Cocoyam Production in Cameroon

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Abstract

Cameroon is a major producer of macabo *(Xanthosoma* spp.) and taro *(Colocasia* spp.), producing about one million tons in 1978. These are staples to many communities in the forest and western highland zones.

Some of the main ways of food preparation from these crops have been described.

Cocoyams, often the main component, are usually intercropped with maize and vegetables and are a catch crop to tree crops like palms, cocoa etc. The maize intercrop however, depresses the yield of macabo by as much as 41%.

Three varieties of macabo and clones from sixteen cultivars of taro have, so far, been identified.

Cocoyams respond to mineral nitrogenous and potassic fertilizers. Potash has suppressed root-rot disease of macabo. So also has shade, which, in addition has depressed macabo yields.

A protein content of over 200 kg/ha for macabo compares well with that for yams (Dioscorea spp.).

Introduction

The colloquial usage of the word "cocoyam" in Cameroon includes both genuses of the edible aroids, *Xanthosoma* spp. and *Colocasia* spp. The local name for *Xanthosoma sagittifolium* Schoot (in Donala and Bakweri dialects) is "macabo" and it is also the common name for this crop in most French-speaking countries. *Colocasia esculenta* (L) Schott is known locally (in the Bakweri dialect) as "Linde" but is generally referred to as taro in Franco-phone countries.

Cocoyams provide the staple food for most of the large communities in the southern forest zone where macabo dominates and in the western highlands, where taro is the main type cultivated.

Production. Exact tonnage production are not known but the figures made available by the Statistical Service of the Ministry of Agriculture and the projected targets of the 4th Five year Development Plan, shown in Table 1 indicate that, outside plantains *(Musa* spp.), root crops command the highest food tonnages and cocoyams were next to cassava in 1974/75 with just over 700,000 tons. Although ravaged during the last two years by the macabo root rot disease, the combined production of aroids in the current year is estimated to be over 900,000 tons. About 60% of this is macabo, supplied mainly by the forest zone.

This production, comes from small peasant holdings of about a quarter to a third of an hectare in size, usually intercropped. Most of the crop is consumed by the grower, with less than a third entering any trade at all, local or foreign. Some quantity of cocoyam is exported with other foodstuffs, to neighbouring Gabon in the south and the Central African Empire to the east.

Utilization and food preparation of macabo and taro. Cocoyam is a major staple in some communities in Cameroon as mentioned earlier and is *not* a femine crop resorted to when cereals and other food types fail, as in Ghana (Karikari; 1971) or other countries. The tuber, which is a secondary growth from the mother corm or rootstock, is used as a vegetable prepared in various ways and eaten with sauce. Both the corm and tubers are used in taro but the corm in macabo is used as animal feed and as planting material only. The tender leaves and flower and leaf buds of both aroids are used as a vegetable after steaming or cooking or as an ingredient of sauce, much like the "Kaloulou" of the West Indies.

The common vegetable dishes are:

- 'Nda sese – a sort of porridge resulting from boiling small pieces of peeled tuber mixed with palm oil, fish or meat, vegetable leaves, onions, salt and chilly pepper to taste.
- 'Ekwancoco' – a delicacy obtained by grating peeled tuber, mixing it with pieces of crayfish or meat, palm oil, salt, and pepper and tying into packets with vegetable leaves (sankey) or with plantain leaves (bible). The latter form can be preserved for days and is used while travelling.
- 'Esubaka' – also called "fufu", is the boiled peeled tuber of macabo pounded to a soft pulp in a mortar and eaten with sauce.
- 'Achu' – this is like fufu but is prepared from taro to a softer pulp and often mixed and pounded with boiled banana *(Musa* spp.). It is eaten with a special sauce made with palm oil and meat to which woodash filtrate or a little sodium or calcium carbonate has been added.

  During eating a depression is made in the achu mound in a plate and the sauce poured in it.
- 'Vembe' – is the local name of the special thick sauce prepared from the young leaves and buds of macabo and taro. It is regarded as a delicacy up to the West Indies.

  It is worthy to note the importance of the sauce- a rich and balanced preparation in the West African diet. Achu is often falsely despised as being based solely on carbohydrates by those who do not care to have a closer look at it.

  The cocoyam is finding more use in the modern African kitchen which is experimenting on the production of more recipes. Cakes, chips, puddings, etc. from cocoyam are becoming a reality.

Peasant cultivation practices. The cropping practices involved in cocoyam production are inter-related with those of other crops with which cocoyams are intercropped. All these are influenced by the ecological conditions and the eating patterns of producers. The following main cropping systems are the many practices that involve cocoyams:

Cocoyams as bi-annual inter-crop with vegetables. Macabo is the main crop that follows land clearing. It is planted in February/March when the rains start, with minimum or no soil tillage especially in the volcanic soils, using short hand hoes. Corn *(Zea mays)* and local vegetables *(Amaranthus* spp., huckle berries, gourds etc.) are intercropped through the macabo. Harvesting of tubers is by 'castration'. This means their extraction from the crom without pulling up the plant, leaving the immature tubers for harvest three to six months later. This continues for two to three years and avoids the problem of storage.

