MANGOES FOR MIDDLE EAST MARKET
SUB SECTOR QUICK SCAN TANZANIA

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TABLE OF CONTENT

LIST OF TABLES AND FIGURES ........................................................................................................... II

ABBREVIATIONS ........................................................................................................................................ III

ACKNOWLEDGEMENT AND DISCLAIMER ................................................................................................ IV

1. INTRODUCTION ........................................................................................................................................ 1
   1.1 BACKGROUND TO THE STUDY ............................................................................................................. 1
   1.2 OBJECTIVES OF THE STUDY ............................................................................................................... 1
   1.3 APPROACH AND METHODOLOGY ....................................................................................................... 2
   1.4 LIMITATIONS ......................................................................................................................................... 2
   1.5 STRUCTURE OF THE REPORT ............................................................................................................. 2

2. SUB SECTOR OVERVIEW ............................................................................................................................. 4
   2.1 SUB SECTOR DEFINITION ..................................................................................................................... 4
   2.2 MARKET TRENDS AND DYNAMICS .................................................................................................... 4
      2.2.1 Global overview: Economic and social impact of mangoes .............................................................. 4
      2.2.2 EU and USA market ......................................................................................................................... 6
      2.2.3 Middle East ....................................................................................................................................... 6
      2.2.4 Regional markets ............................................................................................................................. 7
   2.3 TANZANIA POSITION IN THE MANGO PRODUCTION MAP .................................................................. 7
   2.4 ACTORS AND THEIR FUNCTIONS IN THE MANGO SUB SECTOR IN TANZANIA ......................... 8
      2.4.1 Mango sub sector overview in Tanzania mainland .............................................................. 8
      2.4.2 Fruit planting material ....................................................................................................................... 10
      2.4.3 Pests and diseases in Mango production ........................................................................................ 11
      2.4.4 Mango in Zanzibar islands .............................................................................................................. 12
   2.5 SUPPORT ORGANISATIONS AND INSTRUMENTS USED ................................................................. 12
   2.6 FRESH MANGO SUPPLY CHAIN ANALYSIS ..................................................................................... 13
      2.6.1 Profitability analysis of the various supply channels ................................................................. 15
   2.7 MAJOR CONSTRAINTS AND OPPORTUNITIES .................................................................................. 16
      2.7.1 Farm level (production stage) ......................................................................................................... 16
      2.7.2 Marketing Stage .............................................................................................................................. 17
      2.7.3 Value addition / processing stage .................................................................................................. 18
   2.8 EXPORTING LEVEL ............................................................................................................................... 18
      2.8.1 Policies and Regulations ................................................................................................................. 18

3. SUB SECTOR DEVELOPMENT STRATEGIES ............................................................................................. 20
   3.1 VALUE CHAIN DRIVEN INTERVENTIONS .......................................................................................... 20
      3.2 Proposed way forward ........................................................................................................................ 20
      3.2 Proposed way forward ........................................................................................................................ 21
      3.2.1 Short- Term leverage interventions ............................................................................................... 21
      3.2.2 Medium Term Interventions ......................................................................................................... 21
      3.2.3 Long Term Interventions .............................................................................................................. 22
   3.4 SPECIFIC ENTRY POINTS FOR SCF .................................................................................................... 22

APPENDICES: ............................................................................................................................................. 23

LIST OF TABLES AND FIGURES
Table 1: Production trends of local varieties of Mango in Tanzania
Table 2: Export trend of Mango from Tanzania mainland
Table 3: Profitability - SGM Analysis
Figure 1: World mango production by country (Source: FAOSTAT, 2000)
Figure 2: Mango production in Africa
Figure 3: Map of main mango growing regions in Tanzania
Figure 4: Emerging Fresh mango sector map in Tanzania
Figure 5: Proposed value chain for upgrading

ABBREVIATIONS

AMAGRO Association of Mango Growers Tanzania
CFC Common Fund for Commodities
COMESA Common Market for Eastern and Southern Africa
DALDO District Agriculture & Livestock Development Officer
DRC Democratic Republic of Congo
ETI Ethical Trading Initiative
EU European Union
EUREP-GAP Euro-Retailer Produce working group’s Good Agricultural Practices
FAO Food and Agriculture Organisation of the United Nations
HACCP Hazard Analysis and Critical Control Point
HODECT Horticultural Development Council of Tanzania
MKUKUTA Mkakati wa Kukuza Uchumi Tanzania
MMA: Match Maker Associates Ltd
PPP Public-Private Partnership
SCC: SME Competitiveness Facility
SGM Simplified Gross Margin
SHOP Small Holder Outgrower Project
SME Small & Medium Enterprise
SUA Sokoine University of Agriculture
TAHA Tanzania Horticultural Association
TOR Terms of Reference
TShs Tanzanian Shillings
TZI Trans Zimbabwe Industries
ACKNOWLEDGEMENT AND DISCLAIMER

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Finally, we would like to register that opinions expressed in this report are purely those of the authors based on observations and findings during the study. It therefore goes without saying that the authors, and not SCF who takes full responsibility for any errors of commission or omission that may be found in the report.
1. INTRODUCTION

1.1 Background to the study
SME Competitiveness Facility (SCF) is a matching grants opportunity for businesses in Tanzania that wish to develop or increase their ability to trade and export. The SCF aims to support product quality improvement and the meeting of international standards to enable SMEs access potential markets within and outside Tanzania. SCF supports the Government of Tanzania’s endeavour to develop the business sector as an engine for pro-poor economic growth, in line with Tanzania’s National Strategy for Growth and Reduction of Poverty (MKUKUTA). The SCF focus is on business activities that contribute to export, economic growth, employment creation and the reduction of poverty.

Since early 2006 SCF has focused primarily on two types of interventions: agro processing for fruits and vegetables, spices, natural products such as seaweed, and sisal; and three services: food safety (traceability, food safety audits), trade development (effective trade fair participation, branding, supply chain management) and packaging. SCF phase one will end in June 2008 and SCF II is currently being planned. It is projected that fruit and vegetables will also be in focus in Phase II. It is in this context that SCF has commissioned Match Maker Associates Ltd to undertake a number of selected subsector studies in the fruit and vegetables sector in Tanzania. The studies of different intensities include the following:

**Fully fledged Sub Sector Analysis:**
- Dried fruits and vegetables for urban market and export
- High value and fresh vegetables for local market

**Quick Scans:**
- Fresh and processed tomatoes for local and regional markets
- Baby vegetables for the EU market
- Fresh mangoes for the Middle East market
- Fresh citrus for the local and the regional market

This report focuses on the study of fresh mangoes essentially for the export to the Middle East market. The report provides an overview hence a quick scan and not an in-depth study of mango sub sector dynamics in Tanzania and drawing main reference from the North-Eastern corridor (Tanga, Kilimanjaro, Arusha, and Manyara regions).

1.2 Objectives of the study
Overall objective of the study is to highlight the dynamics of the mango subsector in terms of products and market focus. Furthermore the quick scan would identify the main challenges and opportunities for growth and competitiveness and identify sub sector leverage intervention strategies as well as the roles of various stakeholders.

Specifically the study covers the following areas:
- Identifying the mango export market requirements particularly for the Middle East
- Identifying key players involved in each stage of production and marketing using the value chain approach
• Identifying key input suppliers including technologies, services
• Identifying production base and productivity issues in the study area
• Analyzing the factors affecting performance of the existing value chains
• Identifying ways of improving competitiveness
• Analyzing the roles and relationships of actors in the industry for implementation of the interventions
• Making recommendations that are useful for promoters of the study related to economic development through the growth of SMEs in agriculture and the objectives of MKUKUTA and the on-going planning for SCF II.

