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The Importance of Computerized Analysis on Spoilage of Sweet Orange (Citrus Sinensis), Before Harvest and Carriage to Market, in Nigeria

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Abstract: This research work was carried out, to find the importance of computerized analysis on spoilage of sweet orange, before harvest and carriage to market in Nigeria. 4 Local governments, namely: (Ife East, Ife South, Ife Central and Ife North), local government areas were sampled. 3,200 open questionnaires were distributed to the 4 Local Governments, out of which 800 was used for farmers in each local government. A total of 32 different locations were visited and sampled in all the four Local Governments, out of which 100 questionnaires were used in each location. It was gathered that above 75% of the people supported that, the computerized analysis on spoilage of sweet orange, before harvest and carriage to market in Nigeria, was important, while less than 25% of the people, could not even understand whether there was any need, for the importance of computerized analysis on spoilage of sweet orange, before harvest and carriage to market in Nigeria or mot. The results from the questionnaires when using Pearson one-tailed correlation coefficient, however revealed that there was no significant difference from all the farmers visited and sampled, [$p < 0.01$] and [$p < 0.05$] table 5. This shows a strong positive correlation, which implying that, the importance of computerized analysis on spoilage of sweet orange, before harvest and carriage to market in Nigeria, is strongly influenced and enhanced farmer's support, from the four local government areas, visited and sampled, in Ile-Ife Kingdom of Osun State, and Nigeria in general, and therefore had made the research work to become a reality, [$p < 0.01$] and [$p < 0.05$], table 5 respectively. The reasons may be due to the fact that, sweet oranges are not only, an excellent source and very rich in vitamin C, folic acid; it is also as a good source of dietary fiber, containing a host of other important nutrient element like: folate, thiamine, niacin, phosphorus, magnesium and copper. They are a good source of B vitamins including vitamin B1, pantothene acid and folate as well as vitamin A, calcium, copper and potassium and are also known to be fat free, sodium free and cholesterol free. Histogram with curve was used to depict the summary data of each of the local government areas sampled.

Keywords: Sweet Orange (Citrus Sinensis), Harvest, Spoilage, 4 Local Governments, Osun State, Pearson Correlation

1. Introduction

Sweet Orange (citrus sinensis), the fruit of the citrus species, in the family Rutaceae (US National Institute of Health). It is widely rated as the most planted fruit in Nigeria. In Nigeria, this orange is grown in any part of the country as the climatic conditions in the country has proven to be suitable for its growth. About 930,000 tons of citrus fruits are produced annually from an estimated 3 million hectares of land. Sweet oranges are an excellent source and very rich in vitamin C, folic acid and it is also as a good source of dietary fiber, containing a host of other important nutrient element like: folate, thiamine, niacin, phosphorus, magnesium and copper, [1]. They are a good source of B vitamins including vitamin B1, pantothene acid and folate as well as vitamin A, calcium, copper and potassium. Sweet oranges are also known to be fat free, sodium free and cholesterol free. Citrus species are grown for the juice of their fruits. It is also called sweet orange to distinguished it from the related (citrus avoantium), referred to as bitter orange. The sweet orange

reproduces asexually, varieties of sweet orange arise through mutatirus, [2]. Sweet oranges are one of the most popular fruits around the world. While they are delightful as a snack, or as a recipe ingredient, for many Americans; it is their juice that most associated with good health, having a reputation for being an integral part of a healthy breakfast. Sweet oranges are round citrus fruits with finely, textured skins, that are having colour like pulpy flesh, usually range from about two to three inches in diameter, [3]. Oranges are classified into two general categories: Sweet and bitter. Sweet oranges, being the type most commonly consumed. The popular varieties of the sweet orange (citrus sinensis), include Valencia, Navel and Jaffa oranges, as well as blood orange, a hybrid species that is smaller in size, more aromatic in flavour and has red hues running throughout its flesh. Bitter oranges (citrus aurantium), are often times used to make jam or marmalade, and their zest serves as the flavouring for ligueurs, such as Grand mamier and cointreau, [4].

