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# STABILIZATION OF YIELD PARAMETERS AND SOME NUTRIENT COMPONENTS IN COCOYAM CULTIVARS WITH TIME IN UYO, SOUTHEASTERN NIGERIA

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*ABSTRACT*

*A study was conducted during 1996 and 1997 cropping seasons to determine the influence of harvesting time on the yield, protein and ash components of four cocoyam cultivars. A randomized complete block design with a split-plot arrangement was used. The time of harvesting (12,24,and 36 weeks after planting-WAP) constituted the main-treatments while the cultivars (NCY 001,NCY 002, NCY 004 and NCY 005) were the sub-treatments. Results showed that harvesting at 24 WAP resulted in 45-70% and 16-71% more shoots and leaves per stand, respectively than harvesting either at 12 or 36 WAP. Cultivar NCY 004 produced 16-53% more number of shoots per stand than other cultivars. The percent protein content in the leaves, cormels and corms was highest at 12 WAP whereas ash content increased with delayed harvesting. Cormel and corm yields obtained at 24 WAP was not significantly different from that obtained at 36 WAP, when bulking is supposed to be at optimum. Among the Xanthosoma and Colocasia cultivars, NCY 001 and NCY 004 produced the best corm and cormel yields, respectively and are therefore recommended for planting in this agro-ecology.*

***KEYWORDS**: Cocoyam cultivars, harvesting time, yield, protein, ash.*

## INTRODUCTION

Cocoyam refers to two members of the *Araceae* family that are staple foods for many people in developing countries in Africa, Asia and the Pacific (Agueguia *et al.*, 1992). Two genera, *Xanthosoma* and *Colocasia* are particularly important and extensively cultivated. The species widely grown in Nigeria are *Xanthosoma sagittifolium* (L.) Schott and *Colocasia esculenta* (L.) Schott (Ibe and Iwueke, 1984). The cormel and corm are the major economic parts of cocoyam. The main stored food in the cormel and corm is carbohydrate. Occasionally, young leaves and petioles are also used for food. One of the advantages of cocoyam cultivation is that it has no vines to stake as in yam *(Dioscorea spp.)*, no strong obstructing stems as in cassava (*Manihot spp.*) and no entangling vines like in sweet potato (*Ipomea spp*). In addition, cocoyam has good potential for easy mechanization (Enyinnaya, 1992).Cocoyam as a starchy tuber crop has been widely cultivated and consumed in the southeastern agricultural zone of Nigeria for decades.

Cocoyam is in direct competition with cassava and yam as food (Nwagbo *et al.*, 1987). But the actual yield and nutritional status of the crop with time of harvest has not yet been properly documented. Most of what is produced is consumed locally (Mbanaso and Enyinnaya, 1989). There are about seven cultivars of cocoyam identified in Nigeria (Enyinnaya, 1992). Four of them (NCY 001, NCY 002, NCY 004 and NCY 005) are most popular in Akwa Ibom State. Cultivars NCY 001 and NCY 002 belong to *Xanthosoma sagittifolium* (L.) Schott while NCY 004 and NCY 005 belong to *Colocasia esculenta* (L.) Schott. Onwueme(1991) observed that the global average yield is only about 6,000kgha-$^{1}$. This implies that more research is desirable to raise production level in order to meet it demand. The maturation period for cooyams is said to vary according to the cultivars and ranges from six to eighteen months. The shortest crop duration reported in Sri Lanka is three months, seven to nine months in India, severn to eleven months in the Philippines and six to eight months in Nigeria (Kay, 1987).

Igbokwe (1982) studied the growth parameters in cocoyam and observed that cormel bulking started as early as eight weeks after planting and became very prominent at 12-16 weeks after planting. It has also been reported that the maximum leaf growth occurred during the eighteenth to twentieth weeks in both *Xanthosoma sagittigolium* and *Colocasia esculenta* and leaf production rapidly declined after the twenty second week after planting (Igbokwe and Arene, 1981). At early stages of growth, protein is reported to be highest in the leaves but decreased as the leaf ages while ash content is highest at sixteen weeks afterplanting (NRCRI, 1987). However, another study (Igbokwe, 1983) identified 3 major stages of growth comprising the time of planting to about 8 weeks later, 8 to 24 WAP and 25 WAP to harvest. This suggests that nutrient contents in cocoyam may vary with time. Against this background, a study was therefore carried out to assess the influence of time of harvesting on the yield, protein and ash components of four cocoyam cultivars grown on an Ultisol in Uyo, Southeastern Nigeria.