1.3 Approach and methodology
Being a quick scan rather than an in-depth sub sector analysis, the main approach was to use secondary sources of information as much as it was feasible. These sources were complemented with primary interviews of key actors in the field (farmers, private companies, and support organisations – NGOs and Government departments and R&D institutions). A visit to the Tanga region was necessary since it is the main growing area of mango in the study area. In order to balance the picture, interviews were held with the Association of Mango Growers (AMAGRO) members of Dar es Salaam and the Coast region who are growing different mango export varieties and some are already involved in the export business to the Middle East (Natureripe Kilimanjaro Ltd & Global Fruit & Vegetables Supplies Ltd). During the first mango testing festival event in Tanzania on the 20th November 2007, hosted by Ministry of Agriculture, Food Security and Cooperatives, several AMAGRO members were present, and interviews were held with a wide cross section of stakeholders (public and private sector). The preliminary findings of this study would be validated by a carefully selected stakeholder’ meetings and based of their comments and those of SCF, final report would be prepared.

1.4 Limitations
The usual limitation has to do with reliability of secondary data. Mango sub sector development geared at export market is quite nascent in Tanzania. The sector is dominated by production of traditional varieties (Sindano; Viringe–Embe Tanga; Bongwa; Boribo, Dodo) essentially for the local market and home consumption. Introduction of new exotic varieties (Alphonso, Apple, Kesar, van dyke, Kent, Tommy Atkins etc) have started in the last few years and are yet to bear significant results. Hence the data about production and marketing (export) especially of improved and export varieties are scattered and not complete. The Ministry of Agriculture, Food Security and Cooperatives is yet to put in place a reliable system to collect and analyse relevant data. Information available at the ministry level is incomplete. The other issue is that north-eastern corridor which is the base of this study is not the main mango growing area in Tanzania which implies that in order to draw relevant conclusions about the sub sector; additional interviews in the mango growing areas of the Coast region and Dar es Salaam are inevitable. In spite of these limitations, the consultants have been able to gather and simulate meaningful information to back up analysis and recommendations presented in this report.

1.5 Structure of the report
This report is presented in three main chapters. The first chapter introduces the report in terms of objectives, methodology and limitations. Chapter two analyses the mango sub sector in Tanzania. The analysis starts from market trends & dynamics and then identifies the actors, their functions
and interrelationships in the sub sector. Sub sector mapping summarises the emerging picture of sub sector dynamics and this is followed by assessment of profitability thresholds, support institutions and a summary of major constraints and opportunities for growth and competitiveness. Chapter three focuses on the sub sector development strategies and identification of supply chains for further upgrading. Short, medium and long term leverage interventions are recommended and within them the potential role of SCF is indicated.
2. SUB SECTOR OVERVIEW

2.1 Sub sector definition
Mango is one of the common fruit baskets in most continents in particular Asia, Central and South America and Africa. In Tanzania mango is on the list of five top most fruits i.e. bananas, oranges, pineapple, mangoes and peas. Mango is traded and consumed as fresh or in processed form. There are number of products produced from mango like mango juice, mango pulp, mango flavour, mango kernel oil, mango pickles and powder etc. which have been well introduced and accepted in different market segments. In Tanzania and Africa at large processing of mango is less developed and varieties grown are most suitable for local markets. It is therefore not prudent to cluster mango as one product. In essence there are many sub sectors within mango if one takes the sub sector definition as the match of a product with its target market segment. In this study while recognizing that in Tanzania, over 99% of mango production is consumed by the local market and essentially as a fresh fruit, a choice was made by SCF management to focus on the niche of the export market of fresh mangoes. The target market is the Middle East which is one of the fast emerging markets for Tanzania with less stringent conditions and where comparative advantages may exist based on seasonality with traditional suppliers (India, Philippines, and Thailand etc). Hence the subsector in focus in this study is fresh mango for export market, in particular to the Middle East.

2.2 Market trends and dynamics

2.2.1 Global overview: Economic and social impact of mangoes
Global production of mangoes is concentrated mainly in Asia and more precisely in India which produces an average of 12 Million MT in a year. Mangoes are grown in 85 countries of which 63 countries produce each more than 1 000 MT a year. Total world production of mangoes was 24.4 million MT in 1999 (FAOSTAT, 2000), which played an integral part in the lives of many, not only by being a rich nutrient source but also by serving as a common good that is shared in the culture, the life style and the religion. In 1960 mangoes were not commonly known among the consumers outside of the tropics and there was virtually no international trade of fresh fruit.

In recent years, mangoes have become well established as fresh fruit and processed products in the global market. India is still by far the major producer of mangoes in the world; although, its relative share in the world production has been gradually declining as they are also one of the major consumers.

World demand for mango is ascertained to be increasing however, particularly from temperate countries, where mangoes are rapidly gaining in popularity. The increase in mango production in non-traditional mango-producing areas has been notable and includes parts of Asia, West Africa, Australia, South America and Mexico. International trade of mangoes is dominated by varieties like "Keitt" and "Tommy Atkins" (Emex, 2000).

Apart from India which produced 12 million MT and China 2.4 million MT, the rest of the major world producers of mangoes are shown in figure 1 below.
Figure 1 above indicates that apart from India (commanding half of world production) followed by China; the other major producers would include Martinique (West Indies) followed by Trinidad and Tobago, Puerto Rico, Paraguay, Iran, Oman and Cambodia in that order. World imports of fresh mangoes was expected to increase by 53 percent to 459 000 tonnes by 2005 due to the increasing consumption worldwide. Processed tropical fruits trade transactions, mostly by developing countries amounted to approximately US$1,500 million in 1997. Asia accounts for over 85 percent of the world exports of processed tropical fruits. The consumption of processed mango products such as mango-flavoured beverages either singly flavoured or in multi-flavoured is rapidly increasing, particularly in Europe. Major suppliers of mango pulp (13 to 18°Brix) and concentrates (28 to 32°Brix) are Peru, India and Ecuador. Other processed mango products: dried, jam, jellies, syrup and other retail-packed products are fast gaining markets and commanding better prices than other tropical fruits.

There are so many mango varieties in the world today. For example, Thailand grows over 100 native mango cultivars. The aim is to produce cultivars appropriate for processing or for raw or ripe consumption. One of the persistent problems in mango is damage caused by insects and diseases, which are now being addressed by a number of researchers in Entomology and Plant Pathology. Organically grown mangoes are currently produced in South Africa and India and exported in fresh frozen form.
2.2.2 EU and USA market

Leading importing countries in the EU are the Netherlands, France, England, Portugal, Spain, Belgium, Germany, Denmark, and Sweden. Mango market has already attained its maturity and a significant increase in production is not foreseen (Statement from GDS 2007 report). Mango prices are declining in the world market with growing export volume, though prices fluctuate mainly depending on variety, size, origin and season. Any aim for export to the EU should consider as bottom-line production of marketable varieties, size, colour and appealing appearance, delivery season and competitive price. Access to the EU market is furthermore guided by stringent standards and certification requirements (EUREP-GAP, HACCP and other Ethical Trading Initiatives (ETI) which makes exports on mango from Tanzania among others unattainable. Besides Peru, Brazil and South Africa have the same seasonality as Tanzania and these countries have low sea freight costs to Europe, which give them a comparative advantage over Tanzania in the European market. However, further niche market analysis e.g. organic or fair trade still needs to be identified in terms of the scale of the market opportunity and whether mango exports can be truly competitive.

In the United States of America fruit eaters now regularly choose mangoes over apricots, cherries and plums. Processed mango is an exotic product in the US and gaining in popularity. Over the years the imports of this product have been increasing. Importers in the US think imports will increase even more in the coming years. Americans prefer canned mangoes because they like to have something out of the ordinary. Additionally, mangoes enjoy an ethnic market among Asian and Hispanic Americans. However the issue of standards and certification requirements apply as well in accessing USA market.

