Sri Lanka, 2002). Currently, the demand for organic products is steadily increasing in the western market at 20-25% every year and that of inorganic spices at about 2%.

Effort to promote non-traditional export crops has focused on spices as a major crop in Zanzibar. The international market prefers certified organic spices than other types of spice; smallholder farmers who certified their organic spice seemed

to have premium prices for their produce. However, there is also little empirical evidence on the contribution of spice farming to the farming household income. Nevertheless, in order to capture the market of organic spices internationally, farmers, recently have gone further calling for certification for their spices produced and to some extent this has proved to increase prices of spices (Post and Schahczenski, 2012). Certification of organic spice farms has been recently introduced; however, benefits of this process have not been quantified. Due to scarcity of information regarding the contribution of the certified organic spice product in Zanzibar, this study opted to analyze the importance of organic spice farming to income of smallholder farmers in Zanzibar.

Several studies highlighted the significance of spice farming in improving income of rural communities. In Tanzania, for example Kajembe et al., (2024) assessed livelihood strategy choices among spice farmers in the Eastern Arc Mountains of Usambara and Uluguru Mountains. Ngole and Salehe (2024) assessed the economic contribution of spice farming to household income on the slopes of the Uluguru Mountains, in Morogoro region. Salehe and Salanga (2025) assessed farmers' attitudes and Challenges in organic Spice farming on the slopes of the Uluguru Mountains, Tanzania.

Zanzibar is among the major spices producing areas in the United Republic of Tanzania (Kabote, 2022). Despite the long history of Zanzibar in spice production there is inadequate information on the importance of the certified organic spices farming to smallholder spice farmers' income. Thus, the findings of this study are useful to smallholder farmers who practice certified organic, merely organic and inorganic spice farming. The objective of the study was to assess the contribution of spice farming to income of smallholder farmers. Specifically, the study examined practices of spice farming among smallholder farmers, assessed the farmers' knowledge on the practice of organic spice farming, determined merely organic, certified and non-organic spice production and productivity and examined the contribution of merely organic spices; certified organic spices; and inorganic spices farming to income of the farmers.

2. METHODOLOGY

The study was conducted in two districts of Zanzibar, the West and Central districts. The

West District lies between 6^o.13'57" latitude and 39^o.36'21" longitudes at the elevation of 27.37 metres above the sea level and has an area of 208 km². Central District which lies between 6^o.20'37' latitude and 39^o.36'21' longitudes at 23.2 metres above the sea level has a total area 453 km². These districts have tropical climate, receiving an average annual rainfall of 1700mm. The majority of smallholder spice farmers are found in the two districts, due to their favorable climatic condition and good soil fertility for agriculture.

This study adopted a cross-sectional research design in collection of data from farmers practicing different spice farming practices. A cross-sectional study is an observational study design that examines data on various variables gathered at a single time point within a sample population or predefined subgroup, offering a depiction of the population's characteristics. It is a time-saving, cost-effective, and straightforward approach for gathering preliminary data, wherein a researcher collects data at a single point in time (there is no prospective or retrospective follow-up) and observes variables influencing them (Wang and Cheng, 2020).

A total of five (5) wards were randomly selected in each district. A total of 120 respondents were randomly selected. Out of 120 respondents/ households selected, 40 households were practicing merely organic spice farming, while 40 households practiced certified organic spice farming and 40 did not practice any of the two, but they were practicing inorganic spice farming. A questionnaire survey using a structured questionnaire formulated of open- and closed ended questions was used to collect the data. The in-depth approach was used to administer the questionnaire to the selected respondents. The data collected through the household questionnaire survey included practices of spice farming, types of spices, production of spices, and income from both non spice farming and other activities.

Both descriptive and inferential statistics were applied in analyzing the collected data. The inferential statistics were used for determining various factors to spice production and income. In addition, ANOVA was used to compare the production and contribution of the three types of spice farming.

