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IMPROVING KENYA'S DOMESTIC HORTICULTURAL PRODUCTION AND MARKETING SYSTEM: CURRENT COMPETITIVENESS, FORCES OF CHANGE, AND CHALLENGES FOR THE FUTURE

VOLUME I:
HORTICULTURAL PRODUCTION

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LIST OF ACRONYMS

CIDA	Canadian International Development Agency
COMESA	Common Market for Eastern and Southern Africa
EAC	East African Community
EU	European Union
FAO	Food and Agriculture Organisation
FPEAK	Fresh Produce Exporters Association of Kenya
GDP	Gross Domestic Product
HCDA	Horticultural Crop Development Authority
IBR	Institute for Biotechnology Research
ICIPE	International Centre of Insect Physiology and Ecology
IFAD	International Fund for Agricultural Development
IGAD	Inter-Governmental Authority
JKUAT	Jomo Kenyatta University of Agriculture and Technology
KARI	Kenya Agricultural Research Institute
KBS	Kenya Bureau of Standards
KEPHIS	Kenya Plant Health Inspectorate Service
KFA	Kenya Farmers' Association
KFU	Kenya Farmers Union
KRA	Kenya Revenue Authority
KSC	Kenya Seed Company
MoALD	Ministry of Agriculture and Livestock Development
MRLs	Maximum Residual Levels
NCPB	National Cereals and Produce Board
NGOs	Non-Government Organizations
OPVs	Open Pollinated Varieties
PTA	Preferential Trade Area
QDS	Quality Declared Seed
SADC	Southern African Development Community
TAMPA I	Tegemeo Agricultural Monitoring and Policy Analysis
TFC	Tanzania Fertilizer Company
THRC	Thika Horticultural Research Centre
THRI	Tengeru Horticultural Research Institute
TOSCA	Tanzania Official Seed Certification Agency
TSC	Tanzania Seed Company
UK	United Kingdom
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
WV	World Vision

Executive Summary

Kenya's horticultural sector (defined here to include fruit and vegetable production and marketing, but not flowers) has received a great deal of attention over the past decade due to the rapid and sustained growth of its exports to Europe. This impressive growth has undoubtedly contributed to increased rural incomes and reduced rural poverty in Kenya. Yet despite this growth, exports remain a small fraction of Kenya's overall horticultural sector. For the past decade, over 90% of all fruit and vegetable production was consumed domestically, and the domestic market accounted for over 90% of the total growth in quantity of fruit and vegetable production. While over 90% of smallholder farmers in all but the arid regions of Kenya produce horticultural products, fewer than 2% do so directly for export.

This overwhelming dominance of the domestic market, combined with slower growth experienced in the export sector over the past decade, the challenges that smallholders face to continue participating in the export sector, and the possibility of more rapid growth in domestic demand, all argue for a more active focus on the potentials and constraints of domestic horticulture in Kenya. Such a focus implies also the need to assess the competitiveness of local production and marketing against that of neighboring countries such as Tanzania and Uganda. This paper explores these key issues in three Volumes. The overall objectives of the three Volumes are to provide a broad diagnostic overview of the horticultural sector, to identify specific constraints that limit the system's performance, to make suggestions for selected policy and programmatic changes, and to identify key research that needs to be done to guide further investments to improve sector performance. Volume I – the present volume – focuses on the farm level, examining production and area trends, the role of horticultural production in farmer livelihoods, and farm level competitiveness with Tanzania. Volumes II and III focus, respectively, on domestic and regional marketing of horticultural products, and on technical research and regulatory issues.

The paper is organized as follows. Chapter 1 provides background and briefly discusses the data and methods used in the report. Chapter 2 focuses on production and yield trends for seven fruit and nine vegetable crops, and estimates the international export market share for vegetables. Chapter 3 uses household survey data to examine the role of horticultural production and sales in smallholder livelihood strategies, and evaluates the structure of production and marketing at the farm level. Chapter 4 develops partial farm budgets for onions in Tanzania and Kenya, to assess farm-level competitiveness of the two countries in this crop. Finally, Chapter 5 presents conclusions and recommendations.

Production and Yield Trends: Official production and yield data indicate that the yields of fruits in Kenya over the past decade have been stagnant with the exception of bananas, mangoes and passion fruits, which have risen. Production of banana has recovered dramatically after overcoming disease problems in the mid-1990s. Production of pineapples, mangoes, avocados, and passion fruit has also trended upwards while production of citrus, pawpaw, and "other fruits" has stagnated. Citrus greening disease is a persistent problem contributing to poor performance in that sector.

Production of cabbages and carrots has declined over the past decade, while kales, tomatoes and traditional vegetables show steady increases. Vegetable yields have been stagnant with the exception of French beans and indigenous vegetables, which have risen.

Using data from various sources for 1997-2001, we estimate that at least four- to five times more horticultural produce, by value, was sold in domestic markets than in international export markets. If produce consumed on the farm is included, the domestic share rises to 7-8 times that of the export market. Value added in domestic markets (post farm gate) was at least three times that in the export sector.

Horticulture in Smallholder Livelihood Strategies: Production and sales at the farm level of all the major horticultural crops in Kenya are quite concentrated. Fifteen percent of rural households account for about 80% of all horticultural sales. Concentration is higher for individual crops: in all but one of the top 10 crops, 5% of the rural population accounts for at least 50% of production and at least 70% of sales. Bananas and sukuma wiki are the least concentrated both geographically and at the household level. Improvements in production and marketing of these two crops would have the broadest impacts on income levels and poverty rates. Carrots, french beans, macadamia nuts and oranges are the most concentrated. For these crops, a private sector led strategy of focused assistance to relatively few growers on production and marketing constraints could be most effective in boosting production and sales. Such a strategy would not be effective in oranges unless the citrus greening problem is first addressed.

Households selling the most horticultural produce are better off than other households based on a wide range or indicators. Yet this group still earns a slightly higher income share off the farm than they do through horticultural sales, suggesting substantial continued income diversification. A potential implication is that, if marketing costs and market risk can be reduced and farm level productivity increased, this group of households may be well poised to take advantage of expanding market opportunities through greater specialization.

Regional Competitiveness: Marketing cost budgets (Volume II) show that Tanzanian oranges and, especially, onions are very competitive in the Kenyan market. Farm budgets for onion also demonstrate Tanzania's advantage in this crop: costs of production in that neighboring country are lower by 20-50%, gross margins per acre of land are higher by 60-300%, and gross margins per bag are higher by 15-150%. These results are driven by yields that are 45-100% higher in Tanzania and seed costs that are one-tenth those in Kenya. Higher quality of irrigation in that country may also contribute to Tanzania's advantage, and superior onion storage infrastructure at the farm level allows it to supply the Kenya market throughout the year.

Conclusions and Recommendations: Fresh fruit and vegetable production and marketing value chains are becoming increasingly important to a broad array of Kenyan consumers. These also hold potential market opportunities for important segments of the smallholder farming community. Expanding domestic and regional markets for Kenyan horticultural produce and integrating the country's smallholder farmers into profitable supply chains that satisfy these markets will require investment in three key areas: technical production constraints, "hard" and "soft" market infrastructure, and the legal and regulatory environment. Recommendations regarding technical production constraints (the focus of this Volume) focus on consolidating the country's success in reducing banana diseases, dealing with citrus greening disease in a cost effective manner, and improving adaptive varietal research in the context of a revised seed law that encourages the production of Quality Declared Seed at the village level.

Improving Kenya's Domestic Horticultural Production and Marketing System: Current Competitiveness, Forces Of Change, And Challenges For The Future

Volume I: Horticultural Production

1. Introduction

1.1 Background and Objectives

Kenya's horticultural sector has received a great deal of attention from local and international researchers, government, and donors over the past decade, due to the rapid and sustained growth of its export sector (Jaffee 1994, Jaffee 1995, Swernberg 1995, Kimenye 1995, Stevens and Kennan 1999, Dolan et al. 1999, Kamau 2000, Thiru 2000, Harris et al. 2001, Minot and Ngigi 2002). From a very low base, Kenya's horticultural exports (defined here to include fruit and vegetables but not flowers) grew 9% per year in the first decade after independence, then 17% per year from 1974-1983 (Minot and Ngigi 2002). Growth slowed over the 1980s and 1990s, but still averaged about 4% per annum over the past decade. By the year 2000, fruit and vegetable exports amounted to US$270m, or 15% of Kenya's total export economy. This impressive growth has undoubtedly contributed to increased rural incomes and reduced rural poverty, through both direct production effects and linkage effects, as horticultural incomes from export are re-spent in rural areas.

Yet despite its rapid and sustained growth, exports remain a small fraction of Kenya's overall horticultural sector. For the past decade, over 90% of all fruit and vegetable production was consumed domestically, either on-farm or through domestic markets. Despite higher percent growth rates in the export sector, the absolute amount of growth has come overwhelmingly from the domestic sector: between 1992/93 and 2000/01, the domestic market accounted for 98% of the total growth in quantity of fruit production and 91% of the total growth in vegetable production. Even allowing for higher prices of export commodities, the dominance of the local market is clear.

This dominance is reflected at the farm level. While over 90% of smallholder farmers in all but the arid regions of Kenya produce horticultural products, fewer than 2% do so directly for export (Bawden et al, 2002). Kenyan smallholders who have succeeded in producing for the export market also face a daunting set of challenges if they are to maintain their participation in the sector. These challenges are driven by increasing consumer demand for quality and food safety in the UK and continental Europe, and by the related rise of supermarkets in these areas. By the late 1990s, supermarkets' share of the fresh fruit and vegetable market in the UK had surpassed 70%, and the share of *chains* among supermarkets had increased to nearly 80%. Consolidation in the retail sector has led to increasing market power for large retail concerns, and much more control by them over production practices. A focus on Maximum Residue Levels (MRLs) of pesticides on fresh produce, and the need to ensure that exports do not exceed these, has led to an increasing emphasis on the *traceability* of horticultural production; exporters want to be able to trace production back to the specific farm from which it came in order to ensure quality and safe production and handling procedures.

Researchers, development practitioners, and governments are concerned that these changes in international supply chains for horticultural and other high-value agricultural products will make it increasingly difficult for smallholders to maintain their position in this trade (Dolan *et al.* 1999; Dolan & Humphrey, 2001; Dolan & Sutherland, 2002; Harris et al, 2001; Jaffee 2003; Kamau and Sisule 2001). Estimates of changes in Kenyan smallholders' share of the fresh horticultural export market vary widely. Most researchers seem to agree that shares were as high as 75% in the early 1990s (Harris 1992). The most optimistic current estimate is by Kenya's Horticultural Crops Development Authority (HCDA), which places smallholder export market shares at 40% for fruit and 70% for vegetables, implying an overall horticultural share of 55-60%. Dolan and Sutherland (2002) provide the lowest estimate. Based on interviews with four leading exporters, they suggest that smallholder shares fell to 18% by 1998 and 11% by 2001. Minot and Ngigi (2003) suggest that this figure is probably too low, based on the small number of firms interviewed and on the tendency of exporters to underestimate smallholder shares "to satisfy European buyers who are suspicious of smallholder quality control." Minot and Ngigi cite Jaffee (2003) as perhaps the most reliable current source. Based on interviews with several dozen exporters, he estimates smallholder export market shares of 27% for fresh vegetables and 85% for fresh fruit, for an overall horticultural share of 47%. Part of the reason for this much smaller estimated decline in smallholder participation in the export market (compared to Dolan and Sutherland) is that about 60% of Kenya's fresh horticultural exports are sold, not to UK supermarkets, which have the strictest food safety and quality requirements, but to UK wholesalers and other European countries, whose standards are not as strict.

Thus, outright pessimism about continued Kenyan smallholder participation in fresh horticultural export markets does not seem warranted. Yet their share does appear to have fallen substantially over the past 10 years, from about 75% to under 50%. In addition, Kenya's horticultural export sector as a whole faces increasingly stiff competition from other African countries such as Cote d'Ivoire, Morocco, Zimbabwe, South Africa and Cameroon. Kenya's horticultural export expansion has been aided by the country's preferential duty-free access to EU markets under the Lome Agreement, which currently runs through 2008. If this agreement is not renewed, or if other developing countries obtain similar benefits, Kenya can expect to face even stiffer competition in these markets. Finally, food safety standards in Europe, with emphases on *traceability* and *process standards*, are set to become much more strict in January 2005 under EUROPGAP, implying even higher barriers to smallholder participation. Thus, the continued growth of Kenya's horticultural exports, and the ability of smallholder farmers to participate in any growth that does occur, cannot be taken for granted.

