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Effects of Planting Time and Poultry Manure on Late Season Plaintain Establishment and Yield in Owerri Rainforest Zone of Nigeria

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Abstract
In rainfed agriculture, plantain availability to consumer is seasonal. Late season plantain planting with appropriate organic manure application has been one of the advocated solutions. This experiment was carried out at the Federal University of Technology Teaching and Research farm, Owerri in 2010 late season planting to determine the appropriate time of planting and optimum manure rate that will enhance late season plantain establishment and bunch availability in the tropical rainforest. The experiment was a 3x4 factorial fitted into a randomized complete block design replicated three times. The treatments were three late season months (5th September, 5th October and 5thNovember) and four poultry manure rates (0,4,8 and 12 t.ha^{-1}). The pre and post soil, establishment, growth and yield data were collected and analysed statistically. The post soil chemical analysis showed an improvement on soil pH,(5.30-6.07, 5.59-5.67 and 5.73-5.72), organic matter,(2.098-2.098, 2.476-2.373 and 2.240-2.201%) calcium,(7.03-10.20, 3.60-6.40 and 5.40-5.70 l/kg) organic carbon,(1.696-1.217, 1.436-1.377 and1.436-1.277%) phosphorous (21.39-20.86, 20.20-18.80 and14.60-13.90ppm) and magnesium (0.67-2.00, 0.83-1.17 and 0.83-1.00CMOL) in the treatment that received 8 and12 t ha^{-1} poultry manure in September, October and November planting respectively.. The residual effect of poultry manure resulted in increased yield (8.6, 7.2 and 7.0kg) of the first ratoon crop in September, October, and November planting that received 12t ha^{-1}poultry manure respectively. Although poultry manure rates enhanced plantain establishment, growth and yield when planted in September, October and November, plantain planted in September and manured with 12 t ha-^{1} poultry manure significantly(p=0.05) enhanced plantain establishment,(100%) ,yield (9.2kg in plant crop,8.6 first ratoon) and income return (₦ 7,135,,501.8/ha) in Owerri Rainforest zone of Nigeria.
Keywords: *Planting time, poultry manure, late season plantain, production, humid tropics.*

1.0 Introduction

Plantain (Musa AAB group), a giant ratooning perennial plant of genus Musa and of family Musaceae is an important food crop in the humid tropics sub Sahara Africa including high rainfall areas of South Eastern Nigeria. Plantain provides more than 25% of the carbohydrate and 10% of calorie intake of approximately 70 million people thus making the crop one of the most important sources of food energy in the region. (Nweke 1996;Vuysleke 2001.) Plantain requires large amount of mineral (nitrogen, potassium, etc) to maintain high yields under commercial plantation. The decline of plantain crop yield under continuous cultivation despite the use of mineral fertilizer has been attributed to such factors as acidification, soil compaction and loss of soil organic matter (Juo *et a*l., 1995a). There is need for incorporation of organic manure such as poultry droppings not only to replenish soil nutrient needed to sustain plantain productivity but also to improve the soil physical, chemical and biological properties. Addition of organic amendments such as poultry manure to the soil is not only economical but a management necessity needed to reverse the current ugly trend of soil physical, chemical and biological degradation (Obi and Ebo 1995).

In the humid tropics, plantain is normally grown during early season when other food crops are also grown. This results in abundance of the fruit between July and December month of the year. The commodity becomes scarce from January through June accompanied by high market prizes of plantain. The scenario created hunger gap between the early cropping season and the next early season production. It becomes imperative that vigorous measure should be taken to make plantain fruits available and affordable all the year round since plantain is day neutral (Obiefuna *et al*., 1986) and at the same time maintain the natural resource base. This research was conducted to determine the optimum manure rate and appropriate month of late season planting of plantain suckers required to improve establishment, growth and yield of late season plantain in Owerri rain forest zone of Nigeria.