2.2.3 Middle East

Middle East is one of the fastest growing and developing markets in the world economy today. The region is probably the most investor friendly region with full support from the Governments, attractive tax free facilities and world class infrastructure. Add to this improved Intellectual property Legislations, a high number of High Net-worth Individuals and a young upwardly mobile consumer market keen on leisure and consumer spending, the Middle East is a perfect answer to business investors. Trade flow analysis of mangoes into the Middle East Market, 2005 revealed the following picture:

- The top two importers of mangoes in the Middle East in 2005 were:
  - Saudi Arabia (US$ 13.2 million up from US$ 10.8 million in 2004). Suppliers in the market were Yemen (46%) and Pakistan (42%)
  - United Arab Emirates (US$ 12.8 million slightly down from US$ 13.3 million in 2004). Of this, 85% was supplied by Pakistan
  - Oman, the third largest importer in 2005 with US$ 6.6 million (slightly unchanged from US$ 6 million in 2004). The main supplier was Pakistan (85%)
- Leading exporters to Middle East in 2005:
  - Pakistan (56% up from 55% in 2004),
  - Yemen (15% up from 12% in 2004),
  - India (6% up from 2% in 2004),
  - UAE (4%)
• The Middle East was a growing market share for Pakistan (13%), Yemen (49%), and India (64%) for the period 2004 - 2005.
• Kenya exports to the region fell from 10% in 2004 to negligible levels in 2005, a yet unexplained fall and Uganda and Tanzania have yet a negligible presence in the market.

The Tanzanian season (February to April) which also coincides with Kenya is considered a comparative advantage to access Middle East market since during this time there is a gap in the supply from the giants (India, Pakistan, Malaysia, Philippines and Thailand etc ) who dominate in this market from April onwards. During this period it is not only that there is a market gap in the Middle East but also in India which is also a main consumer of mango.

The Tanzanian mango growers have started planting Asian varieties, for example Alphonso and the Apple mango, which are in demand in the Middle East target market. In addition, there have been some efforts to plant Floridian varieties, such as Tommy Atkins. The Association of Mango Growers (AMAGRO) claims that Tanzanian’s comparative advantage in mango exports in the Middle East and Asia is based on seasonality, that is, it can produce at times when some countries in the target market cannot. In addition, Tanzania has cheaper freight to these markets than South America, and land is cheaper in Tanzania than in Kenya. However, some quality improvement and quality control is needed.

Critical success factors for mango entry into the Middle East market have been established to include the following thresholds:
• Free from weevils infestation
• Clean and fresh
• Year round supply
• Taste and size (big & sweet or small but tasty)
• Standard size and trade mark
• Packaging
• Competitive prices

2.2.4 Regional markets
The COMESA import market for mangoes is very small. Total COMESA imports of mangoes in 2005 were US$ 1.15 million, up significantly 490% from the previous year. The leading exporters of mango to COMESA countries are India (82%), South Africa (9%), and Brazil (7%)

The market is highly concentrated in Egypt, who buys most of its mangoes from India and Angola who buys from South Africa and Brazil. Since Egypt is a significant exporter of mangoes itself, further research into the nature of Egypt's demand would be required. The surge in COMESA’s mango imports in recent years is also predominantly Egyptian.

East African exports of mangoes to COMESA are negligible. East African exporters may wish to monitor this surge in Egyptian imports more closely to see if advantages of COMESA membership and proximity can be exploited in order to compete with India.

2.3 Tanzania position in the mango production map
Tanzania is rather an insignificant player when considered worldwide, however when placed in the African context it comes out among the top six producers. However these production figures reflect
over 99% local varieties which are essentially consumed in the country with very limited export potential. Figure 2 indicates the position of Tanzania in the Africa mango map.

Figure 2: Mango production in Africa

According to these figures, Nigeria is the highest producer of mangoes in Africa, followed by Egypt, Madagascar, DRC, Sudan and Tanzania. However, taken in totality Africa’s export contribution to the global market less than 15% and even to a lesser extent the processed mango products. In the case of Tanzania the varieties produced are essentially for local market and hence very negligible contribution in the export market picture. The situation in Tanzania is further analysed in the subsequent chapters.

2.4 Actors and their functions in the mango sub sector in Tanzania

The main actors in the fresh mango subsector are input suppliers, small scale producers, traders (middleman) and wholesale and retailing outlets and emerging exporters. The functions and characteristics of the different actors in the subsector are described for the Tanzania mainland and Islands respectively.

2.4.1 Mango sub sector overview in Tanzania mainland

The Mango is generally grown in the tropics and sub-tropics as a consequence it’s produced across a large latitude range in Tanzania, under widely varied environments, soils and management conditions. However, this widespread production brings with it a range of special problems or challenges. Mango production in Tanzania is predominantly a smallholder crop, often produced at subsistence level with minimum inputs in terms of crop management. Mango orchards are normally small, not exceeding two to five hectares of land. Mango is one of the rather
traditional fruit crop grown mainly in Coastal Zone (Dar es Salaam, Coast, Tanga) and Morogoro and Tabora regions.

Fig 3: Map of main mango growing regions in Tanzania

In North Eastern Tanzania, which is the study area, mango is mainly grown in the Tanga and Kilimanjaro regions. According to regional office statistics Korogwe and Muheza districts are the main producing areas. The estimated area under mango production is 2,560 ha and 1,863 ha for Korogwe and Muheza respectively. It is further estimated that annual production is around 43,500 MT for Korogwe and 31,942 MT for Muheza. Over 95% of mango produced in Tanga is traditional varieties.

In Mombo area a model farm (Mr Shebuge) of improved / export quality varieties exist since 1996. In this farm 18 different varieties have been tested and are at production stage. Apart from mango production the farm produces and sells planting materials. Agricultural Research Institute (ARI) Mlingano in Tanga and Sokoine University of Agriculture (SUA) are also producing seedlings of improved variety. However, the dissemination and adaptation of improved varieties has been rather slow. Coupled with this; are the incidences of pests and diseases which are now widespread in Tanzania and these are becoming a threat if a solution is not found.

Mango is also grown in limited volumes in the lower (dry) belts of Rombo, Same and Mwanga districts in Kilimanjaro region. Negligible amounts of mango are grown in Arusha region and the other districts in the study area. The local variety is mainly sold on the local markets in Tanga, Dar es Salaam and Zanzibar. The improved varieties are sold in upmarket hotels and supermarkets in Dar es Salaam and Arusha. Demand for improved varieties by up market is increasing. Current production practices cannot cope with the increased domestic and international consumer demands in terms of quantity, quality and consistency. Local traders usually buy from farmers and in turn organize for transport to urban areas where they sell to urban based traders or directly to consumers. For the improved and export varieties, the marketing channels is often directly from farmers to up market clients (supermarkets and some hotels) and to the export markets.
Common mango varieties grown include Apple, Palma, Boribo, Dodo, Haden, Keitt, Kent, Van Dyke, Tommy Atkins, Ngowe, Hadijar and various other local landraces. Apple and Ngowe have high demand by the export market sub-sector. Increased production of mangoes in Tanzania is constrained by a combination of factors:

- Poor agronomic practices,
- Losses due to insect pests and diseases (especially the *Bactrocera invadens* – *Inzi mvamizi* in Swahili. and
- Poor market access.

Tanzania is exporting only a very small percentage (less than 0.05%) of the total mango production mainly to the Middle East (Anon, 2003). Table 2 below shows the export trends from year 2000 to 2003. The ministry who provided the data acknowledged the fact that the data may be underestimated as the exercise was not comprehensive. But it is important to establish that there has been growing trend for mango exports from year 2000.