Figure 1. *Sweet Orange (citrus sinensis), the fruit of the citrus species, in the family Rutaceae.*

ORANGE HISTORY/ORIGIN:

Figure 2. *Orange, History/Origin.*

Oranges originated thousands of year ago in Asia, in the region from Southern China to Indonecia from which they spread to India. Sweet oranges were introduced into Europe around the 16th century by various groups including the moors and the Portuguese, as well as the Italian traders, and explorers who found them on their voyages to Asia and the middle East. Sweet oranges trees began to be grown in the Caribbean Islands in the late 15th century after Christopher Columbus brought the seeds there on his second voyage to the new world. Spanish explorers are responsible for bringing oranges to Florida in the 16th century, while Spanish Missionaries brought them to Califonia in the 18th century, beginning the cultivation of this citrus fruit in the two states widely known for their oranges, [5].

YEARS OF MATURITY OF SWEET ORANGE (citrus sinensis) IN NIGERIA:

Figure 3. *Sweet Orange, years of maturity.*

Sweet orange matures very fast. Between 3 – 4 years, after planting. In the Southern Nigeria, Oranges are generally available from May/October, with seasonal variation depending on variety. After well grown, it became a seasonal and perishable fruits and goods for consumption both for the buyers and the people.

SWEET ORANGE (citrus sinensis), SPOILAGE BEFORE HARVEST AND CARRIAGE:

Figure 4. *Sweet Orange, risks involved in spoilage before harvesting and carriage to market.*

In order to maintain high quality of sweet oranges, for both short term and long term harvest and carriage to Market,

there are some risks involved concerning spoilage before harvesting and carrying them. This is because, in Nigeria, sweet orange is extremely sensitive to issue of pest and disease, infection, premature fruits drop due to attack by nocturnal fruit piercing moths, termite damage to stern bark and tree roots and gummosis as well as death of budded seedlings.

Figure 5. *Sweet Orange, spoilage before harvest and carriage to market.*

The sweet orange fruits are usually prone to spoilage due to the bad roads and long hours of travel, before reaching the nearby markets, which is also caused by bad roads. The spoilage, in-turns, always lead to great loss for both the farmers and the buyers.

Most of the problems which affects sweet orange production in Nigeria is that, a significant percentage of the product are spoilt or denatured before getting to the consumer markets. Also, some pests and disease of the orange crop can easily spread from one tree to the other if not tacked on time and most times causes reduction in productivity.

SWEET ORANGE (citrus sinensis), CARRIAGE TO MARKET:

Figure 6. *Sweet Orange, harvest and carriage to market.*

In Nigeria, the major markets for this fruit are basically made up of two categories: the fresh fruits Market,(since the fresh fruits are majorly perishable and not durable). And the processed fruits Market, (where electro-mechanical devices/machines is used for changing such raw materials into finished goods for the consumers). The major producing States for Sweet Oranges are: Oyo, Ogun, Osun, Kogi, Nassarawa, Bennue, Ebonyi, Kaduna, Taraba, Ekiti, Imo, Kwara, Edo, and Delta.

2. Material and Methods

The responses of the farmers in different locations of the four local government areas can be seen from the decision table as below:

Table 1. *The Decision Table.*

Sub	Above 75%	Below 25%	Open headed Questionnaires
Computerized Analysis on spoilage of sweet orange before harvest and carriage to market is important in Nigeria.	X		
I do not know		X	
State open questionnaires			X

The below are the points ticked by the majority of the people (above 75% table 1) from the questionnaires who understood and supported, the importance of computerized analysis on spoilage of sweet orange, before harvest and carriage to market in Nigeria.

Figure 7. *Sweet Orange, and its importance.*

[a]. In Nigeria, Sweet Oranges can be eaten in its raw form. [b]. sweet oranges are low in calories and full of nutrients. [c]. It can be used to produce fruit juice and other end products like: frozen concentrates, fragrant peels, pectin, flavours etc. [d]. Vitamin C in oranges contain fiber, potassium and choline, all of which are good for your heart. [e]. It helps to lower our risk for many diseases. [f]. Sweet oranges are a healthy source of fiber that may help lower blood sugar levels. [g]. Fiber also aids in digestion and may help lower cholesterol by blocking the absorption of cholesterol into the blood stream. [h]. Potassium, an electrolyte mineral, is vital for healthy functioning of the nervours systems. [i]. Lack of potassium can lead to an irregular heart beat (arrhythmia). [j]. Lack of potassium can lead to increased blood pressure. [k]. Lack of potassium can lead to a depletion of calcium in bones. [l]. Potassium found in sweet oranges help to lower pressure, thereby protecting the human body against stroke. [m]. Too much of potassium can lead to hyperkalemia. [n]. Sweet oranges are high in folate, a B vitamin.. [o]. A B vitamin in orange helps the body to lower level of