## MATERIALS AND METHODS

A two year field experiment was conducted at the University of Uyo Teaching and Research Farm, Uyo, Akwa Ibom State, Nigeria. The farm is located in the tropical rainforest zone of Nigeria and lies between latitude 4°30' and 50° 30' N and longitude 7° 05' E and 80° 20' E, and with an altitude of 38. I m above sea level. Uyo has a mean annual rainfall of about 2000mm, a mean monthly relative humidity of 79%, a minimum temperature of 22.50° C and a maximum of 30.70° C. Soil textural analysis showed that the soil is loamy sand. The organic matter content, percentage potassium and total nitrogen are low while available phosphorus is generally

high (Ndon and Ndaeyo, 2001).

The design of the experiment was a randomized complete block with a split-plot arrangement. The main treatments were three times of harvesting (12,24 and 36 WAP) while the sub-treatments were four cultivars of cocoyam (NCY 001, NCY 002,NCY 004 and NCY 005) obtained from National Root Crop Research Institute, Umudike, Nigeria and replicated 4 times. The experimental site, which measured 12x21m, was cleared, ploughed, harrowed and ridged at 1 m apart each year. The cormels of each cocoyam cultivar weighing about 60g were planted on ridges at 50 cm along the rows on 23rd April, 1996 and 16th April, 1997, respectively. Weeding was done manually twice at 6 and 16 weeks after planting (WAP) and NPK fertilizer (15-15-15) at 400kgha$^{-1}$ was applied using ring method.

Data collected included sprouting percentage, number of shoots per stand, number of leaves per stand, height, and leaf area (measured by graphical method). Harvesting of each of the four cultivars was done at 12,24 and 36 WAP. Destructive samplings was done at each stage of harvest and the crops were separated into leaves, cormels and corms. They were washed and cleaned to remove traces of sand and water before weighing on a scale to determine their fresh weights and then oven dried at 105°C for 72 hours. The dried leaves, cormels and corms were ground to powdered form and analysed to determine the crude protein and ash (minerals) contents using the methods described by AOAC (1980).

## RESULTS

### Percent Sprouting, Number of Shoots and Leaves

The cocoyam sprouting percentage differed significantly among time of harvesting and cocoyam cultivars in both years (Table 1). The mean percentage sprouting for the cultivars in 1996 were 88.54, 80.21, 71.88 and 87.29% for NCY 001, NCY 002, NCY 004 and NCY 005, respectively. Cultivars NCY 001 and NCY 005 gave 2-19% and 9-32% better sprouting than others in 1996 and 1997, respectively. Harvesting at 36WAP gave 2-15% and 9-32% better sprouting than when it was done at 12 and 24 WAP. The interaction effects between time of harvesting and the cultivars for sprouting percent were however not significant in both years. Time of harvesting significantly affected the number of shoots and leaves per stand of all the cocoyam cultivars in both years (Table 1). In 1996 and 1997, harvesting of cocoyam at 24 WAP (3.13 and 4.13) resulted in 66-74% and 23-65% more shoots per stand, respectively than harvesting at both 12 and 36 WAP. The NCY 004 cultivar (2.17 and 4.25) produced 16-50% and 16-55% more number of shoots per stand than other cultivars in 1996 and 1997, respectively. The interaction between time of harvesting and cocoyam cultivars produced significant effect on the number of cocoyam shoots.

Generally, the number of shoots per plant increased with time irrespective of the cultivars up to 24 WAP after which it declined. Similarly, the number of leaves per stand increased with time in both years up to 24 WAP (6.81 and 11.44) after which a decrease was observed (Table 1). Harvesting at 24 WAP produced 18-62% and 15-80% more leaves than at 12 and 36 WAP in 1996 and 1997, respectively, Among the cultivars, NCY 004 (7.08 and 1.50) produced 18-61% and 22-57% more leaves in 1996 and 1997, respectively than other cocoyam cultivars. Significant interaction effects were observed between time of harvesting and cocoyam cultivars with number of leaves per stand dropping drastically by 76-80% after 24 WAP.