### Table 2: Export trend of Mango from Tanzania mainland to Middle East

<table>
<thead>
<tr>
<th>Year</th>
<th>Crop</th>
<th>Weight (Tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>Mangoes and mangosteens, fresh or dried</td>
<td>8.482</td>
</tr>
<tr>
<td>2001</td>
<td>Mangoes and mangosteens, fresh or dried</td>
<td>35.768</td>
</tr>
<tr>
<td>2002</td>
<td>Mangoes and mangosteens, fresh or dried</td>
<td>87.460</td>
</tr>
<tr>
<td>2003</td>
<td>Mangoes and mangosteens, fresh or dried</td>
<td>49.125</td>
</tr>
</tbody>
</table>

Source: MAFC, 2005

### 2.4.2 Fruit planting material

Before decentralization, fruit propagule production was the responsibility of research centres and central district nurseries supervised by district horticulturists. Root stocking materials and budwood were obtained from the research and district mother tree orchards. From these centers, individual nurseries obtained budwood for multiplication. This arrangement ensured adherence to nursery
ethics of propagating materials that are true to type, disease and pest free. Decentralization has caused demise of the central nurseries. A total of 25 mother tree orchards and corresponding nurseries were in existence in the 1970’s including 1 spices/herbs collection at Zigi in Amani-Tanga. This number has dwindled to only 6 namely 1 each at Igurus i in Mbeya; Mpiji in Dar Es Salaam; Songa in Muheza; Bugaga, Kasulu for tropical fruits and 2 in Lushoto for temperate and tropical fruits.

The list of varieties in each of these mother tree orchards can hardly be obtained presently but it is evident that these mother tree orchards are in bad condition due to lack of funding and rehabilitation needs. Some of the varieties have long been lost and overgrown by rootstock shoots. The orchards are old and needs replanting/replacement. There is need to upgrade the orchards to cater for the growing demand of fruit tree propagates with a wide variety of choices such as extending the harvesting period, processing requirement and for fresh market. There is a big operational gap between mother tree orchards and mini nurseries now managed by individuals or communally based nurseries. There is need to revive the central nurseries, invest in training pomologist/virologist who should oversee that materials to be distributed are really clean by conducting virus indexing. Farmers should be sensitized to invest into nursery plant production and be offered necessary training.

SUA orchard and nursery is currently multiplying 9 varieties of mangoes including exotic varieties (Alphonso, Tommy, Keith, Red Indians, etc). The nursery has annual capacity of multiplying between 15,000 – 20,000 seedlings. Few private nurseries have mushroomed as a spin off effect of this university initiative. Enterprise Works, a USAID funded program in Southern Tanzania has also been supporting this initiative and the issue for now is further dissemination and support to farmers to adapt.

2.4.3 Pests and diseases in Mango production

A wide range of insect pests and diseases attacks the mango crop. Fruit flies (Ceratitis spp./Bactrocera spp.) and mango seed weevil [Sternochetus mangifera (F.)], both quarantine pests, are by far the most damaging insect pests of mangoes all over Africa including Tanzania (Acland, 1971; Griesbach, 1992; Joubert et al., 2000). Other insect pests include aphids, scales, mealybugs, coconut bugs, mosquito bugs (Helopeltis spp.) and mango gallflies (Varela, et al. 2006). Powdery mildew (Oidium mangiferae Berthet) and anthracnose [Colletotrichum gloeosporioides (Penz.) Penz. & Sacc. in Penz] are the key diseases affecting mango production in Tanzania.

Since 2003 Tanzania is also invaded by Bactrocera invadens a quarantine fruit fly. In Eastern Africa, the insect was first reported by Kenya in 2002, then Tanzania in 2003 and West Africa in 2004. Bactrocera invadens is indigenous pest in Far East but with natural enemies, but in Africa it is recommended to use cultural prevention mechanisms and use of technical traps and baits.

SUA has been implementing a project titled: “Fruit Fly pest control in small scale orchards in Tanzania from 2004-2008”. The objective of the project is improvement of fruit production at SHF level through gathering of baseline data on biological aspects pertaining to fruit fly pest species, development of awareness programme for local farmers and strengthening research and training capacity at SUA. The university has spent most of its time to understand Bactrocera invadens and to assess the situation in the country and almost all areas have been invaded. Although proposed
prevention methods can work, to be effective the prevention campaign should be national or rather region wide movement. This project was conducted jointly by SUA and Royal Museum of Central Africa (RMCA) Tervuren Belgium.

It may seem that a lot of the information derived from research has not been properly packaged and disseminated for use by the majority of smallholder mango growers. Furthermore, due to a lack of locally validated information on best control options for the key insect pests and diseases, agribusiness oriented mango growers rely on the use of broad-spectrum synthetic pesticides for control of the key pests in order to produce blemish-free fruits.

2.4.4 Mango in Zanzibar islands

Boribo Muyuni, is a popular mango variety in Zanzibar. Main constraints in the production and marketing of mango in the islands include suitability of only a few varieties for export, seasonal variability in output; pests and disease problems particularly the Mango fruit fly, Ceratitis cosyra, high freight charges, limited cargo space and lack of technical know-how on scientific management practices. The steps undertaken by government to remove the constraints to promote exports, has included expanding nurseries, pricing, extension and training and research.

Recently there is significant demand for mango for the export market, mainly to the Gulf States. The demand for mango in the Gulf States is higher during October to March, which is the off-season for the major suppliers, India and Pakistan. Mango exports from the Islands have been consistently rising from 16 tons in 1992, then 36 tons in 1994 to about 100 tons in 1995 worth $60,000 of which 30% was earned by rural smallholder farmers. Mango exports in the Islands are projected to reach 2,000 tons worth $1 million by the year 2007. Unguja Island is the main mango production area in the islands.

2.5 Support organisations and instruments used

Despite the popularity of mangoes on the domestic, regional and international markets, the government of Tanzania has only of late put the crop on focus and is providing a number of support packages. This is in recognition of the market potential that the crop has but also realizing that there is a threat of pests and diseases affecting production and productivity.

Some of the main Government initiatives according the Ministry in revamping the subsector include:

- Distribution of quality planting materials through its orchards of mother trees and demonstration plots in farmers' fields
- Importation and distribution to some selected farmers and R & D institutions pests control chemicals and trapping methods (netting, lure traps, bait traps)
- Dissemination through training, posters and other mechanisms for fruit fly pest management
- Conducting agricultural shows e.g. Nanenane in several zonal grounds (e.g. Morogoro, Dodoma, etc).
- Supporting initiation of the representative bodies in the subsector development for enhancing dialogue with stakeholders such as the Horticulture Development Council - HODECT
- Backstopping to farmers' organisation (the Association of Mango Growers - AMAGRO).
Recently the government is encouraging public private partnership (PPP) in starting up export initiatives in the sub sector. In November 2007, the government of Tanzania has initiated a pilot project on the development of horticultural outgrower schemes for the export market whereby the focus initially would be on mangoes and passion. The project led by Trans Zambezi Industries (TZI) of Zimbabwe with financial support (grant and a loan) from Common Fund for Commodities (CFC) would start up a state of the art processing facility for concentrates in Nkuaranga (Coast region) and would establish over 4 years period starting from 2007, around 600 smallholder outgrowers. The project would deliver a package of the much needed technologies that would improve production, productivity as well as accreditation services to improve export market access.

Currently there are rather limited non governmental organisations which are explicitly targeting the sub sector. A number of NGOs currently focusing on horticultural products lines in response to a recently launched USAID APS programme may consider supporting the mango sub sector (ADCI VOCA- SHOP Project and TAHA. Sokoine University of Agriculture has been implementing a fruit fly projects 2004-2008 and is seeking ways of extending the project outcomes countrywide.

