
THE MARKET POTENTIAL FOR BAMBARA GROUNDNUT

**FRI/NRI/DFID PROJECT ON
MARKETING AND PROCESSING OF BAMBARA (W. AFRICA)**

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1. INTRODUCTION AND BACKGROUND

1.1 Purpose and Structure of the Study

The main objective of this study is to try and assess the production and commercial potential of bambara groundnut. The study is divided into six sections. This introductory section provides background information on the origins of this study and on various aspects of bambara groundnuts and their production. The second section briefly reviews the research methodology used and the very limited data sources that are available for analysis. A third section provides broad estimates and discussion of global, regional and country production, along with a discussion of the major constraints to production. A fourth section discusses the various ways in which bambara is processed and consumed. The fifth section reviews marketing structures and methods and contains limited data on market size, prices and exports. The concluding section summarises some of the major findings of the previous sections and makes some recommendations as regards possible strategies to be pursued to expand production and markets.

1.2 Bambara in Africa

Bambara groundnut [*Vigna subterranea* (L.) Verdc.] is something of an enigma. It is grown widely throughout Africa but is largely unknown outside the continent. It is produced on smallholdings, predominantly by women as a subsistence food crop, and over recent years production appears to have been in decline. Over the past century a substantial body of scientific literature has been built up dealing with such aspects as its agronomy, physiology, entomology, and plant breeding. This literature refers to the attractive qualities of this legume, namely its tolerance of drought; the ability to grow in poor soils and semi-arid conditions often unsuitable for other legumes; its low fat content (5-6%) but rich source of protein (16-22% DM) and carbohydrates (42-60%); its resistance to pests and diseases; and its nitrogen fixing ability which helps to increase soil fertility, without recourse to expensive fertilisers. However, there has been very limited discussion of the commercial aspects of bambara, probably because of its dominant use as a subsistence food alongside the fact that it is grown predominantly by women and consumed by some of the poorest members of the population. Thus to quote Prof. Azam-Ali:

“such crops suffer the triple penalty of a sceptical research network, a disinterested industry and a disenfranchised agricultural community” (Azam-Ali 1996 p.11).

In a similar vein, Doku (1996) states that:

“ It is a paradox that an indigenous African crop, which produces an almost completely balanced food, is one of the most drought tolerant, easy to cultivate crops, which makes very little demand, if at all, on the soil should be so relegated in its own countries....”.

However, when the effort and time required to process bambara is considered, together with the large quantities of water and fuel that are needed, alongside the fact

that very little research has been undertaken on improving cultivation and yields, then the gradual decline in production is perhaps not so paradoxical. According to Dr C.J. Swanevelder (1998):

" It is one of the most important crops in Africa, but because of pod losses during harvesting, superstition and traditional preferences the market is undersupplied."

1.3 Background to the Study

This study forms part of the first phase of a project being funded by the Department of International Development's (DFID) Crop Post Harvest Research Programme (CPHP). The overall project title is "Improvement in the storage and marketing quality of legumes (2nd phase): marketing and processing of bambara groundnuts" and is lead by Dr Plahar, Director of the Food Research Institute (FRI) in Accra, Ghana and Dr Peter Golob of the Natural Resources Institute (NRI), Chatham, Kent, UK.

The previous project had investigated the qualitative and quantitative losses arising in the storage of cowpea and bambara by small-scale producers (Project R6503 Improvement in the storage and marketing quality of legumes). The research showed that bambara losses at farm level were relatively light, although damage to stored bambara could be severe once it entered the marketing chain. Farmers were mainly concerned with the processing of bambara, which was an important factor discouraging production. The first project was not mandated to investigate the processing constraints and hence the major objective of this second FRI/NRI project is to contribute to reversing the apparent decline in bambara by modifying existing processing practices or introducing new technology that facilitates cooking, currently an arduous task, by significantly reducing the time involved. The production of a cost-effective method will then be subjected to limited testing in villages using Participatory Rapid Appraisal (PRA) approaches to ensure it meets the socio-developmental criteria of producers and their communities. If a cost-effective and socially acceptable solution cannot be developed by the end of the first phase the project will be terminated.

In addition, as part of the first phase of the project it is important to assess the production potential of bambara in Ghana and other African countries to determine the feasibility of both local and global marketing opportunities. If a viable improved bambara cooking technology could be developed this could be used in other African bambara producing countries, especially in southern Africa. For example, in Zimbabwe most bambara is consumed fresh within a month of harvest and the market for dried bambara appears limited. A new technology could stimulate an increase in production for a dried product that could be easily stored and processed. An aim of this market study is to try to identify possible opportunities for countries to increase output.

Alongside the FRI/NRI project, the CPHP is funding a related project lead by Prof. Azam-Ali of the University of Nottingham UK, which is investigating the factors affecting the processing and increased utilisation of bambara groundnut in southern

Africa, specifically in Zimbabwe and Swaziland. The report from this project should be completed in the second half of 2000.

1.4 What are Bambara Groundnuts?

Bambara is an annual legume, related to cowpea, and botanically known as *Vigna subterranea* (L) Verdc. There are two botanical varieties namely *V. subterranea* var. *spontanea*, which includes the wild varieties, and *V. subterranea* var. *subterranea* which includes the cultivated varieties (Swanevelder 1998). Although the term bambara groundnut is commonly used in the literature various other names are used such as *aboboi* and *akyii* (Ghana) the *nyimo bean* (Zimbabwe) or the *jugo bean* in South Africa. Invariably each language has its own name or variation on a name, and Kay (1979 p.17) contains a list of other indigenous names.

Bambara is like the more common groundnut, forming pods and seeds on or just below the surface. The pod is small (1.5 cm long), round or slightly oval shaped and wrinkled and contains mostly one or sometimes two seeds. The beans/seeds are round (up to 1.5 cm diameter), smooth and when dried, very hard and they come in a range of colours including white, cream, brown, red, black and mottled. Bambara takes 1-2 weeks to germinate. Pod and seed development takes place approximately 4 to 7 weeks after fertilisation and takes place on or below the soil surface. The pod develops first, after approximately 4 weeks, followed by the seed after a further 10 days. Yields vary widely ranging from 50 kg/ha to 3,500 kg/ha being recorded in the literature - with the latter being achieved only in controlled experiments. Yields in Africa are typically low, ranging between 300-800 kg/ha (EU n.d.). Current estimates in Ghana and Zimbabwe suggest yields are low, averaging below 500 kg/ha. A variety of factors have been cited for the low yields including lack of improved cultivars, poor soils, inappropriate crop management, the amount and distribution of rainfall and pests and diseases.