homocysteine, an amino acid that is common in red meat and is linked with poor heart health. [p]. Sweet orange promotes clear, and healthy skin. [q]. Most citrus fruits have a good deal of vitamin C. [r]. Vitamin C, a potent antioxidant, that protects cells by scavenging and neutralizing harmful free radicals. [s]. The vitamin C in sweet oranges may boost a person's immunity to everyday viruses and infections. [t]. The vitamin C in sweet oranges is associated with a reduced risk of colon cancer, due to preventing DNA mutations from taking place. This shows that, about 10 to 15 percent of colon cancers have a mutation in a gene called BRAF.

3. Case Study Area

The study has been conducted in Nigeria. It is located in the West of Africa on the Gulf of guinea and has a total of 923,768 km^2 (356.669 square mile), making it the world's 32nd – largest country (after Tanzania). It is comparable in size to Venezuela, and is about twice the size of California. It shares a 4.047 kilometres (2.515 square mile), border with Benin (773 km.), Niger (1497 km.), Chad (87 km.), Cameroon (1690 km.), and has a coastline of at least 853 km. [51]. Nigeria lies between latitude 4° and 14°N, and longitude 2° and 15°E *(Encyclopaedia Britannica)*.

Nigeria is a densely populated country with the highest density of 477.0/square mile. As at a (2012) estimate, the country held a population of more than 168.8 million people up from the 140 million recorded in her (2006) population census (World Bank Nigeria Data (2012)). Of this population, about 87 million people (52%) dwell in rural areas while 81 million dwell in urban areas (Trading Economics Rural Population Chart (2012)). The Male/Female ratio is 1: 05, where male commands 51.21%, while females, 48.79% (Nigerian Census, (2006)).

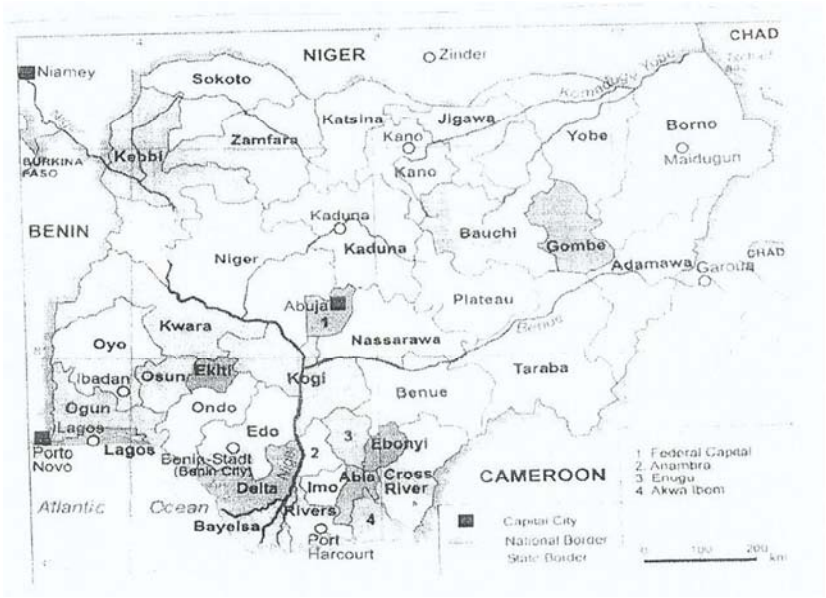

Figure 8. *The Study Area Map of Nigeria.*

4. Results and Discussion

Questionnaires were distributed to 4 Local government areas that is, (Ife East, Ife South, Ife Central and Ife North). The results from the questionnaires however revealed that, the importance of computerized analysis on spoilage of sweet orange, before harvest and carriage to market in Nigeria, are manifold:

There was no significant difference on the people in all the local government areas visited, [$p < 0.01$] and [$p < 0.05$].

