

# ***Wild Plants for Medicinal and Culinary Use: Nigeria***

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## **Summary**

A survey conducted among farmers in southwestern Nigeria revealed the local medicinal values and culinary uses of an indigenous plant called *Crassocephalum bialfræ* (*C. bialfræ*). Over 18 months, farmers from the eight states in southwestern Nigeria were surveyed to discover how the plant was being used. During this period, samples of two biotypes of this plant were collected for a greenhouse study on propagation using the stem cuttings and seeds as well as a chemical analysis of the plant. In this study, *C. bialfræ*, which was raised from stem cuttings, branches and canopy spread, was compared to those raised from seeds. The study discovered that the nutrient contents for the two treatments did not differ significantly.

A key finding is that stem/vine cutting is the best planting material for the propagation of *C. bialfræ* and that the nutrient contents compare favorably with the cultivated species. Preliminary investigations have revealed that the vegetable is rich in nutrients while the ethnobotanical survey showed that farmers use the juice extract from fresh leaves to stop bleeding caused by injury and illness.

The innovative aspect of the research is that it is the first time an attempt has been made to propagate *C. bialfræ* in southwestern Nigeria where people traditionally have eaten it as a vegetable and used it for medicinal purposes. A review of the literature indicates that information is lacking on deliberate cultivation of *C. bialfræ*. This study therefore represents pioneer research on the propagation of this plant as a food and medicinal product.

## **Background and Justification**

In the past, *C. bialfræ* was prevalent in the markets of southwestern Nigeria. Women, in particular, gathered the vegetable on a regular basis. Despite its local popularity, there was no record on propagation practices for *C. bialfræ* before this study.

Today *C. bialfræ* is an endangered species threatened with extinction. Farmers have made little effort to prevent the loss of this high premium leaf vegetable. That is because farmers have focused their attention on exotic leaf vegetables that are less nutritious but have attracted more attention from the scientific community.

In southwestern Nigeria, farmers use seeds and stems as propagules. However, for the cultivation of vegetables, farmers prefer the use of seeds. For example, *Solanum macrocarpon*, *Celosia argentea*, *Cochorus olitorius* and *Amaranthus cruentus* are major leaf vegetables that are cultivated with seeds only. This study shows that *C. bialfræ* produces flowers after one year of cultivation and it takes another three months for the seeds to mature.

The study addressed the need to formulate detailed agronomic practices for *C. bialfræ*. The need to determine the best planting material was a crucial first step. Then it was necessary to access the nutrient contents of the plant material to justify cultivating the plant on a commercial basis.

The preliminary study revealed that the viability of the seeds (1.5%) is poor. Such low viability is not encouraging to farmers in southwestern Nigeria, especially when considering the use of stem cuttings taken from semi-hard portion produced a 100% survival rate. Better branching and spread and higher leaf yields would make *C. bialfræ* more acceptable to farmers. For this study, the use of stem cuttings 10 cm long has been established to be the best for propagating *C. bialfræ*. The nutritional content of the plant was not changed by the planting materials used. Much research still needs to be done on other agronomic practices for this novel vegetable.

## Description

During the survey, the seeds and semi-hard stem cuttings were collected from the wild. Seed samples were dried before planting in a nursery greenhouse. The seeds were raised in the nursery because of the low germination rate (1.5%). Stem cuttings were 10 cm long. Plastic buckets used in the greenhouse were 20 cm in diameter and 30 cm in height, and were perforated and filled with fertile topsoil. Only one stand was planted in each bucket. Watering was done in three-day intervals. The treatments constituted the seed/stem cuttings.

The experiment was a randomized design of four replicates. As growth progressed, data was collected on weekly basis on such agronomic traits as leaf number, branch number, canopy spread, stem-length growth rate, flower number, and seed number. Three months after planting, succulent leaves grew on the plants. Each bucket was harvested, washed, bagged separately and then oven dried at 70°C for 72 hours. Thereafter, samples were analyzed for iron, calcium, phosphorus, ash, dry matter, ether extract, nitrogen free extract, crude fiber and crude protein content.

Strict monitoring of the experiment was ensured. All measurements were collected at the appropriate time using reliable instruments. Changes in length and height were measured using graduated rulers. Stem growth was assessed using the micrometer screw gauge while chemical analysis was carried out using the appropriate methods.

The study showed that the two variants of *C. biafrae* compare favorably in terms of growth, leaf yields and nutrient composition. For example, phosphorus, iron and calcium levels were about the same in red and green stem variants. The nutrient composition and leaf yields also compared favorably with the species routinely cultivated in southwestern Nigeria. In fact, the *C. biafrae* is richer (Ca and CP) and better leaf-yielding than the *Amaranthus cruentus* and *Celosia argentea* that are routinely cultivated in the region. The study also showed that stem cutting significantly out yielded seed propagated plants. Leaf yield is the primary goal of any cultivated vegetable, and, as shown in this study, leaf yields obtained through stem cutting is the best propagule for *C. biafrae* husbandry.