The plant is indigenous to tropical Africa but is now found in Asia, parts of Australia and Latin America. The crop can be cultivated up to 1 600 m above sea level and does well on poor soil, which is low in nutrients. Sandy loam soils are preferred, with the crop growing poorly on calcareous soil. An average day temperature of 20 to 28 °C and widespread rain (6-7 cm) during the growing season are ideal. Too much rain during harvesting can damage the crop.

Planting dates vary according to location, thus in southern Africa planting is undertaken in October - November with harvesting in March or April, while in western Africa planting is in June/July with harvesting in September/October. The use of irrigation in Zimbabwe has led to new crop coming onto the market as early as January. If an international market were to develop for bambara, then the existence of different harvesting periods would permit more year round sourcing and less market disruption arising from a poor harvest in one or two origins.

Harvesting is by hand and the methods of processing are relatively simple, with the canning of bambara being the most sophisticated method used. Bambara can be cultivated singly or with other crops. Invariably in Ghana it is inter-cropped with groundnuts, while in southern Africa it is usually intercropped with babala, sorghum,

maize and tuberous crops. It is usually planted after maize in commercial production systems.

As yet, diseases and pests do not appear to be a problem during cultivation, although various viruses and fungi have caused problems. Bambara beans are either not treated or on occasions some control measures are used to protect the bean in storage. Farmers do not appear to use conventional insecticides to protect the bean. In Ghana the bean is sometimes treated with the dried leaves of a labiate weed known locally as "kim kim" (*Synidrella nodiflora*), also treatment may be through a mixture of ash and dipping the bean into a boiled water-based infusion of "kim kim", or in water with shea butter, which is grown extensively in northern Ghana.

2. RESEARCH METHODOLOGY AND SOURCES OF DATA

The small scale of both bambara production and marketing considerably limit the scope for the application of economic analysis and market research to bambara. In comparison with other legumes, namely groundnuts and cowpeas, and certainly in comparison with a large number of other food crops, there is scant information available on the production and marketing of bambara groundnuts. Invariably neither governments nor any other bodies regularly collect data on either production or trade. The only exception appears to be Zimbabwe, where estimates are made relating both to the type of areas and production systems in which bambara is grown, and Togo. Although bambara has a trade classification number (0713.3390), it is not separately specified in trade statistics. This reflects both the low volume of international trade in bambara and the fact that when it is traded internationally it is invariably informal (unrecorded) cross-border trade.

Although no official data were available, extension officials in the Ministry of Agriculture in northern Ghana had some knowledge of the crop and were able to provide some advice on production techniques. In contrast, Agritex in Zimbabwe did not appear to provide support or promotion for the crop. Meanwhile some NGO's such as the Intermediate Technology Development Group, and its related organisations, have some involvement with the crop. This includes efforts to characterise the germplasm, improve crop management techniques and develop marketing links.

One source of information has been the International Bambara Groundnut Network (BAMNET), which over the past decade has refocused attention on bambara and has stimulated research particularly on plant physiology, agronomy and germplasm acquisition. However, other than the occasional price and production data there has been very limited data available on the markets for bambara. Nevertheless, various organisations such as the European Union and IPGRI have recognised the need to rejuvenate the crop by supporting various research programmes, which have tended to focus on three broad areas: namely environmental ovulation of reproductive development; germination and seedling growth; and growth, biomass accumulation and adaptation to drought (Sesay, et al., 1996)

The BAMNET meeting, held in December 1998, recognised the paucity of information concerning post-harvest issues and its members saw the necessity of

concentrating on the issues of processing, marketing, information and communication as well as crop improvement and breeding (Begemann, BAMNET Newsletter 19/10/98).

Over the past decade, it does appear that there has been growing international interest in bambara. BAMNET the bambara information exchange network is playing an increasingly important role in this since it facilitates greater contact between individual researchers (and organisations), many of whom are working in countries where R & D activities in relatively minor crops have been substantially reduced because of cutbacks in government expenditures. In addition, the fact that bambara is a minor crop produced by poor women on marginal lands limits the pressure that these people can exert on government. Moreover, most of the research to date has been undertaken in isolated under-funded laboratories and field stations with very little co-ordination or structure. The pooling of information through the Internet is helping to create a critical mass of information. Nevertheless, almost all the companies contacted that traded internationally in edible nuts and related products had not even heard of the bambara groundnut!

Production and trade estimates were obtained from both interviews and from literature searches, including gray literature. Nevertheless, the output, trade and price estimates contained in this study have to be treated with considerable caution, in part because of the subsistence nature of much of bambara production and thus the very limited volumes entering trade. Attempts to estimate likely potential production capacities are even more difficult, if not impossible. These will depend on a range of factors which are difficult to quantify including land availability and suitability, bambara's competitive advantage with other crops, trends in market demand and prices, and the ability to improve the processing of bambara.

3. BAMBARA PRODUCTION

3.1 Production Areas and Volumes

While bambara groundnuts are grown in Africa, Asia and, to a much lesser extent, Latin America, global production is dominated by sub-Saharan Africa, where it is widely grown, particularly in west and southern Africa. However, production is usually undertaken on very small scattered plots, which restricts the ability to collect data. Production is predominantly for subsistence, with women dominating the production, processing and marketing processes. Bambara is invariably the third most important legume produced in a country after groundnut (*Arachis hypogaea*) and cowpea (*Vigna unguiculata*). It is seen as having several advantages including its ability to grow on poor soils in relatively arid conditions and that it is nutritionally superior to other legumes as well as being a preferred food crop for many local people (Linnemann, 1990; Brough and Azam-Ali, 1992).

