Tropical Root Crops

Production and Uses in Africa

Proceedings of the International Symposium of the International Society for Root Crops —

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TROPICAL ROOT CROPS: PRODUCTION AND USES IN AFRICA
ABSTRACT

A mixture of original research, updates on procedures, literature reviews, and survey reports, this document resulted from the second symposium of the International Society for Tropical Root Crops — Africa Branch, with 77 participants from 16 countries. The focus was cassava, yams, cocoyams, and sweet potatoes, from the perspectives of breeders, agronomists, soil specialists, plant pathologists, entomologists, nutritionists, food technologists, etc. Learning from past successes and failures, many of the researchers directed their efforts toward problems obstructing progress in reaching improved production and use of root crops and attempted to view, realistically, the context in which their results would be applied.

RéSUMÉ

Résultats de recherches récentes, mises à jour sur les méthodes de recherche, revues de publications et rapports de sondages sont contenus dans ce document issu du Deuxième symposium de la Société internationale pour les plantes-racines tropicales — Direction Afrique, qui a réuni 77 participants de 16 pays. Des communications sur le manioc, le taro, le yam et la patate douce ont été présentées par des phytosélecteurs, des agronomes, des pédologues, des phytopathologistes, des entomologistes et des spécialistes de la nutrition et des aliments, entre autres. Tirant leçon de leurs succès et de leurs échecs, beaucoup de ces chercheurs ont dirigé leurs efforts vers la solution des problèmes qui entravent l’augmentation de la production et de la consommation des plantes-racines et ont tenté de considérer d’un œil réaliste le contexte qui sera celui de l’application de leurs recherches.

Resumen

Una mezcla de investigaciones originales, actualizaciones de procedimientos, reseñas de literatura e informes de encuestas, este documento es el resultado del segundo simposio de la Sociedad Internacional de Raíces Tropicales, Filial Africana, que contó con 77 participantes de 16 países. El simposio se centró en la yuca, el yam, el cocoyam y las batatas, desde la perspectiva de los fitomejoradores, los agrónomos, los especialistas en suelos, los patólogos vegetales, los entomólogos, los nutricionistas, los tecnólogos alimenticios, etc. A partir de los éxitos y fracasos anteriores, muchos de los investigadores encaminaron sus esfuerzos hacia los problemas que obstaculizan el avance para lograr una producción y un uso mejorados de las raíces y trataron de obtener una visión realista del contexto en que los resultados pueden ser aplicados.
TROPICAL ROOT CROPS: PRODUCTION AND USES IN AFRICA

EDITORS: E.R. TERRY, E.V. DOKU, O.B. ARENE, AND N.M. MAHUNGU

PROCEEDINGS OF THE SECOND TRIENNIAL SYMPOSIUM OF THE INTERNATIONAL SOCIETY FOR TROPICAL ROOT CROPS — AFRICA BRANCH HELD IN DOUALA, CAMEROON, 14 – 19 AUGUST 1983
## CONTENTS

**Foreword** ................................................................. 9

**Participants** ............................................................... 11

**Official addresses**
Opening address *Nkaifon Perfura* .......................... 15
Presidential address *Bede N. Okigbo* ....................... 16
Closing address *Nkaifon Perfura* ......................... 17

**Introduction**
Production potentials of major tropical root and tuber crops *E.V. Doku* 19
Potential utilization of major root crops, with special emphasis on human, animal, and industrial uses *D.G. Coursey* .................. 25