Cocoyams as an annual inter-cropped with vegetables. Macabo or taro are the main crop but are planted on mounds or interspersed beds and are harvested in November/ December (after 9 to 10 months) as the soil and climatic condition cannot support growth during the dry season.

The practice of burning crop residue and vegetative material which have been incorporated into beds ('ankara) often precedes planting. It has been known to increase yields but is detrimental to the soil structure.

After harvest, the land is either left under fallow or planted to coffee by the men who ask their wives (food growers) to go, further a field.

Cocoyams as a catch crop to perennials. It is usual to plant cocoyams as a catch crop under young cash crop like cocoa and palms. This association has been found beneficial to young palms and cocoa, but ends when the tree crops form a canopy.

Investigations

Research on cocoyams in Cameroon started since 1967 by the 'Institut de Recherches Agronomiques Tropicales and des Cultures Vivrieres (I.R.A.T) but was dropped four years later due to shortage of researchers. With the formation of the Cameroon National Root Crops Improvement Programmé three years ago cocoyams studies have resumed.

The following studies have been undertaken:

- Collection and screening of macabo and taro cultivars.
- Production and testing of clones.
- Growth studies,
- Agronomic investigations.

Under current investigation are the following lines of work:

- Further collection and screening of cultivars,
- Multi-locational agronomic studies,
- Macabo root rot disease studies (epidemiological studies and seedling production and screening).

Materials and Methods

A collection tour of growing areas was made and the material planted and screened in Dschang, Station (1,400 meters above sea level). Later, the collection was transferred to Bambui Station (1,300 meters) and enlarged. In 1975, it was extended to Ekona Station (600 meters).

Growth studies were undertaken at Dschang. They involved monthly samples from three months after planting, of two cultivars each of macabo and taro, one red, one white (in respect to tuber flesh colour) to study the number and weight of tubers and roots, the weight of aerial portion, the weight of the total plant and the evolution of crude proteins in *Xanthosoma* compared with two common species of *Dioscorea* yam, on dry matter basis.

Agronomic trials included varietal yield trials on macabo and taro, the responses to mixed fertilizers and to potash, the effect of shade and potash on root-rot disease and inter-cropping macabo with 3 sizes of maize varieties.

Plants were spaced one metre on ridges which were one metre apart, giving population density of 10,000 stands per hectare.

Results and Discussion

Varieties and cultivars of macabo *(Xanthosoma* spp.). Three main varieties of macabo, classified on the basis of the color of the tuber flesh, have been identified but the adual number of cultivars within each group has not yet been completely determined. These are:

- the *white* variety with green leaf sheaths, petioles and Lamina but with a white corm and cormel flesh:
- the *red* variety with varying shades of pink leaf sheaths and petioles and corm and tuber flesh pink to red in colour:
- the *yellow* variety with dark green sheaths and petioles: the leaves are dark green with a tinge of yellow on leaf veins; corm and cormel flesh is yellow. This variety is considered by some botanists to belong to a different species of macabo. It is a larger plant with a longer cycle of growth and yields heavier than the other two.

Clones of taro *(Colocasia* spp.)

Sixteen cultivars have been identified and clones produced from them. Their main characters are listed in Table 2.

Growth studies show rapid development between the third and sixth month for macabo, during which period the white variety gains about 2.5 kilograms while the smaller red variety increases by about 1.8 kg (Figure 1).

Feeder root development seems to reach a peak in the fifth month and declines while tuber growth takes over (Fig 1). Tuberisation, however, starts earlier by the third month.

The white variety yielded heavier than the smaller red variety (Fig. 2).

Taro growth seems to follow a similar pattern to macabo only that the plant is generally smaller, growth between the third and fifth months being 1.7 kgs for the red clone and 1.2 kg for the white (Fig. 5). Here, unlike macabo, the smaller white clone studied yielded more than the larger red one (Fig. 6).

In 1978, growth studies between macabo plants raised from mother corms and those from cormels (tubers) and, in either case, plants from apical or side buds, were compared. Plants from corms had an initial advantage of sprouting quicker and maintained this to maturity by producing a large number and weight of tubers per plant. (Figure III). Plants from apical buds developed faster and yielded more than those from side buds of the same type of planting material. There was, however, no appreciable difference between corms/side buds and cormels/apical buds. This trial is being repeated for confirmation.