**Table 1. Effects of time of harvesting on percentage sprouting, number of shoots and leaves of cocoyam cultivars in Uyo, southeastern Nigeria.**

| Time of harvesting (WAP)* | Cocoyam Cultivars | Sprouting (%) | | No. of shoots per Stand | | No. of leaves per Stand | |
|---|---|---|---|---|---|---|---|
| | | 1996 | 1997 | 1996 | 1997 | 1996 | 1997 |
| 12 | NCY001 | 81.25 | 78.13 | 1.25 | 1.75 | 6.00 | 5.75 |
| | NCY002 | 66.63 | 75.00 | 0.75 | 1.25 | 2.00 | 4.50 |
| | NCY004 | 56.25 | 59.38 | 0.75 | 5.25 | 10.0 | 16.0 |
| | NCY005 | 78.13 | 100.00 | 1.50 | 4.50 | 4.25 | 12.50 |
| | Mean | 70.31 | 78.13 | 1.06 | 3.19 | 5.56 | 9.69 |
| 24 | NCY001 | 90.63 | 96.88 | 2.75 | 2.25 | 7.25 | 6.25 |
| | NCY002 | 84.38 | 96.88 | 1.75 | 2.50 | 4.00 | 5.50 |
| | NCY004 | 75.00 | 71.88 | 4.75 | 6.25 | 9.75 | 17.00 |
| | NCY005 | 90.00 | 100.00 | 3.75 | 5.50 | 6.25 | 17.00 |
| | Mean | 85.16 | 91.41 | 3.13 | 4.13 | 6.81 | 11.44 |
| 36 | NCY001 | 93.75 | 96.88 | 0.75 | 1.75 | 4.25 | 3.50 |
| | NCY002 | 90.63 | 100.00 | 0.75 | 2.00 | 2.25 | 3.25 |
| | NCY004 | 84.38 | 71.88 | 1.00 | 1.25 | 1.50 | 1.50 |
| | NCY005 | 93.75 | 100.00 | 0.75 | 0.75 | 2.25 | 1.00 |
| | Mean | 90.63 | 92.19 | 0.81 | 1.43 | 2.56 | 2.31 |
| LSD (P<0.05) among time of harvesting | | 15.83 | 11.16 | 1.72 | 1.44 | 2.86 | 4.46 |
| LSD(P< 0.05) among cultivars | | 21.46 | 12.28 | 1.20 | 1.51 | 3.55 | 3.38 |

* WAP = weight after planting

### Height and Leaf Area

In 1996 and 1997, the effects of time of harvesting and cultivars were significant on the cocoyam height and leaf area (Table 2). Cocoyam harvested at 24 WAP (0.32 and 0.39m) grew taller than those harvested at both 12 and 36 WAP by 39 WAP by 39-57% and 16-46% in 1996 and 1997, respectively. Among the cultivars, NCY 002 produced the tallest plants and exceeded other cultivars by 12-54% in 1996 and 7-56% in 1997. The leaf area also differed significantly among time of harvesting and cocoyam cultivars (Table 2). In both 1996 and 1997, cocoyam leaf area increased gradually with time and reached a peak at 24 WAP (60-92% and 58-76% larger than at 12 and 36 WAP) after which it declined drastically. The NCY 001 cultivar (3.44 and 6.97m$^2$) produced plants with the widest leaf areas, which were 22-62% and 30-62% larger than other cultivars in 1996 and 1997, respectively. The interaction between time of harvesting and cultivars did not indicate significant effect on plant height and leaf area in both years although a decline in height and leaf area set in from 24 WAP.

**Table 2: Effects of harvesting time on height and leaf area of cocoyam cultivars in Uyo, southeastern Nigeria.**

| Time of harvesting (WAP) | Cocoyam Cultivars | Height per Stand(m) | | Leaf area(m$^2$) | |
|---|---|---|---|---|---|
| | | 1996 | 1997 | 1996 | 1997 |
| 12 | NCY001 | 0.24 | 0.37 | 3.41 | 6.29 |
| | NCY002 | 0.24 | 0.40 | 0.83 | 2.78 |
| | NCY004 | 0.06 | 0.21 | 1.38 | 2.46 |
| | NCY005 | 0.24 | 0.33 | 2.58 | 4.42 |
| | Mean | 0.20 | 0.33 | 2.05 | 3.99 |
| 24 | NCY001 | 0.35 | 0.43 | 6.38 | 11.57 |
| | NCY002 | 0.37 | 0.46 | 6.72 | 8.47 |
| | NCY004 | 0.23 | 0.28 | 2.33 | 4.89 |
| | NCY005 | 0.33 | 0.39 | 4.88 | 5.67 |
| | Mean | 0.32 | 0.39 | 5.08 | 7.65 |
| 36 | NCY001 | 0.15 | 0.34 | 0.51 | 3.06 |
| | NCY002 | 0.23 | 0.38 | 0.51 | 3.35 |
| | NCY004 | 0.11 | 0.06 | 0.19 | 0.67 |
| | NCY005 | 0.06 | 0.06 | 0.34 | 0.12 |
| | Mean | 0.14 | 0.21 | 0.39 | 1.80 |
| LSD(P< 0.05) among time of harvesting | | 0.11 | 0.10 | 3.86 | 4.18 |
| LSD (P< 0.05) among cultivars | | 0.12 | 0.13 | 2.28 | 3.19 |