Table 2. *People's respondent.*

Wards	Ife East		Ife South		Ife Central		Ife North	
People's Response	The importance of computerized analysis on spoilage of sweet orange, before harvest and carriage to market in Nigeria.	I do not know	The importance of computerized analysis on spoilage of sweet orange, before harvest and carriage to market in Nigeria.	I do not know	The importance of computerized analysis on spoilage of sweet orange, before harvest and carriage to market in Nigeria.	I do not know	The importance of computerized analysis on spoilage of sweet orange, before harvest and carriage to market in Nigeria.	I do not know
	568, 71.0%	232, 29.0%	554, 69.3%	246, 30.7%	557, 69.6%	243, 30.4%	552, 69.0%	248 31.0%

From the above table 2, in Ife East, there are 568 people's response with 71.0%, Ife South, 554 with 69.3%, Ife Central, 557 with 69.6%, and Ife North, 552 with 69.0%, were those People who supported that, the computerized analysis on spoilage of sweet orange, before harvest and carriage to market in Nigeria was important., while in Ife East, 232 with 29.0%, Ife South, 246 with 30.7%, Ife Central, 243 with 30.4%, and Ife North, 248 with 31.0% respectively, could not even know whether there was any need or not for the computerized analysis on spoilage of sweet orange, before harvest and carriage to market in Nigeria.

Table 3. *The different locations and local governments, also the summary data collected, from the 4 Local Governments sampled, out of which 800 were used in each local government.*

LOCAL GOVERNMENT	LOCATION	IFE EAST		IFE SOUTH		IFE CENTRAL		IFE NORTH	
Peoples Respondent	A	71	29	68	32	75	25	68	32
	B	77	23	72	28	73	27	79	21
	C	69	31	79	21	78	22	74	26
	D	75	25	64	36	62	38	65	35
	E	62	38	60	40	59	41	62	38
	F	72	28	70	30	69	31	70	30
	G	68	32	69	31	70	30	64	36
	H	74	26	72	28	71	29	70	30
TOTAL =	8	568	232	554	246	557	243	552	248
Grand Total =	8	800		800		800		800	

Table 4. *The descriptive statistics.*

Descriptive Statistics			
	Mean	**Std. Deviation**	**N**
IFEEAST	71.0000	4.72077	8
IFESOUTH	69.2500	5.67576	8
IFECENTRAL	69.6250	6.36817	8
IFENORTH	69.0000	5.58058	8

Correlations

Table 5. *The Pearson Correlation of the 4 local governments.*

Correlations					
		IFEEAST	**IFESOUTH**	**IFECENTRAL**	**IFENORTH**
IFEEAST	Pearson Correlation	1	.368	.337	.629*
	Sig. (1-tailed)		.185	.207	.047
	Sum of Squares and Cross-products	156.000	69.000	71.000	116.000
	Covariance	22.286	9.857	10.143	16.571
	N	8	8	8	8
IFESOUTH	Pearson Correlation	.368	1	.892**	.758*
	Sig. (1-tailed)	.185		.001	.015
	Sum of Squares and Cross-products	69.000	225.500	225.750	168.000
	Covariance	9.857	32.214	32.250	24.000
	N	8	8	8	8
IFECENTRAL	Pearson Correlation	.337	.892**	1	.699*
	Sig. (1-tailed)	.207	.001		.027
	Sum of Squares and Cross-products	71.000	225.750	283.875	174.000
	Covariance	10.143	32.250	40.554	24.857
	N	8	8	8	8
IFENORTH	Pearson Correlation	.629*	.758*	.699*	1
	Sig. (1-tailed)	.047	.015	.027	
	Sum of Squares and Cross-products	116.000	168.000	174.000	218.000
	Covariance	16.571	24.000	24.857	31.143
	N	8	8	8	8

*. Correlation is significant at the 0.05 level (1-tailed).
**. Correlation is significant at the 0.01 level (1-tailed).