Evolution of proteins of macabo compared with that of white yam *(Dioscorea rotundata)* and yellow yam *(Dioscorea cayenensis)* showed rapid protein formation between the sixth and eight month. A total of about 200 kgs/ha was obtained for macabo against 235 kg for white yam and 140 kgs for yellow yam.

Agronomic trials produced the following results: _
– optimum weight of planting sett for macabo is 400-500 grams.
– planting setts with apical buds (tops) produced more than those from side buds (tops) produced more than those from side buds (middles and bottoms)
– optimum planting density (spacing for macabo was 1 meter by 1 meter and that for taro is 1 meter x 66.7 cms giving 15,000 stands/ha.

Yields from 40,000 and 30,000 stands/ha were high but not economical in view of the extra planting material used. Yields are given in Table 3,

Macabo intercrops well with a variety of food crops if it is not unduely shaded. Although originally an under storey plant in the tropical forest it has adapted to sunshine which influences yield. Work on the effect of shade continues but preliminary results indicate yield reductions of more than 40% by shade of 50% light intensity. The shaded plants show better vegetative growth and appear to tolerate root rot disease more, but the diseased unshaded plants give a higher tuber yield.

Results of inter-cropping macabo with three maize varieties of different height, maturity duration and morphology, also indicate the effect of shade on macabo. The figures in Table 4 below show a depression of yield of macabo which increases with the size, and, therefore, the shading ability of maize variety.

Mixed fertilizer (NPK) trials showed a response to potash and nitrogen by macabo. Table 5 contains the yields of the top 5 treatments of mixed fertilizers compared with the control. All five proved profitable and all, except one with heavy dose of phosphorous, had return/cost ratio of over 3.

Note that the top two treatments contain potash and all but one have nitrogen. Other trials not reported here have confirmed the need for these two in most of our soils in Cameroon in which cocoyams are grown.

Three levels of potash fertilizer 200, 100 and 50 units/ha were applied to macabo. The times were 6, 14 and 22 weeks. One treatment received three applications, 4 treatments received 2 applications (early + middle or Middle + late) 6 treatments received one application (early, middle, or late).

A complimentary dose of 100 units/ha of phosphorus was applied at planting and of 200 units/ha of nitrogen split-applied thrice at the times already indicated.

Root-rot disease was scored in addition to recording the yield. Results are summarized in Table 6

The results show advantage of early application of potash to yield and the reduction of disease incidence.

Root-rot disease of macabo. Root-rot disease on macabo, similar to that reported by Posnette (1945) in Ghana, is now found in most growing areas of the crop in Cameroon and is causing a lot of devastation.

Work is now being undertaken by a pathologist provided by IITA Ibadan, with the funding of IDRC Canada and AGCD Belgium.

Preliminary studies on this disease indicate that potash fertilizer and shade reduce its incidence. The disease has been induced by infecting healthy material with inoculum obtained from diseased plants and is shown by table 7

Note that although the healthy material was eventually completely attacked, its yield was better than the rest because the disease came late to it.

Problems of cocoyam cultivation. The constraints to cocoyam production in Cameroon which needs attention by researchers are:

– the control of root-rot disease of macabo by breeding for resistance in addition to other measures.

- physiological studies to understand growth/yield relationships.
- the reduction of the bulk and weight of planting materials.
- the establishment and maintenance of proper germ-plasm collection.
- storage, marketing and reduction of post-harvest losses as production expands.

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Table 1. Food Production and Projected Annual Increase in Cameroon (in Metric Tons)

	1967 & 1968	1974/1975	Projected 1980/1981	% Annual Increase
1. Millet and Sorghum	480,000	306,900	500,000	8.5
2. Maize	258,000	307,000	500,000	8.5
3. Rice (paddy)	17,000	24,000	1000,00	30.0
4. Wheat	–	–	30,000	–
5. Cassava	668,000	746,000	1,000,000	5.0
6. Cocoyams (Xanthosoma spp and Colacasia spp)	380,000	705,000	900,000	4.25
7. Yams	167,300	454,000	1,324,000	19.5
8. Sweet Potatoes	60,000	74,000	296,000	9.2
9. Solanum Potatoes	16,590	62,326	200,000	21.5
10 Banana Plantains	954,000	1,143,000	2,600,000	14.7
11. Beans	53,460	80,000	90,900	1.86
12. Local Vegetables	108,160	238,000	276,000	2.65
13. Imported Vegetables	18,000	50,400	120,800	15.6
14. Gourds (melon pumpjins etc)	–	45,800	76,000	8.8
15. Groundnuts (con-exported)	–	129,000	173,000	5.0