The small numbers of global estimates on bambara production vary widely. Thus, FAO estimates, based on the returns from each country, place annual global output during the 1990s at between 40,000 to 50,000 tonnes (FAO production estimates). However this is likely to be an under-estimate. Coudert (1984) estimated world

production at 330,000 tonnes of which West Africa accounted for 45-50%. He ranked the crop third among the pulses grown in West Africa after groundnut and cowpea. According to Linneman (1987) and Duke (1981) the most important producers in Africa were:

Nigeria	50,000 - 100,000 tonnes per year
Niger	12,000 - 30,000
Mali	35,000 - 65,000
Burkina Faso	20,000
Togo	8,000
Ghana	15,000 - 20,000
Cote d'Ivoire	7,000
Chad	15,000 - 20,000
Benin	4,000

While production has been recorded in Asia (including Indonesia, India, Sri Lanka, the Philippines and Malaysia), Australia and some Latin American countries, the only known production estimates relate to African countries.

3.2 West Africa

Burkina Faso

Bambara is grown in all the regions of Burkina Faso predominantly as a subsistence crop. Production was estimated at approximately 20,000 tonnes in the late 1980s compared with 75,000 t for cowpea and 160,000 t for groundnuts. Bambara is intercropped with cereals but on poorer soils it is grown as a single crop. Most

Ghana

Three decades ago, according to Doku and Karikari, (1971) bambara was ranked as the second most important grain legume in Ghana, after cowpea. The 1970 Agricultural Census said there were 28,700 ha of bambara in the Upper Region and only 2,800 ha in rest of the country. While cowpea production has increased since then, production of bambara appears to have fallen. For many years, according to Doku (1996), production and utilisation was slightly ahead of cowpea, but the introduction of high yielding cowpea varieties and improved methods of pest control led to the neglect of bambara. Nevertheless, people like the flavour, preferring it to cowpea.

Average annual production of bambara in 1987-89 was estimated at 90,000 tonnes (compared with 210,000 tonnes for cowpea) with the bulk of production being undertaken in the three northern regions of Ghana - namely Northern, Upper West and Upper East - (Tran et al 1999). Production is entirely by smallholders, and there are an estimated 410,000 smallholders in the region.

Discussions held in ten villages visited in the Northern and Upper East regions

suggest that bambara is widely grown throughout the northern region, predominantly by women. No improved varieties of bambara appeared to have been developed neither does there appear to any classified varieties with farmer using seed testa colour and pattern to distinguish between the range of cultivars grown.¹ The use of traditional varieties combined with planting on poor soils meant that yields were invariably low. Production by the vast majority of producers does not exceed a few bags of 50-60 kg each per year. There are one or two larger commercial producers, but their annual output did not exceed 100 bags (c 5 tonnes). Wide variations in yields were quoted and one need to differentiate between shelled and unshelled production per hectare. Quoted yields ranged between 350 to 800 kg/ha with most quotes closer to the smaller level.

In northern Ghana bambara is planted in July and harvested at the beginning of the dry season, usually in September/October and even November. The grain is either eaten fresh or dried and stored usually on farm. Later sections of the report discuss processing and the ranges of uses (Section 4) as well as marketing and prices (Section 5). The range of uses includes direct consumption as food in the grower's household as well as for seed for next year's crop; traditional gifts for weddings or funerals or for sale.

Nigeria

Northeastern Nigeria and northern Cameroon are thought to be the centre of origin of bambara groundnut (Heller et al 1997 p5). Production in the early 1970s was estimated at around 100,000 tonnes but production has fallen significantly since then. One factor behind the decline has been drought. While production in northern Nigeria has fallen substantially it is reported that output in the southern and forest zones has increased. The crop is primarily cultivated for subsistence purposes although a certain proportion enters the market.

Sierra Leone

There is a strong tradition of growing bambara as a pulse crop in the four northern districts of Sierra Leone. It is grown both as a subsistence crop and as a cash crop. While women producers are in the majority, it would appear that in some areas men also grow bambara. Production appears to have fallen in recent years because of a lack of seeds, a lack of ready markets and the on-going civil war (EU nd).

Togo

While the crop is known and cultivated in Togo, output is lower than cowpea, groundnut and soybean. As in much of Africa, it is a marginal crop grown by women for subsistence purposes on marginal land. Official statistics suggest 8,510 hectares were cultivated in 1994, mainly in the Savannah and Kara regions, producing 4,403 tonnes. The data covering the period 1982 to 1994 show wide variations in acreage ranging from a peak of 10,400 ha in 1985 producing almost 6,000 tonnes to only

¹ For details of the qualities of the various bambara varieties grown in Ghana see Tran (1999) pp. 38-41.

2,800 hectares in 1988 and production of 1,255 tonnes (Heller et al 1997 p60). An estimated 80% of the crop is consumed locally.

3.3 Southern Africa

Botswana

Botswana both produces and imports bambara. However, production is estimated to be low at less than 500 tonnes and it is intercropped with other products (Heller et al 1997). It is grown for subsistence purposes as well as a cash crop. Yields appear to be very low in part because of drought (EU nd).

South Africa

According to Swanevelder (1998) production in South Africa is confined to the Northern Province and KwaZulu-Natal, as well as neighbouring Swaziland. It is widely grown by small-scale farmers and in Mpumalanga it is the second most important food legume and the third most important food crop (after maize and groundnut) grown by the smallholder farmers. It is cultivated both as an intercrop with maize, cowpeas and melons and as a sole crop. The size of bambara plots range from 300 to 2,500 m²/farmer. It is mainly used for human consumption and is eaten in the fresh and dried and cooked forms.

Swaziland²

Production of bambara in Swaziland appears to be declining in part because of land availability and rainfall patterns. Nevertheless, a recent survey (Sesay, Kunene and Earnshaw, 1999) suggested that 98% of farmers interviewed regarded bambara groundnut as a profitable food crop and are keen to increase their productivity. Mainly women produce it predominantly as a subsistence crop. However, production is insufficient to meet demand and sizeable quantities of dried bambara are imported from neighboring South Africa.

Much of the domestically produced bambara is consumed in the fresh form as a snack, although some is used as a seed for planting, while some is dried to cook and use as a relish. The latter is bought from markets or supermarkets, and the out-of-season usage is very small.

Zambia

Bambara is a minor legume crop in Zambia, with production being undertaken in a number of agro-ecological zones in the Western, Southern and Eastern Provinces of Zambia. One source argued that output was "very low" based on an estimated 600,000 smallholders each cultivating less than 0.25 ha and average yields of only 300-400 kg/ha.

² Much of this section is based on discussions with Karen Hampson of the University of Nottingham who is currently (June 2000) undertaking an analysis of the production and processing of bambara in Swaziland and Zimbabwe.