2.6 Fresh Mango supply chain analysis

The fresh mango sub sector for the export market in Tanzania is just emerging. In order to place in context the dynamics in the sub sector, other supply channels serving the local urban markets have also been identified. Three supply channels have emerged:

- **On farm rural/semi urban markets channel.**
  This is the traditional channel characterised by farmers who sell part of their produce on the open air or road side markets. If you drive on the main road from the North to DSM, the children of rural farmers sell mangoes on the road side literally throughout the year. Periodic rural markets too are visited by these farmers cum traders. This channel handles the traditional varieties and during peak harvesting season the number of traders increases tremendously.

- **Urban market biased channel.**
  This channel is driven essentially by traders who in turn use rural middleman / brokers to connect them with farmers. This channel handles most of the mango crop during the season. In the urban markets of Dar es Salaam and Arusha a marketing system is in place whereby the main wholesale market is Tandale and Kilombero respectively which receives the bulk of fresh fruit from upcountry, from which sub wholesalers and retailers buy and sell to consumers. The main urban consumers are green grocers /kiosks and urban dwellers. During the high season when market is flooded with mangos literally all segments of market (low to high income could afford mangoes). During the lean season (June to Sept) however the prices are quite expensive comparatively and middle to high income champion the fruit. During these times occasional imports of specific varieties by supermarkets like Imalaseko and Shopritte do come in the market from mainly South Africa but also from Kenya and Zambia.

- **Emerging export market.**
  During this study we have established that only two farmers cum exporters are at an advanced stage while many others are still building up production base of export quality and varieties. The present exporters are NatureRipe Kilimanjaro Ltd and Global Fruits and Vegetables Supplies Ltd. The export volume is still very small (3-5 tons a year) usually by air to the Middle East. NatureRipe
is a member of Tanzania Horticultural Association (TAHA) and also the AMAGRO where in fact they assume the chairmanship. This channel involves direct farming and exporting function with limited outsourcing from other producers. But during the study it was established that the aim of AMAGRO is to eventually organise joint export marketing for its members, hence more outsourcing by current exporters may become a reality. With growth prospects established for Middle East market and other countries, this channel has great potential to grow. The three channels are depicted in the sub sector map presented in Figure 4 below.
2.6.1 Profitability analysis of the various supply channels

Gross Margin analysis for improved variety done with a model farmer in Mombo revealed the following picture:
Interviews with traders buying from the farm and selling directly to final consumers indicated to be realising a gross margin of around 40%.

With exporters the gross margins and actual profitability can only be maximised with increased economies of scale. The exporters indicated that the prices and hence margins fluctuates with seasonality. In recent export consignment one exporter indicated that they managed to gain around TShs 200-300 net margin per mango sold to Middle East market compared to TShs 100 – 200 on the local up market. The same conclusion was arrived by sub sector analysis made in Kenya where they concluded that export margins are higher than local market. However, given the very small volumes and high freight costs (currently Tanzania uses airfreight) it would not make a business case to continue at this scale. In general when mango is grown according to good agronomic practices provides a much more lucrative return compared with many other cash / food alternative crops.

### 2.7 Major Constraints and Opportunities

The major constraints which are currently hindering the development of the mango supply chain can be categorized according to the basic stages in the supply chain: the farm level, the marketing stage, the processing stage and the export stage as well as the policy & regulatory level.

#### 2.7.1 Farm level (production stage)

Tanzania is still washed with traditional varieties. Very slow pace has been observed in moving to commercial production of export based varieties. At the farm-level, key constraints faced by farmers are the lack of clean planting material, inadequate technology transfer support, the length of the production cycle, pests and disease infestation and inadequate post-harvest handling.
facilities. Concerning planting material, there is a generalized shortage of grafted seedlings and very few farmers have gone into mango in commercial way. Farmers tend to use inferior, low yielding seedlings or remain with traditional varieties. Farmers do not have knowledge on improved production technology, and there is little or no use of fertilizers and pesticides. Pests – mainly the mango seed weevil and fruit fly – and diseases – mainly anthracnose and powdery mildew – are also major problems. Some fruit trees are so tall and big such that spraying is only not viable but also impossible. Farmers often lack motorized pumps for effective pest and disease control. Coupled with this, is poor crop management practice, which leads to flower and fruit fall.

Where mango is harvested only once a year, mango farmers have not taken mango as a core crop but rather a supplementary crop. They have diversified to other crops, including passion fruits, melons and seedling production, to smooth their income pattern throughout the year. At harvest time, there is often an oversupply which leads to low prices and product losses. Farmers suffer from poor post-harvest handling techniques, leading to significant losses, which affect returns to the farmer and traders. It was established that post harvest losses could be as high as 60%. Furthermore, farmers do not have good storage facilities available at the farm level, and this forces them to sell their product immediately after harvest. No collective bargaining takes place yet on the price, and each farmer interacts individually with the trader and other buyers, often receiving prices well below reigning market prices.

The main opportunity is the presence of research and development projects at SUA that has been assessing possibilities of coping with pests and diseases. Besides this the government policy is quite positive on encouraging new and improved varieties. To this effect the government is supporting seedlings production in farmer fields and is willing to work with AMAGRO members for technology dissemination.

### 2.7.2 Marketing Stage

At the marketing stage, a major constraint is the poorly developed transport infrastructure, such as the bad road conditions that serve production areas which further contribute to post-harvest losses and a deterioration of quality leading to low selling prices. In many rural areas transport costs are in fact prohibitive, both within and outside the country. Tanzania is only using air freighting presently which is definitely very expensive and may not be able to cope with huge volumes in future. Supply is not well organized with collection, grading and packaging facilities and, therefore, farmers are not able to separate higher quality fruits to be remunerated accordingly. Moreover, farmers often lack the necessary information on alternative marketing possibilities and on alternative product uses, such as drying, and other options for value addition. Traders and few exporters in place often suffer from poor access to credit, which makes it difficult for them to finance their operations.

In regard to exports, inadequate post-harvest/husbandry control, wrong varieties for sea freight, inadequate sea freight facilities and high air freight costs are among the major constraints. Moreover, the need to comply with the EUREP-GAP (which has now changed to GLOBALGAP) and traceability standards, which are necessary to enter the EU market, constitute a further challenge, hence the main reason to resort to Middle East market. Exporters indicated that they often suffer from price instability in international markets and from stiff competition from other countries like India, Pakistan, Brazil, Mexico and Costa Rica. These competitors offer higher quality varieties at lower prices, due mainly to lower shipping costs.
The main opportunity as indicated in the market analysis chapter is on the market growth prospects and the fact that Tanzania could build on its comparative advantage during certain seasons. In addition the organization of farmers under AMAGRO may allow for building the necessary critical mass.

2.7.3 Value addition / processing stage

Concerning processing, major constraints are the insufficient plant capacity and organization of supplies. Currently, an insignificant percentage of mangoes produced in Tanzania are processed. The better quality fruits are exported or sold to up market clients and few existing processors are left with fruits of the lowest quality. On the consumption side, the price of natural mango juice is too expensive for domestic consumers, who mostly consume cheaper products and indigenous varieties. Relatively cheaper imported mango juices are available on the market from Kenya, Mauritius, South Africa and Egypt. These countries enjoy preferential tariffs under the regional trade agreement such as COMESA. Further competition comes from locally manufactured, chemically sweetened mango flavoured soft drinks.

The opportunity for value addition is unquestionable. Technologies for value addition like drying and juices, pulps etc are out-developed. The market for fruit pulp is growing. The issue is organizational capacity at the sub sector and in the development of the local and regional market for processed products.

