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## CONCLUSION

Based on the results obtained for nutritive values and phytochemicals of *Cytosperma chamissonis* cocoyam, it could compare more favourably to that of other root crops (cassava, yam and potatoes). The fresh leaves and corm samples were superior in terms of crude protein, nitrogen free extract (NFE), crude fibre and also in magnesium, potassium, sodium, iron and manganese to cassava, yam and sweet potatoes for inclusion as feedstuff. The methods of processing in this study really reduced the HCN, oxalate contents of the leaves and corms appreciably for improvement of the nutritive values of the leaves and corms. Also the results of the T – test confirmed that the levels of proximate fractions, vitamins and phytochemicals and minerals did not differ significantly (P>0.05) in the preference of either boiled sun dried or raw sun dried corms or fresh and dried leaves. Consequently, leaves and corms of the swamp taro cocoyam are highly recommended for incorporation in diets of livestock.

## RECOMMENDATION

It is therefore recommended that greater emphasis should be placed on swamp taro cocoyam production because of its numerous benefits and the need to solve the problem of low level of animal protein intake in Nigeria. This could be achieved by encouraging farmers to engage in massive or commercial planting of swamp taro cocoyam (*Cytosperma chamissonis*) as feedstuff.

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**Table 2:** Phytochemical Composition (Toxicants) of parts of Swamp taro cocoyam (*Cytosperma chamissonis*).

| hytate (%) | Phenol (%) | Tannin (%) | Saponin (%) | Flavonoid (%) | Alkaloid (%) | HCN (%) | Oxalate (%) |
|---|---|---|---|---|---|---|---|
| .20±0.01[a] | 0.29±0.01[a] | 0.44±0.06[a] | 0.37±0.01[a] | 1.25±0.01[a] | 0.73±0.02[a] | 13.40±0.07[a] | 0.28±0.01[a] |
| .26±0.01[a] | 0.47±0.01[a] | 0.28±0.05[a] | 0.21±0.02[a] | 2.07±0.02[a] | 1.57±0.01[a] | 9.01±0.04[b] | 0.42±0.01[a] |
| .47±0.01[a] | 0.24±0.01[a] | 0.23±0.05 | 0.09±0.02[a] | 0.43±0.01[a] | 1.25±0.01[a] | 8.49±0.06[a] | 0.48±0.02[a] |
| .32±0.13[a] | 0.20±0.01[a] | ND | 0.05±0.01[a] | 0.32±0.01[a] | 0.45±0.01[a] | 4.23±0.04[b] | 0.15±0.01[a] |

ed, [ab]Means bearing different superscript along the same column for the pairs of fresh and dried leaves, and raw sun dried and boiled sun dried corms are
ent ($P<0.05$).

**Table 3:** Mineral Composition of parts of Swamp Taro Cocoyam (*Cytosperma chamissonis*).

| u (mg/100g) | Mg (mg/100g) | K (mg/100g) | Na (mg/100g) | Zn (mg/100g) | Fe (mg/100g) | Ca (mg/100g) | Mn (mg/100g) |
|---|---|---|---|---|---|---|---|
| 81.90±2.63[a] | 29.60±1.60[a] | 408.83±0.89[a] | 65.06±1.47[a] | 0.07±0.00[a] | 7.25±0.01[a] | 0.28±0.01[a] | 0.77±0.01[a] |
| 8.18±4.01[b] | 20.00±0.80[b] | 354.67±0.13[b] | 48.43±0.13[b] | 0.05±0.02[a] | 1.16±0.01[b] | 0.05±0.01[a] | 0.48±0.01[a] |
| 2.71±1.34[a] | 77.60±0.80[a] | 316.67±1.20[a] | 84.87±1.44[a] | 0.12±0.01[a] | 4.32±0.02[a] | 0.36±0.02[a] | 1.64±0.02[a] |
| 1.38±1.33[a] | 65.60±0.80[b] | 242.33±0.33[b] | 77.60±0.88[b] | 0.07±0.01[a] | 2.06±0.01[b] | 0.33±0.01[a] | 0.97±0.05[a] |

different superscript along the same column for the pairs of fresh and dried leaves, and raw sun dried and boiled sun dried corms are significantly different