A Likert scale analysis was done as follows: in the assessment of attitude of the spice farmers, seven statements were used. The scores were

as follows: 5 = strongly agree, 4 = agree, 3 = undecided/neutral, 2 = disagree and 1 = strongly agree. These statements were part of the questions formed the questionnaire. In the analysis, several assumptions were made. In the assumptions, it was said that if all the respondents were to score 5 in each statement the total score would have been 35 (5 x 7); if they were to score 3, the total score would have been 21 (3x7) and otherwise all were to score 1 in each statement, the total score would have been 7 (1x7). Half of maximum score was $35/2 = 16.5$. From the above assumptions the three levels were made as: 1 – 16 = low attitude; 17 – 21 = moderate; 22 – 35 = High (Chingonikaya and Salehe, 2018).

3. RESULTS AND DISCUSSION

3.1 Smallholder Farmers' Practices on Spices Farming

3.1.1 Types of spices grown

Findings from Table 1 show that farmers in the study area were observed to grow 10 types of spices. Clove was grown by many farmers (65%), followed by black pepper (47.5%), vanilla (45%) and cinnamon (42.5%). The domination of cloves in types of spice cultivated in Zanzibar

has a long history since during colonialism. Despite of Vanilla being cultivated by many farmers, its production was found to be low comparing to other types of spices. Spice farmers grow vanilla only for tourist purposes; the study found that majority of spice farmers grew at least one vanilla plant. Vanilla is less produced in Zanzibar nature as it needs to be pollinated by hands. It also needs good moisture supply and therefore mulching is essential for this purpose.

3.1.2 Technologies adopted in spice farming

The findings in Table 2 show that majority of farmers in the study (70%) adopted intercropping, while 68.3% adopted the use of organic fertilizer (68.3%) and 80% used mulching regardless of their engagement in certification processes. This made majority of spice farmers to practice organic spice by default. Only few farmers were using inorganic products such as fertilizers, pesticides and herbicides. Inorganic fertilizers were mainly used at nursery stages of spice farming. These findings match with the study done by Gills et al. (2013) which showed that majority of farmers adopted conservation measures such as mulching and intercropping spice farming during the early stage of growth.

Table 1. Types of spice grown and production (n = 120)

Type of spice	Do not Grow	Grow	Average Yield (kg/household)
Black Pepper	52.5	47.5	251
Nutmeg	70	30	230
Cardamom	66.7	33.3	21
Lemon grass	61.7	38.3	28
Cinnamon	57.5	42.5	346
Cloves	35	65	394
Vanilla	55	45	16
Turmeric	94.2	5.8	54
Ginger	95.8	4.2	61
Hot Chilly	79.2	20.8	36

Table 2. Technologies adopted in spice farming in percentage (n = 120)

Practices	Not Adopted	Adopted
Improved Seeds	91.7	8.3
Organic Fertilizer	31.7	68.3
Organic Pesticides	67.5	32.5
Inorganic Fertilizer	76.7	23.3
Inorganic Pesticides	83.3	16.7
Inorganic Herbicides	97.5	2.5
Crop Rotation	53.3	46.7
Intercropping	30	70
Terrace	98.3	1.7
Mulching	20	80

Majority of participants of focus group discussions indicated that in relation to certification of organic spice, but not all crops were certified. They further indicated that only few with market potential spices were certified. The mentioned black pepper, cinnamon, nutmeg, vanilla, cardamom and lemongrass were certified. The participants of the FGDs, pointed out that;

"In unguja there was only one buyer named *Ecoland* herbs who bought certified organic spices. Even though there was only one buyer of certified spices but its demand had not been fully supplied" (FGDs in unguja, 2017).

