PRODUCTIVITY OF COCOYAM/VEGETABLE COWPEA INTERCROP AS INFLUENCED BY SPATIAL ARRANGEMENT AND COWPEA GROWTH HABITS

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ABSTRACT
Two years field experiments laid out in randomized complete block design were conducted during the 2006 and 2007 wet seasons in the lowland humid forest zone of south-eastern Nigeria to investigate the productivity of cocoyam / vegetable cowpea intercropping as influenced by spatial arrangement and cowpea growth habit. Cocoyam and vegetable cowpea were each planted in monoculture and intercropped within and between rows. The results showed that corm yields obtained from cocoyam intercropped within the row of climbing *Akidienu* were significantly higher than the yields when combined within erect IT86F-204-1. The erect IT86F-204-1 gave higher fresh pod yield under sole cropping while the climbing *Akidienu* gave higher fresh pod yield when intercropped within cocoyam plants. Intercropping did not depress cowpea pod yield except where cocoyam was combined between erect IT86F-204-1 in 2006. Assessment of the productivity of the mixtures using LER, ATER and monetary returns showed yield advantages. The highest LER (2.9), ATER (2.5) and net monetary returns (N491,550) (using mean of two years) were obtained when cocoyam was intercropped within the climbing *Akidienu* vegetable cowpea rows.

Keywords: Productivity, Intercrop and spatial arrangement

INTRODUCTION
Cocoyam (Taro – *Colocasia esculenta* (L) Schott or Tannia – *Xanthosoma sagittifolium* Schott) is grown in the tropical and subtropical regions of the world (Lyonga and Nzietchueng, 1986). It is an important group of tropical tuber crops produced and consumed as a staple food and constitutes one of the major subsistence crops in these regions (Maduewesi and Onyike, 1980). An important characteristic of cocoyam is its high requirement for moisture and shade. Onwueme (1987) reported that cocoyams require rainfall above 2000 mm per annum for optimum yields. Ibe and Iwueke (1984) recommended mulching as standard practice if optimum yield of cocoyams is to be obtained. Onwueme (1978) also recommended mulching especially for upland farms. Chinaka and Arene (1987) reported that mulching increased yield of *Xanthosoma sagittifolium* by 115.6% and *Colocasia esculenta* by 105.5%. It has been shown that growing crops as live mulch effectively conserved the soil moisture (Udealor, 1993). Cocoyam like yam and cassava is generally grown in mixture with other crops like maize, sugarcane, groundnut, melon and banana. (Okigbo, 1985).

Intercropping cocoyam with other crops as an efficient production system was recommended for regions where pressures on land are high (Devos and Wilson, 1973). As a companion crop in such system, cowpea is useful in nitrogen fixation (Mohammed and Clegg, 1993). Green and Blackner (1995) attributed the nitrogen value in intercropping system to the residue decomposition of cowpea rather than mineralization of nitrogen from biological nitrogen fixation by cowpea. Besides, the amount of light intercepted by crops in mixture will depend on the geometry and plant architecture of the component crops (Heitholt *et al*., 2005). Spatial arrangement in traditional farming is haphazard, without any attempt to arrange the crops in a way that the components intercept adequate solar energy. The arrangement of the components in a crop mixture will influence the amount of solar energy available to the components, particularly when both crops are of different heights and architectures (Wahua and Millers, 1978). Information on the effect of planting pattern

on cocoyam intercropping is meagre. The objective of the present study was to determine the effect of spatial arrangement and cowpea growth habit on cocoyam/cowpea intercropping.

MATERIALS AND METHODS

Field experiments were conducted during the rainy seasons of 2006 and 2007 at the research farm of Michael Okpara University of Agriculture, Umudike. Umudike is located on latitude 05^{o} 29^{1} N, longitude 07^{o} 33^{1} E and at elevation of 122 m above sea level. The soil was a sandy loam soil characterized as a *typic paleudult* (Udealor, 1993). The soil physical and chemical properties of the sites are shown in Table 1.