*Zimbabwe*³

Zimbabwe is the major producer of bambara in southern Africa. Table 1 contains estimates of bambara production in Zimbabwe. This suggests that production is of the order of a minimum of 10,000 tonnes – although some believe that since a sizeable proportion of production is for subsistence uses the quantities produced are larger. One major exporter estimated production at between 30–40,000 tonnes but argued that this could be subject to a wide margin of error. Production is solely undertaken by smallholders often on communal lands on the poorer soils in regions IV and V. The crop is produced both for direct consumption by the growers and for sale. Land shortage was a major factor limiting the expansion of production, while a decline in soil fertility was cited as the major factor behind falling yields.

Some attempts have been made by larger commercial farmers to produce bambara but these seem to have failed. In addition, there has been some discussion of contract farming of bambara, as is currently undertaken with cowpea. Under this system seed is provided to the grower and a buying price is set prior to planting. Everything has to be sold to the company but if prices rise then more may be paid to the growers. Apparently some 500 smallholders are producing organic bambara but it is not clear whether this is through a contract farming arrangement. Generally there appears to be little or no contract farming of bambara, in part because of the scale of smallholder production and difficulties with contract enforcement.

The planting of the crop takes place in November with harvesting around May. Farmers usually hold back some production for planting the follow season, although some producers consume or sell all their production and buy seed at the start of planting. A range of seed types are available and some limited research is being undertaken to provide improve seeds.

3.4 Other African Producing Countries

Kenya

Only very small amounts of bambara are now produced in Kenya although ethnobotanic surveys have shown that its importance has declined significantly over the past 30 years. Data collected by the Ministry of Agriculture suggested production in the mid 1990s was undertaken on 150–200 ha and annual output was below 200 tonnes. Production is undertaken in western Kenya. Recently enquiries have been made from Kenya regarding imports. Bambara is consumed in a variety of ways as well as having a number of medicinal uses.

Tanzania

Bambara is grown in most regions of Tanzania where it is inter-cropped with other cereals. Only a small proportion of production enters the market and some is exported.

³ This section is based on the author's discussion in Zimbabwe in January 2000 along with later discussions with Karen Hampson.

One feature of Tanzanian output is the cream colour of the beans compared with the mixed colours of many other origins. According to one source, production is becoming more marginalised in part because changing farming systems are leading to a greater marginalisation of the crop.

3.5 Other Producing Countries

Data on production in other countries outside west and southern Africa is almost non-existent. It has been reported to have been grown in a wide range of countries including India, Sri Lanka, the Philippines, Malaysia and Brazil. However, its seems production in these countries is very small or negligible. The only country outside Africa where bambara is known to be grown and marketed commercially is Indonesia, but even here production is very small and thought to be concentrated in West and Middle Java.

3.5 Bambara Production Constraints

There would appear to be a number of benefits from increasing the production of bambara. Some of the major beneficiaries would be women in rural communities whether it is northern Ghana or the communal lands in Zimbabwe. Increased output would not only improve food security and provide larger quantities of this nutritious food crop but also would increase the surplus available for commercial cash sales. However, there are a number of factors that limit the production of bambara including agronomic practices, difficulties in processing; limited marketing opportunities; the fact that it is predominantly produced by women. The remainder of this section briefly outlines some of these constraints.

Agronomic Practices

Obviously agronomic influences can play an important role in limiting output. These can take a variety forms including climatic factors, land and labour availability, and competition from alternative crops. Discussions amongst growers would suggest that there is a lack of awareness regarding the best agronomic practices for growing bambara as well as the nutritional qualities of the crop and the marketing opportunities. There is a vicious circle to the extent that bambara is invariably grown on poor soils, leading to low yields and research has shown that production could be significantly increased above typical farmers yields (EU nd). In addition, the production, harvesting and initial processing of bambara is by hand; there is no mechanical production or processing equipment undertaken, other than canning.

Land availability and reduced soil fertility can restrict production and some growers believe that in order to obtain good yields then the land must be left fallow for at least one year.

Processing Difficulties

Once dried, the seed becomes very hard to cook, requiring large amounts of time and fuel which is a major constraint to its increased utilisation. BAMNET and others in

the sector have argued that unless improvements are made to post-harvest characteristics, particularly those concerning processing, production will continue to remain stagnant or decline further.

Obviously if a more efficient technique of processing bambara could be developed it would have a number of attractions. It would not require sophisticated or expensive equipment; it would provide home-based employment opportunities and income for impoverished rural women as well as providing improved nutrition alongside better food and household security.

Gender Issues

Bambara is often referred to as the 'crop of women' reflecting the fact that it is predominantly produced and processed by women. As a result it is perceived as both a women's crop and a subsistence crop and as such it tends to have a lower status and priority and is thus less valued and given less attention than it deserves. If it became more of a cash crop then men are likely to become increasingly involved in both production and trading.

Limited Government Assistance

Throughout Africa, governments appear to have a negligible involvement with the crop; whatever involvement there was has tended to diminish in the light of budgetary cutbacks arising from the various Structural Adjustment Programmes.

In Zimbabwe the parastatal Grain Marketing Board has some minor involvement in the marketing the product but it would appear with little success. One factor is that it has demanded that the bambara be sorted into separate colours.

Limited Marketing Opportunities

Currently market opportunities appear limited and the knowledge and stimulation of demand are important factors that could stimulate production. Outside Africa the crop is rarely known. A major constraint limiting the expansion of the market is that supplies cannot be guaranteed. Thus traders in Zimbabwe pointed out their inability to forward contract for the crop because of the subsistence nature of production. The inability to be able to guarantee supplies increases the reluctance of both traders and processors to invest in promoting and developing the product.

In addition, bambara faces competition both at the production and marketing level. Thus, many producers, despite scarce land resources, will continue to produce a range of crops as a food security strategy. Some crops such as cowpeas are seen as giving higher yields and being easier to produce. Similarly consumers face a range of alternative products, and in southern Africa bambara competes with both domestically produced and imported beans, including sugar beans. One factor cited as limiting consumption was the "creation of gas" and the associated stomach problems this created.

Both the lack of markets as well as problems of access to markets limits production.