The newly launched PPP project that has been promoted by Ministry of Agriculture & Ministries of Industries and Commerce involving Trans Zambezi Industries of Zimbabwe (TZI) with support from Common Fund for Commodities (CFC) for production and export of concentrates of mango and passion fruits is a great opportunity for the sub sector development in Tanzania. The project estimated costs is around USD 5,600,000 to be implemented fro 2008-2010. It is planned to attract 600 outgrowers from the coastal belt. Apart from concentrates the project expects to export fresh fruits as well.

2.7.4 Exporting level

Very limited volumes and value of produced mangoes are exported. Presently Tanzania could only export fresh mangoes and the trend is just picking up. Only a handful of companies have started to explore export market and most common destination is Middle East. The companies presently exporting from Tanzania include Natureripe Kilimanjaro Ltd (exporting about 3-5 tons starting from 2005) and Global Fruit and Vegetable Supplies ltd. There is no track record yet and the issue of quality, quantity and consistency is bound to affect the sub sector. The production base is building up as indicated by AMAGRO interviews and hopefully producers would be able to deal with pest & diseases in order to meet the market conditions.

2.7.5 Policies and Regulations

As indicated in the report, the government is quite explicit in supporting horticultural sector as one of one of the potential sources of growth for Tanzania. The Agricultural sector development programme (ASDP) now in full swing provides resources and capacity building funds at District level. Mango growers if well organised have a possibility to access such resources. What is an apparent gap is between policy intentions and implementation. During the study the Ministry of
agriculture hosted a PPP initiative to launch an export based processing facility that would engage several outgrower base in the Coast region. This is an opportunity to build upon.

2.8 Summary of the main findings

- Over 95% of mango production in Tanzania is of the local varieties and for the local consumption
- The North Eastern corridor of Tanzania is less advanced in production of export varieties mango compared to the Coast, Dar es Salaam, and Morogoro regions.
- Initiative to grow export varieties is on the increase and is supported by the private and public sector.
- Apart from the seemingly growing international market demand, access to EU/USA may not be feasible for Tanzania in the short run, but an alternative is to build on existing links with Middle East market where Tanzania may have some comparative advantages to build upon.
- The main challenge is for the smallholder farmers to step up from traditional practices to commercialisation of mango production for the export market. It involves among others adapting improved varieties, overcoming the pests and disease threat, organisational capacity for exporting, technical and infrastructural upgrading.
- Opportunities for sub sector development could arise from building on current export initiatives under AMAGRO umbrella and linkages to upcoming processing of export quality concentrates.
3. SUB SECTOR DEVELOPMENT STRATEGIES

3.1 Value chain driven interventions

The logical way to move forward in promoting competitiveness and growth in the fresh mango sub sector is by focusing on growth potential supply chains. In this analysis it has become evident that the emerging supply channel for export market is the one that connects medium/large scale farmers who have started integrating export activities. Through these exporters as potential market leaders, more small scale producers (preferably members of mango growers association) could supply to the same channels. The main challenge is to have a collaboration strategy among the willing farmers and exporters whom could address together issues of becoming competitive in the export market. Bottom line is that export varieties of sizeable volumes are initiated and that the issue of pest and disease barrier to export market is addressed.

The other supply chain opportunity is to link up smallholder mango growers with the emerging processing and export facilities for mango and passion concentrates. Recently through the Ministry of Agriculture a program to support commercialisation and linkage of mango growers in the Coast region has started. Trans Zimbabwe Industries with support from Common Fund for Commodities are planning to set up state of the art processing facility and will basically be contracting smallholder farmers. This upcoming supply chain is worth monitoring and support. The potential value chain for further development is visualised below in figure 5.

Figure 5: Proposed value chain for upgrading
3.2 Proposed way forward

There is a foregone potential for the mango sub sector contribution to income and employment opportunities in terms of reduced availability of locally produced high quality fruits and natural juices. Some of the recommended potential leverage points would include:

3.2.1 Short- Term leverage interventions

The thrust in the short run is to facilitate setting up of a commercialized market linkage base for export quality varieties. The commercialization agenda for mangoes in Tanzania is still at infancy stage. Tanzania is ranked high in production of traditional varieties which are growing rather widely with very limited agronomic attention and is not yet in the map of producing export varieties.

- Promotion of research findings on how to go about combating pests and disease infestation of mango varieties. Building on Ministry’s and SUA project interventions as it comes to an end in 2008. It has been recommended that a nation or region wide approach is required.
- Capacity building of interested farmers on crop husbandry, technological application and overall farm management as key to the development of the mango sub sector and export oriented value chain.
- Improvement of exports of fresh fruit through better quality control and management of the value chain. Given that a sizeable quantity of fruits does not normally meet export standards, other utilization must be examined.
- Improvement in extension provided to mango farmers is required. The need to improve plant breeding is required particularly for hybrid and improved varieties. In some areas, better quality could be achieved by adapting existing varieties, but developing new locally-adapted varieties in the long run should be explored.

3.2.2 Medium Term Interventions

- The development of processed products particularly for export (concentrates), given that shipping and handling costs are lower for processed products.
- Awareness rising on the opportunities for mango commercialization in Tanzania. See the case of Philippines in text box 1 below.

Box 1: Promoting mango sub sector development: Case of Philippines

The National Mango Congress in the Philippines is an annual event established to create awareness of new technologies in production, harvest, and post-harvest handling of fresh mango fruits, processing and value adding, access to markets and credit facilities and other economic opportunities that the mango industry can offer to its stakeholders.

The first National Mango Congress was done in the Province of Cebu in 1999. The venue of the event is rotated among the three major islands of the Philippines - Luzon, Visayas and Mindanao. Normally, the holding of the Mango Congress happens at the last week of November in order to encourage more mango farmers from all over the country to attend and benefit from all the information given out during the event. The Congress itself is a three-day event with the President of the Republic being the usual keynote speaker during the opening of the Congress; The topics of discussion ranges from the latest techniques and technologies in the production and production inputs, post-harvest and processing, market development and market information as well as institutional linkages. For Instance the theme for 2007 is "Meeting the Challenges of the Expanding Local and Global Market". The participants are mostly mango growers (individual farmers and cooperatives), input suppliers, buyers/traders, contract sprayer/service providers, financiers/investors, processors, exporters, scientists/researchers, and national and local government officials.

The National Mango Congress also strengthens and links the various cooperatives of mango growers in the country with market players (exporters, processors, etc.) and other service providers (chemical companies, farm enterprises, etc.). Furthermore, the National Mango Congress has been an effective medium where industry stakeholders are allowed to talk about the challenges ailing the mango industry and to collectively seek solutions to such challenges and grab opportunities for the growth for the various stakeholders.
3.2.3 Long Term Interventions

- Infrastructural development to support the sub-sector. In the area of physical infrastructures, particular emphasis should be given to storage facilities and to transportation. Concerning institutional infrastructures, the development of adequate credit facilities and other services required by the supply chain and setting up collective farmers’ bodies, responsible for marketing and for the interaction with other stakeholders in the chain, must be examined.