Table 2. Clones of Taro from Cameroon Cultivars

No. No.	Origin lowland (L) highland (H)	Description	Height range (cms)	Yield Range tons/ha (tubers and corms)
Ta 1	Alobzack	Dark green leaf, red petiole	80–100	15–17
Ta 2	Mungo (L)	Large, pale green leaf yellow petiole	110–120	13–15
Ta 3	Dschang (H)	green leaf and petiole small plant	70–90	13–14
Ta 4	Bafou (H)	Dark green, leaf and petiole spreading	60–70	14–16
Ta 5	Bafou (H)	Green leaf, light pink petiole	60–70	13–14
T6	Bafou (H)	Green leaf, green petiole pink at leaf junction	75–85	14–15
T7	Dschang (H)	Very green, red mark at petiole joint, spreading plant	40–50	17–18 (acceptable tuber)
T8	Dschang (H)	Dark green, red petiole	80–90	14–15
T9	Manjo (L)	Small plant green	60–70	12–14
T10	Dschang (H)	Greenish yellow	60–70	10–12
T11	Manjo (L)	Large plant, greenish yellow	100–120	14–16
T12	Dschang (H)	Dark green, red slender petiole	80–100	12–13
T13	Manjo (L)	Small plant, dark green	60–70	10–12
T14	Nkambe (L)	Av. plant pale green	90–100	17–20
T22	Dschang (H)	Large plant green but dark red point of petiole insertion	120–150	17–18
T24	Dschang (H)	Violet green, red petiole	80–100	10–12

Table 3. Spacing and Yield of Taro (sole crop)

Treatment (Spacing)	Population density/ha	Yield (Corms and Cormels) mt/ha.
50 cm x 50 cm	40,000	21.2
30 cm x 66.7 cm	30,000	21.0
50 cm x 100 cm	20,000	17.9
66.7 cm x 100 cm	15,000	16.7
100 cm x 100 cm	10,000	14.8
100 cm x 200 cm	5,000	9.1

% (of Variability = 12.7
Sig. diff. 5% – 1.87 tons

Table 4. Macabo yield depression by maize intercrop.

		Maize Varieties	
	Local (early, small)	Coca (medium)	290 (large, late)
Maize yield (mt/ha)	2.9	3.8	5.9
Macabo yield (mt/ha)	17.6	16.9	10.3
Production per stand of Macabo	2.0	1.8	1.2

Table 5. Response of macabo to mixed fertilizers.

(units/ha	Yield mt/ha	% Increase over control	Cost of fert. + application (1000 franes CFA)	Extra per hectare (1000 franes CFA)	Return/ Cost Ratio
P100 + K240	25.9	54.1	20.0	73.2	3.7
N100 + K240	25.1	49.4	18.0	75.0	4.0
N100 + KO	24.3	44.6	8.8	66.2	7.5
N100 + P200	23.7	41.0	23.8	45.2	1.9
N50 + P100	22.4	33.3	11.9	45.1	3.8
NO PO KO	16.8	–	–	–	–

Table 6. The effect of potash fertilizer on yield and root-rot disease of macabo.

K_2O Treatment (unit/ha)					% Disease Score	Tuber Yield (mt/ha)
6 weeks		14 weeks		22 weeks		
0		200		0	7.1	19.4
50	+	100	+	50	11.7	18.3
100	+	100		0	11.7	17.3
0	+	100	+	100	20.8	16.2
100		0		0	31.4	15.9
50	+	50		0	18.1	15.6
200		0		0	34.8	15.3
0		100		0	14.0	15.2
0		50	+	50	25.7	15.2
0		0		200	65.5	12.9
0		0		0	56.4	11.9

G.M. 15.6 + /ha
Coef. of variability 13.63%
Std. Error $\pm$ 0.865 ton/ha.
LSD 5% = 2.4 +/ha.

Table 7. The effect of root-rot inoculum on macabo.

Treatment	Disease (%) (90 days)	Score % (150 days)	Score % (210 days)	Score % at harvest	Yield mt/ha cormels
Healthy material and diseased mixed	18.7	27.5	33.3	100	6.4
Healthy material innoculated	13.3	24.1	46.6	100	6.1
Healthy material	3.3	4.1	4.5	100	13.9
Diseased materials	15.0	21.6	45.8	100	6.1

