# Mango- a Potential Export Crop for Ghana

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## ABSTRACT

*The introduction of mango into Africa by the European traders in the 16th century and into the Gold Coast, now Ghana, during the last century is recalled. The role of the early European trading expeditions in introducing such cultivars as Rupee, Ceylon and Kensington and the conduct of agronomic studies on the crop on some agricultural experiment stations is acknowledged. The introduction of such newer fibreless cultivars as Haden, Keitt and Palmer by the United States Agency for International Development (USAID) and Crops Research Institute (Ghana) is also noted.*

*Ghana's traditional agricultural export structure is described and followed by the inception of the Ghana Export Promotion Council and its role in the institutional promotion of the non-traditional agricultural products such as pineapple and mango. A brief account of the export performance of mango during the past six years is provided.*

*The main constraints to production, post-harvest handling, product quality and transportation of the export crop have been identified and interventions to resolve them outlined.*

*Keywords: Mangifera indica (L.), introduction, environment, exports, production constraints, interventions.*

## INTRODUCTION

The mango (*Mangifera indica (L.)*) is an evergreen, tropical fruit tree which thrives in both the tropics and sub-tropics. It produces fruit abundantly in almost every part of Ghana mainly from March to May each year. In some cultivars a second crop is taken again in November or December. Ghanaians relish the fruit which is consumed in appreciable quantities during the season and supplies both carbohydrates and vitamins A, C and a fair amount of calcium and iron.

Mango is not indigenous to Ghana but is of Hindu origin (Singh, 1968). Mauny (1953) claimed that the diffusion dated from the time of the European penetration into Africa in the middle of the 19th century.

The term "local", as applied to the most widespread mango type, is therefore a misnomer. Early Ghanaian trainees from Trinidad also brought back with them some cultivars which were planted on agricultural stations, notably Kpeve and Ejura when the erstwhile Department of Agriculture was established in 1890 (Agble, 1978). The early introductions included such cultivars as Peter, Blackman, Kensington, Divine, Julie, Ceylon 1 and Ceylon 2 from Trinidad and Jaffna and Rupee from Ceylon (Godfrey-Sam-Aggrey and Abutiate (1973). As at now, only the Jaffna and Julie cultivars can be identified with certainty, the rest having been lost over the years. Jaffna and local have, however, almost become endemic.

Some agronomic trials were conducted on the Ejura Agricultural Station between 1957 and 1960 on the early cultivars to assess their adaptability, flowering and fruiting phenology, spacing and yield responses and, in some cases, eating quality.

Results showed that all the cultivars were well adapted to the climatic and soil conditions in Ghana and yielded reasonably well despite minimum management care. The most popular among them were Jaffna, Julie and the local.

Further introductions were made by the United States Agency for International Development (USAID). These were planted at Somanya in the Eastern Region. Some cultivars were, however, lost through annual bush fires and through lack of proper care. Surviving cultivars were Kent, Haden and Alphonso.

In 1965 the Crops Research Institute (CRI) introduced eleven cultivars namely Palmer, Zill, Keitt, Florigon, Earlygold, Eldon, Jacquelin, Ruby, Sunset, Springels and Irwin. Later, budgrafts were abstained from the USAID cultivars at Somanya and added to the C.R.I. introductions and planted in a museum at Ejura (Anon., 1968). In 1979 Kensington M 18409, Selection 12-47 M 19448, Selection 19-50 M 20222 and Tyler Premier M 17858 P.I. 275486 were added

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to the museum plantings. Other cultivars introduced in the 1970s were Yellow Bombay and Neelum which were planted in the University of Science and Technology orchard in Kumasi. The latest introduction was Tommy Atkins from the Volcani Institute, Israel. Budwood was received and propagated on the local as rootstock (Abutiate 1989, unpublished).

All the introduced cultivars have shown good adaptability to the local environment (Abutiate, 1988). There have, however, been some problems with fruit set in Irwin, late fruiting in Alphonso, severe cracking in immature fruit in Keitt and high seed weevil infestation in all cultivars so far examined (Abutiate, personal observation).

## SOILS AND CLIMATE-

There is abundant evidence of suitable environment for the production of good quality mangoes in Ghana. Mango does not make high demands on the soil and can therefore thrive in a variety of soils which may be considered marginal for other corps. It can thrive well on sand or loams, lateratic or alluvial soils provided they are well-drained, have a fair water holding capacity, ground water at a depth not less than 3 to 4 metres and a pH of 5.5-7.0. Low soil fertility is not a critical factor in mango cultivation because this can be corrected by adequate fertilization. In fact, in very high fertility soils, mango trees tend to be more vegetative than reproductive (Samson, 1982).