Kenya's economy is also changing, with continued high rates of urbanization expected to drive increases in demand for horticultural products. If the new government is able to reverse the country's economic decline and stimulate private investment to generate renewed growth in per capita incomes, then the increase in domestic demand for horticultural products will accelerate.[1] Responding to this growing demand will require increased productivity in both the production and marketing parts of the value chain; if productivity and quality remain low in either part of the chain, poor consumers will be faced with increasing prices, and small farmers may see little effective growth in the demand for their output.

[1] Income elasticities of demand for fruits and vegetables are generally high.

All of these factors – the overwhelming dominance of the domestic market, the slower growth experienced in the export sector over the past decade, the challenges that smallholders face to continue participating in the sector, the possibility of more rapid growth in domestic demand, and the need for productivity growth in both production and marketing to meet this demand and protect the real incomes of poor consumers – argue for a more active focus on the potentials and constraints that the domestic horticultural market faces in Kenya. A focus on the domestic market implies also the need to assess the competitiveness of local production and marketing against that of neighboring countries such as Tanzania and Uganda. In this paper we explore these key issues in three Volumes. The overall objectives of the three Volumes are to provide a broad diagnostic overview of the horticultural sector, to identify specific constraints that limit the system's performance, to make suggestions for selected policy and programmatic changes, and to identify key research that needs to be done to guide further investments to improve sector performance. Volume I – the present volume – focuses on the farm level, examining production and area trends, the role of horticultural production in farmer livelihoods, and farm level competitiveness with Tanzania. Volumes II and III focus, respectively, on domestic and regional marketing of horticultural products, and on technical research and regulatory issues.

The specific objectives of this Volume are to:

- Examine production and yield trends and compare the relative sizes of domestic and export horticulture in the economy;
- Estimate the share of domestic FFV production going to international and domestic markets;
- Assess the contribution of domestic horticulture to the livelihoods of rural agricultural households;
- Investigate the farm level competitiveness of Kenya's onion production relative to that of Tanzania; and
- Recommend steps that should be taken to place Kenya's domestic horticulture in a position to compete favorably in local and regional markets.

1.2. Data and Methods

To undertake this study, data were obtained from several sources. Production trends are based on time series data on area and production of fruits and vegetables from Ministry of Agriculture, Lands, and Rural Development (MoALRD). Estimates of production entering international export and domestic market channels are based on vegetable production data from MoALRD and HCDA data on the volume and value of fresh vegetable exports. Rural livelihood results are based on the TAMPA II cross-sectional data set collected through a nation-wide household survey undertaken by Tegemeo Institute in 2000. The household survey covered a wide range of issues related to rural household economies i.e. household characteristics, agricultural production, off-farm activities, and others. The sample covered a total of 1,549 households in 24 Districts, some of which are important in horticultural production. The Districts are grouped into seven agro-ecological zones for this analysis.

Onion enterprise budgets are based on primary data collected in Mang'ola area of in Tanzania, Taveta and Oloitoktok in Kenya, and for Narok, Laikipia and Meru in Kenya. Data from the last three areas were averaged to get one representative synthetic budget for production areas far removed from Mang'ola and Taveta/Oloitoktok region. In each case, 5 -

7 farmers were interviewed as a group to develop an average farm budget for the commodity in that area.

Secondary data on various aspects of domestic and export horticulture were gathered from Kenya Revenue Authority, Horticultural Crop Development Authority, Ministry of Agriculture Livestock and Rural Development-Horticulture Division, Ministry of Trade and Industry, and Central Bureau of Statistics.

The paper is organized as follows. Chapter 2 focuses on production and yield trends for seven fruit and nine vegetable crops, and identifies the international export market share for vegetables. Chapter 3 uses household survey data to examine the role of horticultural production and sales in smallholder livelihood strategies, and evaluates the structure of production and marketing at the farm level. Chapter 4 develops farm budgets for onions in Kenya and Tanzania as a means to evaluate Kenya's competitiveness in this crop. Finally, Chapter 5 presents conclusions, recommendations, and suggestions for further research.

2. Production Trends for Domestic and International Markets

This chapter discusses the current status and trends in production of fruits and vegetables for domestic and export markets in Kenya in the last decade. It relies on official data from Ministry of Agriculture, Land, and Rural Development (MoALRD).[2]

2.1 Fruit Production

Fruits are grown for generation of food and income, as well as providing raw materials for processing firms. According to MoALRD, the top seven fruits in Kenya in terms of area and total production are bananas, citrus fruits, mangoes, avocados, passion fruits, pineapples and papaws. Each fruit's proportion of total area and production between 1992 and 2001 are shown in Table 2.1, while production trends are presented in Figures 2.1 and 2.2. Area trends are shown in Appendix A.

Table 2.1 Area and production shares of seven of fruit crops in Kenya, in 1992 and 2001

Fruits	Area shares		Production Shares	
	1992	2001	1992	2001
Bananas	63	55	58	49
Citrus Fruits	13	11	7	6
Mangoes	10	12	5	8
Avocados	1	3	1	2
Passion fruit	1	2	1	4
Pineapples	6	10	22	28
Pawpaw	4	5	4	4
Other fruits	2	2	2	1

Data Source: MoALRD

Production of bananas predominates in total fruit production, with a total area five times its closest rival and total production six times all others except pineapple. Total output of bananas declined from 1992, reached a minimum in 1995 and has been increasing ever since (Figure 2.1). The decline in banana production has been attributed to widespread diseases e.g sigatoka and panama wilts and pests such as banana weevils and nematodes in the late 1980s and early 1990s (Kahangi, 1996). During the same period, tissue culture banana biotechnology research was in progress and a breakthrough was experienced in the early 1990's. Thus, the increase in production from 1995 has been at tributed to the use of disease free biotechnology products adopted by farmers as planting materials.

A panoramic view of all fruits over the past 10 years (Figures 2.1-2.3) indicates that the output of pineapples, mangoes, avocados and passion fruits has increased most rapidly. Total growth for various fruits over the 10 year period were: bananas 10%, citrus fruits 13%, pawpaw 25%, pineapples 60%, mangoes 99%, avocados 175%, and passion fruits 200%.

[2] Horticultural production data are difficult to collect and quality is thus difficult to determine. A careful assessment of MoALRD methods for estimating area and production would be a useful part of any overall attempt to improve the performance of the domestic horticultural production and marketing system.

FIGURE 2.1: PRODUCTION OF BANANAS AND PINEAPPLES (TONS) IN KENYA (1992-2001)

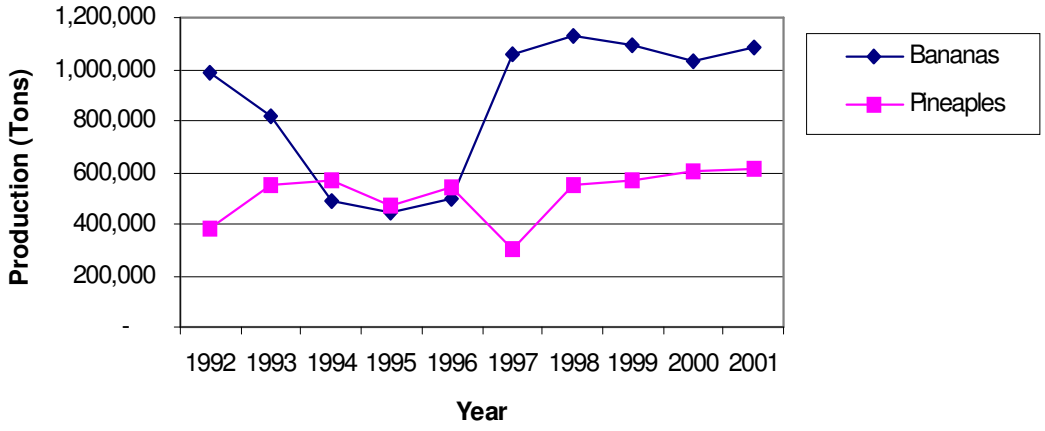


FIGURE 2.2: PRODUCTION OF CITRUS, MANGOES AND PAWPAW FRUITS (TONS) IN KENYA (1992-2001)

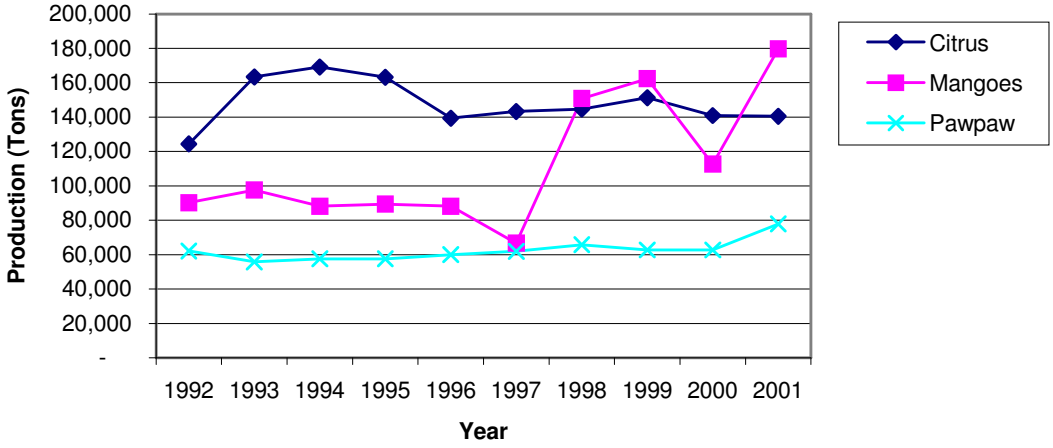
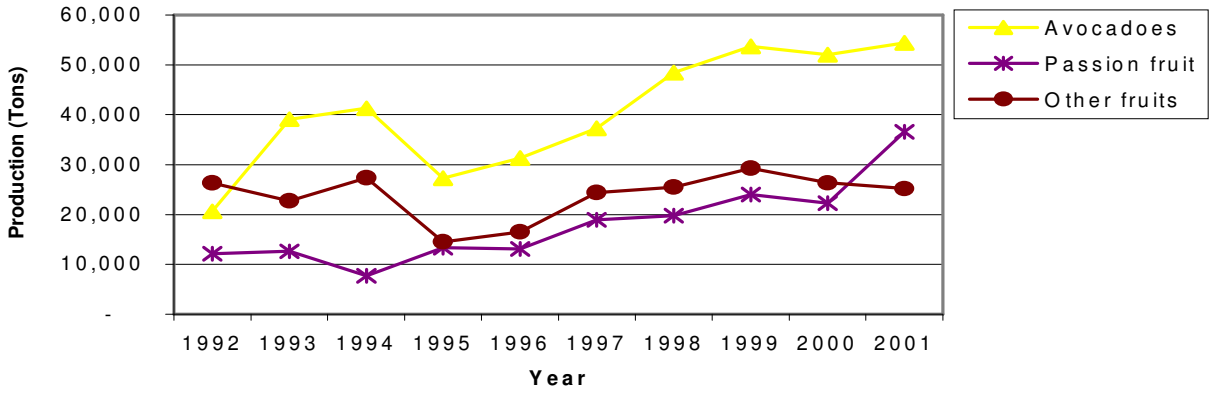


FIGURE 2.3: PRODUCTION OF AVOCADOS, PASSION FRUITS AND OTHER FRUITS IN KENYA (1992-2001)



The production of citrus and other fruits (apples, plums, pears, water melon, grapes, strawberries etc) has been relatively flat. The stagnation in production and low yields of citrus production in Kenya have been attributed to the use of infected planting materials, use of non-budded planting materials, low use of fertilizers and irrigation, inadequate use of chemicals for pest and disease control, and planting of unimproved cultivars of scions and root stocks (Obukosia and Waithaka 2000). As production has stagnated, imports from South Africa, Tanzania, and other countries have met the growing demand. The citrus greening disease has had the greatest adverse effects on orchards in Kenya. The spread of the disease is attributed to a consignment of fruits imported from South Africa in the 1950s when the Government was trying to establish citrus production.

FIGURE 2.4: YIELDS (TONS/HA) OF BANANAS, MANGOES AND PASSION FRUITS IN KENYA (1992-2001).