Composition of parts of Swamp taro cocoyam (*Cytosperma chamissonis*)

| Vit. A (mg/100g) | Riboflavin (mg/100g) | Niacin (mg/100g) | Thiamin (mg/100g) | Vit. C (mg/100g) |
|---|---|---|---|---|
| 13.79±0.03[b] | 0.51±0.01[a] | 2.11±0.01[a] | 0.22±0.02[a] | 153.41±1.05[a] |
| 17.95±0.07[a] | 0.40±0.01[a] | 1.60±0.01[a] | 0.11±0.04[a] | 132.25±1.09[b] |
| 1.39±0.02[a] | 0.04±0.01[a] | 0.05±0.01[a] | 0.09±0.02[a] | 16.43±0.08[a] |
| 1.34±0.01[a] | 0.01±0.00[a] | 0.03±0.00[a] | 0.05±0.01[a] | 8.21±1.05[b] |

different superscript along the same column for the pairs of fresh and dried leaves, and raw sun dried and boiled sun dried corms are significantly different magnesium, potassium, sodium, zinc, iron, copper and manganese. On the other hand, the raw sun dried corm recorded increased micro-nutrient levels of calcium, magnesium, potassium, sodium, zinc, iron, copper and manganese over that of the boiled sun dried corm, suggesting slight effect of boiling (heat) on the levels of the micro-nutrients (Table 3).

Potassium was the most abundant element, followed by sodium, magnesium, calcium in both leaves and corms of swamp taro cocoyam. These elements made the leaves and corms to compare favourably with leguminous crops and other tuber and root crops. However, some micro-nutrient values obtained for swamp taro cocoyam were quite lower than the 24.47 μg/100 vs 25.47 μg/100 (iron), 35.03 μg/100 vs 37.70 μg/100 (copper) and 4.00 μg/100 vs 6.63 μg/100 (zinc) for fresh vs sun dried *X. sagittifolium* cocoyam reported by Udofia (2006). The variations in micro-nutrient levels (Table 3) obtained for processed and unprocessed leaves and corms of swamp taro cocoyam might have been due to soil type, varietal differences, age of plant and season of harvest. The T – test analyses (Table 3) for mineral composition between the fresh and dry leaves, and between the raw sun dried and boiled sun dried corms were significantly (P<0.05) different for Cu, Mg, K, Na and Fe, but not for Zn, Ca and Mn.

The vitamin composition results on Table 4 revealed that the leaves of swamp taro cocoyam contained very high level of vitamin C, 153.41 mg/100 g for fresh leaves and 132.25 mg/100 g for dried leaves; followed by vitamin A, 13.79 mg/100 g and 17.95 mg/100 g for fresh and dried leaves respectively. The raw sun dried and boiled sun dried corms contained 16.43 mg/100 g and 8.21 mg/100 g respectively of vitamin C. Vitamin C is known in skeletal calcification, prevention of anemia and scurvy (Hunt *et al.*, 1980). It also acts as an anti-oxidant. As a result of high levels of vitamin C in swamp taro cocoyam leaves, the plant could be used as an herbal medicine for the treatment of common cold and other diseases like prostate cancer (Okwu and Okeke, 2003 and Okwu and Okwu, 2004). The niacin levels obtained for fresh and dried leaves were 2.11 mg/100 g and 1.60 mg/100 g respectively. These values were quite higher than the range of 0.4 – 0.9 mg/100 g reported by Daisy and Gooding (1987) for *C. esculenta* cocoyam. The differences in niacin levels might be due to the processing method used, age and stage of the plant and season of plant harvest. The T – test analyses (Table 4) for vitamin composition between the fresh and dry leaves, and between the raw sun dried and boiled sun dried corms were significantly (P<0.05) different for riboflavin and vit. C, but not for niacin, thiamin and vit. A.