The most favoured areas for mango cultivation include the coastal and interior savannah zones and the forest-savannah-mosaic transition. Obeng (1973) has stated that the interior savannah zone alone covers almost two-thirds of the whole country and the savannah ochrosols and ochrosol-intergrades developed over granites and basic intrusive rocks have given rise to some of the best soils suitable for industrial development of mango and many other crops. Not all areas of these zones are, however, suitable for commercial exploitation of mango. Very wet and humid areas such as the hilly areas of the Mampong Scarp are unsuitable for production of good quality fruits because of high disease incidence.

The mango tree can tolerate wide variations in temperature ranging from 21°C to 38°C. This temperature range and even higher temperatures have been consistently recorded in several parts of the country with no adverse effects even on trees in the wild.

Mango requires adequate insolation for good eating quality development of the fruits. Suitable areas for commercial development of large orehards are open country with sufficient sunshine which will allow light penetration into the mango tree canopy and enhance attractive colour development of the fruits.

The rainfall demands of the mango tree also vary widely. The tree can thrive and produce in areas receiving less than 750mm rainfall per annum or over 1500mm. Suitable areas for mango cultivation in Ghana experience between 750mm and 1500mm annual rainfall. In mango, a period of dry weather is necessary for bloom. This period coincides with the dry season from November to March in Ghana. In some areas, the short dry period experienced in August also favours some flowering to produce a second crop.

The normal wind velocity in the northern savannah zone,
9 metres above ground, ranges between 5 and 6 k/h (Ussher, 1969). Such wind velocities do not damage mango trees. However, occasionally, very strong winds, especially those which ussher in the first rains after the harmattan season, may rip off mango branches in open locations.

## IMPETUS FOR MANGO EXPORT DEVELOPMENT

Four important developments have combined to create the necessary awareness and contribute directly to the *dies natalis* of the commercialization of mango production in Ghana. The first is the persistent downward trend in export earnings from the traditional export products such as cocoa, timber, gold, diamonds, bauxite and manganese. The situation compelled the Government to initiate policies to diversify the country's export earnings to cope with the balance of payment deficits.

The second was the establishment in 1969 of the Ghana Export Promotion Council (GEPC) to focus attention on the development and export of non-traditional products.

Third was the introduction of the Economic Recovery Programme (ERP) initiated in 1984 which sought to rehabilitate the economy and reverse the economic deterioration suffered in the late seventies and early eighties.

The fourth was the encouraging results obtained from a survey, initiated by the defunct Ghana Farmers Cooperatives with the cooperation of the Ministries of Rural Development and Finance and Economic and

Economic Planning, into the potential of non-traditional agricultural exports from Ghana to West European markets (Anon., 1986). The report revealed that prospects for exporting products, including mango, were excellent and prices were competitive provided regular supplies were available, product was packed to specification, quality was good and assistance was given for product promotion. The report concluded that mango was a product in which Ghana could make progress in exports.

**Structure of Ghana's traditional export sector-**

Agriculture remains the key economic sector with cocoa making the largest sub-sector contribution to agricultural export earnings. In 1986, cocoa contributed over 75% of the total value of agricultural exports (Anon., 1986). Other export products include timber, gold, diamonds, bauxite and manganese. The lower than expected out-turn has been due largely to low production and fall in world prices of these main products exported by Ghana. The situation was worsened in the 1980s by lack of value-added exports which would fetch higher prices and create job avenues.

**The Economic Recovery Programme (E.R.P.)**

In order to rehabilitate the economy and reverse the economic deterioration, the Government embarked on an Economic Recovery Programme (ERP). The major thrust of the ERP was a policy package aimed at re-aligning relative prices in favour of the productive sectors particularly cocoa, timber and minerals, improving the financial position of the public sector and encouraging private investment.

The Government was also to institute appropriate export diversification initiatives with traditional exports playing a major but decreasing role while non-traditional exports such as pineapples, mangoes, furniture and handicrafts increased their relative share (Anon., 1988).

**The Ghana Export Promotion Council (GEPC) and the ERP**

The Ghana Export Promotion Council is an autonomous body established in 1969. It is the national institution for export development and promotion of products in the non-traditional sector under the Ministry of Trade and Tourism. With the inception of the ERP, GEPC came into a renewed national focus. As established, GEPC is responsible for the development of national export awareness, identification of products with export potential and locating markets for them, creating goodwill for Ghanaian products through overseas and local trade fairs and exhibitions, giving exporters the necessary assistance for competitive international market penetration and training them to upgrade their skills in export marketing.