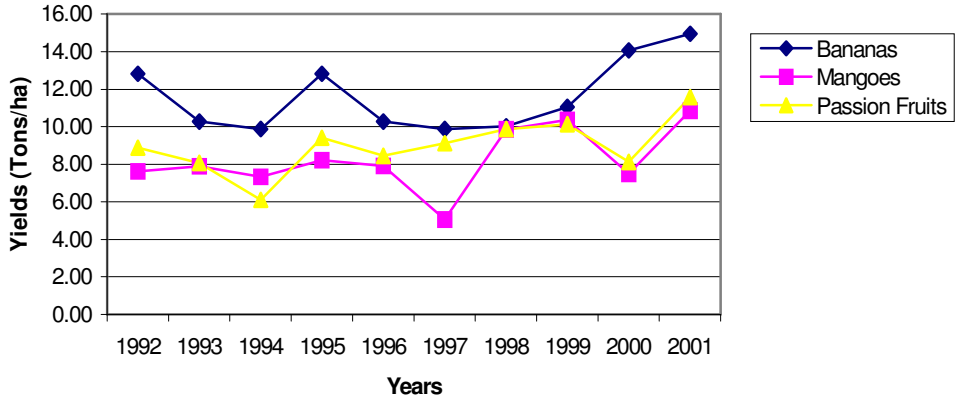


FIGURE 2.5: YIELDS (TONS/HA) OF AVOCADOS, CITRUS AND PAWPAW IN KENYA (1992-2001).

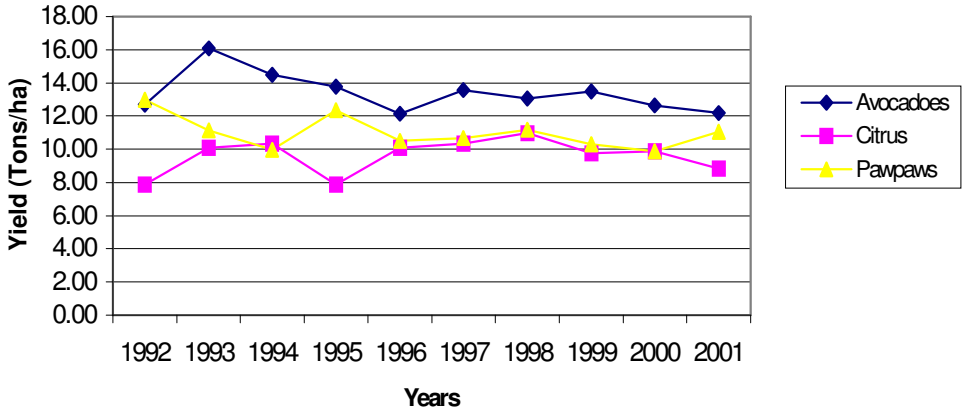
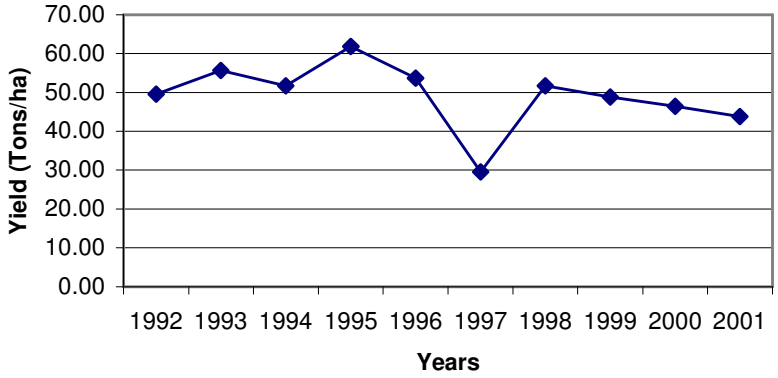


FIGURE 2.6: YIELDS (TONS/HA) OF PINEAPPLES IN KENYA (1992-2001).



The yields of most fruits in Kenya have generally been stagnant with the exception of bananas, mangoes and passion fruits, which have risen (See Figures 2.4 – 2.6). Table 2.2 shows fruit yields in Kenya compared to those in the top five producing countries (by total production) in the world for each crop. Notably, the yield of avocados and pineapples is among the highest in this group, while the yield of mangoes and citrus is in the middle of the pack. The production of mangoes, pineapples, and avocados has been the fastest growing among the seven main fruit crops in Kenya (only passion fruit has shown higher percentage growth in production over the past 10 years). The technology and production system for each fruit differs, however, from country to country. For example, in Kenya production of pineapples is entirely on plantations and it is both a capital- and input intensive system (Jaffee, 1994). The yields would therefore be expected to be higher than those of the countries where the production system is by smallholder farms. Bananas, on the other hand, are produced under much less intensive systems in Kenya than in leading countries like Costa Rica and Egypt, and thus show much lower yields.

Table 2.2. Comparison of Fruit Yield (MT/Ha) Among Top World Producers by Total Production) and Kenya in 2001.

Bananas		Citrus		Mangoes		Pineapples		Avocados	
Country	Yield	Country	Yield	Country	Yield	Country	Yield	Country	Yield
Kenya	14.6	Kenya	5.8	Kenya	10.9	Kenya	43.8	Kenya	12.2
Costa Rica	47.9	Japan	21.9	Sudan	20.5	Colombia	40.8	Dominican	13.1
Egypt	41.0	China	8.5	Congo	16.5	Phillipines	36.8	Mexico	10.0
Equador	33.0	Nigeria	4.5	China	11.1	USA	36.0	USA	7.8
Mexico	28.9	Guinea	5.1	Brazil	8.0	Thailand	22.4	Brazil	6.9
Brazil	11.7	Guatemala	4.2	Nigeria	5.8	China	22.3	China	5.5

Source: FAO Statistics 2001, www.fao.org

2.2 Vegetable Production

Estimates of annual per capita consumption of vegetables in Kenya are around 20 kilograms in rural areas and 40 kilograms in urban areas (National Development Plan 1994-1996). Cabbages, kales, tomatoes, onions, carrots, French beans, garden peas and traditional vegetables are prominent among the vegetables produced, in terms of area and total output (Table 2.3). However, cabbages, tomatoes and kales have predominated in vegetable production for at least the past decade. The total production trends over the past 10 years are presented in Figures 2.7 to 2.9 below whereas the area trends are shown in Appendix B.

Trends in production for most vegetables show a slight increase (Figures 2.7-2.9). However, cabbages show a sharp drop in 1993 and stagnation since that time, while carrots show steady decline in output, with partial recovery in production in 2001. Kales, tomatoes and traditional vegetables show steady increases in output.

Table 2.3: Area and production shares of vegetable crops in Kenya, in 1992 and 2001

Fruits	Area shares		Production Shares	
	1992	2001	1992	2001
Cabbages	25	17	32	22
Kales	21	25	25	31
Tomatoes	17	18	22	24
Onions	6	6	5	5
Carrots	6	4	6	5
French Beans	8	6	2	2
Garden Peas	8	7	2	2
Traditional Vegetables	5	10	3	5
Other Vegetables	4	7	3	4

Data Source: MoALRD

FIGURE 2.7: PRODUCTION OF CABBAGES, TOMATOES AND KALES IN KENYA (1992-2001)

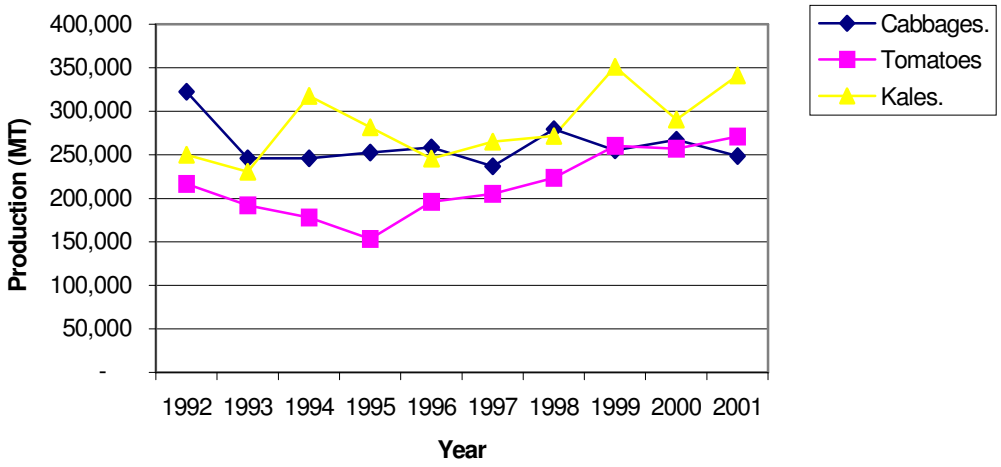


FIGURE 2.8: PRODUCTION OF ONIONS, CARROTS AND OTHER VEGETABLES IN KENYA (1992-2001).

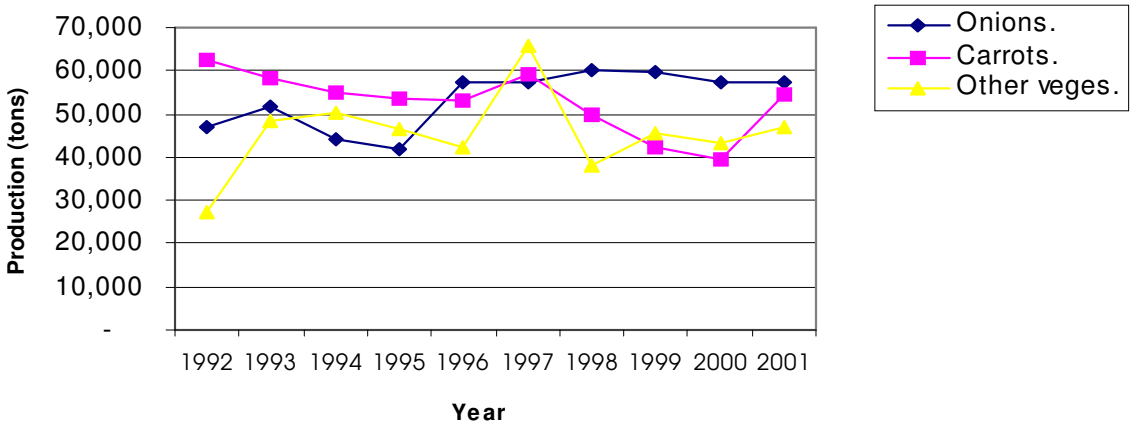
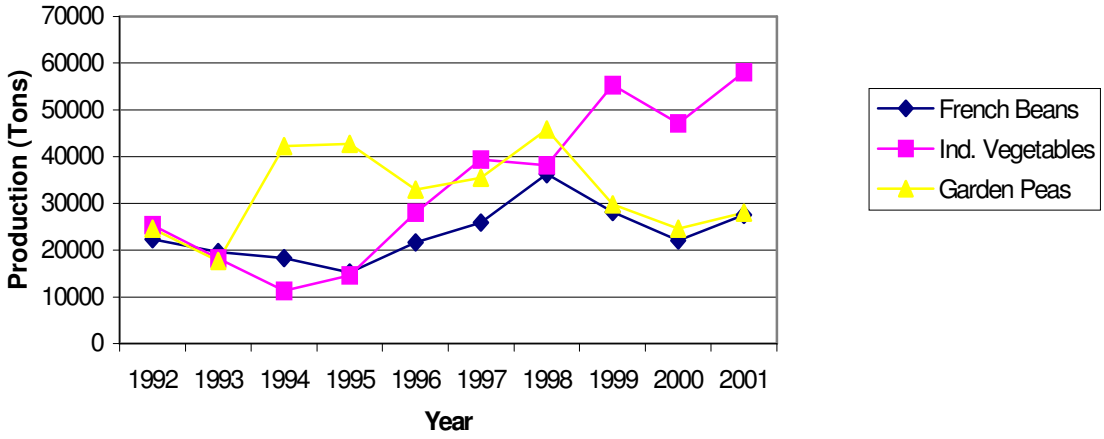


FIGURE 2.9: PRODUCTION OF FRENCH BEANS, TRADITIONAL VEGETABLES AND GARDEN PEAS IN KENYA (1992-2001)



The yield of most vegetables has been stagnant (Figures 2.10 to 2.12). Only French beans and indigenous vegetables showed a slight increase. When compared to the top five producers of each crop in the world, the yield of vegetables in Kenya is the lowest in all crops. In most of the developed countries, production of vegetables is highly capital and technology intensive. It is usually characterized by use of newly developed technologies such as fertigation in green houses e.g. in Israel. Hence most weather factors are made controllable, production is evened out through the year and output per unit of land is relatively high. This is in contrast with production conditions in Kenya where it is usually rain-fed and takes place at almost one point in time. Most farmers also lack knowledge and skills on production techniques. This has resulted in low yields compared to other world producers as well as frequently low quality produce.