**Table 1:** Proximate Composition of parts of Swamp taro cocoyam (*Cytosperma chamissonis*)

| Parameter | Fresh leaves (% Fresh wt.) | Dried leaves (% Fresh wt.) | Raw sun dried corm (% Dried wt.) | Boiled sun dried corm (% Dried wt.) |
|---|---|---|---|---|
| Dry Matter | 15.80±0.32$^b$ | 89.95±0.12$^a$ | 88.73±0.65$^a$ | 86.47±0.01$^b$ |
| Crude Protein | 22.87±0.23$^a$ | 6.53±0.23$^b$ | 7.93±0.11$^a$ | 6.80±0.20$^a$ |
| Crude Fibre | 6.73±0.01$^a$ | 2.31±0.01$^b$ | 1.36±0.05$^a$ | 1.15±0.01$^a$ |
| Ether Extract | 3.21±0.12$^b$ | 9.26±0.04$^a$ | 0.41±0.02$^a$ | 0.35±0.01$^a$ |
| Moisture Content | 84.20±0.32$^a$ | 10.45±0.05$^b$ | 11.27±0.66$^b$ | 13.53±0.03$^a$ |
| Total Ash | 1.99±0.06$^b$ | 10.38±0.05$^a$ | 4.71±0.20$^a$ | 3.35±0.01$^a$ |
| Nitrogen Free Extract | 69.00±0.21$^a$ | 61.40±0.20$^b$ | 74.31±0.05$^a$ | 75.32±0.15$^a$ |

$^{ab}$Means bearing different superscript along the same row for the pairs of fresh and dried leaves, and raw sun dried and boiled sun dried corms are significantly different (P<0.05).

and shade sun dried leaves (20.9±0.45 %) of water leaves (*Talinum triangulare*) reported by Udofia (2006). The NFE values obtained for the fresh leaves (69.00±0.26 %) and dried leaves (61.04±0.20 %) for swamp taro cocoyam were quite higher than the values of 17.5 % for sweet potato peel reported by Agwunobi (1995) and 27.84 % for fresh cocoyam (*X. sagittifolium*) reported by Udofia (2006). The T – test analyses for proximate composition between the fresh and dried leaves were significant ($P<0.05$) for CP, CF, ether extract, total ash and NFE. However, the T – test analyses for these same fractions were not significant ($P>0.05$) between the raw sun dried and boiled sun dried corms. It could mean that the method of processing these samples have effect on the proximate composition of the cocoyam samples tested (Table 1).

The phytochemical analysis (Table 2) revealed different percentages of toxicants in the leaves and corms of swamp taro cocoyam. These results showed that the swamp taro cocoyam leaves were found to be rich in iron, flavonoid and alkaloid. Flavonoid is the most common widely distributed groups of plant phenolics (Ahemafule *et al*., 2006). Its biological functions include protection against allergies, inflammation, platelet aggregation, microbes, ulcer and tumors (Farguar, 1996 and Okwu, 2004). It therefore means that swamp taro cocoyam leaf is medicinal. Flavonoids have also been reported to function as pigments, an indication that the leaves can serve as pigmented agents in feeds. Alkaloids are used as analgesics, anti-spasmodic and bacterial antigens (Stray, 1998). It shows marked physiological effects when administered to animals (Ahemafule *et al*., 2006).

The values of cyanide, 13.40±0.07 % for fresh leaves and 9.01±0.04 % for dried leaves obtained in this study (Table 2) were quite higher when compared with the values of 1.04 mg/100 g for fresh cocoyam corm (*X. sagittifolium*), 4.53±0.06 mg/100 g for sun dried *X. sagittifolium* corm, 6.88 mg/100 g for fresh water leaves and 0.90 mg/100 g for shade dried water leaves obtained by Udofia (2006). The variations in reported cyanide levels might again be attributed to varietal differences among the cocoyam species and analytical techniques. The deleterious effects exhibited by a lethal dose of cyanide is characterized by its rapid reaction with metal ions and copper in the blood, leading to series of reactions to form cyanohaemoglobin which is not an oxygen carrier. In experimental animals, the principal manifestation of toxicity is stupor or convulsion (Montgomery, 1980). Large dose of cyanide cause death by inhibition of cell respiration. This is an indication of the effect that might occur as a result of consumption of fresh or unprocessed swamp taro cocoyam leaves.

The oxalate levels obtained for the fresh leaves (0.28±0.01 %) and dried leaves (0.42±0.01 %) seem low when compared with the level of 0.76 % for cocoa leaves reported by Concon (1988). Similarly, lower levels of oxalate were obtained for the corm, 0.48±0.02 % (raw sun dried corm) and 0.15±0.01 % (boiled sun dried corm) against the higher levels of 335.53 mg/100 g and 123.00 mg/100 g reported by Udofia (2006) for fresh and sun dried cocoyam (*X. sagittifolium*) respectively. The drastic reduction of oxalate in boiled sun dried samples in this study might be attributed to its boiling before sun drying and in its dried leaves probably because of its volatile nature. This observation is similar to those of many researchers (Eka, 1977; Osagie, 1992; Osagie *et al*., 1996 and Osagie, 1998). Equally, oxalates decrease the availability of dietary essential minerals such as calcium. At high concentration, oxalate causes death in animals due to its corrosive effects. In small amounts, it causes a variety of pathological disorders including hyperoxaluria, pyridoxine deficiency and calcium oxalate stones.