An important innovation was the crusading role the GEPC played in collaboration with the Ministry of Trade and Tourism in the establishment of incentive schemes for exporters. Under this Export Incentive scheme, several measures were introduced to boost the export of non-traditional horticultural products such as mango. The recent establishment of the Export Finance Company Limited has created an additional enabling environment for partly solving the chronic liquidity problems of non-traditional exporters generally.

A database for exporters and importers has also been built to provide assistance programmes, both national and international, for export companies and to monitor performance of exporters for the purposes of export support schemes. These are generally classified under six categories but this paper will be restricted to all horticultural products which include mangoes, pineapples and vegetables.

This classification facilitates rational national accounting and allows for easy mobilization and direction of resource support to the sector (Anon., n.d.).

**Export Performances:**

Fresh mangoes were first exported to the United Kingdom in 1987. Since then, exports have staggered rather widely over the years due mainly to unavailability of fruit in sufficient quantities. For a start, exports were based mainly on the local cultivar, and to a small extent, on fruits from a few commercial orchards.

Even though new orchards continued to be planted, some of which are coming into production, the mango industry is still faced with very serious problems. The irregular pattern of bearing, typical of the monoembryonic cultivars, has frustrated the pioneers in the industry. In addition to this, other serious drawbacks due to annual losses through fruit-piercing moth damage, mango mealy bug infestation, disease attacks due to poor orchard management and post-harvest handling and, in recent times, the mango seed weevil, continue to thwart progress towards sustained production in present orchards.

As a result of these problems, fresh mango exports have not made appreciable impact on the non-

traditional export subsector. With improvement in production technology and better post-harvest handling, however, exports are likely to increase substantially.

Export volumes and corresponding foreign exchange earnings over the past six years are summarised in the accompanying table.

horticultural crops in the past has been the over-dependence of the economy on the traditional export products to the almost exclusion of 'non-traditionals until very recently.

However, changes in the world economies have now compelled the country to diversify sources of export earnings. The situation has thus given an impetus to

***Table 1: Fresh Mango Exports from Ghana (1987 - 1992)***

| Year | Quantity (t) | Value US Dollars |
|---|---|---|
| 1987 | 75.3 | 14,356.27 |
| 1988 | 24.9 | 6,630.28 |
| 1989 | 36.6 | 10,054.02 |
| 1990 | 245.5 | 38,555.79 |
| 1991* | 23.5 | 10,031.85 |
| 1992 | 46.9 | 28,996.66 |

**Source** Ghana Export Promotion Council, Accra
*Mango/Avocado pear conglomerate.

## CONSTRAINTS AND STRATEGIES TO IMPROVE PRODUCT DEVELOPMENT

The expansion of efficient mango production for export is beset by serious bottlenecks in support services such as research and technical know-how for production, harvesting and handling and farm management as well as lack of packaging and marketing infrastructure.

### Support Services.

Research is important in generating knowledge and appropriate technology for the grower. In order to ensure effective technology transfer to the farmer, vast improvements are needed in the existing technologies themselves to ensure adoption by farmers by way of improved research-extension-farmer linkage (Abutiate, 1988). This linkage, Abutiate (1989) stated, must take full account of the farmers' socio-economic situation and their priority needs to make a meaningful impact.

Until very recently, horticultural crop production in general and mango in particular, even for the domestic market, received very little attention beyond sporadic plantings on agricultural stations established several years ago. This low recognition may explain, in part, the dearth of research information on horticultural crops particularly mango in Ghana. Another equally important reason for the low profile accorded the development of pineapple plantations and mango orchards in suitable areas for production of these crops for export. Technical know-how for production therefore needs to be generated and passed on to extension agents for dissemination to farmers.

In the interim, information available elsewhere on production and handling should be assembled with some modification, for immediate use.

In the long term, newer cultivars need to be introduced and evaluated for commercial plating. Particular emphasis should be placed on cropping pattern, high fruit quality with long shelf-life and amenable to easy pest and disease management programmes when evaluating the cultivars. Fruits should also be attractively-coloured, firm at ripe eating stage and fibreless with not more than 10% seed content. Any new information obtained should be passed on quickly to producers.

### Production Technology.

Good commercial production starts with location selection under appropriate climatic conditions. For mango production, the best locations are gently, undulating areas with low water table and a clearly defined, short, dry spell to enhance flowering.