Table 6. *The Frequency Table of (Ife East, Ife South, Ife Central, and Ife North) including the mean, mode std. deviation of the 4 local government areas.*

```
FREQUENCIES VARIABLES=IFEEAST IFESOUTH IFECENTRAL IFENORTH.
/NTILES=4.
/NTILES=10.
/STATISTICS=STDDEV VARIANCE RANGE MINIMUM MAXIMUM SEMEAN MEAN MEDIAN MODE SUM SKEWNESS SESKEW.
KURTOSIS SEKURT.
/GROUPED=IFEEAST IFESOUTH IFECENTRAL IFENORTH.
/HISTOGRAM NORMAL.
/ORDER=ANALYSIS.
```

Statistics					
		IFEEAST	**IFESOUTH**	**IFECENTRAL**	**IFENORTH**
N	Valid	8	8	8	8
	Missing	0	0	0	0
Mean		71.0000	69.2500	69.6250	69.0000
Std. Error of Mean		1.66905	2.00669	2.25149	1.97303
Median		71.5000[a]	69.5000[a]	70.5000[a]	68.6667[a]
Mode		62.00[b]	72.00	59.00[b]	70.00
Std. Deviation		4.72077	5.67576	6.36817	5.58058
Variance		22.286	32.214	40.554	31.143
Skewness		-.826	.032	-.634	.651
Std. Error of Skewness		.752	.752	.752	.752
Kurtosis		.824	.794	-.311	.017
Std. Error of Kurtosis		1.481	1.481	1.481	1.481
Range		15.00	19.00	19.00	17.00
Minimum		62.00	60.00	59.00	62.00
Maximum		77.00	79.00	78.00	79.00
Sum		568.00	554.00	557.00	552.00
Percentiles	10	63.8000[c]	61.2000[c]	59.9000[c]	62.6000[c]
	20	68.1000	64.4000	62.7000	64.1000
	25	68.5000	66.0000	65.5000	64.5000
	30	68.9000	67.6000	68.3000	64.9000
	40	70.4000	68.7000	69.7000	67.1000
	50	71.5000	69.5000	70.5000	68.6667
	60	72.6000	70.4000	71.6000	69.7333
	70	74.1000	71.4667	73.2000	71.6000
	75	74.5000	72.0000	74.0000	72.6667
	80	74.9000	73.8667	74.8000	73.7333
	90	76.4000	77.6000	77.1000	77.5000

a. Calculated from grouped data.
b. Multiple modes exist. The smallest value is shown.
c. Percentiles are calculated from grouped data.

Tables (7, 8, 9, and 10) The frequency Tables for (Ife East, Ife South, Ife Central and Ife North).

Table 7. *Valid and cumulative percentages of Ife East.*

IFEEAST					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	62.00	1	12.5	12.5	12.5
	68.00	1	12.5	12.5	25.0
	69.00	1	12.5	12.5	37.5
	71.00	1	12.5	12.5	50.0
	72.00	1	12.5	12.5	62.5
	74.00	1	12.5	12.5	75.0
	75.00	1	12.5	12.5	87.5
	77.00	1	12.5	12.5	100.0
	Total	8	100.0	100.0	

Table 8. *Valid and cumulative percentages of Ife South.*

IFESOUTH					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	60.00	1	12.5	12.5	12.5
	64.00	1	12.5	12.5	25.0
	68.00	1	12.5	12.5	37.5
	69.00	1	12.5	12.5	50.0
	70.00	1	12.5	12.5	62.5
	72.00	2	25.0	25.0	87.5
	79.00	1	12.5	12.5	100.0
	Total	8	100.0	100.0	

Table 9. *Valid and cumulative percentages of Ife Central.*

IFECENTRAL					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	59.00	1	12.5	12.5	12.5
	62.00	1	12.5	12.5	25.0
	69.00	1	12.5	12.5	37.5
	70.00	1	12.5	12.5	50.0
	71.00	1	12.5	12.5	62.5
	73.00	1	12.5	12.5	75.0
	75.00	1	12.5	12.5	87.5
	78.00	1	12.5	12.5	100.0
	Total	8	100.0	100.0	

Table 10. *Valid and cumulative percentages of Ife North.*

IFENORTH					
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	62.00	1	12.5	12.5	12.5
	64.00	1	12.5	12.5	25.0
	65.00	1	12.5	12.5	37.5
	68.00	1	12.5	12.5	50.0
	70.00	2	25.0	25.0	75.0
	74.00	1	12.5	12.5	87.5
	79.00	1	12.5	12.5	100.0
	Total	8	100.0	100.0	

Figures: (9, 10, 11, and 12). The Histogram with Curve, for (Ife East, Ife South, Ife Central and Ife North).