### Dry Matter Yields of Leaves, Cormels and Corms

Time of harvesting and cocoyam cultivars produced significant effects on dry matter yields of leaves, cormels and corms in both 1996 and 1997 cropping seasons (Table 3). However, no clear trend was maintained in the dry matter yields observed in the cocoyam leaves, cormels and corms irrespective of the harvesting time. In 1996 and 1997, harvesting at 24 WAP indicated 9-51% and 29-47% more dry matter in the leaves (1.07 and 1.64 kgha$^{-1}$), respectively than other harvesting times. The dry matter yield of leaves of all the cultivars increased with time from 0.34 kg ha$^{-1}$ in 1996 and 0.09 kg ha-$^{1}$ in 1997 at 12 WAP to 1.07 kg ha$^{-1}$ in 1996 and 1.64 kg ha$^{-1}$ in 1997 at 24 WAP, after which it declined at 36 WAP (0.15 kg ha$^{-1}$ and 0.30 kgha$^{-1}$). Among the cultivars, NCY 001 and NCY 004 produced 9-15% and 29-47% more dry matter than other cultivars in 1996 and 1997, respectively (Table 3). The interaction between ime of harvesting and cultivars indicated significant effect on the leaf dry matter in both years with leaf dry matter increasing up to 24 WAP irrespective of the cultivars and time of harvesting.

Table 3.
**Effect of time of harvesting on the dry mater yields of levels, cormels and corms of cocoyam cultivars in Uyo, Southeastern Nigeria.**

| Time Harvesting (WAP) | Cocoyam cultivars | Dry matter yield (Kg ha$^{-1}$ 1996 | | | 1997 | | |
|---|---|---|---|---|---|---|---|
| | | Leaves | Cormels | Corms | Leaves | Cormels | Corms |
| 12 | NCY001 | 0.38 | 0.09 | 0.23 | 0.95 | 1.07 | 1.14 |
| | NCY002 | 0.41 | 0.00 | 0.10 | 0.67 | 0.03 | 0.59 |
| | NCY004 | 0.20 | 0.03 | 0.44 | 0.55 | 1.55 | 1.98 |
| | NCY005 | 0.37 | 0.05 | 0.24 | 1.41 | 1.69 | 1.69 |
| | Mean | 0.34 | 0.04 | 0.25 | 0.90 | 1.09 | 1.35 |
| 24 | NCY001 | 1.50 | 0.73 | 0.64 | 1.29 | 6.00 | 3.16 |
| | NCY002 | 0.57 | 0.23 | 0.50 | 1.11 | 1.36 | 1.36 |
| | NCY004 | 1.71 | 0.21 | 1.23 | 1.55 | 4.89 | 4.71 |
| | NCY005 | 0.50 | 0.53 | 0.82 | 2.60 | 1.75 | 4.37 |
| | Mean | 1.07 | 0.42 | 0.80 | 1.64 | 3.50 | 3.40 |
| 36 | NCY001 | 0.22 | 2.77 | 1.94 | 0.63 | 6.96 | 3.09 |
| | NCY002 | 0.24 | 1.94 | 0.84 | 0.54 | 2.10 | 2.26 |
| | NCY004 | 0.01 | 0.92 | 1.69 | 0.03 | 9.17 | 2.87 |
| | NCY005 | 0.15 | 2.21 | 2.68 | 0.02 | 3.86 | 3.16 |
| | Mean | 0.15 | 1.96 | 1.79 | 0.30 | 5.52 | 2.84 |
| LSD (p<0.05) | Among time of harvesting | 0.66 | 1.85 | 1.39 | 1.08 | 2.32 | 1.90 |
| LSD (P<0.05) | Among cultivars | 0.43 | 0.75 | 0.91 | 0.71 | 2.63 | 1.37 |