Key factors limiting market access include the lack of infrastructure and transport costs as well as limited availability of market information. Many producers appear unaware of its potential as a cash crop. While rural communities in Africa know the crop it is almost unknown outside the continent. Moreover, there would appear to be reduced awareness in the expanding urban areas of many African countries. Even when it is known, there are various traditional perceptions about its consumption (e.g. during funerals or for certain groups in society). There appears to be little knowledge of the various forms in which it can be processed and consumed.

Nevertheless, during the research it was often stated that "demand exceeds supply", and "more would be consumed if supplies were available". Even during the early 1980s it was reported that bambara commanded a high market price, and that demand far outweighed supply in many areas (Coudert, 1982).

4. THE CONSUMPTION AND PROCESSING OF BAMBARA

4.1 The Uses of Bambara

Bambara is consumed almost solely as a food mostly by poor people living in rural areas with very limited resources. There is some consumption in urban and peri-urban areas. The rapid urban population increases and the associated rise of "street food" sales is leading to expanded use in urban areas. In addition, its high protein and fibre content along with its ease of storage has led to its limited use by aid agencies in food deficit and famine situations, mainly as a source of edible lysine protein for human consumption. Very small quantities of bambara are also thought to be used in the US for special niche market applications including as an organic food and "ethno-food". Another niche market identified in Zimbabwe was the use of small bambara nuts as a feed for racing pigeons. Unlike groundnuts, bambara contains only relatively small amounts of oil and, therefore, no oil extraction is undertaken.⁴

Bambara groundnut is a complete food and is eaten in various forms either immature or fully ripe. The semi-ripe seeds when consumed fresh after the harvest are considered more palatable than the hard dried mature ones. The fresh immature seeds are normally boiled, grilled or roasted and eaten as a snack; while the mature seeds are pounded into a flour and mixed with oil or butter to form a porridge or pulversied to make a soup. The use of bambara for making bread has also been reported in Zambia, while some parts of the plant have been used as an animal feed. Black seeds have been reported to be used in traditional medicine in several countries including Namibia, Nigeria and Zimbabwe.

It would appear that most bambara does not enter the market but is consumed fresh after the harvest. However, it is also shelled and stored for consumption later in the year. It can be an important source of food security since bambara stores very well and is not prone to attack by pests or disease. It is an important source of edible protein (particularly lysine), especially in semi-arid areas, and is complementary to staple cereals, which are low in this amino acid.

⁴ However, Heller 1997 reports that in the Congo seeds were roasted and pounded to extract the oil.

A number of value added products are produced from bambara. Canning is the most obvious one, in Ghana, bambara was canned in the 1960's and 1970's. A small scale canning operation began in Zimbabwe the late 1990s (for details see Zimbabwe in Section 4).

Research has been undertaken on the use of bambara in a number of other products. Bambara can be used to produce a vegetable milk comparable with soy milk and protein functionality tests on the ground seed indicate that it can compete with or replace other conventional flours in a range of processed products (Poulter and Caygill, 1980; Brough, Taylor and Azam-Ali, 1993). Bambara has also been used as a feed for pigs and poultry (Doku and Karikari 1971) but this is unlikely to be large since cheaper sources of animal feeds are available. In Ghana, bambara was also reported to be used in the production of bamcorn, a maize/bambara mixture (Lartey, 1976).

In the fresh state it has to be consumed up to approximately 2 weeks after harvesting. As a dried seed it can be stored for consumption later in the year - or indeed several years after harvesting since in comparison with other legumes it stores very well and is less subject to attack by pests and diseases. However, as already pointed out, a major constraint is that it is hard to cook requiring soaking and boiling involving large amounts of fuel and time. The mature beans can then be roasted and consumed as a relish or made into a stiff porridge, which remains palatable for long periods.

Finally, a proportion of each crop of bambara is used as a seed for the next crop. Seed selection takes place after shelling and it is usually carried out on the basis of size, colour and condition.

Ghana

The range of uses include direct consumption as food in the grower's household as well as for seed for next year's crop; traditional gifts for weddings or funerals or for sale. "Tubani" is a traditional product produced from bambara flour and wrapped in leaves, which is widely eaten in northern Ghana and is particularly consumed at funerals. It was stated that most women can make tubani but because of the time consuming nature of its preparation its production tends to be specialised. Bambara beans are boiled and crushed and made into cakes or balls which are fried and used in stews; in southern Ghana it is boiled to produce a kind of porridge; pepper and salt may be added to produce "adaboi", which was also produced in canned form in the 1960s; other canned products included bambara with meat and tomato sauce, as well as bambara in brine.

Southern Africa and Zimbabwe

In southern Africa, bambara is consumed in a wide range of forms. Immature seeds are consumed fresh or grilled. They are also boiled, either shelled or unshelled, and eaten as a meal or mixed with immature groundnuts or green maize. Ripe/dry seeds are pounded to flour and boiled to a stiff porridge, or soaked and then boiled. The porridge keeps well and is traditionally used on journeys. The dried seeds are also

roasted, broken into pieces, boiled, crushed and eaten as a relish with "sadza" (maize-meal porridge). In restaurants in Angola and Mozambique, boiled salted seeds are often served as appetizers.

In Zimbabwe, fresh bambara is popular as a snack in the peri-urban areas when the crop is in season. Dried bambara is less popular. Zimbabwe is also the only country that currently cans bambara, but only small quantities of beans are involved, estimated at less than 10 tonnes per year. The canned product contains a range of bambara varieties and it was argued that this made the product more attractive to the consumer.

Most production is consumed locally as a subsistence crop. When it enters the market it is consumed in several forms but particularly as a snack food and a substitute for beans. It is consumed as a bean rather than a nut; the low oil content (6-8%) means that it cannot be roasted like other nuts.

One argument that has been used to suggest the popularity of bambara is that among the peri-urban population in Zimbabwe, bambara groundnuts commands a higher price than competing legumes, namely groundnuts and cowpeas.

4.2 Bambara Processing

According to one source, food preparations have changed very little since the crop first gained popularity in the Middle Ages (Lewicki, 1974). Currently, the consumption of beans, and the method of processing prior to consumption takes a variety of forms⁵ In Zimbabwe one of the traditional methods used at the household level is that the pulse or dry seed is turned into a paste with porridge type consistency; roasted for a few minutes and then stone ground to remove the skin. (The skin can be used as a chicken feed). Nuts are broken by pounding with a pestle and mortar; broken into small pieces but not very fine. Placed in boiling water for some time – until well cooked. Salt can be added or it can be eaten alone or with staple foods especially maize (*Mutakura*), which is mainly consumed in the dry season. Also it can be eaten with peanut butter (*rupiza*).