Histogram

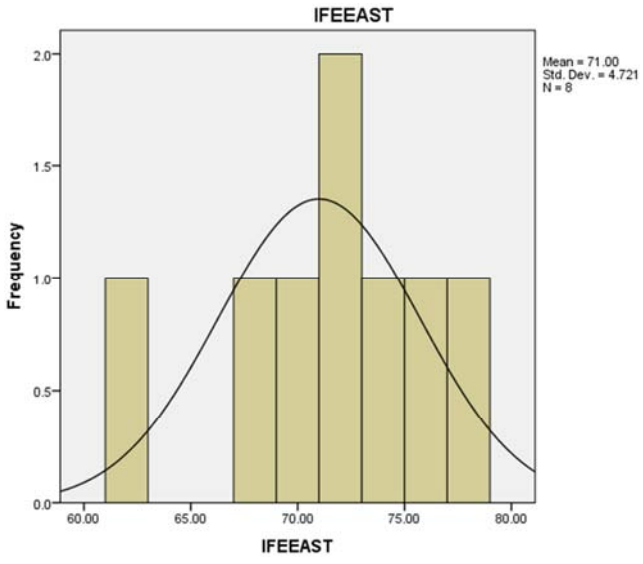

Figure 9. *The Histogram with Curve of Ife East.*

The vertical coordinates represent the frequency (that is, the rate of observations or occurrences) from the data analysis while the horizontal coordinates represent the range from the valid data in Table 7, (that is, based on 1 unit interval as [60, 65, 70, 75, 80], respectively.

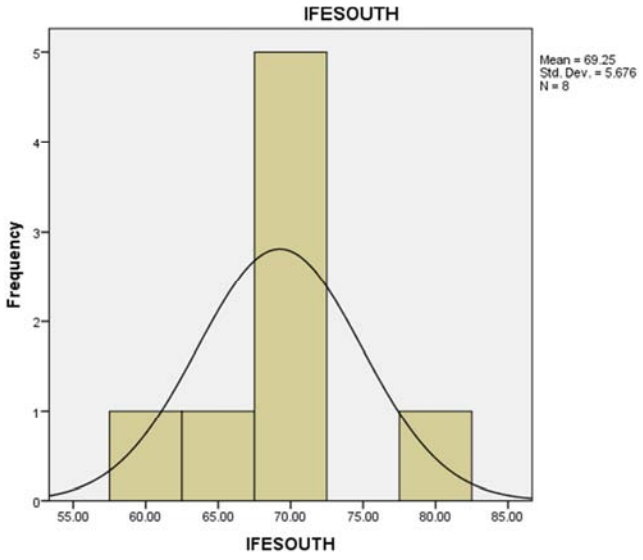

Figure 10. *The Histogram with Curve of Ife South.*

The vertical coordinates represent the frequency (that is, the rate of observations or occurrences) from the data analysis while the horizontal coordinates represent the range from the valid data in Table 8, (that is, based on 1 unit interval as [55, 60, 65, 70, 75, 80, 85], respectively.

The vertical coordinates represent the frequency (that is, the rate of observations or occurrences) from the data analysis while the horizontal coordinates represent the range from the valid data in Table 9, (that is, based on 1 unit interval as [55, 60, 65, 70, 75, 80, 85], respectively.