The levels of phytate obtained in fresh leaves (0.20±0.01 %), dried leaves (0.26±0.01 %), raw sun dried corm (0.42±0.01 %) and boiled sun dried corm (0.32±0.13 %) of swamp taro cocoyam is very low when compared with phytate contents of 1.4 % – 3.52 % in maize and 2.0 % – 2.8 % in sorghum (Concon, 1988). High level of phytate in diets is largely blamed for the complexing of dietary essential minerals in legumes and cereals and rendering them poorly available to monogastrics. It is apparent that phytate content of the leaves and corm of swamp taro cocoyam (*Cytosperma chamissonis*) is safe for livestock and micro-livestock consumption. Tannin, which usually gives rise to a dry pickery astringent sensation in the mouth was low in this study; 0.44 %, 0.28 % and 0.23 % in fresh leaves, raw sun dried corm and boiled sun dried corm respectively (Table 2). High level of tannin above 1 % is said to depress growth rate resulting in a poor feed efficiency and increases the amount of food required per unit weight gain in non-ruminant (Price and Butler, 1980). The trace saponin level obtained for raw sun dried and boiled sun dried corms of swamp taro cocoyam agreed with the findings of Udofia (2006) for fresh and shade dried *X. sagittifolium* cocoyam. The saponin levels of 0.44 % and 0.21 % obtained for fresh and sun dried leaves of swamp taro cocoyam respectively were quite lower than the 35.73 mg/100 g (fresh water leaves) and 6.50 mg/100 g (shade dried water leaves) reported by Udofia (2006). This again might be due to differences in samples studied and its volatile nature. Besides, saponins are known to be bitter and reduce the palatability of livestock feeds and increase excretion of cholesterol concentration (Malinno *et al*., 1987). High level of saponin above 3 % was reported by Price and Butler (1980) and Kumar (1991) to be responsible for cattle losses when they graze on altonibriller (*Drymaria arenaroides*) and thus may be hazardous to livestock at that higher level. But, the swamp taro cocoyam (*C. chamissonis*) leaves and corms have very low levels of saponin, below 1 % (Table 2), rendering the cocoyam very safe for consumption by livestock and micro-livestock. The T – test analyses (Table 2) for phytochemical screenings between the fresh and dried leaves, and between the raw sun dried and boiled sun dried corms were not significantly ($P>0.05$) different for all toxicants determined, except the HCN.

The results of the mineral composition of both the leaves and corms of swamp taro cocoyam (*C. chamissonis*) are shown in Table 3. The micro-nutrient levels obtained from the analysis of the fresh leaves were significantly higher than that of the dried leaves for found in the leaves may serve as defensive mechanism against pest. Minute bundles of oxalate crystals are present in swamp taro cocoyam corms and leaves which have irritating effects (Ukpai and Ejidoh, 1989). Steroidal substances such as sapogenins and saponins found in the cocoyam may be detrimental to the animals, but by proper processing methods these may be reduced drastically. Soaking, sun and shade drying, boiling are traditional food processing techniques commonly used in rural areas and they are cost effective. Sun drying prevents direct, high temperature and promotes nutrient retention, example provitamin A (Osagie, 1992; Linchan, 1994; Eka, 1998 and Ruel, 2001).

The thrust of this work is to determine the effects of these processing techniques on nutrients and anti-nutrients of swamp taro cocoyam so as to recommend it for animal feeding.

## MATERIALS AND METHODS

The corms and leaves of swamp taro cocoyam (*Cytosperma chamissonis*) were harvested in the month of March, before the onset of rain at the University of Calabar Teaching and Research Farm, Calabar, Nigeria. The average temperature, relative humidity, photoperiod and rainfall during the experimental period ranged from 25°C to 28°C, 50 % to 70 %, 12 to 18 hours and 1260 mm to 1280 mm respectively.