Unfortunately, some of the present orchards have already been sited in rather very humid locations

which favour insect pest and disease development and poor fruit colouring. Professional advice on climate soil should be sought on areas intended for the development of mango orchards.

An equally important aspect to pay attention to is cultivar selection. Cultivars known to crop regularly and produce high yields and adapted to the local climatic conditions should be preferred. Cultivars prone to alternate bearing in the main should, if possible, be avoided. Some farmers have already started experiencing long periods of little or no fruit production in their orchards. Top working newer cultivars into such irregular bearers will improve production.

Propagation of orchard trees should be carried out with great care using only budwood from selected cultivars as sources of scion.

Mango trees should be adequately fertilized with nitrogen and potassium to ensure good growth. When bearing starts, growers must ensure that the level of fertilization is adequate to cater for tree development and fruit production.

Attention should also be paid to the training eg. by judicious pruning of the young trees in order to develop a good tree architecture and balanced branch development.

Other areas include pest and disease management. The immediate vicinity of young trees must be kept free of weeds at all times. Where the topography permits, between-row spacings may be mechanically slashed to keep weeds down. In locations where obnoxious weeds are likely to be a problem suitable cover crops such as *Mucuna sp.* may be planted to smother weeds and also prevent soil erosion.

Insects and diseases constitute, perhaps, the greatest threat to mango production. Their management is therefore vital for success. The most important insect pests at present are the mango seed weevil, *Sternochetus mangiferae* (Fabricius) and fruit-piercing moths particularly *Achea* and *Othreis* species. Other less serious insect pests are the mango mealy bug (*Rastrococcus invadens*), fruit spotting bugs, termites, red ants, caterpillars and aphids.

The mango mealy bug has largely been brought under control in several parts of the country by the parasitoid *Gyranusoidea tebygi*. Fruit spotting bugs, termites, red ants, caterpillars and aphids can easily be controlled using conventional chemical methods.

The mango seed weevil and fruit-piercing moths cannot be easily controlled in our orchards because of the large reservoir of host plants. Views have varied about control of the mango seed weevil. While Javis (1946) believed its control was possible, Balock and Kozuma (1964) found some chemicals to be ineffective. However, Shukla and Tandoh (1985) found that spot applications of 0.05% diazinon were effective. Even though studies carried out by Shoeman (1987) in some parts in Africa and Shukla and Tandoh (1985) in India revealed no natural enemies, there is an urgent need to study the bio-ecology of the weevil in the Ghanaian environment to understand its life style and diapausing sites to enable a management programme to be worked out. similarly, new investigations in the light of recent research knowledge, need to be initiated into the management of the fruit-piercing moths even though Cotterell (1938) in his investigations into the moth control in the Gold Coast (Ghana), found no method to be completely satisfactory.

Prusky (1991) has stated that despite the fact that mango is one of the major fruit crops in the world, there is still a comparative lack of technology in its production. This lack is observed in unclear answers concerning the cause and control of some field diseases and post-harvest handling of fruits. He noted, further, that pre-harvest and post-harvest diseases are some of the main factors affecting mango production all over the world and indicated that the most serious of these diseases are bacteria canker or black spot, mildew, anthracnose, stem end rot and Alternaria rot. Important in Ghana are anthracnose, bacteria black spot, stem end rot, mildew and scab diseases. The single most devastating of these diseases which affect mango production in Ghana is anthracnose caused by *Colletotrichum* gloeosporioides Penz. The disease affects leaves, particularly young ones, twigs, blossoms, developing fruits and fruits at post-harvest.

Other diseases such as Aspergillus rot and collar rot, though present in mango orchards, have not become a serious threat yet. It is however, possible that as serious ones are controlled, others less serious will become more prominent.

There is need, therefore, to study the various diseases affecting production and work out management strategies to ensure production of good quality fruits during all seasons.

Satisfactory field management strategies have been worked out for anthracnose and to some extent stem end rot diseases by Kwee and Chong (1985). They recommended a strategy based on sequential spraying of different fungicides at various stages of flowering and fruit development using benzimidazole fungicides, sterol inhibitors, copper and mancozeb (Prusk, 1981).

Other field spraying programmes have also been documented by Jeffries et al., (1990) as being effective against anthracnose disease control in the field but these alternative programmes need to be evaluated locally.