2.0 Materials and Methods

The field experiment was conducted between September 2010 – July 2013 at the Teaching and Research farm, Federal University of Technology Owerri, longitude 7^{0}7’ E, latitude 5^{0} 27’ N and altitude 55.7m above sea level. The climate of the area is characterized by wet and dry seasons which are influenced by the effect of the humid

maritime air mass. The mean annual rainfall is about 2500mm and is bimodal with peaks in July and September. It has a temperature range of 20^0C and 32^0C. The soil is an ultisols characterized by deep porous red soils derived from sandy deposits in the coastal plain which are highly weathered, coarse textured, low in mineral reserve and natural fertility. (Eshet 1993, Onweremadu *et al*., 2007) The field originally planted with cassava and maize was manually cleared stumped and mapped out at 6m x 4m plot seizes. The soil physical and chemical characteristics were determined before and after the experiment. The experiment was a 3 x 4 factorial in randomized complete block Design and replicated three times. The 12 treatments consisted of three (3) months of planting plantain i.e. September, October and November and four poultry manure rates namely: 0, 4, 8, and 12 t ha-^{1} respectively. Cured poultry manure rates for each treatment was divided into two equal parts. The first dose was applied in appropriate treatment holes one week before planting. The second dose of the manure was placed around each plant at 8 months after planting,(MAP). The plantain planting material were late sword suckers spaced at 3.0 m x 2.0m. Weeding was done manually by slashing for the alleys while clean ring weeding was adopted within 50cm diameter of each plantain stand at six weekly intervals. No chemical application was used to control pest and diseases throughout the experimental period. Insects like termites, beetle and grasshoppers were identified but with minimal damage. Harvesting of matured plantain was done from December 2011 to July 2013. This was done manually using matchet to cut the pseudo stem about 2/3, allowing the bunch to drop under its own weight. The rachis was held with the left hand and the bunch cut off from the stalk. Data on soil nutrient content, 1st leaf emergence, establishment, survival, leaf area (cm^2), leaf area index, plant height, girth, flowering fresh bunch weight(kg) and economic return were collected at different stages of the plantain growth. Soil samples were randomly collected from the experimental site using soil auger from a depth of 0-30cm, bulked, air dried and sent to lab for determination of the soil nutrient content at the beginning of the experiment. After crop harvest, soil samples were collected on treatment levels for chemical analysis to evaluate the current and residual effect of poultry manure on the soil. The number of days it took the plantain in each treatment to shoot out the first leave was recorded by physical count as first leaf emergence while the plantain that established and survived after the first few months were physically counted, recorded and later expressed as percentage at 2 and 6 MAP respectively. Leaf area(cm^2) of the treatments was determined by random selection of three uppermost leaves from the experimental plantain, the width and length of the leaves were measured with meter rule. The product of the length and width of the samples multiplied by the factor (0.75) (Edge Osiru 1987) became the leaf area of the plant in the treatment. This was recorded at 8MAP and at harvest. The leaf area index was calculated by multiplying the leaf area of the experimental plantain by the number of leaves in the in that treatment divided by the plot size. This was recorded at 8MAP and at harvest. Plant height of 3 randomly selected experimental plants were measured from the ground level to the base of the last two terminal leaves using a calibrated stick measure. The mean height of the selected plant samples were recorded at 8MAP and at harvest. Plantain girth was taking by measuring the diameter of the pseudo stem 10cm from the base of the plant using a caliper at 8MAP and at harvest.

Days to 50% flowering was taken by counting the number of days within which 50% of the plantain in each treatment flowered. It was recorded at anthesis for each plant and 1st ratoon crop. The bunch weight (kg) for both plant and first ratoon crop was taken at harvest. The peduncle was cut off from the stalk and the fresh plantain bunch weighed using a 50kg Salter weighing balance and recorded per plant according to treatments. The data used in economic analysis involved cost of inputs and outputs. The yield of fresh plantain bunch were determined in kg/ha and then estimated in terms of current market prices at the nearby local markets. The marketable suckers were determined base on the university market garden prices for propagules. The monetary value was determined according to the prevailing market prices of plantain at the end of investigation while the actual gain was the differences between the monetary value of the treatment yield and the production cost of the various treatments. .All data were statistically analyzed using Genstat 2005. Means were separated using fishers LSD (Obi 2002) at 5% level of probability**.**

3.0 Results and Discussion

3.1 Results

3.1.1 Soil Nutrient Status

The soil nutrient status under the various treatments (Table 1) showed marked variation after the experiment when compared with the initial value with general increase in soil pH, organic matter, available phosphorus, organic carbon, calcium and magnesium in the treatments that received poultry manure. Less value were obtained where poultry manure was not applied. However there was reduction in soil nitrogen in all the treatments when compared with the initial value.