### Preparation of Materials

The corms were washed and sliced into small pieces with sharp knife. The sliced corms were shared into two parts, one part was sun dried for three (3) days, while the other part was boiled and then sun dried for five (5) days. Thereafter, these two parts were ground separately with a mechanical blender into powder, labeled and stored in different air-tight bottles for analyses. The leaves were washed, chopped into smaller pieces, sun dried, pulverized, labeled and stored.

### Chemical Analyses

Proximate analysis and phytochemical screening were done on all the samples using methods described by Sofowora (1982) and A. O. A. C. (2000).

### Phytochemical Analysis

Determination of tannin content of all the samples was done by the Ferric Chloride test as described by Harborne (1973). The presence of flavonoids in the samples was determined by the acid alkaline test (Harborne, 1973). Saponin was gotten by emulsion test with the aqueous extract. Alkaloid was obtained by dispensing samples in ethanol and Mayers reagent. Phenol was determined according to the folic cioccifeon calorimetric method (A. O. A. C., 2000). HCN was gotten by the alkaline picrate calorimetric method. Phytate was obtained by the Spectrophotometer method of Oberlease (2005).

### Mineral Determination

All the samples were subjected to wet digestion separately with perchloric and nitric acid by the Johnson and Ulrich method. Calcium, sodium and magnesium contents were determined using Ammonium molybdale.

### Vitamin Determination

Vitamin Determination was done according to the nature of the vitamin (water or fat soluble). Vitamin B, thiamine and riboflavin were analyzed using the Scalar analyzer method as described by Okwu (2004). Vitamin A was obtained by the use of Spectrophotometer method.

### Statistical Analysis

The data obtained at the of the study were analyzed using the descriptive statistic procedure of Steel and Torrie (1980), while comparison between processing methods for tested samples of parameters studied were by T – test according to Wahua (1999).

## RESULTS AND DISCUSSION

The proximate composition of the corm and leaves of swamp taro cocoyam (*Cytosperma chamissonis*) is presented in Table 1. The analyses showed that the fresh leaves of swamp taro cocoyam contained higher crude protein (CP) value (22.87±0.23 %), followed by raw sun dried corm (7.93±0.11 %). The fresh leaves also contained higher crude fibre (CF) (6.73±0.01 %) than either the raw sun dried corm (1.36±0.05 %) or boiled sun dried corm (1.15±0.01 %). The range of values obtained for crude protein of the corm was slightly higher than the 7.8 % for dasheen (*Colocasia esculenta*) reported by Agwunobi *et al.* (2002). But quite higher than the 2.00±0.06 % (fresh) and 3.83±0.06 % (sun dried) reported by Udofia (2006) for *Xanthosoma sagittifolium* cocoyam and 3.2 % for sun dried potato peel by Agwunobi (1995). The differences observed in the crude protein and crude fibre contents of this cocoyam (*Cytosperma chamissonis*) may partly be due to the genetic composition of this variety, season of harvest and partly due to the samples (raw sun dried and boiled sun dried) used for the analyses. Similarly, the ether extract value (0.41±0.66 %) obtained for the raw sun dried corms in this study was slightly higher than the 0.37 % reported by Agwunobi *et al.* (2002) for dasheen cocoyam, but quite higher than the 0.1 % reported for sun dried sweet potato by Agwunobi (1995). However, Udofia (2006) reported higher ether extract values of 0.83±0.06 % and 0.93±0.00 % for fresh and sun dried *Xanthosoma sagittifolium* cocoyam. The nitrogen free extract (NFE) or carbohydrate values of 74.31±0.05 % (raw sun dried corm) and 75.32±0.15 % (boiled sun dried corm) obtained in this study for swamp taro cocoyam were slightly lower than the 78.91 % value reported for sun dried *Xanthosoma sagittifolium* cocoyam by Udofia (2006). The variations observed among these fractions may be largely due to the types of samples (raw sun dried or boiled sun dried) used for the analyses; besides genetic composition of each variety, season of harvest and agronomic factors. However, the crude protein values of the fresh leaves (22.87±0.23 %) and dried leaves (6.53±0.23 %) of swamp taro cocoyam obtained in this study compared favourably with the values of fresh leaves

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# SWAMP TARO COCOYAM (*CYTOSPERMA CHAMISSONIS*) AS A POTENTIAL FEEDSTUFF FOR LIVESTOCK