Table 2.4: Vegetable Yields (Mt/ha) Among Top World Producers (by Total Production) and Kenya in 2001

Cabbages		Tomatoes		Onions		Carrots		Green peas	
Country	Yield	Country	Yield	Country	Yield	Country	Yield	Country	Yield
S. Korea	61.6	Canada	78.2	Japan	46.6	UK	54.1	France	15.0
Japan	40.5	USA	62.5	USA	46.4	Israel	53.6	Cyprus	11.3
Russian	24.0	Italy	52.7	Iran	30.1	USA	37.3	USA	10.4
India	17.9	Morocco	48.9	India	12.8	Poland	27.9	UK	9.8
China	18.9	China	25.8	China	20.8	China	17.8	China	8.1
Kenya	15.6	Kenya	16.7	Kenya	11.2	Kenya	13.6	Kenya	4.0

Source: FAO Statistics 2002, www.fao.org

FIGURE 2.10: YIELDS (TONS/HA) OF CABBAGES, TOMATOES AND KALES IN KENYA (1992-2001)

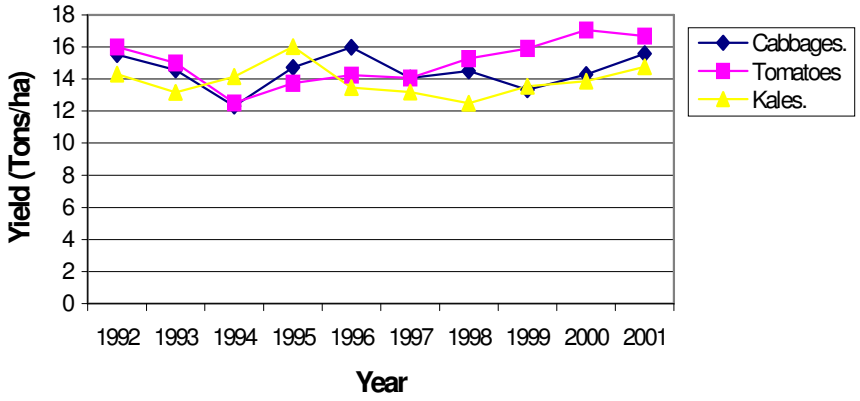


FIGURE 2.11: YIELDS (TONS/HA) OF ONIONS, CARROTS AND OTHER IN KENYA (1992-2001)

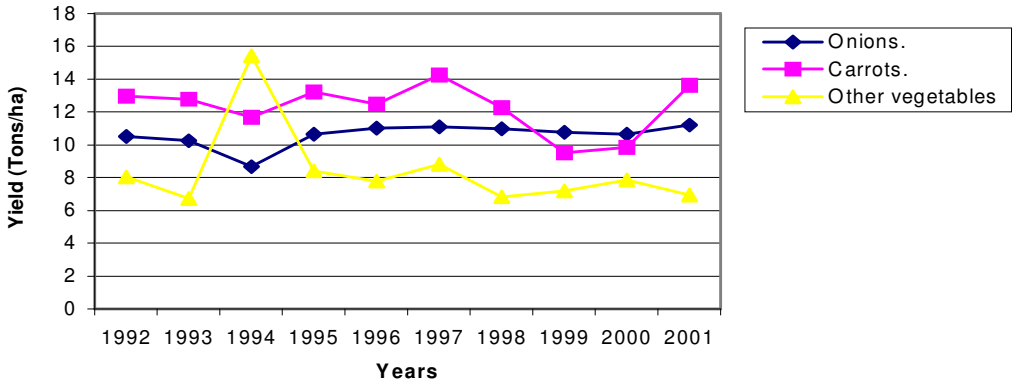
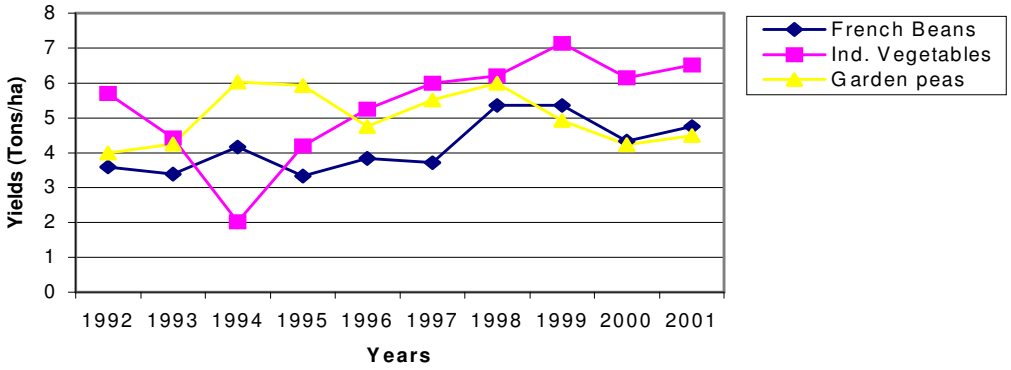


FIGURE 2.12: YIELDS (TONS/HA) OF FRENCH BEANS, INDIGENOUS VEGETABLES AND GARDEN PEAS IN KENYA (1992-2001)



2.3 International Export and Domestic Market Shares

Fruits and vegetables produced in Kenya can be retained on the farm, or marketed through local fresh markets, local processed markets, fresh export markets, or processed export markets. Establishing what proportion of total production flows through each of these channels is hampered by lack of data, especially on processing, and by definitional issues. In this section we first use data from several sources to estimate the proportion of total vegetable production that is a) consumed on farm, b) marketed locally, and c) exported in fresh or processed form. For comparability, we value all flows at farm-gate prices. Next, we value flows in each channel at final prices in that channel to estimate total value added in each of these channels. Together, these two results provide a picture of the relative importance of local and export markets for Kenya's horticultural sector.

We focus on vegetables for two reasons. First, vegetables appear by all accounts to contribute most to horticultural export earnings. FAOStat data on all fresh and processed horticultural exports (not including flowers) show vegetables with about a 60% share. HCDA data, which are limited to fresh exports, show vegetables with an 80-85% share over the past five years. The difference in these shares is due to the overwhelming importance of canned pineapples and pineapple juice in fruit exports – about 85% of all fruit exports according to FAOStat. Second, pineapple production and exports in Kenya are dominated by Del Monte's vertically integrated production, processing, and export operation: including Del Monte in fruit calculations would make them less applicable to the typical smallholder or commercial farm, and we lack data to make the calculations accurately without Del Monte.

Vegetable production data come from MoALRD, and include smallholder and commercial production. MoALRD values production at "farm gate" prices that it col lects. HCDA reports volume and value data for fresh vegetable exports (primarily French beans and Asian vegetables)[3]. These figures represent all exports regardless of whether they come from

[3] "Asian vegetables" include eggplant, chillis, dudhi, karela, okra , and other vegetables used widely in South Asian cooking

smallholder or commercial farms. HCDA values are based on FOB export prices; we revalued these fresh vegetable exports using MoALRD farm-gate prices to make the production and export figures comparable.

This exercise shows that fresh vegetable exports rose from 4-5% of total vegetable production in the early 1990s to over 12% in 2000, before falling to about 7% in 2001 (Figure 2.13). The trend is clearly positive; the lower figure in 2001 is slightly higher than those for 1996 and 1997 and well above those of the early 1990s. Over the past 5 years (1997-2001), fresh vegetable exports averaged 9.3% of production, by value. Adding processed vegetable exports, which FAOStat data show to be about 1/3 as much, by value, as fresh exports, raises the total export share (processed plus fresh) of vegetables in Kenya between 1997 and 2001 to about 12%. In the absence of more detailed data, this final calculation assumes that the mix of processed vegetable exports is comparable to fresh, and that export prices for fresh and processed are also comparable.

As a final step to calculate market channel shares, we use data from the 2000 Tegemeo/MSU Tampa smallholder income survey which show that 64% of total vegetable production that year was sold, and 36% retained on farm. This calculation provides a lower bound for marketed share if we assume, as is reasonable, that commercial producers sell nearly all their production.[4] By combining all these data, we arrive at Figure 2.14, showing that the value of vegetable production sold and then consumed domestically over the past five years has been at least four-to-five times as large as the value exported in fresh and processed form (52% compared to 12%). If produce consumed on the farm is included, the domestic share rises to seven-to-eight times that of the export market.

Value added per unit of farm-gate production is higher in the export sector due primarily to higher quality and health standards. Comparing MoALRD farm-gate prices with HCDA export prices for French beans and Asian vegetables shows that export prices of these vegetables have exceeded farm-gate prices by a factor ranging from 2.7 to 6.2 since 1992, with an average of 2.9, or 290%. In contrast, mark-ups in domestic markets are typically about 100% from farm-gate to collecting wholesaler sales, and an additional 20-25% to retail.[5] These figures imply a 150% total markup from farm-gate to retail in local markets. Applying these markup figures to the share of production flowing through the domestic and export channels, and continuing to value unsold production at farm-gate prices, shows that total value added in domestic vegetable markets is nearly three times that in vegetable export markets (Figure 2.15).

These calculations show two things. First, vegetable exports are an important component of the vegetable supply chain, absorbing about 20% of all sold production by value, and accounting for about one-quarter of all value added after the farm gate. Second, domestic markets nonetheless remain the primary outlet for vegetable production and generate much more value added than do export markets. This conclusion will hold even more for fruit, which has a higher total value of production and lower value of exports.

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[4] Unfortunately, MoALRD does not report production separately for smallholder and commercial farmers. This makes it impossible to calculate a more accurate marketed surplus figure.

[5] See Tables 6.2, 6.4, 6.6., 6.8, and 6.10 for farm-gate to collecting wholesale markups. Mark-ups from collecting wholesale to retail are based on data collected in Wakulima market in November 2003. See Appendix XX for the original price data.

FIGURE 2.13. FRESH VEGETABLE EXPORTS AS SHARE OF TOTAL PRODUCTION, BY VALUE (1992-2001)

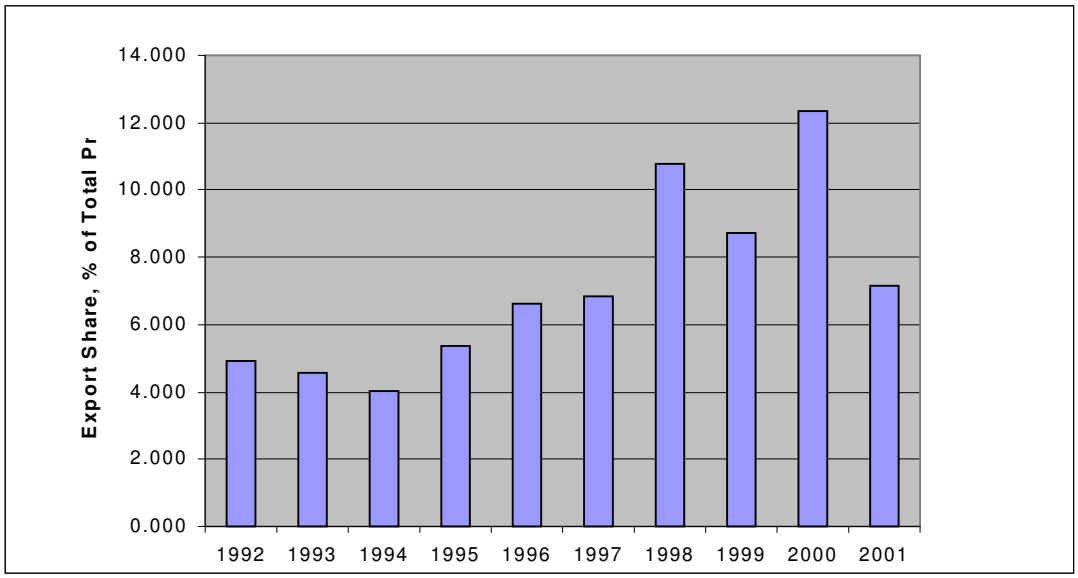
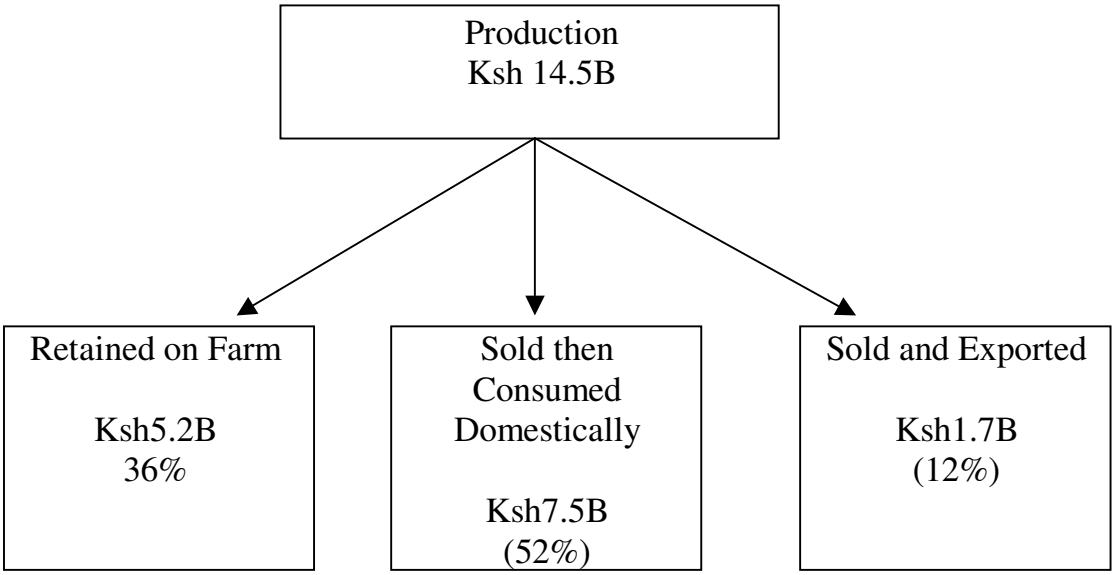
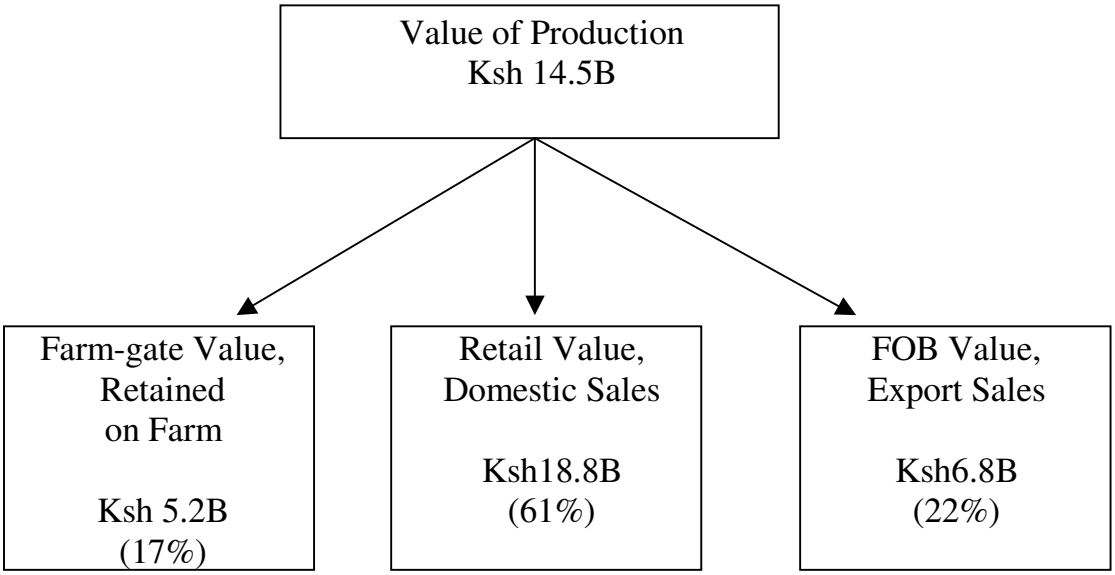