In both 1996 and 1997, the least dry matter yields in cocoyam cormels (0.04 and 1.0 kg ha$^{-1}$) were observed at 12 WAP and were 83-98% and 37%-80% lower than those obtained at 24 and 36 WAP. The dry matter yield of cormels increased generally up to 24 WAP irrespective of the cultivars after which a decline set in. However in 1996, NCY001 had 22-68% more cormel dry matter than other cultivars whereas in 1997, NCY004 indicated 10-78% more cormel dry matter than other cultivars. The interaction between time of harvesting and cultivars was only significant in the 1997 season with dry matter in the cormel increasing with time. The dry matter yield in cocoyam corms at 36 WAP (1.79 kg ha$^{-1}$) was 55-86% higher than other harvesting times in 1996. In 1997, it was 16-60% higher at 24 WAP (3.40 kg.ha$^{-1}$) than at both 12 and 36 WAP. Among the cultivars, NCY005 produced 10-62% more dry matter in 1996 than other cultivars whereas in 1997, dry matter yield in NCY 004 exceeded those in other cultivars by 4-56%. The interaction between time of harvesting and cultivars was not however significantly for corm dry matter yield although it increased with delayed harvesting. The results also revealed that of the *Colocasia* genus, NCY001, gave 39% more cormels and corm dry matter yields than NCY002 while NCY004 gave 22% better cormel and corm dry matter yields than NCY005 for the *Xanthosoma* genus.

Table 4. Effect of time of harvesting on the protein and ash composition of leaves, cormels and corms of cocoyam cultivars in Uyo, southeastern Nigeria.

| Time of harvesting (WAP) | Cocoyam cultivars | Protein(%) | | | Ash (%) | | |
|---|---|---|---|---|---|---|---|
| | | 1996 | | | 1997 | | |
| | | Leaves | Cormels | Corms | Leaves | Cormels | Corms |
| 12 | NCY001 | 1.92 | 1.77 | 1.63 | 1.00 | 1.05 | 1.00 |
| | NCY002 | 1.93 | 1.64 | 1.62 | 1.70 | 1.25 | 1.35 |
| | NCY004 | 1.98 | 1.63 | 1.58 | 1.00 | 1.00 | 1.00 |
| | NCY005 | 1.92 | 1.63 | 1.58 | 2.50 | 2.50 | 2.00 |
| | Mean | 1.94 | 1.67 | 1.60 | 1.51 | 1.45 | 1.34 |
| 24 | NCY001 | 1.79 | 1.27 | 1.28 | 1.00 | 1.00 | 0.25 |
| | NCY002 | 1.53 | 1.27 | 1.24 | 1.55 | 1.00 | 0.25 |
| | NCY004 | 1.64 | 1.26 | 1.24 | 1.00 | 1.00 | 1.00 |
| | NCY005 | 1.62 | 1.22 | 1.23 | 2.00 | 1.50 | 1.00 |
| | Mean | 1.64 | 1.26 | 1.25 | 1.38 | 1.13 | 0.63 |
| 36 | NCY001 | 1.14 | 1.54 | 1.15 | 1.00 | 0.50 | 0.75 |
| | NCY002 | 0.72 | 1.44 | 1.14 | 1.50 | 1.00 | 1.50 |
| | NCY004 | 1.08 | 1.14 | 1.14 | 1.00 | 1.00 | 1.00 |
| | NCY005 | 1.03 | 1.16 | 1.14 | 0.50 | 1.00 | 1.50 |
| | Mean | 0.99 | 1.32 | 1.14 | 1.05 | 0.88 | 1.19 |

### Protein and Ash Composition of Leaves, Cormels and Corms

The percentage protein and ash in the cocoyam leaves, cormels and corms generally declined as the growth stages prolonged (Table 4). The harvesting of cocoyam at 12 WAP gave more protein and ash in the cocoyam leaves, cormels and corms than other harvesting times. A similar trend was also observed among the cocoyam cultivars except that ash content in the corm did not decline at 36 WAP compared to those observed in the leaves and cormels. Of the *Colocasia* cultivars, NCY001 gave a higher protein than NCY002 while for the *Xanthosoma* cultivars, NCY004 produced higher protein than NCY005. However, the reverse was observed when ash was evaluated.