The experiment was conducted on land that was under fallow for one year in 2006 and 2007. The field was slashed and ploughed on 9 April, 2006 and 7 April, 2007, harrowed and ridged at 1m spacing on 18 April, 2006 and 16 April, 2007. Before planting of cocoyam and cowpea, soil samples from 0-20cm depths were collected on 19 April, 2006 and 16, April 2007 from three different locations per plot with a soil auger. The soil samples obtained at the beginning of the experiment were thoroughly mixed and bulked to one composite sample, air-dried, sieved through 2mm sieve and analyzed for pH, organic matter, nitrogen, phosphorus and potassium. The second sampling was done at 28 weeks after planting (WAP) after harvest of cocoyam. The soil sample obtained after harvest of cocoyam was bulked plot-by-plot, air dried, sieved through 2 mm sieve and each analyzed for pH, percentage organic matter using wet oxidation method of Walkley and Black, total nitrogen by Kjeldahl method of wet oxidation, available phosphorus by colorimetric method and exchangeable potassium by Flame photometer (Udo and Ogunwale, 1978).

The experimental design was a randomized complete block design (RCBD) with 3 replicates. The block was divided into experimental units (plots) measuring 3 m X 4 m ($12m^2$). Each block consisted of thirteen treatment combinations. These include:

1. Sole *Akidiani* (spreading cowpea) (40,000 plants per ha)
2. Sole *Akidienu* (climbing cowpea) (40,000 plants per ha)
3. Sole cocoyam (10,000 plants per ha)
4. Sole IT81D-1228-14 (semi-erect cowpea) (40,000 plants per ha)
5. Sole IT86F-204-1 (erect cowpea) (40,000 plants per ha)
6. Cocoyam + *Akidiani* within row (10,000 + 40,000 plants per ha)
7. Cocoyam + *Akidienu* within row (10,000 + 40,000 plants per ha)
8. Cocoyam + IT81D-1228-14 within row (10,000 + 40,000 plants per ha)
9. Cocoyam + IT86F-204-1 within row (10,000 + 40,000 plants per ha)
10. Cocoyam + *Akidiani* between row (5,000 + 20,000 plants per ha)
11. Cocoyam + *Akidienu* between row (5,000 + 20,000 plants per ha)
12. Cocoyam + IT81D-1228-14 between row (5,000 + 20,000 plants per ha)
13. Cocoyam + IT86F-204-1 between row (5,000 + 20,000 plants per ha)

Cocoyam (cocoindia) used for the study was obtained from the National Root Crops Research Institute (NRCRI), Umudike. Cowpea varieties IT86F – 204-1 and IT81D – 1228-14 were obtained from the International Institute from Tropical Agriculture (IITA), Ibadan while Akidienu and Akidiani were obtained from Isuochi in Abia State.The treatments were assigned randomly to the plots. The sole crops were included in the treatments for the assessment of the productivity of the intercrop systems.

Cocoyam (cocoindia) corms/cormels and vegetable cowpea seeds were planted on the same day on 20 April, 2006 and 17 April, 2007 in all the plots. Cocoyam corms weighing 35-50 g were planted on the crest of ridges while two seeds each were sown for vegetable cowpea. The treatments comprised three planting density component ratios of 100:0, 100:100 and 50:50 percent of cocoyam and cowpea, respectively in the mixture. Records were taken on number of corms per plant, corm weight per plant (g/plant), corm yield (t/ha), number of nodules per plant, number of pods per plant, fresh pod weight per plant (g/plant) and fresh pod yield (t/ha).

Land equivalent ratio (LER – sum of the ratios of yields of intercrops to those of sole crops), area time equivalent ratio (ATER) and net monetary equivalent returns (NMER – assessed in Naira per hectare by multiplying the yield of the crop with prevailing market price of the commodity minus the total cost of production within the location) were computed with the formulae of Fisher (1977), Hiebsch and McCollum (1987) and Eke-Okoro *et al*. (2005), respectively.

For each year, separate statistical analyses were performed on cocoyam and vegetable cowpea data. The data were subjected to analysis of variance using Genstat Statistical Package (2003) discovery edition.

RESULTS AND DISCUSSION

The soil chemical properties at harvest of cocoyam are shown in Table 2. Under sole cropping, soil pH was significantly higher with semi erect IT81D-1228-14 than with spreading *Akidiani*. However, under intercropping pH was higher when cocoyam was mixed within climbing Akidienu than within erect IT86F-204-1 or between other vegetable cowpea types except spreading Akidiani. On the average, under sole cropping, soil organic matter and nitrogen content were significantly higher with erect IT86F-204-1 vegetable cowpea than with sole cocoyam by 128% and 105%, respectively. Soil nitrogen was also higher in sole cropped spreading Akidiani cowpea than in cocoyam monocrop. OM was higher in erect IT86F-204-1 than in the other vegetable cowpea monocrops. Under intercropping, soil OM content was higher when cocoyam was mixed within erect IT86F-204-1 plants than other planting patterns or cowpea types. Soil nitrogen did not differ significantly under intercropping among cowpea types and spatial arrangement, although the tendency was for higher values to occur in cocoyam intercropped within erect IT86F-204-1 vegetable cowpea plants.