If these pre-harvest spraying programmes are carried out effectively, post-harvest treatments will only be necessary to ensure that fruits remain clean for the market. On the other hand, if ineffective pre-harvest programmes remain, it will be necessary to treat fruits thoroughly at post-harvest before packaging. Several methods for post harvest treatment of fruits are in use. Jeffries *et al.* (1990) have listed a number of alternatives which have proved effective in anthracnose disease control. These include scrubbing with 1% sodium hypochlorite, hot water dip (50-55°C for 3-10 minutes), hot benomyl dip (500-1000 ppm) or hot/cold dip of prochloraz. Spalding and Reeder (1986) also recommend hot imazalil (1000 ppm) for disinfection of fruits.

Non-chemical control methods, such as orchard hygiene, judicious early pruning of young mango trees to improve air circulation in the canopy need to be put in place. Others are manipulation of post-storage conditions to reduce disease incidence and integration of chemical control with biological component, taking care, however, that a pesticide application does not destroy natural control of the disease operating through the indigenous microflora.

**Farm Management.**

Poor farm management practices in commercial holdings constitute another serious hindrance to mango production. Many of the entrepreneurs lack knowledge in basic farm management and are sometimes unwilling to employ trained personnel to man such key positions on farms. The result is that there is, almost always, over capitalization on labour, equipment and materials. The result is too much labour for too few jobs, expensive equipment underutilized and purchase of materials which cannot be immediately used to increase production.

Very often, proper accounts are not kept of income and expenditure. Depreciation of equipment is also not always taken into account. The result is a false sense of profit while, in actual fact, losses continue to be incurred year after year.

The situation can be corrected by employing personnel with the requisite farm management skills or training of line personnel in basic principles in farm management appropriate with the scale of farm operations.

**Harvesting and Handling**

Without doubt, harvesting constitutes the first step in mango produce handling and marketing. Fruits must be fully mature, almost at the point of ripening, before being harvested. To ascertain the stage of ripening, some fruits should be sliced and the flesh around the seed examined for signs of ripening. If the flesh is yellow, the fruit will ripen satisfactorily but if white or pale yellow, the fruit is immature and will not ripen to good eating quality. Mango fruits should be handled with great care to avoid bruising. Method of picking should properly relate to tree height to avoid damage to fruits. Harvested fruit should also be gently placed in appropriate containers and conveyed to the packing house quickly for processing.

Handling has been defined by Vakis (1981) as all technical aspects of produce movement from harvesting, grading, packaging, quality control, transportation and storage from the harvesting state until it reaches the consumer, Vakis (1987) outlined some major areas in mango and pineapple handling that can effectively enhance export performance of these products by eliminating quantitative and qualitative losses for higher profit margins.

There is urgent need for improvement in the quality of packaging materials, construction of sheds with airy packing facilities and adequately roofed. Very often producers use tightly enclosed packing materials which retain warm air for long periods resulting in rapid produce deterioration.

Produce should be transferred quickly to packing sheds and packaged. Locally manufactured cartons need to be substantially improved with regard to strength, proper ventilation and moisture resistance to avoid collapsing in transit. Packing house facilities need not to be expensive. Thatched sheds constructed with local materials with tables neatly kept make excellent packing units. In fact, thatched sheds remain cool even during the heat of the day.

Mangoes are usually exported by air. This mode of transportation is fast and ensures that produce reaches the consumer in good condition. When produce volumes increase in future and sea transportation becomes necessary, produce will have to be shipped under contrived conditions of 10-13°C with relative humidity of 90 to 95 per cent to maintain quality under the extended period at sea.

All fresh produce from Ghana is greatly handicapped by non-availability or poor port facilities. Fresh produce in containers is left in containers in the open for several hours before being loaded into carries.

Facilities for handling fresh produce generally should include sheds for palletising and inspection, cold stores, pallet scales, office for quality inspectors and mechanical equipment for transferring pallets into carriers.

Quality standards need to be worked out for mangoes as have been done for pineapple. This will ensure that all exports conform to laid down regulations of product uniformity and quality specifications.

A shortage of investment and working capital, inadequate market intelligence and absence of modern processing and canning facilities constitute other impediments which, if not resolved, could hinder produce development.

## CONCLUSION

Mango (*Mangifera indica L.*), an evergreen tropical fruit tree, thrives and produces abundantly in Ghana. Most soils and climatic conditions are suitable for large-scale orchard exploitation. An examination of the export figures over the past few years reveals the mango potential in the non-traditional export sector. This potential can only be fully realised if factors limiting production can be overcome. These include support services such as research and extension, technical know-how for production including insect pest and disease management, harvesting and farm management practices. Other constraints are lack of packaging and marketing infrastructure, shortage of investment and working capital in some areas of the country, insufficient market intelligence as well as absence of modern processing and canning facilities to take export rejects.

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