3.1.2 Plantain Establishment and Survival

Time of planting has significant effect on the time of first leaf emergence (Table 2). The September plantings developed first leaf earlier than October and November plantings irrespective of poultry manures rates applied. There were high rates of establishment (100%) and survival (100, 88.8 and 66.6%) in all the treatments that

received poultry manure while less percentage of establishment (77.6%) and survival (33%) were obtained in treatments without manure treatments. September and October plantings recorded better establishment and survival at 2 and 8 MAP

3.1.3 Leaf Area (Cm^2) and Leaf Area Index (LAI)

Both planting time and manure rate had significant effect on the leaf area and leaf area index on the treatment at 8MAP and at harvest (Table 3). The highest leaf area and leaf area index were recorded in September plantain that received 12 t ha^{-1} poultry manure and least values of leaf area and leaf area index were recorded in November plantain without manure application.

3.1.4 Plantain Height (cm) and Stem Girth (cm)

Planting time and manure rate had significant effect on the height and girth of the plantain treatment at both 8MAP and harvest (Table 4). The plantain planted in November produced taller plantain than those planted in October and September respectively. Plantain without manure developed dwarf plantains irrespective of time of planting. The plantain that was planted in September and was manured with 12 t ha^{-1} had highest girth above others while the ones without manures irrespective of the month of planting had lowest girth.

3.1.5 Days To 50% Flowering and Fresh Bunch Weight (kg/plant)

Time of planting and manure rates significantly influenced the number of days to 50% flowering in plantain treatment (Table 5). Planting plantain without manure prolonged the period of flowering in plantain. The plantain planted in September took longer number of days to flower than those planted in November. There was significant increase in yield of plantain bunch with time of planting and increased manure rate. The plantain planted in September had heavier bunch weight (yield) than all others planted in October and November. The yield of plantain increased as manure rate increase but reduced significantly in plantain without manure application.

3.1.6 Economic Return for Late Season Plantain Production

Economic returns for late season plantain production (Table 7) showed highest gross income for plantain in September planting that received 12 t ha^{-1} poultry manure which is higher than the other treatments. The result also showed that high income is realizable from October and November planting when 8 and 12 t ha^{-1} of poultry manure are applied. The monetary value was determined according to the prevailing market prizes of the plantain components at the end of the investigation. While the actual gain was the difference between the monetary value of the treatments yield and the production cost of the various treatments.

3.2 Discussion

3.2.1 Soil property.

The soil physical and chemical analysis carried out before planting showed that the soil was acidic and low in fertility. The general increase in soil pH and exchangeable cations from post harvest analysis is as a result of introduction of poultry manure. This agreed with similar work done by Hsich and Hsu 1993, Jinadasa et al., 1997 and Pitram and Singh (1993) who reported that poultry manure increased pH of the soil and thus neutralized the soil acidity. Bessho and Bell (1992) added that the ability of organic manure to increase soil pH was due to the presence of cations contained in the organic manure.

3.2.2 Establishment.

High percentage of establishment and survival of the plantain recorded at 2 MAP and 8 MAP in the treatments that received poultry manure rates suggested that poultry manure apart from supplying the basic nutrients to the plants also serve as mulch that retains the moisture which sustained the plants growth during the dry season (Lal 1975, Obiefuna 1986).

3.2.3 Growth.

Leaf area and leaf area index for the manured treatments appeared higher than the 0 t ha^{-1}application at 8 MAP and at harvest in the various months of planting. The vigorous leaf growth and expansion in the treatments that received poultry manure confirms that poultry manure is richly endowed with nitrogen needed for leaf expansion which helped in attracting more light energy needed for photosynthesis. This agreed with John *et. al* 2004 who reported that poultry manure contain essential nutrient element associated with photosynthetic activity.

3.2.4 Yield.

Flowering in treatments that received 0 poultry manure application were significantly prolonged as a result of nutrient stress which also caused poor floral initiation. The treatment that received 12t ha^{-1} of poultry manure gave very high fresh bunch yield of plantain (9.2, 6.0and 5.8kg) in the various months of late season planting (September, October and November) respectively. The absence of poultry manure impacted negatively on plantain fresh bunch yield in the treatment that received 0 poultry manure. This suggested that poultry manure supplied the basic nutrient needed for growth and yield of the plantain. This is in line with Adejoro (1999) and Gupta et al, (1997) who reported that poultry manure is very rich in nutrients that will boost crop growth and yield.