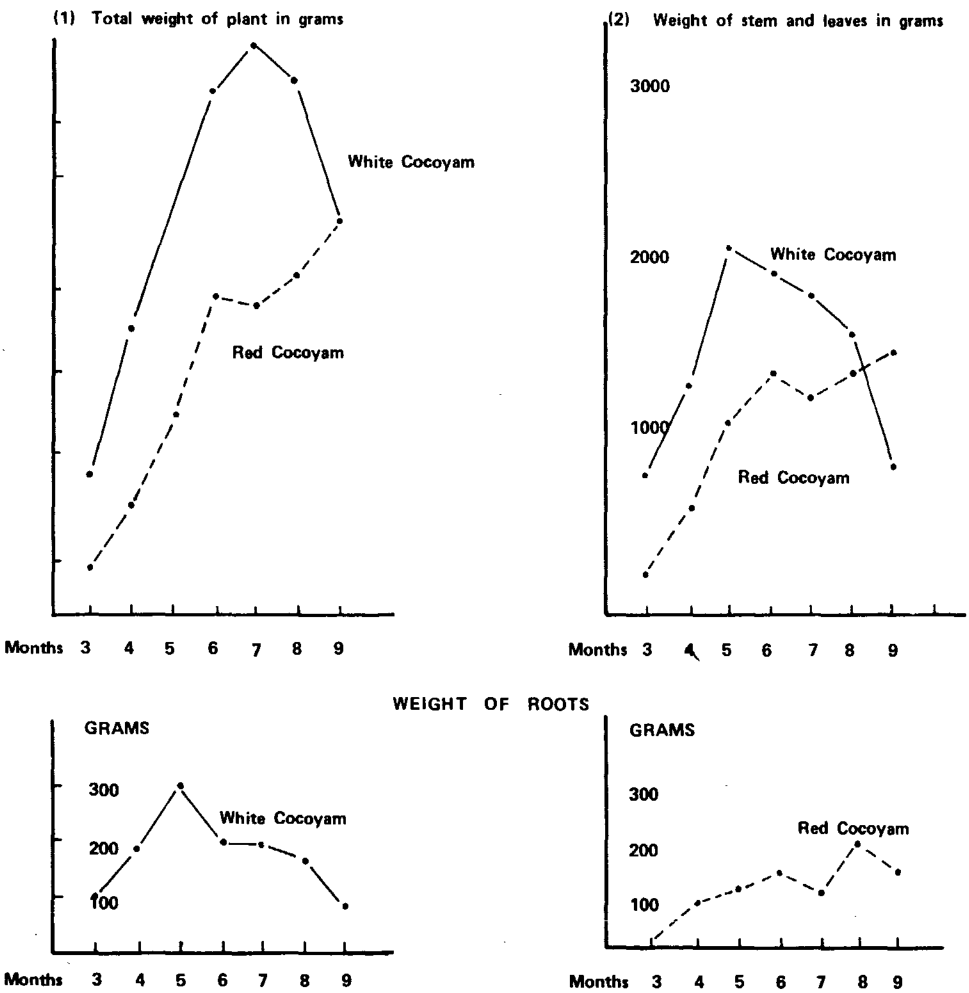

Figure 1. Macabo *(Xanthosoma)* growth studies (1981)