**Cassava**
Genetic parameters of cassava *N.M. Mahungu, H.R. Chheda, S.K. Hahn, and C.A. Fatokun* .......................... 37
Evaluation of cassava clones for leaf production in Zaire *N.B. Lutaladio* 41
Cassava screening in Rwanda *J. Mulindangabo* .................. 45
Effect of variety and planting time on the yield of cassava in Malawi *R.F. Nembozanga Sauti* .................. 49
Response of cassava to fertilizers and town refuse under continuous cropping *S.O. Odurukwe and U.I. Oji* ................. 51
Rapid multiplication of cassava by direct planting *M.T. Dahniya and S.N. Kallon* .................. 53
Effects of shade, nitrogen, and potassium on cassava *I.N. Kasele, S.K. Hahn, C.O. Oputa, and P.N. Vine* .................. 55
Weed interference in cassava—maize intercrop in the rain forest of Nigeria *Ray P.A. Unamma and L.S.O. Ene* .................. 59
Crop performance in complex mixtures: melon and okra in cassava—maize mixture *J.E.G. Ikeorgu, T.A.T. Wahua, and H.C. Ezumah* .................. 63
Soil-conserving techniques in cassava and yam production *P.N. Vine, O.B. Ajayi, D.M. Mitchozounou, E.J. Hounkpatin, and T. Hounkpevi* .................. 67
Factors limiting cassava production among peasants in Lukangu, Zaire *Kilumba Ndayi* .................. 71
Epidemiology of anthracnose in cassava *C. Makambila* .................. 73
Cassava yield losses from brown leaf spot induced by *Cercosporidium henningsii* J.M. Teri, P.W. Mtkwa, and D. Mshana ........................................ 79
Susceptibility of cassava to *Colletotrichum manihotis* Muimba-Kankolongo A., M.O. Adeniji, and E.R. Terry ......................................................... 82
*Borassidiplodia* stem rot of cassava and methods of selecting varieties for resistance G.W. Otim-Nape ................................................................. 86
Distribution and severity of cassava mosaic in the Congo R. Massala .................................................................................................................. 89
The cassava mealybug front hypothesis: role of indigenous natural enemies K.M. Lema, R.D. Hennessey, and H.R. Herren ........................................ 90
Comparative bioecology of two coccinellids, predators of the cassava mealybug, in the Congo G. Fabres and A. Kiyindou ........................................ 93
Effects of fertilizer application on postembryonic development and reproduction of the cassava mealybug K.M. Lema and N.M. Mahungu .............................................................. 97
Control of the cassava green mite in Uganda B. Odongo and G. W. Otim-Nape ......................................................................................................... 101
Studies on the nutrient content of yellow-pigmented cassava O. Safo-Kantanka, P. Aboagye, S.A. Amartey, and J.H. Oldham ......................................................... 103
Microbial breakdown of linamarin in fermenting cassava pulp M.A.N. Ejiofor and Nduka Okafor ............................................................... 105
Performance of a cassava peeling machine P.M. Nwokedi ........................................ 108
An improved technique of processing cassava fufu Festus A. Numfor ........................................ 111
Cassava-based diets for rabbits R.T. Fomunyam, A.A. Adegbola, and O.L. Oke ..................................................................................................................... 114
Effects of cassava meal on the hatchability of chicken eggs D.A. Ngoka, E.C. Chike, A.B. Awoniyi, T. Enyinnia, and S.O. Odurukwe ........................................ 117

**Yams**

In-vitro culture of *Dioscorea rotundata* embryos C.E.A. Okezie, F.I.O. Nwoke, and S.N.C. Okonkwo ......................................................... 121
Economic indices for clonal selection and breeding of yams O.O. Okoli, J.U. Nwokoye, and C.C. Udugwu ......................................................... 125
Seed-yam production M.N. Alvarez and S.K. Hahn ........................................ 129
Natural antifungal compounds from the peel of yam tubers S.K. Ogundana, D.T. Coxon, and C. Dennis ........................................ 133
Optimal time for fertilization of *Dioscorea rotundata* S.C.O. Nwinyi ........................................ 136
Effects of staking on tuber yield of three cultivars of trifoliate yam S.N. Lyonga and J.T. Ambe ......................................................... 138
Effect of time of staking on the development of anthracnose disease of water yam A.O. Nwankiti and I.U. Ahiara ........................................ 140
Thermodynamics applied to the storage of yam tubers Godson O. Osuji 143
Root-knot susceptibility of crops grown with yam in Nigeria U.G. Atu and R.O. Ogbiuje ........................................ 147
Effects of cover plants on root-knot nematode population U.G. Atu and R.O. Ogbiuje ........................................ 149
Survival of *Botryodiplodia theobromae* in yam tissues B.I. Aderiye and S.K. Ogundana ........................................ 151
Variability in the chemical composition of yams grown in Cameroon
  T. Agbor Egbe and S. Treche ........................................ 153
Mineral content of yam tubers: raw, boiled, and as flour A. Bell ...... 157
Introduction of flour from Dioscorea dumetorum in a rural area
  G. Martin, S. Treche, L. Noubi, T. Agbor Egbe, and
  S. Gwangwa’a .......................................................... 161