3.2 Farmers' knowledge on the Practice of Organic Spice Farming

Table 3 shows that the statement "Use of manure, cultural diseases/infection control and soil conservation is the basis for organic farming" was strongly agreed by 40%, while those who strongly disagreed on the statement that Reduced use of chemical fertilizers and industrial chemicals is an advantage of organic farming were only 3%. This provides an impression that majority of the farmers have understanding that organic spice farming does not require any artificial chemicals. More than quarter of respondents (34.2%) agreed on the statement that "An advantage of organic farming is the reduced use chemicals and industrial fertilizers. This shows that many farmers have the knowledge of spice organic farming.

Table 3, further, shows that majority of the farmers (26.7%) were not in a position of agreeing or disagreeing on whether organic farming improves soil fertility or not.

However, more than quarter of respondents (28.3 and 31.7 respectively) disagreed and strongly disagreed that "Economic income gains when practicing integrated farming are not convincing". This could be interpreted that many farmers have understanding that organic farming leads to high income gains compared to inorganic spice farming. This argument is reported by various studies (e.g. Miyashita, 2015) that organic spice farming improves household income.

More than a quarter (20.2% and 32.5% respectively) of the respondents disagreed and strongly disagreed on the statement that the farm income may decrease when practicing organic

farming as opposed by only 8.3% of the respondents who strongly agreed on the statement. This shows that very few farmers have acknowledged the gains of the organic farming. Probably, these farmers had not practice organic farming. Table 3, further, shows that more than half of respondents (58.5%) had an opinion that farm income might decrease when practicing organic farming while 62.5% of respondents disagreed on the statement that export market favour more organic spices than inorganic ones.

The findings mentioned in Table 4 show that nearly half (46.7%) of the respondents had low knowledge about organic spices, while more than quarter (33.3%) had high knowledge of organic spices and less than quarter (20%) of the respondents had moderate knowledge. These results mean that regardless of the fact that majority are having low knowledge about organic spices it means that spice producers have not realized the premium benefit accrued from organic spices selling. In addition, it can be due to the fact that the procedures of crops certification in Tanzania have been recently introduced.

Farmers with secondary education were 19.9 times more likely to have favourable attitudes compared to those with informal education (OR = 19.854, 95% CI: 2.199–179.234, $p = 0.008$), highlighting education's role in understanding complex organic standards and certification processes. Conversely, market inefficiencies (OR = 0.291, 95% CI: 0.116–0.729, $p = 0.008$) and inadequate storage (OR = 0.333, 95% CI: 0.113–0.985, $p = 0.047$) significantly reduced the likelihood of favourable attitudes, underscoring how external constraints erode farmers' confidence in organic farming's viability (Sok et al., 2021).

3.3 Organic, Certified and Non-organic Spice Production in kg/household Per Annum

The study tried to determine production of spices based on the three types of farming namely merely organic, certified organic and non-organic spice farming. The results in Table 5 show that non organic spice farming had high production with an average of 174.3kg/household compared to others merely organic and certified organic spice farming types, which had the average of 86.3 kg/household and 70.2 kg/household respectively.

Table 3. Attitudes of farmers towards organic spice farming (n = 120)

Statements	5=Strongly Agree	4=Agree	3=Neutral	2=Disagree	1=Strongly disagree
Use of manure, cultural diseases/infection control and soil conservation is the basis for organic farming	48 ¹ (40.0) ²	31 (25.8)	26 (21.7)	12 (10.0)	3 (2.5)
An advantage of organic farming is the reduced use of chemical fertilizers and industrial chemicals	36 (30.0)	41 (34.2)	31 (25.8)	9 (7.5)	3 (2.5)
Organic farmers improve soil fertility sustainably	26 (21.7)	29 (24.2)	32 (26.7)	28 (23.3)	5 (4.2)
Economic income gains when practicing integrated farming are not convincing	13 (10.8)	20 (16.7)	15 (12.5)	34 (28.3)	38 (31.7)
Farm income may decrease when practicing organic farming	10 (8.3)	16 (13.3)	20 (16.7)	35 (29.2)	39 (32.5)
Organic spice farming improve household income	13 (10.8)	18 (15.0)	19 (15.8)	30 (25.0)	40 (33.3)
Export market favor more organic spices than inorganic	13 (10.8)	19 (15.8)	13 (10.8)	36 (30.0)	39 (32.5)