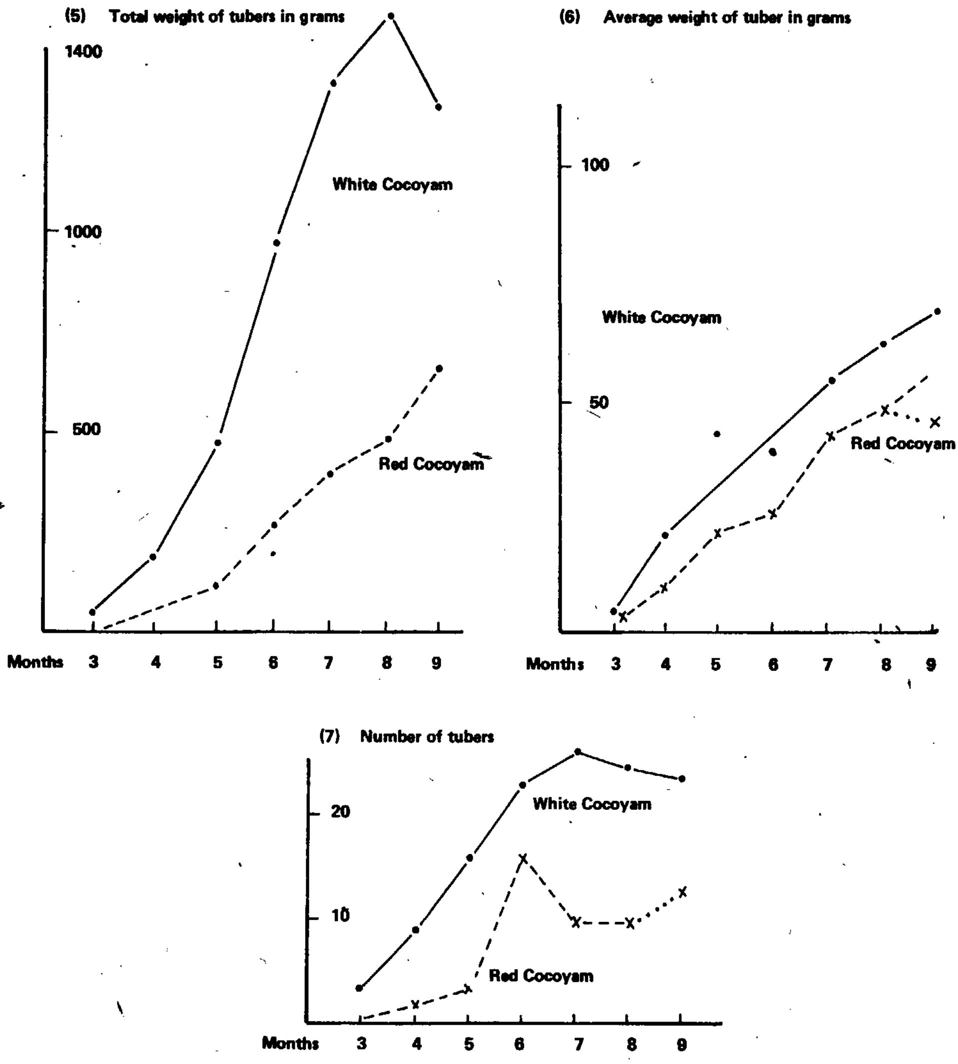

Fig. 2. Macabo *(Xanthosoma)* growth studies (1968)