The study also notes that *C. biafrae* thrives well in cacao and kolanut plantations because of its need for moist soil. Such an environment is no longer readily available in southwestern Nigeria because of industrialization and the neglect of cacao farms. An important finding of this study shows that *C. biafrae* can be grown outside cacao and kolanut plantations. However, efforts have not yet been made to compare the leaf yields in cacao plantation with the plants raised in the greenhouse.

## Partnerships

For 17 years, Nigerian universities were handicapped by economic sanctions imposed by the West on Nigeria's military regime. Today, however, a growing network of scientific cooperation is taking hold domestically and internationally, especially with institutions in Europe and America. Now that Nigeria has re-established a democratic political framework, many in the Nigerian scientific community hope that international agencies and foreign universities and research institutes will collaborate with Nigeria on a variety of developmental projects.

Obafemi Awolowo University in Ile-Ife, Nigeria, and the research group that has been established at its department of plant sciences, will benefit from collaboration with other centers focusing on biodiversity and conservation of plant genetic resources in Nigeria. The main areas of collaboration will be training, staff exchange, research visits, postdoctoral fellowship and short course participation in its faculty of agriculture.

Currently, a relationship has been established with Folu Dania Ogbe, department of botany at the University of Benin, Nigeria, for such exchanges.

Internationally, plans for collaboration and sharing of the results with other organizations have already been established. In Denmark, contacts have been established for collaboration at the Danish Institute of Agricultural Sciences. Within Nigeria, collaboration has been established at the department of pharmacognosy at Awolowo University, a World Health Organization (WHO) Collaborating Center. The drug research and production unit also are collaborating on the medicinal aspects of this plant to study the mechanism of its action and examine the possibility of developing it for clinical use.

## Replicability

Most developing countries have weak economies and many of their citizens live in impoverished rural areas. Families often cannot pay for milk, egg and meat. Many farmers in Nigeria will find the cultivation of *C. biafrae* with its high nutrient value using stem cuttings to be a welcome venture. The crop will also provide an additional source of revenue for vegetable sellers, especially for women. More importantly, efforts to cultivate this high premium plant will prevent loss of genetic diversity and help conserve the resource base in Nigeria. Ultimately, consumption of *C. biafrae* as a vegetable can also assist in solving malnutrition-related diseases in developing countries.

The policy implications are great. In many countries, efforts are being made to establish agencies that are concerned with the conservation of genetic diversity. In Nigeria, for example, the Federal Environmental Protection Agency (FEPA) has made conservation of biodiversity a major policy initiative. The World Wide Fund for Nature (WWF) is pursuing the same objective. The United Nations University (UNU) and the International Foundation for Science (IFS) have displayed interest in the conservation of plant diversity as well.

The Nigerian government should encourage efforts to curb the loss of genetic diversity by focusing, for example, on propagating such novel and high premium crops as *C. biafrae*, as well as by helping to educate citizens on the nutritional and medicinal values of this plant. To achieve these goals, the horticultural units of the Ministry of Agriculture in Nigeria should be strengthened with qualified personnel both in research and education.

## Patenting and Commercialization

The main objective of the study has been to help Nigerians understand and appreciate the economic potential and health benefits of the use and cultivation of green leafy vegetables that are indigenous to many areas in the country.

Patenting and commercialization were not the primary objectives. However, additional development of this project would likely lead to such ventures.

## Lessons Learned

This project, is the first attempt to initiate local studies on the propagation and domestication of the traditional plant, *C. biafrae*. Before this project, there were no institutional frameworks on the conservation of plant genetic resources in southwestern Nigeria.

The study highlights the importance of protecting and maintaining the region's biodiversity. Research showed that most traditional leaf vegetables that were easily obtained in southwestern Nigeria in the late 1960s and early 1970s were no longer available for harvest in the 1990s. Scientists at Obafemi Awolowo University fear that many traditional plants may eventually become extinct. This concern is well founded. Research into the flora of southwestern Nigeria indicates a lack of information on the domestication, propagation and cultivation of some traditional leaf vegetables that have long been part of everyday life for most locals in this area. Without such information, traditional leaf vegetables can and have become extinct, especially when new agricultural practices are adopted.

During the initial 18-month implementation period, the total cost of the project was US\$2,300. A US\$1,800 contribution received from the Nigerian government and a personal contribution of US\$500 funded the work. Additional financial contributions to date include a personal contribution of US\$1,450, a university contribution of US\$1,800 and a UNU/INRA donation of US\$12,000 for a total of US\$15,250. With this sum, field assistants were hired but many resigned once they failed to be compensated for the job they were doing.

Field surveys represented an important part of the study because the information obtained from them revealed the current uses of such traditional plants as *C. biafrae*. These surveys were scheduled for the weekends because researchers taught on the weekdays. A bus or car was needed to reach distant areas of southwestern Nigeria but only public transportation was possible given budgetary constraints. The ability to overcome such transportation challenges is a major testament to the commitment and determination of the research crew.