Another traditional method is to boil the fresh seed to prepare *Mukove* or *Nyimo nyoro*. The process involves boiling and adding salt to taste. After boiling the nuts are easy to peel. *Mukove* is usually eaten during the mid summer.

Another method used by the canning company, Tulimara is to dry the grain with the pod removed and add salt for seasoning. Some soak overnight to reduce the cooking time, others just boil. Also some boil together with maize. Boiling is undertaken until soft, and this can take up to 5 hours; however if soaked beforehand then boiling can be reduced to about 3 hours. The length of boiling partly depends on the amount and type of fuel available; most use firewood, although some use electricity if it is available. An estimated 2kg of bambara will feed about 10 people.

⁵ Details of processing methods were obtained from discussions with Rosalia Madamba of the Dept. Research and Specialist Services; and her unpublished paper.

5 BAMBARA MARKETING AND PRICES

5.1 Bambara Marketing

Marketing Structures

Key features of bambara marketing are the informality and relative simplicity of marketing structures. As a result, a variety of marketing channels have been created leading to some difficulties in trying to generalise. A sizeable proportion of output does not enter the market but is consumed by the producer and her extended family. The majority of producers hold back some of their production as seed for planting next year, although some producers either consume all their production or sell it for cash and purchase close to planting. Any surplus that is marketed is often done so informally by the producer (or a family member) for cash at a local market. At the market it may be bought directly by the ultimate consumer or by a small processor or trader. Sometimes bambara may be bought directly from the grower by an itinerant trader who will aggregate the small purchases made and sell on. Some traders will purchase the fresh bambara which they will then sell at a market stall. Some will be sold to itinerant street vendors.

In contrast to many commodities, no traders were identified who specialised solely in bambara. Moreover, with a few exceptions, all the traders handling bambara dealt with relatively small quantities of the product. Some large wholesale traders were identified in Zimbabwe and South Africa and these were responsible for exporting or importing several hundred tonnes of bambara. These larger traders either tended to have their agents operating in the producing areas who bought directly from the growers or they bought directly from small traders. The larger traders transported bambara in 28-31 tonne lorries or in containers.

For several reasons, particularly the scale, yields and uncertainty of production, there appears to be no contract or forward purchasing of bambara from growers. The only example of forward purchasing that was identified was between a large seed trader in Zimbabwe and a South African trading company. Each year the Zimbabwe company agrees to supply the South African company with several hundred tonnes of bambara. By trading together for many years, both companies have developed a good relationship with a sizeable degree of trust. Thus, although a "price" is agreed each year, both companies recognised the uncertainty of supply and prices, and in exceptional circumstances when the prices rose the contract price could be increased by mutual agreement.

Bambara is available in some of the larger urban markets, such as Makola Market in Accra and Mbare Market in Harare, which implies some degree of aggregation of supply. However, supplies to these markets tend to be seasonal and the proportion of output sold through these outlets appears to be relatively small.

Bambara is retailed to the customer in a variety of forms and by a variety of methods. The retailers vary from petty informal traders who may sell tubani, fresh or packaged beans in small quantities to large supermarkets which sell packaged bambara.

However, each of the small number of supermarkets contacted in Ghana and Zimbabwe said that turnover of the dried packaged bambara was small although the volume of trade tends to be greatest at planting time and following the harvest. This was also the case with small quantities of canned bambara available in Harare.

Traders tended to differentiate between bambara sold for food and bambara sold for seed. In South Africa, the latter was sold in 10-15 kg bags. Bambara for foodstuff use is available in a range of packaged sizes from 250 kg to 5 kg as well as being sold loose in many markets.

Grading and Specifications

Bambara is invariably not classified or standardised. In most instances there appears to be no grading system and if any selection is undertaken, (and this is rare), it is invariably based on colour sorting since bambara is available in a range of differing colours. One Zimbabwe exporter removed the smaller seeds from his shipments – and these were used to feed racing pigeons. There are no definite criteria to measure quality, while a series of measures are used to measure quantity, ranging from "koko bowls" in Ghana, to bags of 50 kg in Zimbabwe.

Bambara is invariably sold in mixed colours for which there is a preference. Some years ago one Zimbabwe trader undertook research on colour variations and tried to market the colours separately but with no success.

International Trade in Bambara

No country appears to collect official export or import data on bambara, and even if it was separately specified the amounts traded would be small or negligible. Over a dozen European and US companies were contacted that traded in edible nuts and beans as well as related products and almost all of them had not heard of bambara groundnuts! The major export companies in South Africa and Zimbabwe also confirmed that no exports of bambara from Africa to either North America and Europe was taking place, with the possible exception of an (unconfirmed) shipment to the West Coast of the USA. It was mentioned in Zimbabwe that a Japanese company had expressed interest in purchasing bambara but they required large regular shipments which under the present production system would be impossible to satisfy. As regards Indonesia, according to one source "there is no export in substantial amounts, since demand exceeds production; small amounts seem to be exported to USA as "ethnofood". Retail packs of Indonesian bambara (known locally as Kacan Bogor or Bogor Nuts) are sold via the Internet.⁶ Some decades ago, there were several unsuccessful attempts to develop exports to Europe as an animal feed.

Any international trade that does take place is in dried rather fresh bambara and invariably involves small quantities of unrecorded cross border trade with neighbouring countries. For example, bambara is traded in small quantities across the

⁶ The company is called IndoMarket based in New York and at its store and via the Internet it sells 200 gm retail packs at \$2.80 per pack. The website address is <http://store.yahoo.com/indomerchant/kachobognut.html>

Sahelian region of West Africa; thus, Ghana sells some bambara to Burkina Faso and Togo.

The biggest international trade in bambara takes place between southern African countries especially between South Africa and Zimbabwe. This trade takes place both formally and informally. Estimates of Zimbabwe exports, and South African imports, ranged between 1,500 to 3,000 tonnes per year. South Africa was also reported to be importing small quantities from Malawi, Mozambique and Tanzania. Also, Swaziland imports bambara from South Africa with one source estimating that Swaziland's annual imports were of the order of 300 tonnes. Zimbabwean traders also reported selling bambara seed to Angola and Mozambique, as well as exporting to neighbouring Botswana as well as Uganda. A South African trading company has recently received a trade inquiry from Kenya.