FIGURE 2.14. MARKET CHANNEL SHARES (FARM, LOCAL SALES, EXPORT SALES) OF TOTAL VEGETABLE PRODUCTION IN KENYA, 1997-2001, VALUED AT FARM-GATE PRICES



Source: Derived from Tegemeo/MSU 2000 household survey data, production data from MoALRD, and export data from HCDA

FIGURE 2.15. TOTAL VALUE ADDED (AND SHARE) IN FARM, LOCAL SALES, AND EXPORT SALES CHANNELS FOR VEGETABLES IN KENYA, 1997-2001



Source: Derived from Tegemeo/MSU 2000 household survey data, production data from MoALRD, and export data from HCDA

3. Fruits and Vegetables in Rural Household Livelihoods

Rural households in Kenya participate in a wide variety of economic activities to ensure their consumption and increase their incomes. This chapter uses data from the 2000 Tegemeo/ MSU Rural Household Survey to evaluate the role that horticultural production and sales play in rural livelihoods. The sample covered 1559 smallholder households in the relatively high potential areas of 24 districts. We examine seven areas of the country that were sampled in this survey, as show in Table 3.1. Surveyed areas not included in this analysis due to low sample size include Northern Arid and Marginal Rain Shadow.

Table 3.1 Districts and sample sizes by zone in "high potential" and "low potential" samples

Zone	Districts	Sample Size
Coastal Lowlands	Kilifi and Kwale	80
Eastern Lowlands	Taita Taveta, Kitui, Machakos, Makueni and Muingi	170
Western Lowlands	Kisumu, Siaya	188
Western Transitional	Bungoma and Kakamega	171
High Potential Maize Zone	Bungoma (higher elevations), Kakamega (higher elevations), Bomet, Nakuru, Narok, Trans Nzoia, Uasin Gishu	420
Western Highlands	Kisii, Vihiga	163
Central Highlands	Meru, Muranga, Nyeri	268

3.1 Most Widely Grown and Sold Horticultural Crops

Table 3.2 shows that, throughout areas of Kenya where cropping is practiced, nearly all households grow horticultural crops. The partial exception to this pattern is in areas of the Western Lowlands sampled in the 2000 survey. Western Lowlands also has the lowest mean production value among those growing, the lowest percentage of households selling, and the lowest mean sales value among those selling. Eastern Lowlands, Western Highlands, and Central Highlands stand out for high production values, high proportions of households selling, and high mean sales values among those selling.

Tables 3.3 and 3.4 illustrate the importance of different horticultural crops in production and sales, by zone. Table 3.3 presents the most commonly grown and sold crops, while Table 3.4 presents those crops that are most valuable in production and sales. Table 3.3 highlights the importance of bananas throughout the country. In five of the seven zones, this crop is the most widely grown, and is second in one zone; only in the Western Lowlands is it not among the top three. In five of the zones it is the first or second most widely sold. Sukuma wiki also stands out, being among the three most widely grown in four of the zones and among the three most widely sold in all but one zone (Coastal Lowlands). Other widely grown crops include mangoes, pawpaw, and avocado. On the sales side, mangoes are among the three most widely sold in the Coastal and Eastern Lowland zones, while cabbage takes third place in two of the three higher elevation zones. Avocado takes second place in both Western and Central Highlands. Surprisingly, tomatoes appear only once in the table, as the second most widely sold crop in the Coastal Lowlands.

Table 3.2 Percent of households growing and selling horticultural crops, and average value of horticultural production and sales, by geographical area in selected "high potential" areas of Kenya

Geographical Area	% of Households Growing	Mean value of production among those growing	% of Households Selling	Mean value of sales among those selling
Coastal Lowlands	96.2	18,614	65.8	10,386
Eastern Lowlands	99.4	27,762	80.7	18,577
Western Lowlands	82.5	4,898	51.4	3,879
Western Transitional	100.0	13,972	87.3	7,328
High Potential Maize Zone	97.5	10,001	70.7	7,778
Western Highlands	100.0	19,730	90.1	12,673
Central Highlands	100.0	21,349	83.0	16,148

Table 3.3. Most widely grown and sold horticultural crops, by geographical area in selected "high potential" areas of Kenya

Geographical Area	Most widely grown			Most widely sold		
	First	Second	Third	First	Second	Third
	---------- % growing ----------			---------- % selling ----------		
Coastal Lowlands	Bananas (76)	Cowpea lvs (75)	Coconut (73)	Coconut (49)	Tomatoes (20)	Mangoes/ Lemons (14)
Eastern Lowlands	Bananas (78)	Mangoes (64)	Pumpkin (61)	Bananas (34)	Suk. Wiki (32)	Mangoes (32)
Western Lowlands	Cowpea lvs. (43)	Pawpaw (43)	Mangoes (41)	Mangoes (18)	Bananas (18)	Suk. Wiki (14)
Western Transitional	Bananas (90)	Suk. Wiki (77)	Pawpaw (54)	Bananas (56)	Suk. Wiki (48)	Cowpea lvs. (23)
High Potential Maize Zone	Suk. Wiki (77)	Bananas (58)	Indig. Veg. (52)	Suk. Wiki (46)	Bananas (22)	Cabbage (21)
Western Highlands	Bananas (94)	Avocado (77)	Suk. Wiki (68)	Bananas (63)	Avocado (52)	Suk. Wiki (44)
Central Highlands	Bananas (91)	Suk. Wiki (82)	Avocado (71)	Suk. Wiki (41)	Avocado (35)	Cabbage (31)

Table 3.4 shows the three most valuable crops in production and sales, and their contribution to the total value of production and sales in each zone. Bananas maintain their importance in both production and sales, while sukuma wiki, being one of the lowest priced crops, stays among the top three in both production and sales in only two zones. Tomatoes appear more often, twice among the most valuable in production and three times among the most valuable in sales.

Table 3.4. Most valuable horticultural crops in production and sales, by geographical area in selected 'high potential" areas of Kenya

Geographical Area	Most valuable in production			Most valuable in sales		
	First	Second	Third	First	Second	Third
	------- % of total prodn value -------			------- % of total sales value -------		
Coastal Lowlands	Coconut (30)	Mangoes (26)	Bananas (15)	Coconut (54)	Mangoes (20)	Bananas (16)
Eastern Lowlands	Bananas (22)	Avocado (14)	Cabbage (9)	Bananas (18)	Avocado (13)	Macadamia Nuts (12)
Western Lowlands	Bananas (27)	Mangoes (13)	Pawpaws (12)	Bananas (26)	Sugarcane (14)	Mangoes (13)
Western Transitional	Bananas (51)	Suk. Wiki (10)	Pineapple (7)	Bananas (47)	Suk. Wiki (14)	Tomatoes (10)
High Potential Maize Zone	Bananas (19)	Pumpkin (14)	Tomatoes (14)	Tomatoes (21)	Bananas (16)	Cabbage (13)
Western Highlands	Bananas (63)	Suk. Wiki (9)	Tomatoes (8)	Bananas (58)	Tomatoes (12)	Suk. Wiki (11)
Central Highlands	Cabbage (27)	Bananas (23)	Carrots (10)	Cabbage (38)	Carrots (14)	Bananas (12)

Note: % of total production and sales values are within zones.

3.2. Income Share Analysis

Income shares indicate the proportion of total household income that comes from different types of economic activities, and thus reveal the importance of different types of activities in smallholder income and food security strategies. Income includes the value of all crop and livestock production, even if retained on farm, plus off-farm incomes and remittances. Table 3.5 shows mean household income shares of eight different economic activities during 2000. Off-farm labor (informal business and wages plus formal salaries and remittances) is a key contributor to overall income in all zones, with shares ranging from 27-29% in Western and Central Highlands to 60% in Coastal Lowlands. Horticultural income shares are highest in Western Highlands at 26%, even though total value of horticultural production and sales in this area are below those in Eastern Lowlands and Central Highlands (Table 3.2); the discrepancy is due to very low overall income levels in the Western Highlands. Other zones with relatively high horticultural shares are Coastal Lowlands and Eastern Lowlands. Only in Western Highlands does the horticultural share exceed that of cereals, tubers, and pulses, but horticulture exceeds livestock in four of the seven zones and exceeds industrial crops in five of the seven. Horticultural sales are equivalent to or greater than sales of cereals, pulses, and tubers in six of the seven zones, reflecting the fact that households tend to sell a greater proportion of their horticultural production than they do their staples.

3.3. Concentration of Horticultural Production and Sales

The previous results suggest that horticultural production and sales are an important but not predominant contributor to income for the average household. Yet averages can hide a great deal of variability. Examining levels of concentration of horticultural sales will allow us to peer behind these averages and assess differences in the role that horticultural production and sales play across households. In Table 3.6, we break all households in our sample into seven

groups: households that did not produce any horticultural crops, households that produced but did not sell, and five groups of equal size (quintiles) among those that did sell horticultural produce, ranging from those that sold the least (quintile 1) to those that sold the most (quintile 5). Results suggest that horticultural sales are highly concentrated in Kenya. Only 3% of households in the sample did not produce any horticultural crops and therefore also did not sell, but over 20% of those that did produce did not sell any. Among those that did sell, one-fifth (15% of the total population) sold extremely small amounts – only Ksh 234 on average. Nearly 80% of the total value of horticultural sales among all households was accounted for by the largest 20% of all sellers, who represent only 15% of the total population.