The number of corms harvested per plant, corm weight per plant and corm yield in tons per hectare was not significantly affected by intercropping, planting pattern or cowpea growth habit (genotype) in both years (Table 3). However, as average of the two years, corm yield was significantly higher when cocoyam was planted within climbing Akidienu than between spreading Akidiani, semi erect IT81D-1228-14 and erect IT86F-204-1 by 92 %, 87 % and 110 %, respectively. Compared to sole cropping, intercropping within climbing Akidienu increased corm yield by 77 %.

Under sole cropping, the number of nodules per plant was similar in erect IT86F-204-1 and semi erect IT81D-1228-14 but significantly higher than the values in spreading Akidiani and climbing Akidienu at 4 and 12 WAP (Table 4). Similarly, under intercropping, the number of nodules produced per plant was higher when cocoyam was mixed between erect IT86D-204-1 than other cowpea types and planting patterns. In both cropping systems (sole and intercrop), the number of pods produced per plant was significantly higher in erect IT86F-204-1 vegetable cowpea than others (Table 5). Intercropping cocoyam between cowpea plants significantly increased the number of pods per plant compared to when cocoyam was within cowpea plants especially in 2006. Fresh pod weight was generally higher in semi erect IT81D-1228-14 in sole crop than in others. Under sole cropping, fresh pod yield was significantly higher in erect IT86F-204-1 than spreading Akidienu in 2006 and other types in 2007. However, in the intercrop, fresh pod yield was higher when cocoyam was combined within the climbing Akidienu than the other cowpea types and spatial arrangement, especially in 2007. On average, intercropping did not reduce cowpea fresh pod yield except when cocoyam was combined between erect IT86F-204-1.

There were yield advantages of growing cocoyam and vegetable cowpea in mixture as depicted by LER of 1.23 – 2.79 (2006) and 1.75 – 3.08 (2007), especially when cocoyam was intercropped within climbing Akidienu (Table 6). The partial LER of the component crops showed that cocoyam always contributed more to the total yield than cowpea especially when cocoyam was intercropped within cowpea plants. In 2006 and 2007 cropping seasons, the highest ATER was also obtained when cocoyam was intercropped within climbing Akidienu vegetable cowpea. Generally, intercropping within cowpea crops tended to improve the

productivity of the system. In 2006 and 2007 cropping seasons, the economic performance of the cropping systems showed that more money was realized in intercropping than sole cropping (Table 7). The highest net income was achieved when cocoyam was intercropped within climbing Akidienu in both seasons. Cocoyam intercropped within climbing Akidienu had the highest combined net return of N555100 and N428000 in 2006 and 2007, respectively.

The results of this study have shown that soil OM and N were generally higher in the intercrops and sole vegetable cowpea than the initial values. There was a depression in the nutrient values in the sole cocoyam compared to the initial soil values. The higher values for soil OM and N in the intercrop and sole cowpea are attributable to litter falls from the vegetable cowpea plant and their subsequent decomposition. In a study involving cassava / vegetable cowpea intercropping, Udealor (2002) showed that vegetable cowpea produced up to 860 Kg/ha dry leaf litters while sole cassava produced less than 70 Kg/ha over the same period. This result also conforms to the findings of Udealor and Asiegbu (2004) in which higher soil nutrient values were obtained with cassava / vegetable cowpea and sole vegetable cowpea than with initial soil values in sole cassava. Among the cowpeas, the higher OM and N contents obtained with IT86F-204-1 (erect cowpea) reflected in the number of nodules produced by this genotype.