Zimbabwe is reported to be trying to establish the production of organic bambara, presumably for export. However, a major constraint to organic production and sales is the need to undergo the certification process involving foreign evaluators, which can be an expensive process.

Trade Procedures and Tariffs

Tariffs on bambara are negligible. However there are a number of other barriers to trade. Thus, if bambara is officially exported from Zimbabwe to South Africa an export permit is required and there are 12 or 13 steps involved in obtaining permission to export e.g. quality of seed, bank, customs, phyto-sanitary certificates. Similarly if Swaziland imports bambara from Zimbabwe then the need for a number of permits combined with the level of transport costs can seriously restrict sales. Imports into Swaziland from South Africa are much easier and almost all consumption of dried bambara in Swaziland consists of South African imports.

Bambara is exported in break bulk not in containers and invariably in 50-kg bags, which appears to be the dominant form in which bambara is shipped. Formal exports are transported in bags on lorries of 28-31 tonnes, although occasionally containers are used. Alongside official "formal" exports there are reported to be sizable quantities shipped informally particularly between Zimbabwe and South Africa over Beit Bridge. These are undertaken in small trucks and shipments can be as low as 1-2 bags. While most international trade in bambara is in 50kg bags there were reports of small retail packs of 500 gm to 5 kg being exported from South Africa to Swaziland.

5.2 Bambara Markets in West Africa

Cameroon

Bambara is thought to have originated in northern Cameroon and it is a staple food for much of central, littoral and northern Cameroon but no estimates of market size are available. It is mainly cultivated by women and primarily for domestic consumption.

The crop is mainly consumed fresh. It is invariably inter mixed with other crops but in the rare cases when men grow it is cultivated in a pure stand.

Ghana

Without a formal survey it is very difficult to obtain an accurate estimate of the quantity sold, but it is almost certainly less than half of production and could be as low as 25 per cent.⁷ Sales not only take place for consumption in the region but also to traders who will transport it for sale in the urban markets of central and southern Ghana, particularly Accra and Kumasi. Consumers in these regions are likely to be urban dwellers and will require good quality produce, for which they are prepared to pay a premium. Most urban sales take place in markets where the bambara is invariably in loose form; there is at least one company selecting and packaging cream-coloured bambara for sale in supermarkets.

The marketing of bambara is almost exclusively limited to the women members of the household; and women dominated the trading activity at the local market. Wholesalers of bambara are few and far between. The amounts traded tend to be small and are combined with other grain and legume marketing activities - one trader in Bolgatanga reported buying 20-40 bags of bambara in season.

The low quantity of bambara entering trade is not because of a lack of markets or traders. Throughout the northern regions (and indeed throughout the whole of Ghana and many other African countries) there are a large number of integrated markets - village, district, regional and national markets. Alongside are a large number of traders operating at all scales of activity ranging from petty traders to large wholesalers and exporters. Thus, in the Northern Region there are over 100 markets held every 6 days or every 3 days. In the Upper East Region there are 36 markets operating every 3 days. According to one source (Asuming Brempong 1991) 94% of villages in Ghana are within 10 kms of a market and 54% of villagers sell at market. Thus, the lack of functioning markets is not a constraint to increased trade in bambara - neither is the problem of storage, post harvest losses, taxation or other government interventions. However, the lack of finance and credit does act as a constraint to trading activities, as well as a constraint on production.

All the villages and towns visited in northern Ghana supported the findings in Golob et al 1996, that not only is there considerable entrepreneurial activity in the region but also that this activity was not confined to trade. Small scale processing and storage of commodities were important income generating activities, undertaken by even the poorest women, who also recognised the benefits of storing for sale in the lean season.

There are no official export data on bambara, and even if it was separately specified the amounts exported are negligible - and at best would include small quantities of unrecorded cross border trade with neighbouring Burkina Faso and Togo. Even exports of groundnuts from Ghana are small, despite there being a sizeable domestic production and international market for the product.

⁷ More data on bambara production and markets will become available following the survey being undertaken in Ghana by FRI in July/August 2000.

5.3 Bambara Markets in Zimbabwe and Southern Africa

Most of the bambara produced in southern Africa is consumed locally in both the fresh and dried form. One major Zimbabwean trader argued that the fresh trade was more lucrative but smaller, while another thought that that approximately 60% of bambara was consumed in the fresh form.

As previously discussed, southern African countries are the largest exporters and importers of bambara with almost all the trade being inter-regional. Zimbabwe appears to be the world's largest exporter of bambara – known locally as *nyimo* (Shona) beans. As yet, South Africa has not been able to compete with Zimbabwe, but this could change as a result of Zimbabwe's rising production costs, especially for transport, and its stable exchange rate. Zimbabwe exports are estimated at only 2,000 to 3,000 tonnes a year and these are mainly shipped to South Africa, with lesser amounts to other countries in the SADEC region including Botswana, Angola, Mozambique and Swaziland. A small proportion of these exports was reported to be seeds for planting. Most exports take place in the cooler months – June to November. While the harvest is in March/April only small quantities are available immediately after the harvest in part because possible insect attacks on other crops are greater and in part because farmers need to shell the bambara crop by hand. The above export figure is likely to relate to formal exports but, in addition, there is a sizeable informal trade. Exports are not separately specified in the export statistics.

Zimbabwe is also the only country that currently cans bambara, but production is very small and it is thought that no exports of tinned bambara are being undertaken. The tinned product appears to be predominantly marketed through supermarkets and, according to one source, is consumed mainly by the white population.

The size of the domestic market is difficult to estimate but could be anything from 7,000 to 30,000 tonnes depending on domestic production. Certainly bambara is well known throughout Zimbabwe to the extent that various recipe books are available incorporating bambara based foods. The dried market is quite competitive involving a number of buyers, in part because there is a good export market. Many small indigenous traders are buying relatively small quantities – perhaps up to 20-30 tonnes at a time.

Bambara is also popular in neighbouring countries and a sizeable formal and informal trade is undertaken, in both dried and, to a lesser extent, fresh bambara. Usually bambara is sold at a premium to competing legumes. Estimates of the size of the South African market range between 1,500 to 4,000 tonnes with import supplying a sizeable share of the market. However, in view of the apparent popularity of bambara (or jugo bean – as it is more commonly referred to) in Zwa-Zulu Natal and northern South Africa the market may in fact be smaller.