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## ABSTRACT

A study was conducted to determine the nutritional potentials of some parts (corm and leaves) of swamp taro cocoyam (*Cytosperma chamissonis*) as a feed resource for livestock. The corm was prepared by washing in water before slicing into small pieces with sharp knife. The sliced corms were shared into two parts, one part sun dried for three days and the other part boiled and then sun dried for five days. Thereafter, the two parts were ground into powder separately with a mechanical blender, labeled and stored in different air-tight bottles. The leaves were washed, chopped into smaller pieces, sun dried, pulverized, labeled and stored. These stored samples were subjected to series of chemical analyses (proximate, phytochemical, mineral and vitamin determinations) to elucidate their chemical, toxicant, mineral and vitamin compositions. The results of proximate composition of the corm and leaves showed that the fresh leaves contained higher crude protein value (22.87±0.23 %), followed by raw sun dried corm (7.93±0.11 %). The fresh leaves also contained higher crude fibre (6.73±0.01 %) than either the raw sun dried corm (1.36±0.05 %) or boiled sun dried corm (1.15±0.01 %). The boiled sun dried corm had the highest nitrogen free extract (NFE) or carbohydrate value (75.32±0.15 %), followed by the raw sun dried corm (74.31±0.05 %) and the fresh leaves (69.00±0.26 %). The dried leaves had the lowest NFE value (61.04±0.20 %). The results also showed that the leaves were richer in iron, flavonoid and alkaloid than the corm. In the contrary, the corm contained higher levels of phytate than the leaves. The results of vitamin and mineral determinations showed that the cocoyam leaves contained higher levels of evaluated vitamins (vit. A, riboflavin, niacin, thiamin and vit. C) than the corm. Besides, the leaves contained higher levels of magnesium, copper, potassium and iron than the corm, while the reverse is true for calcium, zinc, sodium and manganese. The statistical analyses for proximate composition between the fresh and dried leaves were significant ($P<0.05$) for CP, CF, ether extract, total ash and NFE. The analyses for these same fractions were not significant ($P>0.05$) between the raw sun dried and boiled sun dried corms. The analyses for mineral composition between the fresh and dry leaves, and between the raw sun dried and boiled sun dried corms were significantly ($P<0.05$) different for Cu, Mg, K, Na and Fe, but not for Zn, Ca and Mn. The analyses for vitamin composition between the fresh and dry leaves, and between the raw sun dried and boiled sun dried corms were significantly ($P<0.05$) different for riboflavin and vit. C, but not for niacin, thiamin and vit. A. The results of this study are indicative that the leaves and corm of swamp taro cocoyam are promising feed resources for livestock. It is therefore recommended that greater emphasis be placed on the production of swamp taro cocoyam because of its numerous benefits.

**KEY WORDS:** Cocoyam, Nutritive, Phytochemical, Processing method

## INTRODUCTION

The ever increasing cost of livestock feed and the attendant increase in the cost of animal products such as meat, egg and milk calls for the exploration of the use of non-conventional feed ingredients in the feeding of the domestic animals (Ani and Omeje, 2007). The non-conventional feedstuff being considered in this study is swamp taro cocoyam meal. Swamp taro cocoyam (*Cytosperma chamissonis*) is a non-conventional feedstuff or plant food that provides readily available energy with easily digestible carbohydrate. The nutritional quality of swamp taro cocoyam compares favourably with cassava, potatoes and yam (Onwueme, 1987). The substitution of grains with roots and tubers is economical and roots have a great potential in many areas of the world as a major supplier of energy for animals (Emmanuel and Samuel, 2009).

Swamp taro cocoyam leaves are nutritious as are the corms which are regarded as a delicacy in some parts of Nigeria. Besides, cattle, sheep, goats and rabbits also enjoy swamp taro cocoyam leaves because of its high nutrient contents which can be compared to a pasture from well-cultivated legumes (Oyenuga, 1968). The high percentage of ash in the leaves is preferably responsible for their high palatability to livestock (Onwueme, 1982). In the southern part of Nigeria, the young leaves are taken as spinach. Both the leaves and petioles can be utilized as vegetables and are useful source of vitamin A and C (Agwunobi *et al*., 2002). The leaves are particularly useful as food for people with anemia, as they are rich in iron, folic acid and vitamin C which assist in iron assumption (Moi, 1979).

However, swamp taro cocoyam contains anti-nutritional factors which could be a limitation to its use (Okon *et al*., 2007). Some of the anti-nutritional factors

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