Corm yields were usually not depressed but increased when cocoyam was combined within climbing *Akidienu* cowpea rows, indicating complementarities between the component crops in intimate mixtures. Corm yields obtained from cocoyam intercropped within the climbing *Akidienu* was higher due mainly to the greater shading provided by the latter. According to Knipscheer and Wilson (1987), cocoyam is shade tolerant and associated crop has a moderation effect, with cocoyam producing a reasonable yield when grown under shade. The wide maturity gap between cowpea (about 3months) and cocoyam (about 7months) enhanced the compatibility of cocoyam and cowpea as intercrops especially in climbing *Akidienu*. Similar results had been reported by Udealor and Asiegbu (2005) and Njoku and Muoneke (2008) in cassava and cowpea intercrop. On the other hand, corm yield reductions occurred when cocoyam was combined with erect IT86F-204-1 owing to absence of shading and the similar height or growth habit of the intercrops, which encouraged stiffer competition. The importance of height difference among cultivars in determining the competition between species in intercropping was demonstrated by Elmore and Jackobs (1984) for Sorghum/Soybean intercropping and Okpara *et al*. (2009) for cocoyam and cowpea intercropping

The yield response of vegetable cowpea to the cropping system varied. Generally, the climbing *Akidienu* gave higher fresh pod yield than spreading *Akidiana* and erect IT86F-204-1 especially when intercropped within cocoyam plants. Both the sole crop and intercropped semi erect IT81D-1228-14 cowpea gave poor yields in 2007 due to serious rodent damage. On the whole, intercropping did not reduce cowpea fresh pod yields except when cocoyam was combined between erect IT86F-204-1, probably because of greater shading of the latter in between row planting pattern.

Assessing the productivity of the intercropping system using LER, ATER and monetary returns showed yield advantages. The highest yield advantage (mean of 2 years for LER = 2.9, ATER = 2.5 and net returns = N491, 550) was accrued when cocoyam was intercropped within climbing *Akidienu* vegetable cowpea rows. The base crop, cocoyam, was not only more productive in climbing *Akidienu*, pod yield of the latter was satisfactory with a high yield advantage of 190 % on the basis of LER. Ogbuehi and Orzolek (1987) had reported that intercropping where land is scarce would always generate higher monetary returns per unit area of land compared to sole cropping. Based on LER, ATER and monetary returns of the system, intercropping cocoyam within climbing *Akidienu* appeared to be the most productive with the highest income to the farmer, and is recommended over sole cropping system. The cocoyam crop benefits from the share of nitrogen fixed by the climbing cowpea. Further more, the two crops are compatible, as their growth stages for competition for growth resources do not overlap.

CONCLUSION

Based on the conditions of this investigation, it is concluded that manipulation of crop combinations, genotypes and agronomic management such as spatial arrangement may have the ultimate advantage of improving the utilization of growth resources, compatibility and performance of intercrops. Furthermore, the results showed that cocoyam / vegetable cowpea mixture is more productive than sole crop of each component because of complementary effect of the component species in this system. Hence, for higher productivity, climbing vegetable cowpea, *Akidienu*, is recommended, with cocoyam alternated within rows of climbing vegetable cowpea.

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Table 1: Effect of intercropped cocoyam with vegetable cowpea and planting pattern on the soil chemical properties at harvest in 2006 and 2007 cropping seasons combined

		pH (H_20)			OM (%)			N (%)		
Treatment	**Planting scheme**	**2006**	**2007**	**Mean**	**2006**	**2007**	**Mean**	**2006**	**2007**	**Mean**
Cocoyam	Sole	3.64	5.10	4.37	1.85	0.75	1.30	0.10	0.09	0.095
Akidiani	Sole	4.21	4.21	4.21	3.18	1.64	2.41	0.21	0.17	0.190
Akidienu	Sole	4.07	5.05	4.56	3.25	1.82	2.54	0.18	0.15	0.165
IT81D-1228-14	Sole	4.34	5.03	4.69	2.25	1.82	2.64	0.15	0.18	0.165
IT86F-204-1	Sole	3.86	5.05	4.46	3.75	2.18	2.97	0.21	0.18	0.195
C + Akidiani	Within	3.87	5.10	4.49	2.65	1.54	2.10	0.17	0.13	0.150
C + Akidienu	Within	4.34	5.43	4.89	3.55	1.47	2.51	0.18	0.14	0.160
C + IT81D-1228-14	Within	4.16	5.08	4.62	2.25	2.00	2.13	0.15	0.17	0.160
C + IT86F-204-1	Within	3.90	4.13	4.02	2.80	1.77	2.89	0.16	0.18	0.170
C + Akidiani	Between	4.09	5.50	4.80	2.37	1.48	1.83	0.13	0.18	0.155
C + Akidienu	Between	4.16	4.59	4.34	3.00	1.34	2.17	0.18	0.13	0.155
C + IT81D-1228-14	Between	4.22	4.50	4.36	3.25	1.40	2.33	0.17	0.11	0.140
C + IT86F-204-1	Between	4.26	4.66	4.46	3.75	1.55	2.55	0.17	0.15	0.160
$LSD_{0.05}$		0.56	0.18	0.408	1.48	0.11	0.174	0.04	0.06	0.029
Initial value		4.02	5.47	4.75	2.10	1.14	1.62	0.15	0.11	0.130