3.2.5 Income Return.

The economic return of late season plantain using poultry manure clearly indicated high income / economic return with highest income return of seven million, one hundred and thirty-five thousand five hundred and one naira eighty kobo (₦7,135501.80) realizable from September planting that received 12t ha^{-1} poultry manure. However, no income rather losses accrued when 0 poultry manure was applied in the various months of late season plantain. This suggested that the use of poultry manure for late season especially September plantain production is a profitable enterprise capable of boosting farmers' revenue at the least cost of production since poultry manure is relatively cheap, environmentally friendly and locally available to resource poor farmers. This agreed with Smitt *et al* 2004 who reported that use of poultry manure as a means of boosting soil fertility is economically justified.

4.0 Conclusion.

The post harvest soil analysis revealed that poultry manure increased soil pH of soil samples from plots that received poultry manure. Thus the addition of poultry manure served as soil amendment and nutrient source which enhanced the establishment, growth and yield of late season plantain. The application of 8-12t ha^{-1} manure accelerated plantain maturity irrespective of the time of panting. Plantain planted in September, October and November, that received 12 t ha^{-1} poultry manure produced significantly (p=o.o5) high plantain yield. However, September planting manured with 12 t ha^{-1} poultry manure produced significantly (p=0.05) higher plantain yield and income return in Owerri Rainforest zone of Nigeria.

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Table 1 Soil chemical properties at the beginning and end of the experiments

	%N	%O.M	%O.C	P(PPM)	KCMOL/ Kg	CaCMOL /kg	Mg CMOL /kg	Na CMOL/ Kg	Al + H_20 100gs	AL/ 100gs	PH in H_20
Original Soil Property	0.039	1.376	0.798	4.90	0.006	0.32	0.10	0.004	0.180	0.12	4.50
After Crop Harvest Treatments Manure t ha $^{-1}$											
Sept. 0.0	0.018 (-0.021)	1.468 (+0.092)	0.896 (+0.098)	8.25 (+3.35)	0.0032 (-0.0028)	0.60 (+0.28)	0.58 (+0.48)	0.006 (+0.002)	0.31 (+0.13)	0.27 (0.15)	4.80 (+0.3)
4.0	0.031 (-0.021)	2.545 (+1.169)	1.476 (+0.678)	19.70 (+14.8)	0.0046 (-0.0014)	3.00 (+2.28)	0.87 (+0.77)	0.0043 (+0.003)	0.16 (-0.02)	0.08 (-0.04)	5.88(+1.38)
8.0	0.04 (+0.001)	2.098 (+1.547)	1.696 (+0.898)	21.39 (+16.49)	0.0051 (-0.0009)	7.03 (+6.71)	0.67 (+0.57)	0.0074 (+0.0034)	0.52 (+0.34)	0.41 (+0.29)	5.30 (+0.8)
12.0	0.021 (-0.008	2.098 (+0.722	1.217 (+0.419)	20.86 (+15.96)	0.0064 (+0.004)	10.20 (+9.88)	2.00 9+1.9)	0.0074 (+0.0034)	0.52 (+0.34)	0.41 (+0.29)	6.07 (+2.2)
Oct. 0.0	0.019 (-0.02)	1.464 (+0.088)	0.968 (+0.17)	8.20(+3.30)	0.0031 (-0.0029)	0.59(+0.27)	0.25(+0.15)	0.0061 (+0.0021)	0.30 (+ 0.12)	0.05 (-0.07)	4.90 (+0.4)
4.0	0.035 (-0.004)	2.855 (+ 1. 479)	1.656 (+0.858)	24.22 (+19.32)	0.0044 (-0.0016)	2.40 (+2.0)	0.50(+0.4)	0.0061 (+0.0021)	0.56 (+ 0.38)	0.40 (+0.28)	5.28 (+0.78)
8.0	0.030 (-0.009)	2.476(+1.1)	1.436 (+0.638)	20.20 (+15.3)	0.0082 ("+0.0022)	3.60(+3.28)	0.83(+0.73)	0.0061 (+0.0021)	0.56 (+0.38)	0.40 (+0.28)	5.59(+1.09)
12.0	0.027 (-0.012)	2.373 (+0.997)	1.377 (+0.579)	18.80 (+13.9)	0.010 (+0.0022)	6.40(+6.08)	1.17(+1.07)	0.0061 (+0.0021)	0.20(+0.02)	0.12 (+0.0)	5.67 (+1.17)
Nov. 0.0	0.017 (-0.022)	1.465 (+0.089)	0.928 (+0.13)	8.24 (+3.34)	0.0033 (-0027)	0.65(+0.33	0.55(+0.23)	0.0061 (+0.0021)	0.32(+0.14)	0.28 (+0.16)	4.70(+0.2)
4.0	0.024 (-0.015)	2.236(+0.86)	1.656 (+0.858)	17.60 (+12.7)	0.004(-0.002)	4.5 (+4.18)	0.85(+0.75)	0.0045 (+0.0005)	0.16 (-0.02)	0.08 (-0.04)	5.78(+1.28)
8.0	0.025 (-0.014)	2.240 (+0.864)	1.436 (+0.638)	14.60 (+9.7)	0.0041(-0.0019)	5.4 (+5.08)	0.83 "(+0.73)	0.0074 (+0.0034)	0.12 (-0.08)	0.07 (-0.05)	5.73(+1.23)
12.0	0.023 (-0.016)	2.201 (+0.85)	1.277 (+0.479)	13.90(+9.0)	0.0066 (+.0006)	5.7 (+5.38)	1.00(+0.9)	0.0061 (+0.0021)	0.6(+0.42)	0.08 (-0.04)	5.72(+1.22)