Other obstacles added to the challenges faced by the research crew. Language barriers limited the number of interviews. In southwestern Nigeria, there are many different dialects of the primary language, Yoruba. Field assistants needed to understand dialects from a particular region to understand respondents. Interpreters were hired and a small honoraria was paid. A second major obstacle was illiteracy. About 90% of the farmers in the area surveyed are illiterate. This made the job of filling out the questionnaire by the field assistants and researcher painfully slow. The third obstacle was pockets of communal wars in different parts of southwestern Nigeria. The states of Edo and Delta in the Niger delta were omitted from the survey because of armed conflicts in these regions. Barring a peace agreement, there is no way of overcoming this problem. A fourth obstacle was personal circumstances of the field researchers. Salaries were inadequate to cover such basic expenses as food and travel. The only time available to conduct the study was during the weekends due to work commitments. These factors led to a great deal of stress among project participants, accounting for a high turnover rate.

To insure the growth of the study, a number of changes must be considered.

Public awareness must be heightened through print and electronic media. Transportation for field researchers must be improved to insure that all study areas are examined in an efficient and safe manner. Salaries for field assistants must be sufficient to maintain a steady workforce. The primary researcher should obtain a short leave from the university to do a thorough job. Finally, more lab equipment is needed to conduct in-depth analyses of plant materials.

### **Problems Faced**

There were many obstacles faced during the study, including lack of financial support and lack of equipment. Funds provided by Obafemi Awolowo University for the initial investigations were insufficient to complete the research. All investigations on agronomic details currently have been suspended because of the lack of funds. Lack of funds has also hampered such projects as the stem cuttings on local farms during the initial stage of the research.

### **Impact**

The advantages of developing propagation techniques for *C. biafrae* are compelling. The cultivation is compatible with the environment. The practice does not require any agrochemical that may release toxic components into the environment, and, as a result, does not affect the health of the soil. In addition, the plant, *C. biafrae*, does not leave any dangerous residue after harvesting. During propagation, no foreign component is used. Organic fertilizers are the only additive used by farmers or housewives.

*C. biafrae* is rich in nutrients and can be a money-earning crop for farmers. A project like this one could help promote sustainable development in the third world generally and Nigeria in particular. A reasonable level of consumer demand for this vegetable already exists in southwestern Nigeria. A combination of research and development intervention to support a marketing system could make this vegetable even more appealing to urban population in Nigeria.

The initial study of producing *C. biafrae* indicates that it can be sustained over the long term. The plant can be harvested several times a year due to its rapid rate of regeneration from the stem. Several stem cuttings can be made without much cost and distributed to farmers for propagation. The practice can easily be passed on to farmers through extension services, cooperative projects and media campaigns. Each farmer or farm family can raise the vegetable from stem cuttings that are available locally. No foreign component or input is required, and the stem cutting provides the opportunity for uniformity. This combination of factors makes the practice sustainable.

### **Future Plans**

The ideal circumstances that would foster additional research are an atmosphere of peace in which surveys could be administered without fear of attack and physical harm. Such an atmosphere would also raise the prospects for adequate funding for supplies and equipment.

Though some factors are beyond the researcher's control, others are more easily attainable. For example, to broaden the success of the initial study, Obafemi Awolowo University, in collaboration with the faculty of pharmacy, plans a leaf vegetable conservation garden that will include representatives of all

the traditional leaf vegetables available in southwestern Nigeria. Materials for studies on propagation and other aspects of the plants will be obtained from work in this garden. The university also intends to equip its analytical laboratory to help meet international standards.

Efforts are now underway to assess the use of stem cuttings for propagating *C. biafrae* on local farms. This will mark the starting point in the popularization process. Three farmers have been identified in Ile-Ife district — Kajola, Ajebandele and Fasina — where the preliminary on-farm evaluation is expected to take place.

To attract funds from external sources, evidence derived from previous work done should be convincing, well argued and tailored to meet the need of communities. Scientific researchers should manage the funds judiciously and produce a product that educates as well as outlines strategies for potential economic growth.

To meet these challenges, the publication of a pictorial book on the traditional leaf vegetables of southwestern Nigeria is planned. This book will contain information on nearly all aspects of the traditional leaf vegetables. It is hoped that the most important funding institutions, such as Third World Academy of Sciences (TWAS), United Nations University/IRA (UNU/IRA) & International Foundation for Science (IFS) and the Nigerian government, will support this effort.

Plans for further improvement and expansion of the project are ongoing. Investigations into the practice of growing *C. biafrae* are to be augmented through several studies. A group of studies, for example, will focus on the effects of certain changes on plant productivity, including the effect of stem cutting size, spacing, cutting/harvesting height, organic fertilizers on the plant. Another study is designed to observe in more detail seed viability and dormancy. A study on how *C. biafrae* effects bleeding is of great interest, and an assessment of its viability as a suitable medicine in emergency care should be pursued.

The overall promotion of *C. biafrae* to facilitate its medicinal and vegetable use should be studied. A breeding and selection program for nutrient content improvement should be carried out with specific observations focusing on potential soil fertility improvements, weed suppression/allelopathy, and resistance to pests and diseases. Plans for patenting and commercialization of this plant will likely be initiated as more data becomes available.

### **Implementing Institution**

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