C = Cocoyam

Table 2: Effect of intercropped cocoyam with vegetable cowpea on corm yield and yield components in 2006 and 2007 cropping seasons

		Number of corms /plant		Corm weight (g/plant)		Corm yield (t/ha)		
Treatment	**Planting scheme**	**2006**	**2007**	**2006**	**2007**	**2006**	**2007**	**Mean**
Cocoyam	Sole	16.4	19.8	41.2	42.9	10.2	8.64	9.42
C + Akidiani	Within	21.2	21.6	49.6	45.8	10.6	9.95	10.28
C + Akidienu	Within	27.6	32.2	62.5	55.0	17.3	16.06	16.68
C + IT81D-1228-14	Within	19.8	30.2	54.4	54.9	10.4	16.01	13.21
C + IT86F-204-1	Within	29.9	28.8	54.6	53.11	13.9	16.02	15.00
C + Akidiani	Between	35.2	22.9	54.5	43.1	9.6	9.29	9.45
C + Akidienu	Between	27.2	22.6	53.4	45.3	8.4	8.95	8.68
C + IT81D-1228-14	Between	25.3	20.6	52.7	45.0	7.9	9.93	8.92
C + IT86F-204-1	Between	26.7	17.8	40.9	44.2	6.9	9.00	7.95
$LSD_{0.05}$		ns	ns	ns	ns	ns	ns	7.62

C = Cocoyam

Table 3: Effect of intercropped vegetable cowpea on number of nodules/plant in 2006 and 2007 cropping seasons

		Week after planting					
		4WAP		8WAP		12WAP	
Treatment	**Planting scheme**	**2006**	**2007**	**2006**	**2007**	**2006**	**2007**
Akidiani	Sole	2.00	1.67	5.70	9.83	4.03	5.00
Akidienu	Sole	1.67	2.00	8.70	6.83	3.33	3.73
IT81D- 1228-14	Sole	6.33	5.07	15.7(	23.3[illegible]	6.33	6.89
IT86F- 204-1	Sole	9.83	7.67	11.7(	22.0(	4.53	10. 6[illegible]
C + Akidiani	Within	1.00	1.12	13.7(	25.9(	8.33	3.83
C + Akidienu	Within	4.67	4.67	2.70	33.0(	8.50	5.13
C + IT81D-1228-14	Within	3.33	3.00	8.30	18.0[illegible]	4.83	5.27
C + IT86F-204-1	Within	6.50	5.83	11.7(	3.00	9.77	9.43
C + Akidiani	Between	2.00	2.33	3.70	5.43	7.90	3.67
C + Akidienu	Between	6.00	4.17	7.00	14.4(	7.40	6.93
C + IT81D-1228-14	Between	8.67	2.50	8.30	13.7[illegible]	9.60	7.06
C + IT86F-204-1	Between	22.0(	20.1[illegible]	22.3(	9.47	10.8[illegible]	6.79
$LSD_{0.05}$		7.40	4.63	ns	ns	3.42	4.19

C = Cocoyam

Table 4: Effect of intercropped cocoyam with vegetable cowpea on fresh pod yield and yield components of vegetable cowpea in 2006 and 2007 cropping seasons