The market in Swaziland could be of the order of 500 tonnes of which an estimated 300 tonnes is imported. No commercial production is thought to be undertaken, although there is certainly some production for subsistence purposes. Consumption is predominantly by the older generation.

5.4 Bambara Prices

Despite the lack of regular price series, it is apparent from discussions that bambara prices fluctuate widely, in part reflecting both the location and the large variations in production. Fluctuations in demand appear to be much smaller and hence have less impact on price fluctuations. As with most agricultural crops, prices invariably fall following the harvest and rise during the year. Prices tend to at their peak just prior to planting, when purchases are being made for those who have not maintained a store of seed for planting. It was suggested that on occasions prices might fall occasionally around the planting period, as more seeds became available. A doubling of prices between harvest and planting was not unusual. Since this is the case, growers could benefit by increasing the volume of bambara that they store.

Obviously factors other than simple supply and demand will affect prices such as prices of alternative food crops, location of production, exogenous factors, such as new market entrants, purchases by relief agencies, and the quality of beans available.

The neglected nature of bambara is reflected in the lack of price and other data available, which limits the ability to analyse market and price trends. For example, in Ghana the Policy Planning, Monitoring and Evaluation Department of the Ministry of Agriculture collect a large number of prices for agricultural products but prices of bambara (and cowpea) are not collected on a regular basis. Indeed no organisation appears to collect prices on a regular basis and hence no regular price series are available. Therefore, one is dependent on prices collected at a single point in time. For example:

- Ghana: early 2000 buyers were offering 60-cents/lb. fob Ghana.
- South Africa in 1998 prices were quoted as ranging from R3 to R20/kg, in July 2000 wholesales prices equivalent to \$355/tonne were quoted.
- Swaziland; April 2000: retail 10 kg mixed colours were quoted at E45.
- US: in early 2000 US market prices were quoted at \$250 to \$350 per tonne but could be as high as \$500 to \$800.
- Zimbabwe: in July 1999 prices ranged between Z\$6,000 to Z\$7,500 per tonne; some farmers were selling at Z\$18 per kg with individual market sales at Z\$20 per kg. Prices can fluctuate by as much as 50% in a month.

6 CONCLUSIONS AND RECOMMENDATIONS

Outside sub-Saharan Africa, bambara is hardly known and consumption is negligible. Even within Africa it is sometimes referred to as the "neglected" or "forgotten" crop, despite the fact that it appears to be grown and consumed in the majority of sub-Saharan African countries. Nevertheless, even in SSA, bambara is a minor crop; invariably it is produced on a small scale as a subsistence rather than cash crop by women as part of a diversified farming system involving the production of several crops. There appears to be negligible commercial production and the small-scale of excess of five hectares. This lack of commercial production and the small-scale of existing production, combined with the low population densities, large distances and poor transport and storage infrastructure all limit the market potential of the crop. Most of current production is consumed either fresh or in the dried form by the extended families of the women producers. Where a surplus is marketed for cash it is mostly marketed locally to supply local needs. Other than shelling and food preparation undertaken in the household, further processing of the crop is minimal. The only exception is a canning operation in Zimbabwe - and even here the canning operation is completed in a few weeks and involves the processing of small quantities of bambara, probably in the region of perhaps 10 tonnes per year.

Although several thousands tonnes of bambara production are traded within regions in Africa, particularly southern Africa, negligible quantities enter international trade. Remarkably it has proved impossible to identify any individual grower, company or organisation - whether producer, trader, financier, processor, retailer, researcher - that specialised solely in bambara. The nature of bambara production and marketing, as well as the very limited data available, severely limits the scope for detailed market analysis. The limited evidence available does suggest that production has fluctuated, and in recent times bambara appears to have lost importance partly because of competition from other crops. However, there does appear to be scope to expand production and markets in many sub-Saharan African countries. Scientists working on a recent EU funded Project concluded that "bambara groundnut is a species that has much to offer in many rainfed production systems and for which appropriate agronomic strategies can be applied to substantially improve current production levels" (EU nd p.60).

Anecdotal evidence suggests that demand for bambara appears to exist but the market is small. In order to create a larger market then a series of production and marketing constraints will need to be overcome, this in spite of the apparent attractive qualities of bambara. The characteristics that make it a promising crop include:

- nutritional and taste qualities
- the low utilisation of purchased inputs
- the ability to grow in poor soils and harsh environments
- resistance to pests and diseases.

Alongside these positive characteristics, there are a number of constraints that include:

- very low yields

- production on marginal lands
- time and energy consuming processing techniques
- a lack of commercial production

Without the successful development and expansion of the crop then it is unlikely that sizeable domestic, regional and international markets can be developed. An increase in output would allow a growing proportion of output to enter the cash economy and possibly regional and international trade. A number of policies could be pursued with donor and government support to assist in the expansion of the crop; these include:

- efforts to increase yields through better seed selection and breeding leading to the availability and better distribution of higher yielding varieties
- improved agronomic and management practices
- improved extension services and training programmes
- the development of contract farming opportunities
- improved processing techniques
- efforts to expand in the market in urban areas; a factor having a dramatic impact on food consumption in Africa is the rapid increase in migration and urbanisation; as a result "street foods" are now a major sector of food processing in many African countries supplying a wide spectrum of workers and students; associated with this is the growth of demand for relatively easy food preparation techniques and the associated demand for "fast foods"
- improved market awareness and access; this applies to domestic, regional and international markets
- promotion of existing and new bambara products at consumer, retailer and trader level; nutritional values, compilation and exchange of recipes and cooking methods;
- development in the niche organic and fair traded markets
- possibility of developing bambara as a constituent of weaning foods for babies
- research effort to overcome the digestibility problems.

However, while several sources have argued that "demand exceeds supply", there is a danger in encouraging production too much in case there is no viable market in the short term for the increased output. There are several examples where this has happened and, as a result, farmers have produced a surplus which they have found difficult to market and have been discouraged from future production. Nevertheless, it is vital to remember that identifying and developing successful further opportunities for the production, processing and marketing of bambara will have direct benefits mainly for many women producers who currently represent some of the most impoverished groups of people in sub-Saharan Africa.

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