¹frequency; ²percentage

Table 4. Summary of levels of knowledge of the spice farming among farmers (n = 120)

Scores	Frequency	Percentage	Levels
22-35	39	32.5	High
17 – 21	25	20.8	Moderate
7 – 16	56	46.7	Low

Table 5. Spice production in kg/household per annum

Type of spice	Merely organic	Certified organic	Non-organic	Mean
Black Pepper	128	80	250	152.7
Nutmeg	180	105	268	184.3
Cardamom	10	36	23	23.0
Lemon grass	12	18	36	22.0
Cinnamon	167	150	345	220.7
Cloves	156	123	467	248.7
Vanilla	18	12	18	16.0
Turmeric	68	49	102	73.0
Ginger	78	103	156	112.3
Hot Chilly	46	26	78	50.0
Overall	86.3	70.2	174.3	110.3

The production according to the types of the spice farming revealed that inorganic type of farming still dominates and provides high yield among the farmers. A plausible reason may be due to the fact that the use of inorganic fertilisers and herbicides respond quickly to the spice farming as opposed to merely organic and certified organic spice farming. In addition, merely organic farming requires intensive labour, which if, a household relies on family, could probably not afford to supply such labour (Overfield and Fleming, 2001). On the other hand, the certified organic spice farming has been recently introduced in Zanzibar and Tanzania in general (MKUZA, 2007; Miyashita, 2015), which is likely to be practiced by few farmers. These farmers practicing the certified farming might also be having difficulties in handling the practice. However, RGoZ (2009) gave prediction yield of the spices in Zanzibar, not quite different from the ones presented in this study. The only exception is that this study used yield per household, while RGoZ (2009) predicted in terms of yield in acreage.

In assessing variances production of types of spice farming a one way ANOVA was used

whereby three objects (merely organic, certified organic and inorganic spice farming) was assessed; data collected were standardized by \log_n to meet the model demand on normality. There was a significant difference among then three types of the spice farming at $p < 0.05$ (Table 8). The score of three groups accounted for $F=7.43$; $p=.007$. The actual differences in mean score between merely organic and certified organic spice farming show that there were quite minimum, but there were significant differences between the two types and inorganic spice farming.

The effect size calculated using the *Beta squared* was 0.03129. Post-hoc comparison using the Turkey test indicated that the mean score for group 1 (merely organic farming) ($M=5.94$, SD 1.74) and group 2 (certified organic farming) ($M=5.86$, $SD=1.3$) was significantly differed from group 3 ($M=6.55$, $SD=2.08$). However, there is no significance difference between group 1 and 2. The increased production by those certified their spices might be a result of close extension services from NGOs/certification companies as it was reported by Negera (2015) who reported that producers who receives extension services

Table 6. Production variance for types of spice farming in kg/household (n =120)

Types of spice farming	Mean	F-value	P=value
Merely organic	112.3 ± 39.83		
Certified organic	119.3 ± 16.16		
In-organic	174.3 ± 56.04		
Overall	110.0 ± 65.53	7.43	0.007

has an increase amount of spice supplied to the market. Since certified organic spice farmers in Zanzibar has access to close supervision from various NGOs and Companies dealing with certified organic spices and are more likely to get more production than those who do not have access to extension services or those with minimal extension services.

3.4 Factors Influencing Organic Spice Farming

A multiple regression was done to assess factors influencing level of knowledge on certification of organic spices (Table 7). Nine variables entered in a model, these include farm size, government extension workers visits, district name, occasional training from spice farming supporters, household age, spice farming support, NGOs/company visit/advice on spice farming. The model shows three variables to be significant to certification of spice farming, these variables are district name, NGOs/company visit/advice of spice farming and farm size ($p < .05$). organizations as determinant of certification organic spice farming probably due to the fact that majority of the organizations for organic spice farming are working in West District of Zanzibar since it is in town and easily accessible. Farmers who work with these NGOs/companies are likely to get trainings of certification of organic spice farming.