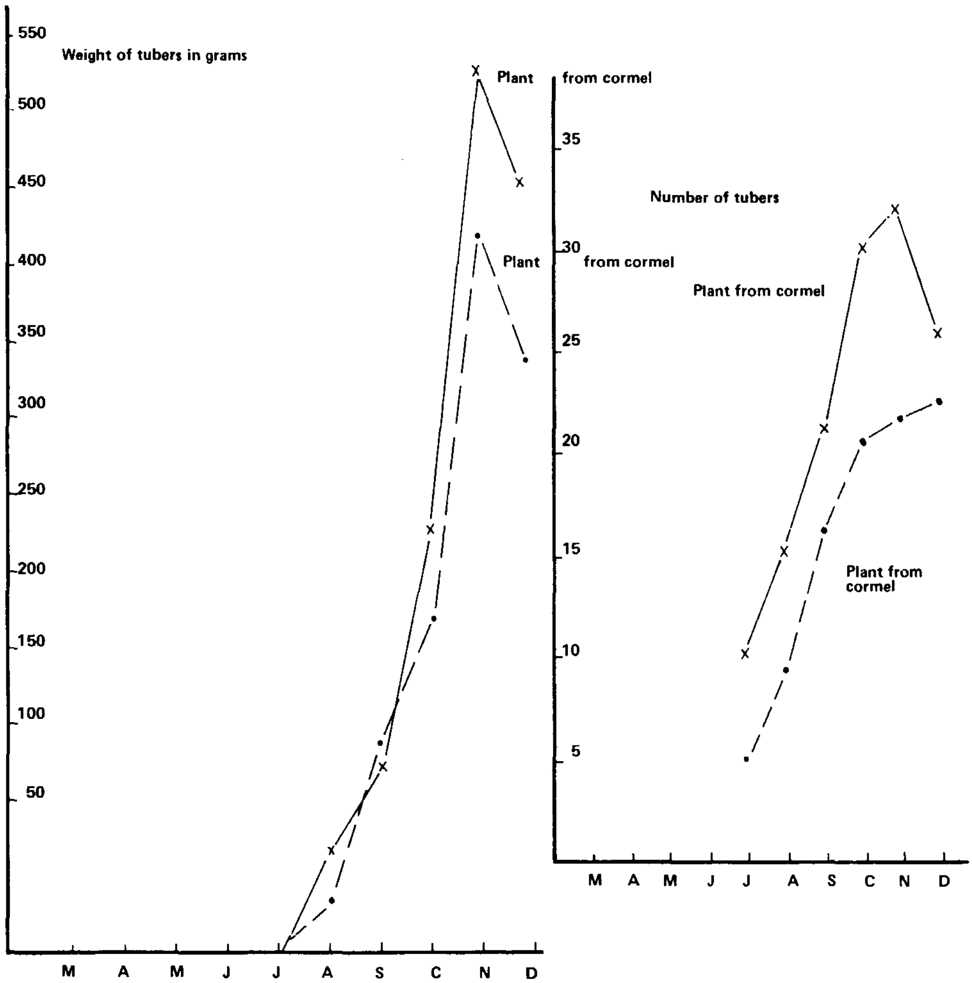

Figure 3. Macabo *(Xanthosoma)* growth studies 1978

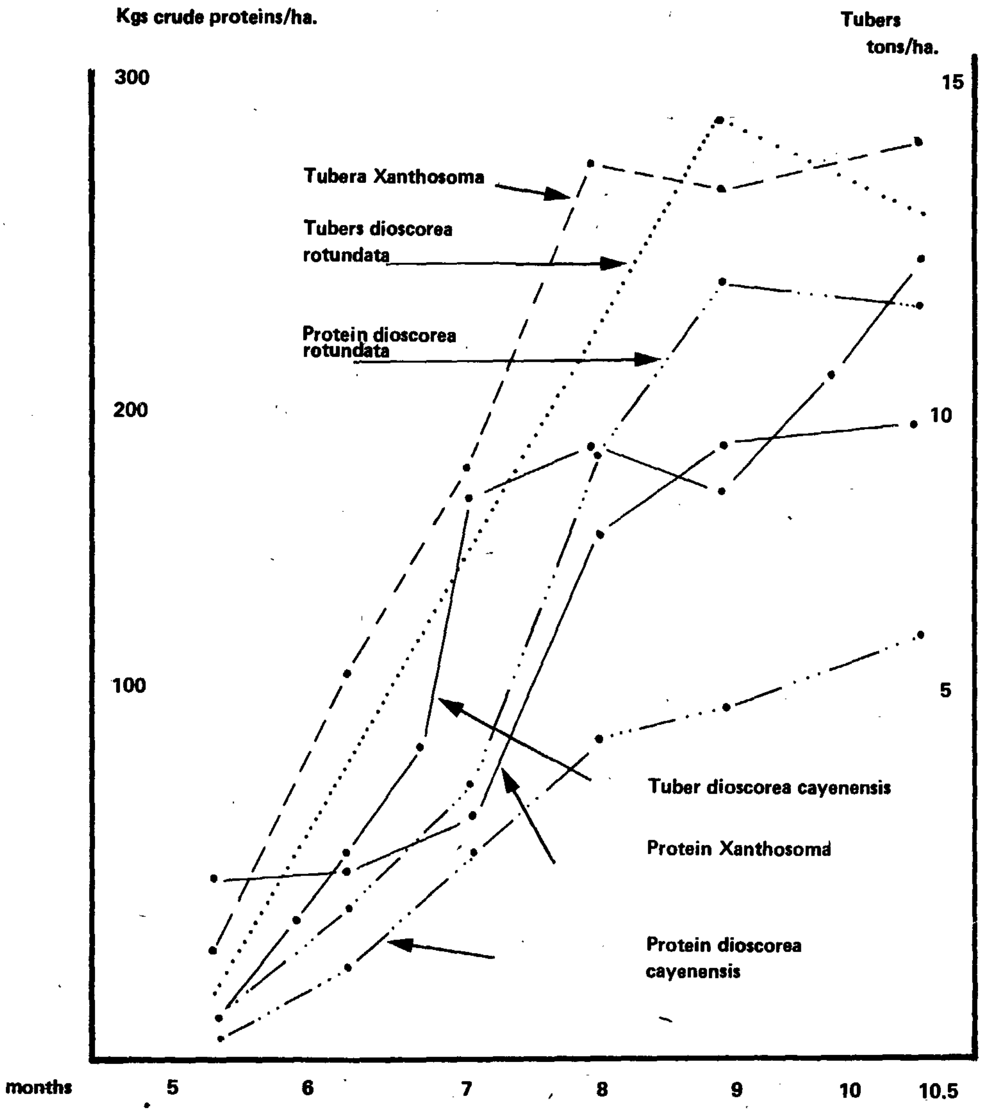

Fig. 4. Evolution of crude proteins per hectare (xanthosoma compared with two yam species)