Table 3.5 Income shares by geographical area in selected areas of Kenya

Geographical Area	Cereals, tubers, pulses		Horticultural crops		Indus-trial crop sales	Live-stock	In-formal off-farm (wages+ business)	Salary and Remit-tances	Total (%)	Total (Ksh *per capita*)
	Retained	Sold	Retained	Sold						
Coastal Lowlands	19.7	1.6	11.5	4.1	0.0	3.2	37.3	22.6	100	13,493
Eastern Lowlands	18.9	2.9	10.2	8.4	0.7	12.7	20.5	25.6	100	17,006
Western Lowlands	17.4	3.8	6.6	3.7	4.7	22.7	18.5	22.6	100	7,321
Western Transitional	15.7	4.5	5.8	5.0	33.2	7.3	16.0	12.5	100	17,865
High Pot' Maize Zone	13.4	14.3	3.8	3.6	3.9	26.1	19.1	15.8	100	20,847
Western Highlands	20.8	3.4	12.4	13.9	16.0	6.6	8.3	18.6	100	12,716
Central Highlands	8.2	3.5	0.5	6.9	29.1	23.9	12.2	16.7	101	28,501

Table 3.6. Concentration of horticultural sales: percent of total sales by quintiles of total household horticultural sales value

Sales category	**% of farmers**	**Average value of horticultural production per hh (Ksh)**	**% of total prodn in sample**	**Average value of horticultural sales per hh (Ksh)**	**% of total sales in sample**
No production	3.2	—	—	—	---
Production, no sales	21.2	3,911	5%	0	0%
1 Lowest sales	15.1	3,475	3%	234	0%
2	15.1	5,927	6%	1,112	2%
3	15.2	8,953	9%	2,807	5%
4	15.1	15,496	15%	7,850	14%
5 Highest sales	15.1	61,995	61%	43,980	79%

Table 3.7 examines how these households are distributed across our seven zones. We see that Western Lowlands has by far the highest proportion of non-producers, and that it along with Coastal Lowlands has the highest proportion of non-sellers and the lowest proportion of

sellers in the top sales quintile. Central Highlands, Eastern Lowlands, and Western Highlands stand out for their relatively large proportion of large horticultural sellers.

Table 3.7 Concentration of horticultural sales: distribution of households across quintiles of total household horticultural sales value, by zone

Sales category	National	Zones						
		Coastal Low-lands	East. Low-lands	West. Low-lands	Western Tran-sitional	High Potential Maize Zone	West. High-lands	Cent. High-lands
	---------- % of hhs in each category ----------							
No production	3.2	3.8	0.6	17.0	0.0	2.8	0.0	0.0
Production, no sales	21.2	30.4	18.6	31.3	12.7	26.6	9.9	17.0
1 Lowest sales q'tile	15.1	17.7	9.9	17.0	13.9	18.3	11.9	13.9
2	15.1	17.7	12.4	13.6	19.3	16.0	14.6	13.1
3	15.2	13.9	16.1	11.4	19.3	13.0	21.2	14.7
4	15.1	8.9	18.0	6.8	24.1	13.3	20.5	14.7
5 Highest sales q'tile	15.1	7.6	24.2	2.8	10.8	10.0	21.9	26.6

Table 3.8 examines the characteristics of households in each of these horticultural sales categories. Several patterns emerge. First, the mean level of education of the head of household steadily rises as the value of horticultural sales increases. The total increase in mean years of education of the household head over the categories is 2.2 years. Second, the largest horticultural sellers appear less likely than other households to be headed by females, and non producers of horticultural crops appear more likely to be female-headed. Third, cropped area also rises steadily through the quintiles of sellers, though producing non-sellers actually crop more total area than do the sellers in the bottom two sales quintiles. Non-producers have the lowest mean area. Fourth, horticultural sellers in the top sales quintile are clearly better-off than other households: total value of assets, total per capita income, and total per capita cash income all rise substantially in this last group. The fact that assets, and not just income, are higher in this group suggests that those households with high horticultural sales during the survey period have enjoyed higher incomes for some time, which they have used to increase their asset holdings. Non-producers are clearly worse-off than other households, with the lowest amount of cropped area, lowest per capita incomes, and lowest assets.

Fifth, households that produce but do not sell horticultural crops are virtually indistinguishable from all but the largest sellers; the incomes and assets of the former are comparable to sellers in the top four sales quintiles. This suggests that these households have chosen to earn most of their cash incomes not from horticulture but from other agricultural and non-agricultural activities. Finally, the share of off-farm income in total income falls steadily as horticultural sales increase, being replaced largely by horticultural sales. It should be noted, however, that the actual value of off-farm income is highest among households in the top horticultural sales category, despite the off-farm income share being the lowest in this group.

We close this section by examining the concentration of horticultural production and sales – both geographically and at the household level – by individual crop. Table 3.9 presents indicators of geographical and household level concentration for the top ten crops, based on total sales value in our sample. We see that a majority of these 10 crops (banana, cabbage, tomato, sukuma wiki, avocado, onion, and orange) are sold in at least six of the seven zones, and are produced in all seven. Of these, sukuma wiki appears to be the least concentrated geographically, with the top zone (High Potential Maize Zone) accounting for less than 30% of total sales and just over 30% of total production. Orange, on the other hand, while produced in all seven zones and sold in six of them, shows greater geographical concentration, with about 50% of production and nearly 60% of all sales coming from the High Potential Maize Zone. Carrots are the most concentrated in sales, with 94% of production and 96% of sales coming from the Central Highlands. Nearly 80% of Macadamia Nut sales come from the Eastern Lowlands, and this crop is produced in only two of our seven zones.

Table 3.6 already showed that the concentration of sales at the household level is high, with nearly 80% of sales coming from only 15% of the rural households. Table 3.9 shows that production and sales of sukuma wiki and banana are substantially less concentrated than other crops, while carrot, french bean, macadamia nut and orange show the highest concentration. Among all these latter crops, 5% of rural households account for nearly all sales, and for 90-100% of production.

3.4 Summary

This review has shown that the production and sales of all the major horticultural crops in Kenya is quite concentrated. In all but one of the top 10 crops, 5% of the rural population accounts for at least 50% of production and at least 70% of sales. Because the larger producers and sellers tend to specialize in one or two crops[6], concentration at the crop level is higher than it is across all crops; in the latter case, 15% of rural households account for about 80% of all horticultural sales.

Nevertheless, useful distinctions can be made between crops. Bananas and Sukuma wiki are the least concentrated both geographically and at the household level. Each is produced throughout the country and is actively marketed; in most areas at least one-third of all rural households sell these crops. Improvements in production and marketing of these two crops would have the broadest impacts on income levels and poverty rates. Returns to research and general extension on banana diseases may therefore be very high. Maintenance and expansion of use of disease free planting material, which was a major success of the mid-1990s period, is especially important. Key constraints to sukuma wiki production and marketing need to be better understood.

Carrots, French beans, macadamia nuts and oranges are the most concentrated in production and sales. Five percent of the rural population accounts for nearly all sales of these crops, and except for oranges, they are produced in four or fewer of our seven zones. These characteristics suggest that a strategy of focused assistance to relatively few growers on production and marketing constraints could be effective in boosting production and sales. Such a strategy would likely not be effective in oranges unless the serious disease problems

[6] The top quintile sells an average of six horticultural crops, but the most important of these accounts for 64% of the households' horticultural sales, on average.

in that crop are first addressed (see Chapter 6 for more detail on citrus greening disease). Broader income gains through such focused activities would be achieved through re-spending of incomes by the relatively few direct beneficiaries.

Cabbage, tomato, avocado and onion fall between these two other groups in terms of concentration of sales. Each is produced in at least six of our seven zones, and 5% of the rural population accounts for 81-88% of sales.

The review also showed that the largest horticultural sellers are better off than other households based on a wide range or indicators: they have more education, crop more land, are more likely to use fertilizer, have higher assets and incomes, and are less likely to be female-headed than other households. Interestingly, this group still earns a slightly higher income share off the farm than they do through horticultural sales, though their off-farm share is lower and horticultural sales share is higher than any other group. This pattern suggests that these households are still relatively diversified in their income strategies, as is typical of African smallholders. A potential implication is that, if marketing costs can be reduced, farm level productivity increased, and market outlets be made more reliable, this group of households may be able to specialize substantially more in horticulture and thus be well poised to take advantage of expanding market opportunities.

Table 3.8. Concentration of horticultural sales: selected household level indicators by quintiles of total household horticultural sales value

Horticultural Sales Category	**% of farmers**	**Mean education of head of hh (years)**	**% female headed households**	**Cropped area (acres, Main season)**	**% Using fertilizer on farm**	**Total value of assets**	**Total *per capita* income (Ksh)**	***Total per capita* cash income (Ksh)**	**Off-farm income share**	**Horti-cultural sales share**
No production	3.2	5.4	26.7	3.4	52	74,700	10,562	8,332	54%	0%
Production, no sales	21.2	5.4	18.0	4.9	39	145,411	16,309	11,392	41%	0%
1 Lowest sales quintile	15.1	5.5	16.7	3.6	49	97,065	14,140	10,453	40%	1%
2	15.1	6.4	11.4	3.8	55	169,232	15,616	10,700	35%	2%
3	15.2	5.9	15.2	5.0	60	104,799	15,747	10,834	34%	4%
4	15.1	6.6	15.7	4.8	68	114,824	18,819	13,550	34%	12%
5 Highest sales quintile	15.1	7.4	8.1	5.9	83	204,038	32,611	23,192	24%	22%

Table 3.9. Concentration of horticultural production and sales by crop: indicators of geographical and household level concentration of top 10 horticultural crops by sales value

Zone	Banana	Cabbage	Tomato	Suk. Wiki	Avocado	Onion	Carrots	French Beans	Maca-damia Nuts	Orange
Geographical Sales Indicators										
Sales share of top zone	33.9	67.8	41.9	29.3	47.4	48.1	96.2	46.8	78.9	57.9
Name of top sales zone	W. High-lands	W. High-lands	High Pot. Maize	High Pot. Maize	E. Low-lands	Central Highlands	Central Highlands	E. Low-lands	E. Low-lands	High Pot. Maize
Number of zones selling	7	6	7	7	6	6	4	4	2	6
Geographical Prod'n Indicators										
Production share of top zone	28.3	62.1	38.6	31.5	44.2	41.0	94.0	46.0	74.0	50.2
Name of top production zone	same	same	same	same	same	same	same	same	same	same
Number of zones producing	7	7	7	7	7	7	6	4	2	7
HH Level Sales Indicators										
National Gini Coefficient, sales	0.909	0.951	0.949	0.869	0.948	0.961	0.978	0.982	0.997	0.983
National sales share, top 5%	69.7	83.6	81.4	56.5	81.0	87.7	98.1	100.0	100.0	99.1
HH Level Prod'n Indicators										
National Gini Coefficient, prod'n	0.795	0.936	0.923	0.769	0.907	0.921	0.972	0.980	0.996	0.967
National prod'n share, top 5%	50.1	79.0	73.4	45.2	71.0	74.4	94.9	100.0	100.0	90.9
Marketed Surplus, %	43.9	81.2	72.4	58.8	50.0	72.1	84.7	92.3	92.4	65.3

4. Costs of Production for Onion in Tanzania and Kenya

Marketing analysis in Volume II of this paper shows that oranges and, especially, onions from Tanzania are quite competitive in the Kenyan market. In this chapter we examine the farm-level determinants of this competitiveness for onions, presenting partial budgets for this crop in Tanzania and Kenya.

Synthetic crop budgets were developed for four production areas – three in Kenya and one in Tanzania – through group interviews of farmers. Tanzanian onions reaching Kongowea market in Mombasa and Wakulima market in Nairobi are produced at Mang'ola, approximately 200 km from Arusha town (450 km from Nairobi). Locally, Kongowea market gets onions from Taveta, Oloitoktok (Kimana) and also Karatina whereas Wakulima market gets onions primarily from Oloitoktok, Laikipia, Narok, Meru, and Karatina. Production of onions in these areas is by irrigation. To facilitate comparison, it was important to categorize areas with similar production systems, climate and a common market for the commodities. Hence separate onion enterprise budgets were developed for Mang'ola in Tanzania, and for Taveta and Oloitoktok in Kenya. The budgets for Narok, Laikipia and Meru were averaged to get one representative synthetic budget for production areas far removed from Mang'ola and Taveta/Oloitoktok region. In each case, 5-7 farmers were interviewed as a group to develop an average farm budget for the commodity in that area. Results are shown in Tables 6.19 to 6.21 below. Table 6.19 presents detailed costs by item, Table 6.20 expresses these in percentage terms, and Table 6.21 summarizes the information to show cost of production and gross margin for farmers per bag.

4.1 Cost of Production

Results in the three tables indicate that the onion production system in Tanzania has a higher cost per acre than in Kenya, but lower costs and higher returns to farmers per bag. These lower unit costs of production in Tanzania are driven by seed costs one-tenth of those in Kenya, and average yields that are more than 50% higher.