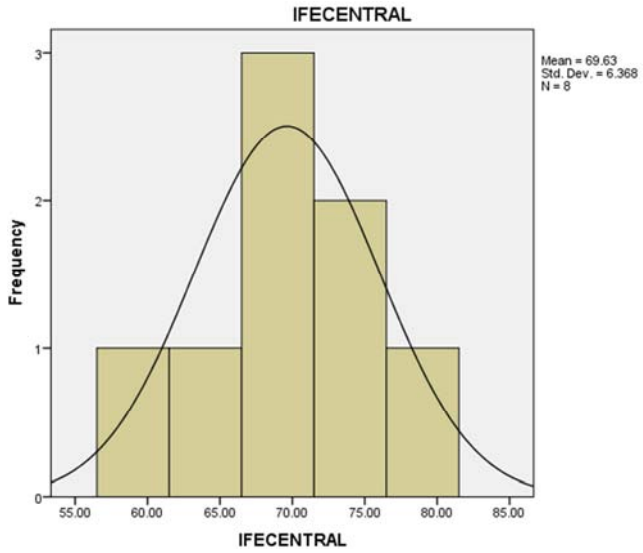

Figure 11. *The Histogram with Curve of Ife Central.*

Figure 5 The histogram of Ife North.

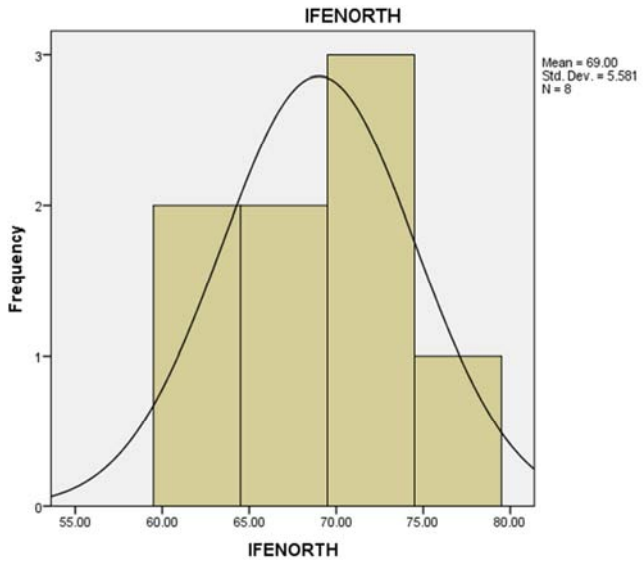

Figure 12. *The Histogram with Curve of Ife North.*

The vertical coordinates represent the frequency (that is, the rate of observations or occurrences) from the data analysis while the horizontal coordinates represent the range from the valid data in Table 10, (that is, based on 1 unit interval as [55, 60, 65, 70, 75, and 80], respectively.

5. Recommendations

1. Nigerian Government should encourage sweet orange plantation, by given funds/loans to prospective investors 2. Federal government should support the farmers by given enough assistance in terms of seedlings subsidy, so as to booth their production 3. Workshop at different intervals should be organised to farmers, so as to educate them in the uses of current farmer's equipments, to increase their sweet orange output production and eradicate sweet orange spoilage. 4. Some of the rural areas roads in, Nigeria, are bad. Government should provide good motor-able roads to farmers in plantation areas with high concentration of sweet orange farm. 5. Government should provide electricity in rural areas for Farmers to enable them to stay longer in their farm for maximum increase in their sweet orange harvest Production. 6. Government should organised Agricultural extension services to farmers by providing and bringing agricultural equipments closer to them, so as to reduce the cost of sweet orange harvest to the buyers. 7. Government should erect large storage facilities at intervals for sweet orange farmers, to avoid losses and spoilage. 8. For high Productivity and ultimate high investment, The Federal Government of Nigeria should encouraged sweet orange farmers to make research and seek expert opinion and advice for the latest productivity techniques to maximize profit.

6. Conclusion

The following conclusions are made based on the findings of this study. Since sweet oranges are an excellent source and very rich in vitamin C, folic acid and it is also as a good source of dietary fiber, containing a host of other important nutrient element for human health, like: folate, thiamine, niacin, phosphorus, magnesium and copper; the results of this study provide the empirical evidence that the importance of computerized analysis on spoilage of sweet orange, before harvest and carriage to market in Nigeria, had enhanced people's achievement in our society and in Nigeria at large. The society, therefore should use, the importance of computerized analysis on spoilage of sweet orange, before harvest and carriage to market in Nigeria's techniques, to argument peoples' maximal output in businesses, in order to attain minimum goal needed for everybody in the society.

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