Cocoyams, Sweet Potatoes, and Others
In-vitro methods for cocoyam improvement E. Acheampong and
  G.G. Henshaw ............................................................. 165
Production of hybrid Xanthosoma sagittifolium and test for resistance to
  Pythium myriotylum A. Agueguia and S. Nzietchueng ............... 169
Growth and development of Colocasia and Xanthosoma spp. under
  upland conditions M.C. Igbokwe .................................... 172
Effects of water-table depth on cocoyam B.S. Ghuman and R. Lal ... 175
Intercropping cocoyams with plantain: effects on the yield and disease of
cocoyams M.C. Igbokwe, O.B. Arene, T.C. Ndubuizu, and
  E.E. Umana ............................................................... 182
Root rot of Xanthosoma sagittifolium caused by Pythium myriotylum
  in Cameroon Samuel Nzietchueng .................................... 185
Sweet-potato production potential in Rwanda G. Ndamage ............. 189
Comportment studies with sweet potatoes in the highland zone of
  Cameroon S.N. Lyonga and J.A. Ayuk-Takem .......................... 192
Effects of vesicular-arbuscular mycorrhizae, temperature,
  and phosphorus on Fusarium wilt of sweet potato J.M. Ngeve and
  R.W. Roncadori ......................................................... 197
On-farm trials as a link between research and technology transfer
  H.J. Pfeiffer ............................................................. 203
Plantain in root-crop farming systems S.K. Karikari ................... 206

References ................................................................. 209

Abstracts
Yellow-pigmented cassava revisited K.A. Oduro .......................... 229
Distribution and utilization of cassava in Malawi R.F. Nembozanga Sauti 229
Can cassava productivity be raised in Zambia? N. Hrishi .............. 230
Prospects for developing new white yam varieties M.O. Akoroda ....... 230
Extension of root-crops technology to African farmers T. Enyinnia,
  H.E. Okereke, and D.A. Ngoka ...................................... 231
GROWTH AND DEVELOPMENT OF COLOCASIA AND XANTHOSOMA SPP. UNDER UPLAND CONDITIONS

M.C. IGBOKWE

Dry-matter accumulation by the different parts of cocoyams, Xanthosoma sagittifolium and Colocasia esculenta, was studied for 2 years (1980–81) under the upland conditions at Umudike, Nigeria. Sprouting started within 2 weeks after planting and was almost completed by 4 weeks. Leaf production, especially for X. sagittifolium, was slow in the first 6 weeks but, thereafter, increased rapidly, reaching a maximum at 16–20 weeks after planting. Leaf-area index was also maximum at this time. Cormel bulking was noticed as early as 8 weeks but became prominent at about 12 weeks. Maximal development of corms and cormels was achieved in C. esculenta at 22–26 weeks and in X. sagittifolium at about 26 weeks. At this period, leaf dry matter and leaf-area index were minimal, and cormel production accounted for 40–70% of the total tuber yield. Prolonging the duration of maximal foliation (to beyond 20 weeks after planting) would considerably increase the yield of Nigerian cocoyams.

Several workers have studied growth and development of yams (Sobulo 1972a; Njoku et al. 1973; Okezie et al. 1981; cassava (Enyi 1972b; CIAT 1980); potatoes (Ihenwe and Allen 1978); and sweet potatoes (Scott 1950; Wilson and Lowe 1973; Enyi 1977b). Similar studies on cocoyams have been mainly limited to wetland or irrigated conditions such as in Hawaii where the crop could last for up to 15 months (Plucknett and de la Peña 1971). Sivan (1980) studied Colocasia esculenta in the upland conditions in Fiji where cocoyams grow for up to 12 months. Lyonga (1978) summarized cocoyam growth studies in Cameroon based on monthly samples taken from 3 months after planting at Dschang.

My work was intended as a supplement to Lyonga’s work — a study of the accumulation of dry matter by the different parts of both Xanthosoma and Colocasia spp. under the upland conditions in Nigeria, where growth rarely continues after about 7 months.

RESULTS AND DISCUSSION

Three major stages of growth were identified for cocoyams based on this study (Fig. 1). The first stage was from planting of the cormel to about 8 weeks later. Sprouting started after 2 weeks, reached 30–74% a week later, and was 76–91% at 4 weeks after planting. This stage was characterized mainly by emergence and growth of roots and leaves. Mean number of roots was 40 and 30 for Colocasia and Xanthosoma respectively, whereas mean root length was 27.4 and 17.9 cm. Growth, especially of the leaves, was slow — perhaps, as Onwueme (1978) suggested,
because growth was dependent on the nutrient reserves in the planted sett.