## DISCUSSION

This study revealed that sprouting of cocoyam was better at 24-36 WAP than at 12 WAP whereas the number of shoots and leaves were highest at 24 WAP. Cultivars NCY004 gave the highest number of shoots and leaves. The highest sprouting percentage, number of shoots and leaves observed when time of harvest was delayed (24 and 36 WAP) compared to early harvesting (12 WAP) could be attributed to the fact that the plant had relatively ample time to sprout and attain optimum or near optimum growth before harvesting. The number of shoots was observed to correlate with the number of leaves per stand. This is in consonance with the findings of Ibe and Iwueke (1984) that cocoyam growth is at its peak at 14 WAP. Also, the number of shoots and leaves of cocoyam per stand has been specifically reported to reach its peak at 16-24 WAP and declined thereafter (Safo-Kantanka *et al.*, 1991). Maximum leaf growth was observed at 24 WAP on all the cultivars in both years but declined afterwards due to senescence. Among the growth parameters considered, the interactions between time of harvesting and cocoyam cultivars were not significant for sprouting percentage, height and leaf area. However, the interactions were significant for number of leaves and shoots. Both growth parameters

increased with delayed harvesting up to 24 WAP irrespective of the cultivars, after which a decline was observed. These findings agree with that reported earlier by Igbokwe and Arene (1981) and Sivan (1979) that the cocoyam leaf area develops slowly from planting and peaks at about 16-20 WAP, depending on the variety, and thereafter declines.

Cultivars NCY001 and NCY002 (*Xanthosoma species*) produced taller plants than NCY004 and NCY005 (*Colocasia species*). The senescence process was more rapid in the Colocasia cultivars (NCY004 and NCY005) than in the Xanthosoma species (NCY 001 and NCY 002) which remained green at 36 WAP. It was observed that senescence, which affected the number of shoots and number of leaves per stand and leaf area at 36 WAP, caused the reduction in dry matter yield of the leaves at this growth stage. The study indicated that NCY001 and NCY004 yielded more than other *Xanthosoma* and *Colocasia* cultivars, respectively. However, NCY004 and NCY005 produced more number of corms and also consistently produced more number of shoots per stand than NCY001 and NCY002 in both years. Each of these shoots produced corms, which accounted for the higher yield obtained in NCY004 and NCY005. The interaction effects between time of harvesting and the cultivars on the yield parameters considered revealed no significant effect on corm dry matter yield although harvesting from 24 WAP gave better dry matter yield on the average.

In contrast, significant interaction effects were observed in the leaf and cormel dry matter yields with dry matter increasing in the leaves up to 24 WAP after which it declined whereas that of cormels increased linearly up to 36 WAP. The leaves, cormels and corms of the four cocoyam cultivars contained higher percentage of protein at 12 WAP, when they are still very tender. The percentage content of ash on the other hand increased gradually when harvesting was delayed (Table 4). This suggests that more protein could be obtained when harvesting is done at 12 WAP than at both 24 and 36 WAP. This finding agrees with an earlier report that the cocoyam protein content is highest in the leaves but decreased with increase in the age of the leaves (NRCRI, 1987). Despite the advantage of high protein and ash content, it would be still be economical to harvest cocoyam from 24 WAP (Enyinnaya, 1991) because at this stage of growth cormels and corms would have achieved optimum bulking and also stored enough foods (carbohydrate). The yield obtained in this study at 24 WAP was not significantly different from that of 36 WAP when bulking is supposed to be at optimum. This implies that harvesting of cormels for consumption could be done as from 24 WAP. This observation corroborates the findings obtained from NRCRI (1987) that harvesting from 24 WAP will give a good index and that not much would be gained when the crop stayed longer than 27-30 WAP. Moreover, finding at NRCRI Umudike, Nigeria revealed that the farmer could detach and start eating the cormels from 20 WAP without any loss in the total or additional yields (Ibe and Iwueke, 1984) that could come for delaying beyond 20 WAP.

## CONCLUSIONS

It could be concluded that it is better to harvest cocoyam leaves and use as a green vegetable when it is succulent or tender and the protein and ash contents are highest. Moreover, the corms and cormels are best harvested as from 24 WAP because at this stage, physiological maturity and optimum food storage in the corms and cormels would have been attained. The NCY001 and NCY004 have indicated, from their corm and cormel yield performances, to be better *Xanthosoma* and *Colocasia* cultivars, respectively and are therefore recommended for planting in this agro-ecology.

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