		Number of pods/plant			Pod weight (g)/plant			Fresh pod yield (t/h)		
Treatment	**Planting scheme**	**2006**	**2007**	**Mean**	**2006**	**2007**	**Mean**	**2006**	**2007**	**Mean**
Akidiani	Sole	40.8	19.1	29.9	3.5	3.0	3.3	5.7	2.7	4.2
Akidienu	Sole	36.7	23.8	30.3	4.8	4.5	4.6	7.4	3.1	5.2
IT81D-1228-14	Sole	28.4	6.8	17.6	6.8	5.8	6.3	7.6	1.3	4.5
IT86F-204-1	Sole	53.0	39.6	46.3	3.1	2.8	2.9	6.6	4.4	5.5
C + Akidiani	Within	38.7	20.2	29.4	3.5	3.2	3.3	5.4	2.7	4.0
C + Akidienu	Within	42.3	24.4	33.4	7.5	5.3	6.4	8.4	5.3	6.8
C + IT81D-1228-14	Within	28.0	5.2	16.6	4.9	5.2	5.0	8.0	1.1	4.6
C + IT86F-204-1	Within	63.6	38.1	50.9	3.4	2.7	3.1	6.2	4.2	5.2
C + Akidiani	Between	57.8	36.8	47.3	4.0	3.3	3.7	4.6	2.5	3.7
C + Akidienu	Between	59.3	34.9	47.1	4.6	4.6	4.6	7.7	4.3	6.0
C + IT81D-1228-14	Between	47.4	10.2	28.8	7.8	6.5	7.2	7.4	1.4	4.4
C + IT86F-204-1	Between	79.7	50.9	65.3	3.1	3.5	3.3	3.6	3.8	3.7
$LSD_{0.05}$		15.3	10.5		1.0	0.7		1.9	0.7	

C = Cocoyam

Table 5: Land equivalent ratio and area x time equivalent ratio in cocoyam/vegetable cowpea intercropping system in 2006 and 2007 cropping seasons

		Land equivalent ratio							
		Partial						Area x Time equivalent ratio (ATER)	
		2006			2007				
Treatment Combination	Planting scheme	Cocoyam	Cowpea	Total	Cocoyam	Cowpea	Total	2006	2007
				1.00	1.00		1.00		
Cocoyam	Sole	1.00							
Akidiani	Sole		1.00	1.00		1.00	1.00		
Akidienu	Sole		1.00	1.00		1.00	1.00		
IT81D-1228-14	Sole		1.00	1.00		1.00	1.00		
IT86F-204-1	Sole		1.00	1.00		1.00	1.00		
C + Akidiani	Within	1.04	0.95	1.99	1.15	0.91	2.06	1.60	1.71
C + Akidienu	Within	1.70	1.09	2.79	1.86	0.22	3.08	2.37	2.61
C + IT81D-1228-14	Within	1.02	0.92	1.94	1.85	0.84	2.69	1.58	2.36
C + IT86F-204-1	Within	1.36	0.93	2.29	1.85	0.95	2.80	1.93	2.43
C + Akidiani	Between	0.94	0.81	1.75	1.07	0.95	2.02	1.44	1.65
C + Akidienu	Between	0.82	0.96	1.78	1.04	0.71	1.75	1.41	1.47
C + IT81D-1228-14	Between	0.77	0.98	1.75	1.15	1.02	2.17	1.37	1.77
C + IT86F-204-1	Between	0.68	0.35	1.23	1.04	0.87	1.91	1.02	1.57

C = Cocoyam

Table 6: Effect of spatial arrangement on economic returns of cocoyam and vegetable cowpea mixture in 2006 and 2007 cropping sea

Gross Returns (Naira/ha)

	2006			2007			Mean		
Treatment/ Cropping syst	**Gross inco**	**investment c**	**Net inco**	**Gross inco**	**Investment c**	**Net inco**	**Gross inco**	**Investment c**	**Net inco**
Sole									
Cocoyam	255000	94500	160500	216000	97000	119000	235500	95750	139750
Akidiani	169800	34000	135800	79500	34000	45500	124650	34000	90650
Akidienu	230100	34000	196100	129000	34000	95000	179550	34000	145550
IT81D-1228-14	227100	34000	193100	39900	34000	5900	133500	34000	99500
IT86F-204-1	198000	34000	164000	132000	34000	98300	165150	34000	131150
Spatial Arrangement									
Within Row									
C + Akidiani	426100	128500	298100	328250	131000	197250	377175	129750	247675
C + Akidienu	683600	128500	555100	559000	131000	428000	621300	129750	491550
C + IT81D-1228-14	500000	128500	371500	433850	131000	302850	466985	129750	337175
C + IT86F-204-1	532600	128500	275600	525850	131000	394800	529225	129750	335200
Between Row									
C + Akidiani	378000	128500	249500	308150	131000	177150	343075	129750	213325
C + Akidienu	431100	128500	302600	315250	131000	184250	373175	129750	243425
C + IT81D-1228-14	419500	128500	291000	288750	131000	157750	354125	129750	224375
C + IT86F-204-1	281400	128500	152900	340200	131000	209200	310800	129750	181050

C = Cocoyam