3.4 Specific entry points for SCF

- Dissemination of Research results from SUA research findings on pests and disease management that would affect mango export potentiality. Tanzania seems to be in a quarantine zone with respect to fruit fly pests (especially bactrocera invadeus). The SUA project has recommended that a national awareness raising and consensus building on how to move ahead in combating the disease is a must.
- Capacity Strengthening of Association of mango growers and extension of services to NE corridor as potential entry point for a market focused value chain development.
- Linking up with upcoming projects in NE corridor involved in horticultural development e.g. SHOP Project etc
# APPENDICES

## Appendix 1: List of people met

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Position/Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Mr I. Seushi</td>
<td>Farmer &amp; SCF Board Chairman</td>
</tr>
<tr>
<td>2.</td>
<td>Ms Fatma Riyami/ Dr Diwani</td>
<td>Natureripe Kilimanjaro Ltd</td>
</tr>
<tr>
<td>3.</td>
<td>Regional Agricultural Advisor</td>
<td>Tanga Region</td>
</tr>
<tr>
<td>4.</td>
<td>Regional Economic Advisor</td>
<td>Tanga Region</td>
</tr>
<tr>
<td>5.</td>
<td>Ms Adah Mwasha</td>
<td>MOAFC</td>
</tr>
<tr>
<td>7.</td>
<td>Mr Millinga</td>
<td>Secretary: AMAGRO</td>
</tr>
<tr>
<td>8.</td>
<td>Mr Diwani</td>
<td>Marketing Manager, Natureripe Ltd</td>
</tr>
<tr>
<td>9.</td>
<td>Mr Naluyaga</td>
<td>TANEXA DSM</td>
</tr>
<tr>
<td>10.</td>
<td>Mr Kirenga</td>
<td>MOAFC</td>
</tr>
<tr>
<td>11.</td>
<td>Members of Kifaa Association</td>
<td>Muheza</td>
</tr>
<tr>
<td>12.</td>
<td>DALDO Office Staff</td>
<td>Muheza</td>
</tr>
<tr>
<td>13.</td>
<td>Mr Shebuge</td>
<td>Mango Farmer Mombo</td>
</tr>
<tr>
<td>14.</td>
<td>Mr Mjema</td>
<td>DALDO Korogwe</td>
</tr>
<tr>
<td>15.</td>
<td>Mr Mbowe</td>
<td>Planning Officer Korogwe</td>
</tr>
</tbody>
</table>
Appendix 2: 
CULTURAL PRACTICES OF MANGO PRODUCTION IN THE PHILIPPINES

The Philippines is known for its excellent fruit products. The carabao mango, better known as Manila Super Mango, makes the country competitive in the world market. The major importers of mango are Japan, Singapore, and Hongkong. The Manila Super Mango is one of the world's best varieties. Other popular varieties are Pico and Katchamita. Our mango industry supports some 2.5 million farmers and farm family members. Tagged as "sure export winner", there is a projected export increase at 13% annually. It is exported in its fresh or processed form. Mango is known for its versatility as all stages of fruit development is suitable for processing. The unripe or immature fruits can be processed into hot or sweet pickles while the ripe ones can be prepared as slices in syrup or in brine, mango juice, concentrate and puree, jam, chutneys, pulp fruit bar, mango wafer, mango powder, dehydrated mango slices, mango milk powder, and vermicelli. Leading areas producing mangoes are Western Visayas (Region VI), Central Luzon and Ilocos Region.

VARIETIES

CARABAO OR MANILA SUPER MANGO - originated from India, Burma and Malaya. It is best serve as fresh fruit. It has a perfect blend of sweetness and sourness, succulent, and has a pleasant aroma. Fleshy and yellow when ripe, very tender, melting in the mouth and less fibrous.

PICO - originated from India, Burma and Malaya. Smaller than the carabao variety. Kidney shaped with round apex and base, which is more, flattened. Light yellow orange when ripe, thick and tough. Has fibrous orange to yellow orange flesh. Sweeter than the carabao variety but not melting.

KATCHAMITA - originated from India and commonly known as India Mango. Skin is green and flesh is yellowish.

CULTURAL PRACTICES

A. Land Preparation
For backyard planting, prepare the land simply by digging a hole wide and deep enough to accommodate the ball of soil that goes with the planting material. This is recommended particularly in fertile, deep and friable soil. On poor soil, dig big, deep holes with a diameter of 30-50 cm. Set aside the top soil to be used to re-fill the hole after planting or transplanting.
For orchard planting in flat or slightly rolling terrain, plow the field as deep as possible and harrow the field twice until fine tilt is attained before the onset of the rainy season. To accommodate other cultural activities and to ensure straight alignment of trees, layout the field using the desired planting system such as, square, quincunx, or triangular system.

B. Planting
Carefully remove the plant material from its container and set it in the hole.
Fill the extra space with topsoil or compost. Preferably do this activity at the onset of rain.
Re-plant dead and missing hills one week after planting.

C. Intercropping
Use leguminous plant as intercrop to add fertility to the soil and to keep down the weeds. Fertilize your intercrop to prevent it from competing with the major crop.
D. Weed Control
Hands pull the weeds and continue cultivating the area. Hand pulling is recommended when the plants are still small and the weeds are too close to the plants. For bearing trees, spray herbicides such as round up or gramoxine to provide better weed control.

E. Irrigation
Irrigate the young and newly established trees, whenever necessary, during the first season (dry) of its growth. For matured trees, water or irrigate the plants during flowering and fruiting.
Mango trees need water during the flowering and the fruiting stages, which coincide with the dry season.
Water increases the number of fruits per panicle and, also, minimizes fruit drop.
Irrigation can be coupled with moisture conservation practices such as mulching, maintaining good vegetation between rows, and shallow cultivation.

F. Mulching
Mulch the base of the tree with dried grass or weeds, or other suitable mulching materials to restrict weed growth, maintain relatively low temperature and prevent excessive loss of soil moisture.
Dense mulches are effective means of reducing weed infestation.

G. Fertilization
Necessary to stimulate early growth and rapid development of young fruit bearing trees.
For one-year-old trees, apply 200-300 grams complete fertilizer in two equal doses per tree. For older trees, mix 300-500 grams complete fertilizer and 200-300 grams of urea per tree. Split the recommended dosage in two, apply at the start and before the end of the rainy season.
For bearing trees, apply 1.5-2.5 kilogram complete fertilizer per tree.
The usual method of applying fertilizer to young and bearing trees is to dig 10-15 holes or use the ring method of fertilizer application by digging a canal around the base of the tree, approximately 3-5 inches deep following the tree canopy. The fertilizer is then placed into the hole and covered with soil.

H. Flower Induction
SMUDGING - Make smokey fire below the tree canopy and allow smoke to pass through the foliage for several days. To produce heavy smoke, place green grasses on top of combustible materials such as dry leaves and coconut husks. It is done continuously for several days. Discontinue when no flowers appear two weeks. Repeat this process one-month to two months after.

CHEMICAL INDUCTION - The more reliable method of inducing off-season flowering is by spraying with potassium nitrate. Besides being effective, potassium nitrate is cheaper and forces mangoes to flower more uniformly. Application rate is 10 grams per liter of water. Spray toward the leaves evenly from the top downward to the bottom of the canopy.
I. Bagging/Wrapping
Mango fruits are as big as chicken’s egg 55-60 days after induction. Wrap the fruits with sturdy materials to resist rain and strong winds. The wrapping bag should be big enough to allow room for fruit development. Its bottom portion should be closed to prevent mango and seed borers from laying its eggs at the apex of the fruit.

J. Pruning
Usually done after harvest to prepare the tree for the next bearing season. Pruning helps increase fruit production, improve quality of fruits, attain desired size and shaped of crown, eliminate undesirable branches and achieve dwarfing effect to enable the trees to be resistant to lodging.

PEST AND DISEASES AND THE WAYS TO CONTROL

PESTS
1. Mango Hopper
Damage: Sucks the plant sap that results in withering and drying of tender shoots, inflorescence and very young fruits. Leaves sweet sticky fluids in plant parts that promotes development of fungus called sooty mold.
Control: Spray the recommended chemicals starting from fruit formation to fruit development.

2. Mango Tip Borers
Damage: Shoots wilt and terminal parts die. Affected panicles break and flowers shed off.
Control: Prune dead branches to discourage pests boring into the tree canopy. Pruning and burning parts prevent its spread.