Across the board, the main cost components are weeding, irrigation and seeds (Tables 4.19 and 4.20). Weeding cost in Tanzania accounted for 17% of TVC whereas in Kenya it ranged between 12% and 14%. Onion farmers in Tanzania weed each basin four times while in Kenya it is done three times (See Appendix C).

The cost component for irrigation was 31% in Tanzania compared to 14% in Narok and 16% in Taveta. Irrigation quality may be higher in Tanzania, however. Unlike in Kenya, a specialized group of people in Tanzania have sharpened the skill to irrigate farms. These people can quite a number of farms simultaneously, working on the basis of well organized irrigation schedules of the farms they manage. Farmers hire the services of these irrigation specialists when they plant onion, and typically pay them an equivalent of 10 bags per acre. Kenyan farmers also typically purchase irrigation services (except in Oloitoktok, where farmers do it themselves and hence the cost is accounted for as part of return to farmers' resources), but the providers have not developed as organized a system as in Tanzania. Hence the payments are relatively lower. A key question is whether the higher cost in Tanzania reflects better quality service resulting in higher yields. Yields in Tanzania average 120 bags per acre, compared to 60-85 bags/acre in Kenya, but it is not clear what role the quality of the irrigation service plays in this difference.

Table 4.1 Distribution of Onion Production Costs (Kshs/Acre) in Tanzania and Kenya

Cost Items	Tanzania Mang' ola	Kenya Oloitoktok	Kenya: Narok/Laikipia/Meru	Kenya Taveta
Number of basins per acre	250	300	300	300
Land	Own	Own	Own	Own
Nursery operations				
	---------- Ksh/acre ----------			
Ploughing and preparation	750	900	1567	800
Seed	640	6250	6400	4400
Irrigation-Nursery/Field	14830	0	6933	6340
Polytrin	3200	3200	2647	1800
Foliar feed			380	750
Spraying labour	420	400	420	450
Main field				
Ploughing	1000.	2000	1467	2000
Making of basins & furrows	2083	1800	2643	1800
Lines for seed placement	1042	600		
Planting/Fertilizer labor	3125	1800	3200	4800
Chemicals	4125	6650	5170	2100
Fertilizers-Nursery/Field	4000	4800	2500	3000
	4000	3300	1305	-
Weeding/Fertilizer labor	8333	5400	6000	5400
Harvesting: Uprooting	2083	3000	3125	3500
Cutting	2083	3000	3125	3500
Total variable cost (TVC)	51714	43100	46882	40640

Source: Authors Computation

Usually, the recommended rate of fertilizer application on onions is 200 kg (4 bags) of DAP or 17:17:17 (NPK) for planting and 150 kg (3 bags) of ASN per acre. In Tanzania, farmers use 4 bags of CAN for planting and 4 bags of ASN for top dressing. In Kenya, onion production regions used less than the recommended rates except Oloitoktok (see Appendix C).

Seed cost in Kenya is higher by a factor of nearly 10 compared to Tanzania. This huge price difference can be attributed to the way farmers obtain seed in the two countries. In Kenya, farmers purchase imported seed, either Red Creole or Bombay Red from the various companies. The cost ranges between Kshs. 2,200 to 3,000/kg. In Tanzania, local farmers produce quality declared seed that is of higher quality and is relatively cheap. See Chapter 7, section 7.1 for more detail on the quality declared seed program in Tanzania.

Table 4.21 shows yield and information related to unit cost of production and gross margins for farmers. In Tanzania, the yield of onion is approximately 120 bags/acre, compared to an average of 73 bag/acre in Kenya. The cost of production is about Kshs 405/bag in Tanzania and an average of Kshs 623/bag in Kenya. Thus, the yield is higher and the cost of production is lower in Tanzania than in Kenya. Both gross margin/acre and gross margin per bag are much higher in Tanzania than in Kenya also. Together with the marketing cost buildup results, these farm measures help explain why Tanzanian onion has a competitive advantage over Kenyan onions.

Table 4.2 Percentage Distribution of Onion Production Costs in Tanzania and Kenya

	Tanzania Mang'ola	Kenya Oloitoktok	Kenya Narok/Likipia/Meru	Kenya Taveta
	% cost of TVC	% cost of TVC	% Cost of TVC	% Cost of TVC
Nursery operations				
Ploughing and preparation	1.45	2.09	3.34	1.97
Seed	1.24	14.50	13.65	10.83
Irrigation	28.68	0.00	14.79	15.60
Polytrin	6.19	7.42	5.65	4.43
Folier feed	0.00		0.81	1.85
Spraying labour	0.81	0.93	0.90	1.11
Main field				
Ploughing	1.93	4.64	3.13	4.92
Making of basins & furrows	4.03	4.18	5.64	4.43
Lines for seed placement	2.01	1.39		
Planting	6.04	4.18	6.83	11.81
Chemicals	7.98	15.43	11.03	5.17
Fertilizers	7.73	11.14	5.33	7.38
	7.73	7.66	2.78	7.38
Weeding	16.11	12.53	12.80	13.29
Harvesting: Uprooting	4.03	6.96	6.67	8.61
Cutting	4.03	6.96	6.67	8.61
Total variable cost (TVC)	100.00	100.00	100.00	100.00

Source: Authors Computation

Table 4.3 Efficiency Measures of Onion Production in Tanzania and Kenya

Items	Tanzania Mang'ola	Kenya Oloitoktok	Kenya Narok/Laikipia/Meru	Kenya Taveta
Yield (bags)	120	85	60.0	75
Price(Kshs/bag)	1,483	1,447	1,241	1,400
Gross output (Kshs/acre)	177,960	122,995	74,460	105,000
Gross Margin (Kshs/acre)	129,398	79,895	24,745	65,080
Cost per bag	405	507	829	532
Gross Margin/bag	1,078	940	412	868

Source: Authors Computation

4.2. Onion Storage

Storage is another aspect that adds a competitive advantage to Tanzanian onions. Farm storage is primarily concerned with making onion available at the desired time in the market. It becomes more useful by being held from periods of relative plenty to periods of relative scarcity. Most farmers in Tanzania have good post harvest management practices. They have built well aerated stores that can keep onions in good condition for a period of six months. This ensures continuous supply of onions to the markets all the year round and reduces the

risk of price instabilities to the farmers. Most onion-producing households have a storage structure. Some of the structures can hold up to 120 bags of onion each weighing 100-120 kgs. The development of the storage system for onions has been a result of local initiatives and donor support particularly from the Spanish Government.

Mang'ola area in Tanzania has only one rainy season, from November to March, and receives less than 500mm. During the rainy season, farmers plant food crops. Very few of them (15%) plant onions (Kamau, 2001). The main onion planting season is the dry period from late February to the end of September. Most of the onion planted in July to September is stored after harvest and sold up to end of May when the onion planted in February is harvested. Thus Tanzania has developed a competitive capability to supply onion to the regional markets throughout the year. Kenya on the other hand is not yet able to store onions, so what is produced tends to be sent to the market straightaway.

5. Conclusions and Recommendations

This report has shown that, despite very high growth rates in export horticulture in Kenya, the domestic market continues to absorb at least 4-5 times more produce, by value, than does the export market. If produce consumed on the farm is included, the domestic share rises to 7-8 times that of the export market. We have also shown that value added after the farm gate is at least three times greater in the domestic than in the export supply chain. At the same time, the domestic horticultural system is relatively uncompetitive in regional markets: while the country imports a substantial share of some horticultural crops, its exports of fresh produce to the region are negligible. We have thus referred to the dualistic nature of the current system, with an export sector of commercial farmers and some organized smallholder farmers closely linked to export companies, competing successfully in the highly competitive and quality conscious European market, while the domestic sector is dominated by smallholder farmers receiving little if any assistance and struggling in some instances to compete with imports.

The domestic horticultural system is also subject to strong forces of change at the present time. Continued high rates of urbanization are expected to drive increases in demand; if per capita incomes begin once again to rise, total demand growth in the domestic market could exceed 5% per year. Satisfying such increases in demand year after year would be a major challenge for any commodity supply chain.

Expanding domestic and regional markets for Kenyan horticultural produce, integrating the bulk of the country's smallholder farmers into profitable supply chains that satisfy these markets, and ensuring consumers of a growing supply of horticultural produce with falling real prices and improving quality will require investment in three key areas: technical production constraints, "hard" and "soft" public market infrastructure, and the legal and regulatory environment. In this Volume we focus on technical production constraints; Volume II deals with hard and soft public market infrastructure, while Volume III deals with legal and regulatory issues.

Control of banana diseases through introduction of disease-free planting material has been one major success of the past 10 years in Kenya's horticultural sector. Given the importance of bananas in rural production and marketing systems, continued progress replacing diseased orchards with clean material would seem to be a low-cost means of protecting and expanding smallholder income earning opportunities with this crop.

Lessons from the experience with banana are partially relevant for citrus greening disease, a key production constraint for oranges in Kenya. The disease also reduces the quality of oranges and thus further undermines the domestic system's competitiveness. Because the vector does not thrive at low altitudes, a phased replacement of infected orchards in those areas of the country should be a high priority. Recent biotechnology breakthroughs should make this possible (see section 7.3.1 for more detail). In mid- altitudes, eradication of the disease would require coordinated felling and disposal of all infected orchards along with planting of new disease free seedlings. This process will be much more costly and logistically complex than a phased replacement in coastal regions. Before such a program is undertaken, therefore, careful consideration must be given to its feasibility given current administrative resources, costs if successfully executed, and expected benefits.

More generally, the horticultural sector suffers from diseased and limited choice of planting material for fruits, and a near absence of locally developed vegetable seeds. Planting

materials from many local nurseries are diseased, low yielding and not true to type, and vegetable seeds are almost entirely imported. This situation is a result of two factors. First, underinvestment in varietal development means that Kenya's agricultural research system has few vegetable breeders and no vegetable seed production technologists. Though seed production equipment was purchased, it has never been installed due to lack of personnel (see Volume III for more detail). Second, the country's regulatory environment stresses control over facilitation. Local seed/varietal development in Tanzania has been an important part of that country's success in capturing significant shares of Kenya's onion and orange markets. HCDA and THRC should carry out registration of newly established nurseries, set guidelines/standards for operations and offer general advisory services to regulate and enhance quality. KEPHIS should undertake inspection and certification of planting materials from these nurseries. A combination of government, donor, and private sector funds needs to be mobilized to provide more resources for adaptive varietal research in the context of a revised seed law that encourages the production of Quality Declared Seed at the village level.

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Appendices

Appendix A. Trends in Fruit Production in Kenya.

FIGURE A.1: AREA TREND UNDER BANANAS IN KENYA (1992-2001)

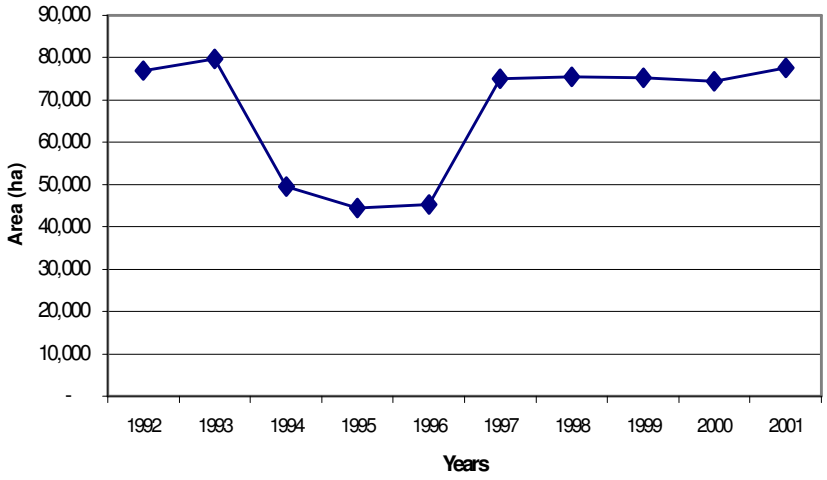


FIGURE A2: AREA TREND UNDER CITRUS, MANGOES AND PINEAPPLES IN KENYA (1992-2001)