Values in bracket () are differences between the original soil property and post harvest property

Table 2: Effect of poultry manure rate and time of planting on days to 1st leaf emergence and percentage (%) establishment (2 MAP) and survival (8 MAP)

Time of Planting	Treatment Poultry rate (t ha^{-1})	1st leaf Emergency	Establishment Survival 2 MAP	8 MAP
September	0.0	13.3	88.9	33.3s
	4.0	13.0	100	66.6
	8.0	13.0	100	88.8
	12.0	13.7	100	100
Mean		13.25	97.23	72.2
	0	26.0	85.5	33.3
October				
	4	26.0	88.9	66.6
	8	26.0	88.9	88.8
	12	26.0	100	88.8
Mean		26.0	90.82	69.38
November	0	33.0	77.8	33.33
	4	33.0	88.1	55.5
	8	33.0	88.8	77.7
	12	33.0	96.7	88.8
mean		33.0	88.03	63.83

		2 MAP	8 MAP	Leaf emergence
$LSD_{(0.05)}$ for planting times	=	1.82	0.70	1.9
$LSD_{(0.05)}$ for poultry mature rate	=	1.63	0.81	2.19
$LSD_{(0.05)}$ for planting x poultry manure rate		1.94	1.40	3.79

Table 3 : Plantain leaf area (cm^2) and leaf area index at 8MAP and harvest as affected by time of planting and manure rates

Treatment		Leaf area (cm^2)		Leaf area index	
Time of Planting	Manure rates (t ha^{-1})	8MAP	Harvest	8 MAP	Harvest
September	0.0	3768.6	4330	0.83	0.95
	4.0	4390.6	6433.3	2.08	3.05
	8.0	6665.0	8010.0	3.57	4.21
	12.0	7704.0	9323.3	5.29	6.02
Mean		4689.9	7024.15	2.94	3.56
October	0.0	3234.0	4273.3	1.76	1.88
	4.0	4689.3	6501.3	2.34	3.15
	8.0	5982.6	7267.0	4.69	4.86
	12.0	7187.6	8373.3	5.06	5.93
Mean		5473.38	6603.73	3.46	3.96
November	0.0	3025.3	3963.6	0.76	0.95
	4.0	6156.3	7676.6	3.39	3.89
	8.0	6948.0	8780.0	4.67	4.96
	12.0	7662.0	9811.6	5.00	5.61
Mean		5947.9	7557.95	3.46	3.85

	Leaf area		leaf area index	
	8MAP	Harvest	8 MAP	Harvest
$LSD_{(0.05)}$For planting times =	568	705.39	0.77	0.95
$LSD_{(0.05)}$For poultry rate =	655.87	814	0.89	1.52
$LSD_{(0.05)}$For planting x P. manure rate =	1136.01	1410.67	1.55	1.85

Table 4: Plantain height (cm) and Girth (cm) at 8 MAP and harvest as affected by time of planting and poultry manure rate