3. Twig Cutters
Damage: Very destructive during the dry season thus reducing the number of flowers formed. It is characterized by the presence of dead twigs and leaves in the canopy.
Control: Pruning and burning of infected parts to prevent its spread.

4. Oriental Fruit fly
Damage: Laying of eggs on the fruit skin provides easy entry for rots and maggots, which feed on the flesh. The mango seed borer eats not only the flesh but also the seed of the fruit.
Control: Bagging or wrapping the fruit when its size is as big as chicken’s egg. Harvesting of fruits when matured green to prevent infestation.

5. Mealy Bugs
Damage: Attacks newly flushed leaves, flowers and fruits by sucking vital plant sap. Affected parts turn yellow, dry up and eventually fall.
Control: Removing of infested fruits, flowers, or leaves from the tree.

DISEASES
1. Anthracnose
Symptoms: Shot holes appear on mature leaves. The most serious fungal disease of mango which causes major damage during flowering up to fruit setting and again after, harvest. Upon ripening of fruit, circular brown to black spots appears resulting to fruit rot.
Control: Spray the recommended chemicals from floral bud formation to fruit development. Dip ripe fruits in hot water.

2. Scab
Symptoms: Grayish-brown spots on the fruits with crack at the center and becomes corky.
Control: Use the same control measures as in anthracnose.

3. Diplodia Stem-end Rot
Symptoms: Grayish violet to light brown lesion at the stem-end of the fruit that later turns black.
Control: Wash fruits with copper fungicide suspension.

HARVESTING, HANDLING, STORING AND GRADING
Do not harvest mangoes before 120 days from induction. If mangoes are for export, maturity index is needed. Fruits are either picked by hand or by means of a net attached to the end of a bamboo pole with a loop or knife at the end.
Sort out immature, undersize, damaged and diseased fruits during grading. Fruits are graded according to variety, size, weight or diameter.
Bamboo baskets lined with newspapers are used for packing mangoes intended for local markets. For export, the mangoes are placed either in wooden crates or carton boxes.
If necessary, mangoes should be stored at 9-10 degrees Centigrade. Ripe mangoes at this temperature can be stored for 18-21 days while freshly matured fruits for 23-26 days.

PROPAGATION OF MANILA SUPER MANGO
One simple way of propagating Manila Super Mango (carabao mango) is by grafting. The advantage derived from this method is early fruiting of the tree and the specific knowledge of what variety the plant will
bear. It is the surest way of perpetuating the desirable characteristics of parent plants and good qualities of the fruit.

Grafting is making use of the plant's scion and connecting it to its own kind. One tip to be considered to attain better production is that the young scion must come from the tree proven to bear good quality fruits and the stock to be used should be healthy, vigorous and disease free. It is the scion that will bear fruits and not the stock where the scion is connected.

**Things Needed in Grafting**
- One year old mango seedling.
- Scion with pronounced bud.
- Sharp knife for cutting the scion and the stock.
- Black plastic pouch with hole, 5 inches in diameter.
- Plastic strip to wrap the connection of the scion to the stock.

**How to Connect Scion**
Chip on both sides of the trunk of the scion making a spearlike shape. Take the leaves off the stock where the scion will be connected which should fit exactly to the split in the stock. Cut the rootstock to a height where there is active growth. Fit the scion to the stock and bind the connection with a plastic strip/tape up to the near tip of the scion where young leaves will come out.

Set aside (place where there is shade) the grafted young Manila Super Mango seedling and leave it there for one month until new leaves appear.

If enough leaves appear loosen the plastic strip and remove all the shoots that develop below the graft union. Transplant the new plant when the leaves of the shoots are already mature.

**Planting**
Start planting at the start of the rainy season. The recommended planting distance is between 10-14 meters.

For fertile, deep, friable soil make deep, wide holes enough to accommodate the mass of soil adhering to the roots of grafted seedlings.

For clayey, rocky or poor soils, make deep, big holes with a distance of 30-50 cm.

Be sure that the topsoil is mixed with compost.

**Harvesting and Post-Harvest Handling**
For trees that bear fruit without the use of chemical inducer, fruits mature 82-88 days after full blooming of flowers. Those, which are treated with chemicals, mature at 110-120 days after flower induction (DAFI).

Visual characteristics of fruit maturity DAFI are the following:
1. flattened shoulder at the stem end
2. fullness of the cheeks
3. yellow-green pedicel end
4. yellowing of the pulp

All fruits within its panicle do not mature at the same time, but mature or not it has specific days when to be harvested. In separating mature fruits from immature ones, floatation in 1% solution is a convenient non-destructive method.
SOME MANGO RECIPES

Pastillas de Mangga
Ingredients
2 cups mango puree
½ cup flour
½ cup refined sugar
½ cup powdered skim milk
Procedure
Sift together powdered skim milk, all purpose flour, and refined sugar. Mix well with mango puree. Cook mixture over moderate fire with constant stirring until mixture no longer sticks to the cooking pan. Remove mixture from pan and form into a cooky sheet. Let stand until cool and slightly stiff. Cut into strips and roll in sugar. Wrap in cellophane paper lined with wax paper.

Frozen Mangoes
Ingredients
Ripe mangoes
Refined sugar
Ascorbic acid or calamansi juice
Procedure
Proportion of ingredients must be five parts fruit to one part sugar. Wash mangoes to remove surface dirt. Slice and scoop out flesh. Gently mix mangoes and sugar with 0.1 percent ascorbic acid or calamansi juice (1 tsp juice for every 2 cups of sugar). Pack in polyethylene bags, seal, and freeze.

Mango Syrup Concentrate for Juice Preparation
Ingredients
4-5 medium-sized ripe mangoes
or 2 ½ cups of mango flesh
½ cup refined sugar
½ teaspoon citric acid
Procedure
Wash mangoes to remove surface dirt. Slice and scoop out flesh from slices with a stainless steel spoon. Separate the flesh from the seed using the blunt end of the knife. Be careful not to include the fibers. Macerate the flesh in a blender to obtain a smooth puree. Add sugar equivalent to one-fifth of the puree. Adjust the flavor by adding citric acid. Pasteurize until temperature reaches 82 degree C (180 degree F). Pour the mixture into cans or glass jars, leaving a 6-cm headspace. Seal immediately. Cool, label, and store.

Mango Halves in Syrup
Ingredients
Firm ripe mangoes
Refined sugar
Calcium chloride
Citric acid
Procedure
Select firm ripe mangoes free from bruises and blemishes. Wash mangoes to remove surface dirt, slice into halves, scoop out flesh with a stainless steel, and place in sterilized jars. Prepare medium syrup 35 degree Brix (approximate 1 cup sugar for every 2 cups of water). If desired, use 50-degree Brix syrup (1-cup sugar for a cup of water). Boil and add calcium chloride (1/4 teaspoon per 4 cups syrup) and citric acid (1/8 teaspoon per 4 cups syrup). Pour hot syrup into jars leaving a ¼-inch headspace. Exhaust by heating the
filled jar over a steamer until the internal pressure seals cap jars tightly. Process in boiling water for 25 minutes. Cool, label, and store.

**Mango Chutney**

**Ingredients**
- 4 cups sliced green mangoes (Carabao or Pico variety)
- 1 piece of ginger root
- 1 clove garlic
- 8 pcs native onions
- 2 pcs hot pepper
- 1 small box raisins
- 2 cups vinegar
- 3 cups brown sugar
- 4 tbsp coarse salt

**Procedure**

Salts sliced green mangoes and allow standing overnight, and then draining. Boil vinegar and sugar. Add spices. Simmer until thick. Add the sliced mangoes and continue cooking until transparent. Pack in sterilized jars. Cool and store.

**Appendix 3:** World mango production by country (Source: FAOSTAT, 2000)

<table>
<thead>
<tr>
<th>Country</th>
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