These findings are in line with those reported by Oluwatusin and Adesakin (2017) who reported that there is positive significant relationship between extension services and adoption of technology. However, other studies indicate that adoption of technologies by farmers is being influenced by availability of land, premium market price of the products and labour (Kinyangi, 2014; Miyashita, 2015).

3.5 Contribution of Spice Farming to Income of the Farmers

The study analyses the contribution of spice farming to household's income. Table 8, Table 9 and Table 10 present the income accrued by the farmers from spice production in the three types of the spice farming, income from other sources and contribution of the spice farming to household's income in percentage respectively.

On an average, spice farmers in the study gained about 425 856 TAS from spice farming. Out of which 361 170 TAS, 565 900 TAS and 350 500

TAS gained from merely organic, certified organic and inorganic spice farming respectively. Table 9 indicates that spice farmers in the study gained about 1 200 000 TAS, 1, 592 666 TAS and 1 491 666 TAS in the categories of merely organic, certified organic and non-organic spice farming respectively. Table 10, further shows that the overall income received by the spice farmers from other sources was 1 427 777 TAS.

In general, spice farming contributed to about 23%, 26% and 19% of the overall income of the households of the farmers under the respective categories of merely organic, certified organic and non-organic spice farming (Table 10). Table 10, further shows that the overall contribution of spice farming to household's income accounted for 23%.

In assessing variances on contribution of each type of spice farming to household income a one way ANOVA was used whereby three objects' (merely organic, certified organic and inorganic) annual income was assessed; data collected were standardized by \log_n to meet the model demand on normality. There was a significance difference at $p < .05$ in a score of three groups ($F=6.72$, $p = .002$). Despite reaching statistical difference in mean score between groups was quite small. The actual differences in mean score among groups show that they were relatively minor. The effect size calculated using the eta squared was 0.18. Post-hoc comparison using the Turkey test indicated that the mean score for group 1 (merely organic) ($M=15.82$, $SD 1.3977$) and group 2 (certified organic) ($M=16.05$, $SD=0.4189$) did not significantly differ; however there was a significant difference between group 3 (inorganic) ($M=16.295$, $SD=1.041$) and other groups 1 and 2 (merely organic and certified) (Table 11).

The variation in income generated from the types of spice farming was minimal because during the holy month of Ramadhan season, the price of spice at local market becomes much high to reach the premium price of certified organic spices. But generally certified organic spice receive premium price throughout the season. This study matches with that one conducted by Ayuya et al. (2015) in Kenya which found that certified producers were less likely to be multidimensional poor compared to their counterfactual case of not participating in organic certification schemes. The similar results were obtained by Parvathi and Waibel (2016) in their study conducted to black pepper smallholder

Table 7. Factors influencing organic spices production

Variables	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	21.780	4.125		5.280	.000	13.606	29.954
District Name	-3.277	1.410	-.174	-2.325	.022	-6.070	-.483
Age of Household Head	.037	.071	.044	.519	.604	-.103	.177
Sex of the Household Head	1.211	1.953	.048	.620	.536	-2.659	5.080
Household size	.027	.516	.004	.052	.958	-.995	1.049
Spice Farming Support	-1.042	2.158	-.041	-.483	.630	-5.317	3.234
Occasional Training from Supporters	1.763	1.629	.092	1.083	.281	-1.464	4.991
Extension Workers Visit in 2015/2016 Cropping Season	1.547	1.925	.061	.804	.423	-2.267	5.362
Organizations' advice about Spice Farming	7.320	2.304	.284	3.177	.002	2.754	11.886
Farm Size	3.171	.723	.383	4.384	.000	1.738	4.605

R=0.448 and R square= 0.403

Table 8. Average of household's income (TAS) received from spice farming per annum (n = 120)