Treatment		Plantain height		Plantain Girth	
Time of Planting	Poultry rate (t ha^{-1})	8MAP	Harvest	8 MAP	Harvest
September	0.0	74.16	92.16	27.6	24.16
	4.0	98.83	165.16	33.0	42.8
	8.0	121.33	214.33	41.0	54.3
	12.0	140.83	269.33	46.5	65.3
Mean		108.79	185.25	37.03	46.64
October	0.0	77.50	88.83	28.3	25.3
	4.0	85.83	172.16	27.8	41.1
	8.0	121.66	214.83	40.5	48.5
	12.0	146.16	274.83	45.0	60.1
Mean		107.79	187.67	35.4	43.75
November	0.0	85.05	105.85	25.1	24.8
	4.0	111.66	200.83	34.1	44.0
	8.0	140.50	257.16	40.5	55.5
	12.0	154.50	284.66	45.3	62.6
Mean		122.93	212.13	36.25	46.73

	Plantain height		plantain girth	
	8 MAP	Harvest	8MAP	Harvest
$LSD_{(0.05)}$ for planting times	8.69	17.82	2.58	3.43
$LSD_{(0.05)}$ for poultry manure rates =	10.04	20.58	2.98	3.96
$LSD_{(0.05)}$ for planting x P. manure rates	17.30	35.65	5.17	6.86

Table 6: Days to 50% flowering and fresh bunch weight (kg) in crop plant and first ratoon plantain as affected by planting time and poultry manure rates

Treatment		Days to 50% flowering		Bunch weight (kg)	
Time of Planting	Manure rate (t ha^{-1})	Crop plant	1st Ratoon	Crop plant	1st Ratoon
September	0.0	493	522.7	0.8	0.6
	4.0	399.7	402.3	4.7	3.5
	8.0	343.3	351.0	8.6	8.0
	12.0	313.3	307.7	9.2	8.6
Mean		387.33	395.9	5.8	5.12
October	0.0	459	526.0	0.4	0.3
	4.0	390	397.3	4.3	3.4
	8.0	335.3	339.0	5.7	6.0
	12.0	327	329.7	6.0	7.2
Mean		377.81	398.5	4.1	4.23
November	0.0	438.3	516.7	0.2	0.2
	4.0	398.3	402.7	3.0	3.0
	8.0	338.0	345.3	4.9	5.8
	12.0	329.0	317.8	5.8	7.0
Mean		375.9	395.42	3.46	4.0

	50% Flowering		Bunch Weight	
	Crop plant	1st Ratoon	crop plant	1stRatoon
LSD $_{(0.05)}$ for planting times	= 6.55	3.3	0.59	0.22
LSD$_{(0.05)}$ for poultry manure rate	= 7.56	3.8	0.68	0.25
LSD $_{(0.05)}$ for planting x P. manure rate	13.10	6.6	1.07	0.44

Table 7 Income return N/ha from late season plantain production with organic manure

Treatments		Cumulative Bunch	Yield Sucker	Gross Income	Cumulative Production Cost	Income Return
Time of planting	Manure/ha rate (t ha^{-1})	₦ /ha	₦/ ha	₦/ ha	₦/ ha	₦
September	0.0	155400	27,195	182595	417236	-234641
	4.0	1820400	368,500	2188900	46 9668.6	1719231.4
	8.0	4910280	1,273,419	6183699	495612.2	568086.8
	12.0	5932800	1,714,314	7647114	511612.2	7135501.8
October	0.0	88800	38,850	127650	417236	-289586
	4.0	1948050	543,900	2491950	470168.6	2021781.4
	8.0	3882375	962,829	4845204	490662.2	4354541.8
	12.0	4348260	931,770	5280030	506662.2	4773367.8
November	0.0	44200	50,505	94905	417230	-322325
	4.0	1387500	369,075	1756575	470168.6	1286406.4
	8.0	3502600	698,005	4200605	490662.2	3709942.8
	12.0	4562750	528,003	50907533	506662.2	4584090.8

1 kg of plantain ₦200 – ₦250 (Feb. June 2012 and Feb. – June 2013)
Source: Mean value (N) per kg from 3 local markets at harvest Owerri Main Market, Ihiagwa Market and Telief Market
Price of sucker ₦70 per sucker. Source: FUTO farm gate price.