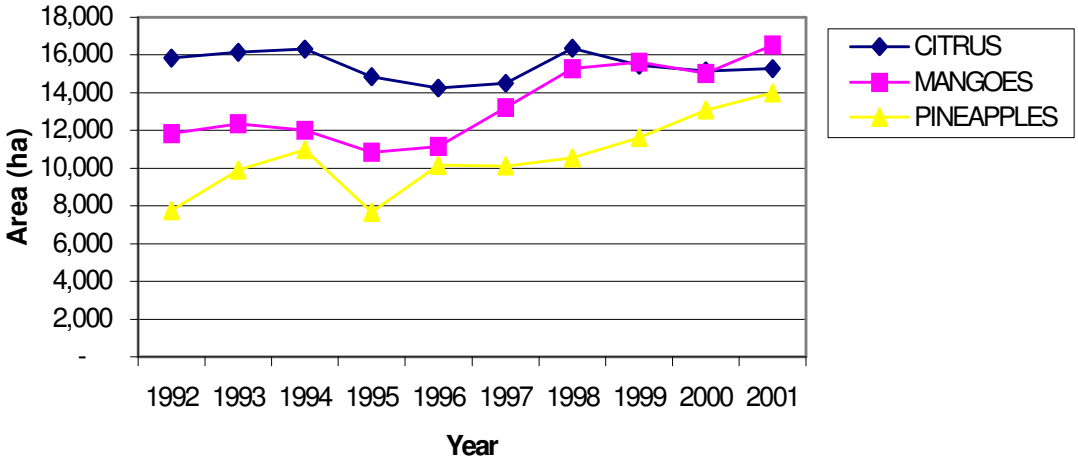
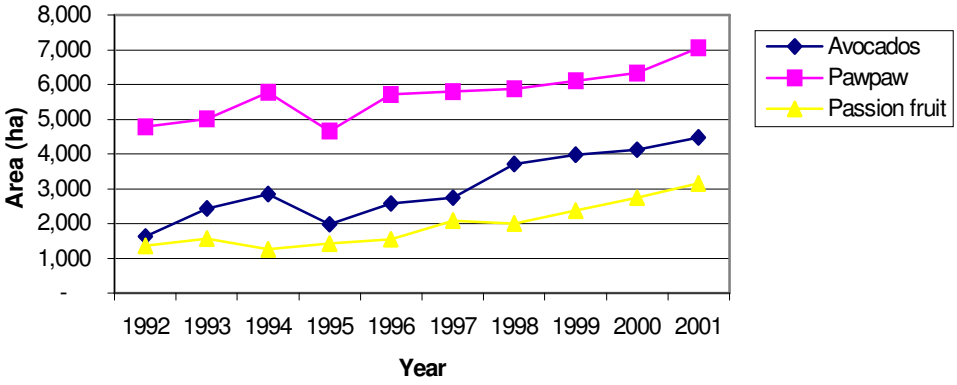


FIGURE A.3: AREA TREND UNDER AVOCADOS, PAWPAW AND PASSION FRUITS IN KENYA (1992-2001)



Appendix B. Trends in Vegetable Production in Kenya.

FIGURE B.1: AREA TRENDS UNDER CABBAGES, TOMATOES AND KALES IN KENYA (1992-2001)

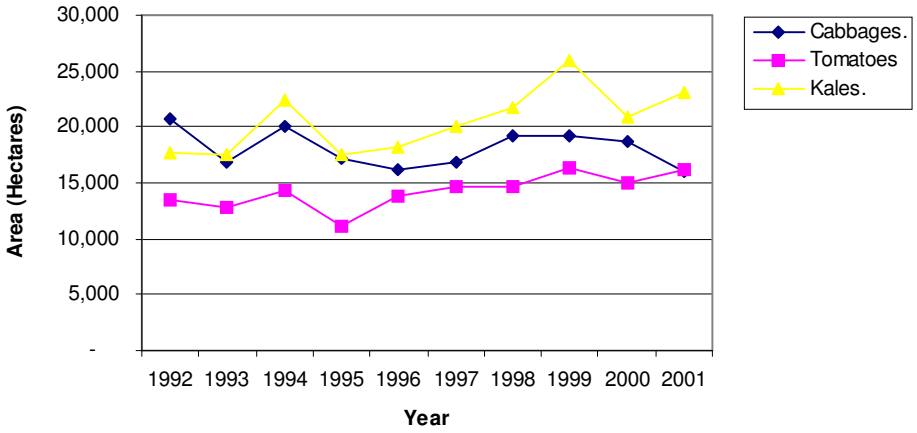


FIGURE B.2: AREA TRENDS UNDER ONIONS, , FRENCH BEANS, CARROTS IN KENYA (1992 2001)

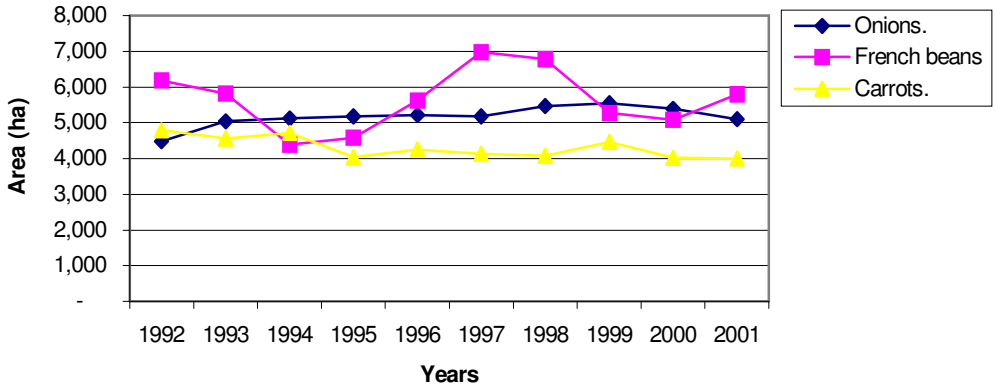
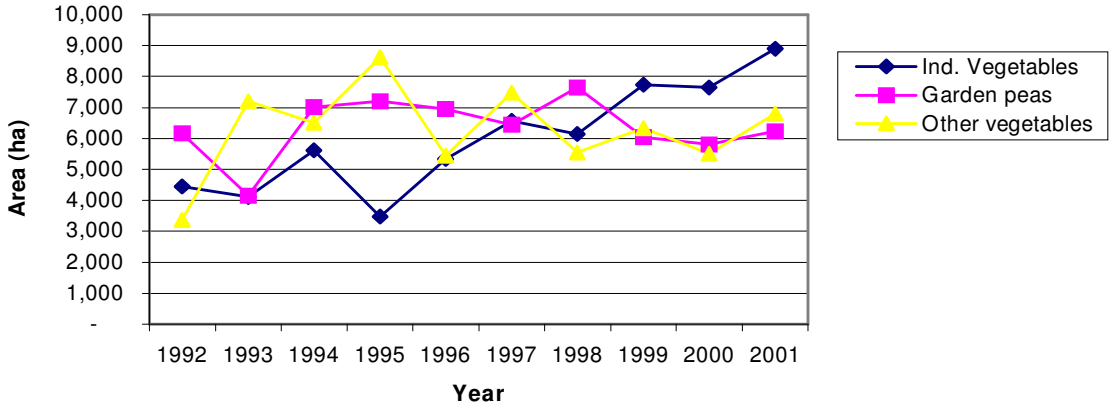


FIGURE B.3: AREA TRENDS UNDER INDEGENOUS VEGETABLES, GARDEN PEAS AND OTHER VEGETABLES IN KENYA (1992-2001)



Appendix C: Enterprise Budgets for Onions in Kenya and Tanzania

Table C.1 : Onion Budgets (Per One Acre) for Mang'ola in Tanzania

Production Items	Specifications	Actual costs (in Tz shs)	**Cost in Kshs**	% cost of TVC
Number of basins per acre	250			
Land	Own land			
Nursery operations				
Ploughing and preparation	30 basins@300	9000	750.00	1.54
Seed	20 cups @ 384	7680	640.00	1.32
Irrigation (Nursery & Field)		177960	14830.00	30.54
polytrin	4 times @10000/0.5ltr	1600	133.33	0.27
spraying labour	1000 per spray; 4 times	4000	333.33	0.69
Main field				
Ploughing	Once @12000	12000	1000.00	2.06
Making of basins & furrows	250 @ 100 per basin	25000	2083.33	4.29
Lines for seed placement	50 per basin * 250	12500	1041.67	2.15
Planting	150 per basin *250	37500	3125.00	6.44
Chemicals	Selcron 3 L @ 16500/L	49500	4125.00	8.49
Fertilizer	CAN 4 bags @12000	48000	4000.00	8.24
	SA 4 bags @12000	48000	4000.00	8.24
Weeding	4 times @100/basin	100000	8333.33	17.16
Harvesting	Uprooting @ 100/basin	25000	2083.33	4.29
	Cutting @ 100/basin	25000	2083.33	4.29
Total variable cost (TVC)		**582740**	**48561.67**	100.00
Yield (bags)		**120**	**120**	
Price/bag		**17796**	**1483**	
Gross output		**2135520**	**177960**	
Gross Margin/acre		**1552780**	**129398.33**	
Cost per bag		**4856.17**	**404.68**	
Gross Margin/bag		**12939.83**	**1078.32**	

Source: Authors' Computation.

Table C.2 : Onion Budgets (Per One Acre) for Oloitoktok in Kenya

Production Items	Specifications	Actual costs (in Kshs)	% Cost of TVC
Number of basins per acre	300		
Land	Own land	0	
Nursery operations			
Ploughing and preparation	30 basins@30	900	2.09
Seed	2.5kg @2500	6250	14.50
Polytrin	2 litres@1600	3200	7.42
spraying labour	100 per spray; 4 times	400	0.93
Main field			
Ploughing	Once @2000	2000	4.64
Making of basins & furrows	300 @ 6 per basin	1800	4.18
Lines for seed placement	2 per basin * 300	600	1.39
Planting	6 per basin *300	1800	4.18
Chemicals	Polytrin	1400	3.25
	Fungicide	2100	4.87
	Foliar feed	750	1.74
Spraying labour	600 ; 4 times	2400	5.57
Fertilizer	CAN 4 bags @1200	4800	11.14
	SA 3 bags @1100	3300	7.66
Weeding	3 times @6/basin	5400	12.53
Harvesting	Uprooting @ 10/basin	3000	6.96
	Cutting @ 10/basin	3000	6.96
Total variable cost		**43100**	**100.00**
Yield (bags)		**85**	
Price/bag		**1447**	
Gross output		**122995**	
Gross Margin/acre		**79895**	
Cost per bag		**507.06**	
Gross Margin/bag		**939.94**	

Source: Authors' Computation

Table C.3 : Onion Budgets (Per One Acre) for Taveta in Kenya

Production Items	Specifications	Actual costs (in Kshs)	% Cost of TVC
Number of basins per acre	300		
Land	own land	0	
Nursery operations			
Ploughing and preparation	1 Manday	80	0.20
Seed	2kg @2200	4400	11.02
Irrigation (Nursery & Field)		6340	15.88
polytrin	1 litre	1800	4.51
Folier Feed		750	1.88
spraying labour		450	1.13
Main field			
Ploughing	once @2000	2000	5.01
Making of basins & furrows	300 basins @ 6 per basin	1800	4.51
Planting	300 basins @ 6 per basin	1800	4.51
Chemicals	fungicide	2100	5.26
Fertilizer (Nursery & Field)	CAN 3 bags @1000	3000	7.52
	Application 300 basins @10/=	3000	7.52
Weeding	3 times @6/basin	5400	13.53
Harvesting	uprooting 500 nets@ 7/=	3500	8.77
	cutting 500 nets @ 7/--	3500	8.77
Total Variable Costs		**39920**	**100.00**
Yield (bags)		**75**	
Price (Kshs/bag)		**1400**	
Gross Output (Kshs/acre)		**105000**	
Gross Margin/acre		**65080**	
Cost/Bag		**532.27**	
Gross Margin/bag		**867.73**	

Source: Authors' Computation

Table C.4 : Onion Synthetic Budget (Per One Acre) For Narok, Laikipia And Meru In Kenya

Production Items	Specifications	Cost (Kshs/acre)	% cost
No. of basins		300	
Seed		6400	12.87
Nursery			
Ploughing and Preparation		100	0.20
Irrigation		2767	5.57
Polytrin		2647	5.32
Foliar feed		380	0.76
Spraying labour		420	0.84
Main field			
Ploughing		1467	2.95
Preparation of basins & Furrows		2643	5.32
Transplanting	5pple@100*4days	3200	6.44
Fertilizer	DAP 100kg (2 bags)	2500	5.03
CAN	1 bag	1305	2.62
Polytrin	2 litre	3000	6.03
Dithane	5 kg	2000	4.02
Foliar feed	2 litre	170	0.34
Irrigation labour		4167	8.38
Spraying labour		4300	8.65
weeding labour	5 pple@100*8	6000	12.07
Harvesting labour	Uprooting	3125	6.29
	Cutting	3125	6.29
Total variable cost		**49715**	100.00
Yield (bags)		**60.0**	
Price/bag		**1241**	
Gross output		**74460**	
Gross Margin/acre		**24745**	
Cost per bag		**828.58**	
Gross Margin/bag		**412.42**	

Source: Authors' Computation