The second stage (about 8–24 weeks after planting) was marked by rapid production and growth of the leaves, which reached a maximum by 16–20 weeks (Fig. 2, Table 1); new corms (evident by 8 weeks and rapidly increasing after 10 weeks) developed very rapidly until 22–24 weeks (Fig. 2).

In other words, during this stage, the leaves, corms, and cormels were all developing rapidly. Sivan (1980) observed similar behaviour in Fiji and termed it “synchronous.” The ratio of tops to corms (plus cormels) during this stage was 2 : 0.2.

The final stage lasted from 25 weeks to harvest and was characterized by a general senescence of the plant. The decline in leaf production started at about 20 weeks and the corms and cormels increased little after 24–26 weeks. Cormels detached and resown at this stage easily sprouted. Leaf-area index was very low (0.24–0.30) by this period (Table 1) and partly accounted for the low ratio (< 0.10) of tops/corms (plus cormels).

![Graph of dry-matter yields of Xanthosoma and Colocasia](image1)

**Fig. 1.** Dry-matter yields of Xanthosoma and Colocasia in 1980 in relation to time from planting.

![Graph of corms, cormels, and leaves of cocoyams](image2)

**Fig. 2.** Number of corms, cormels, and leaves of cocoyams in relation to age, 1981.

<table>
<thead>
<tr>
<th>Weeks from planting (1980)</th>
<th>Leaf area (cm²/stand)</th>
<th>Leaf-area index</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Colocasia</strong></td>
<td><strong>Xanthosoma</strong></td>
</tr>
<tr>
<td></td>
<td><strong>Leaf</strong></td>
<td><strong>Leaf</strong></td>
</tr>
<tr>
<td>8</td>
<td>1343.3</td>
<td>357.0</td>
</tr>
<tr>
<td>10</td>
<td>3170.7</td>
<td>2627.4</td>
</tr>
<tr>
<td>12</td>
<td>4313.6</td>
<td>3187.6</td>
</tr>
<tr>
<td>14</td>
<td>7619.2</td>
<td>4841.5</td>
</tr>
<tr>
<td>18</td>
<td>14267.1</td>
<td>9334.3</td>
</tr>
<tr>
<td>20</td>
<td>2898.0</td>
<td>6959.8</td>
</tr>
<tr>
<td>22</td>
<td>1624.6</td>
<td>4866.1</td>
</tr>
<tr>
<td>24</td>
<td>4526.4</td>
<td>4973.1</td>
</tr>
<tr>
<td>26</td>
<td>1775.4</td>
<td>1609.4</td>
</tr>
</tbody>
</table>

|                           | **Colocasia**         | **Xanthosoma** |
|                           | **Leaf**              | **Leaf**       |
| 8                         | 0.22                  | 0.06           |
| 10                        | 0.53                  | 0.44           |
| 12                        | 0.72                  | 0.53           |
| 14                        | 1.27                  | 0.81           |
| 18                        | 2.38                  | 1.56           |
| 20                        | 0.48                  | 1.16           |
| 22                        | 0.75                  | 0.83           |
| 24                        | 0.75                  | 0.83           |
| 26                        | 0.30                  | 0.24           |

Table 1. Leaf area and leaf-area index of cocoyams in relation to planting time.
Cocoyam is similar to yam in that dry matter accumulates in the aerial parts (vines, leaves, and flowers) at a maximum about 16–20 weeks after planting (Okoli 1980). However, in some species of yams (*Dioscorea alata* and *D. esculenta*), storage-organ development occurs after maximal canopy production (10–13 weeks). Unamma (1981) showed that *D. rotundata* started to form tubers as early as 8 weeks, corresponding to the time corm bulking was observed in this study. Corm bulking proceeds as fast as leaf development and eventually supersedes leaf production. In yams, rapid tuber bulking starts after the attainment of maximal leaf area.

The rapid decline in leaf area after maximal foliation contrasted sharply with results for cocoyams under flooded or irrigated conditions (Plucknett and de la Peña 1971), in which leaf area increased from planting to 24 weeks and declined slowly (Sivan 1980).

Under the upland conditions in Nigeria, maximal leaf area is low and lasts not more than 2–3 weeks. This partly explains the low yields (5–7 t/ha) obtained by farmers, especially on acid-sand soils. Yields could be improved markedly by irrigation and soil amendment to ensure leaf area remains at a maximum for the whole of the second growth stage.

The Director, National Root Crops Research Institute, Umudike, granted me permission to publish this paper. The help rendered by O.B. Arene, J.C. Ognonnya, and C. Iruke was much appreciated.