Type of spice	Merely organic	Certified organic	Non-organic	Mean
Black Pepper	680 000	800 000	700 000	726 666.67
Nutmeg	480 000	500 000	360 000	446 666.67
Cardamom	36 700	460 000	250 000	248 900.00
Lemon grass	55 000	80000	40 000	58 333.33
Cinnamon	850 000	1 300 000	650 000	933 333.33
Cloves	1 200 000	1 600 000	900 000	1 233 333.33
Vanilla	60 000	120 000	60 000	80 000.00
Turmeric	80 000	150 000	70 000	100 000.00
Ginger	130 000	600 000	450 000	393 333.33
Hot Chilly	40 000	49 000	25 000	38 000.00
Overall	361 170	565 900	350 500	425 856.67

Table 9. Average household income (TAS) received from other main sources (n = 120)

Main source	Merely organic	Certified organic	Non-organic	Overall
Crop sales	450 000	750 000	800 000	666 667
Salaried	1 500 000	2 500 000	3 500 000	2 500 000
Business	4 000 000	5 000 000	3 500 000	4 166 667
Remittances	350 000	600 000	500 000	483 333
Livestock sales	300 000	400 000	250 000	316 667
Pension	600 000	300 000	400 000	433 333
Overall	1 200 000	1 591 667	1 491 667	1 427 778

Table 10. Percentage of contribution of spice farming to household's income

Type of spice farming	Percentage contributed to total income
Merely organic	23.1
Certified organic	26.2
Non – organic	19.0
Overall	23.0

Table 11. ANOVA for contribution of types of spice to household income (n = 120)

Types	Mean	Std. Deviation	Std. Error	F-value	P-value
Merely Organic	23.3	0.42	0.09		
Cert Organic	26.2	0.94	0.19		
Inorganic	19.0	1.39	0.34		
Total	23.0	1.04	0.13	6.72	0.002

certified farmers in India. Their findings show that certification systems have a significant impact on income compared to conventional black pepper farming.

4. CONCLUSIONS AND RECOMMENDATIONS

The general objective of the study was to determine contribution of organic spice farming to income of smallholder spice farming households in West and Central Districts of Zanzibar. The focus was on understanding contribution made by each spice farming

category (merely organic, inorganic and certified organic spice farming. However, the study had specified four objectives on: (i) practices of spice farming among smallholder farmers; (ii) farmers' knowledge on the practice of organic spice farming; (iii) merely organic, certified and non-organic spice production and productivity and (iv) the contribution of merely organic spices; certified organic spices; and inorganic spices farming to income of the farmers.

From the study findings, it can be concluded that many farmers grow clove, black peppers and cinnamon, despite the fact that there are various

types of spices grown in the study area. Based on the same order, yield is declining accordingly. The spice farmers are also adopting various technologies including both organic and inorganic fertilizers and herbicides. Some spice farmers are receiving supports from various institutions, however many farmers do not receive any support. From this conclusion, the study recommends that in order to improve all the three types of spice farming (merely organic, certified and inorganic), farmers have to be provided with support from the government particularly extension services and access to reliable markets.

The study, also, concludes that many spice farming respondents had very little knowledge on the certified spice farming and its market. Based on the conclusion on the knowledge of the farmers on certified organic spice farming as a whole, there is a need of increasing sensitization programmes of the practices, marketing, and general importance of the spice farming so as to improve yields and wellbeing of the farmers.

According to the findings of the study, inorganic spice farming gives high yields compared to others. The certified organic spice farming gives very low yield. This provides an indication that the certified organic spice farming is being practiced in a small scale compared to inorganic spice farming. This requires more efforts on promoting the certified spice farming in the study area (Zanzibar) as well as other areas in the country including Tanzania main land.

The study provides an interesting finding that despite the certified organic spices gives low yield, it has given high income contribution to households. Based on the importance of the certified spices giving high contribution to household's income, there is a need of up grading the practice through increasing sensitisation programmes.

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Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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