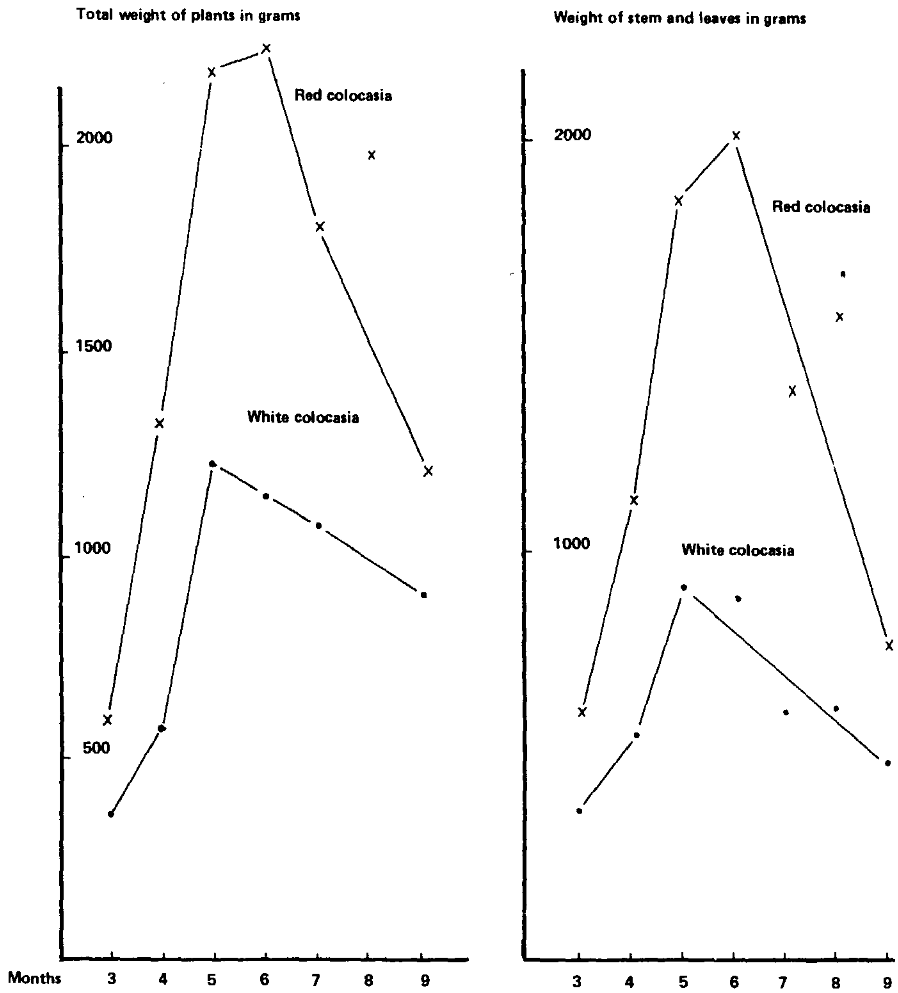

Figure 5. Colocasia growth studies (1968)

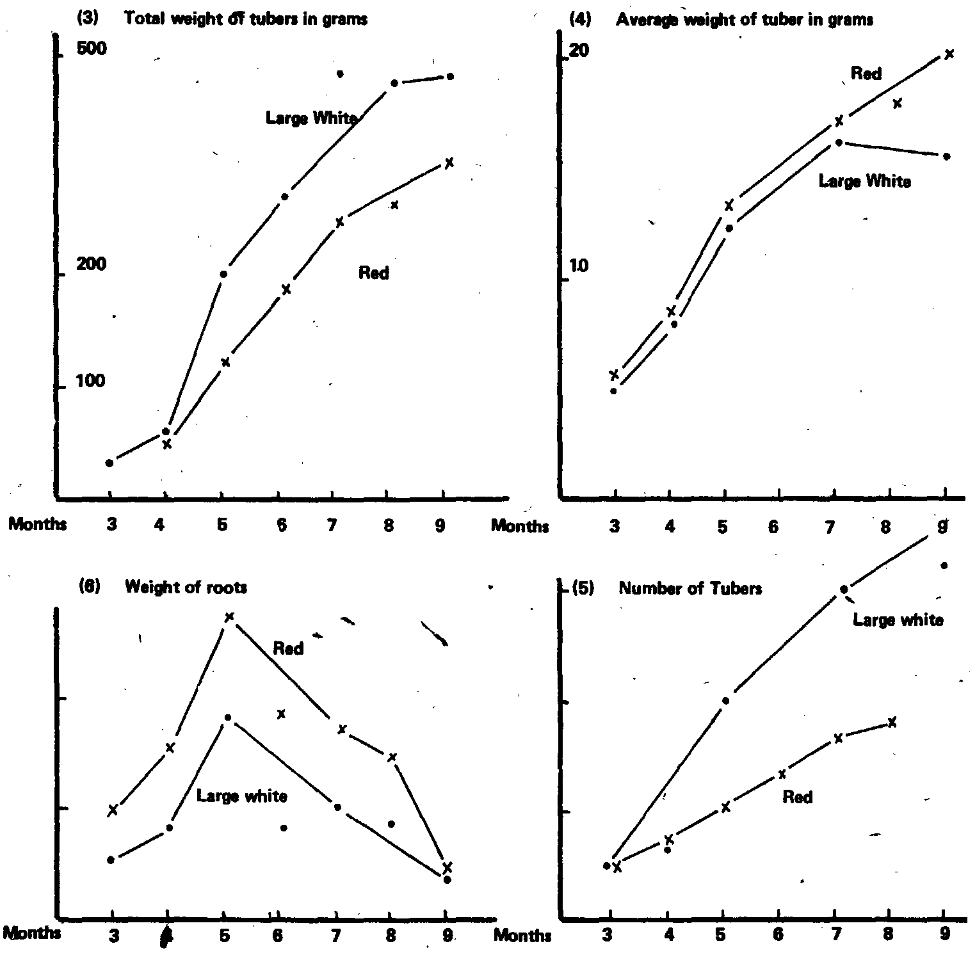

Figure 6. Colocasia growth studies (1968)