

COMMERCIALIZATION BULLETIN: PASSION FRUIT

Bulletin #03

INTRODUCTION

Passion fruit is considered a minor fruit in the world economy as only 640,000 tons is produced worldwide per year. The main producers of passion fruit are South Africa, Australia, Brazil, Colombia, Fiji, Taiwan, Guyana, Hawaii, Japan, Kenya, Peru and Sri Lanka; with minor production from Cameroun and Cote d'Ivoire.

The passion fruit in Kenya is grown mainly for domestic market although there is a small high value international market. About 98% of the total production is consumed domestically both as juice and as fresh fruit. This fruit controls 8% of fruit exports from Kenya (HCDA). As passion fruit does not need high technology to grow it is an ideal crop for smallholder production and hence a large proportion of the fruit exported from Kenya is produced by small scale out-growers making it an important crop for economic development. Domestic production of passion fruits and other fruits is expected to rise after \$11.5 million was pumped into the industry, through The Bill and Melinda Gates Foundation and Coca Cola; the project called project nurture is expected to increase farm incomes and increase revenue. Kenya's market dominance of fruit juice in East Africa is supported by well-developed industrial and manufacturing facilities compared to neighboring countries and a strong and growing production base.



Breeding and introducing new varieties with better resistance to pests and diseases, improved productivity and fruit quality should be high priorities for passion fruit industry. The further development of passion fruit industry represents a niche activity for Kenya to enter into the worldwide market of fruit juice.

MARKETS

A major part of the purple passion produced in Kenya is used in making tropical fruit juices but the production does not fully satisfy the growing demand. Processing companies believe there is great potential for Kenya to increase exports of processed passion fruit juices. Increase in the production of yellow passion fruit using the recently developed sweet yellow varieties, which have lower production costs and higher yields may have overtaken the traditional purple type. There are a number of passion fruit juices with at least seven well known passion fruit juices available in the market ranging from 10 % concentration to 100 %. Besides the well-recognized passion fruit brand, there are a number of micro-processing and selling units spread all over the country dispensing juices to potential buyers. Passion fruit is a fruit which gives a powerful tasting and appealing flavoured juice hence it is used to blend other juices like orange, guava, pineapple and others. The ice cream and candies industry makes use of passion fruit juice and its by products. Despite the juice produced, the rinds can be chopped, dried and combined with molasses as cattle or pig feed; converted into silage; also the seed produces 23 % edible and industrial oil similar to soybean and sunflower; in addition there is an increased interest on the passion fruit in the pharmaceutical industry.

The main export destinations for Kenyan passion fruits are Uganda (76%), the EU (15%) countries of United Kingdom, France, Germany, The Netherlands and Belgium; Georgia (5%); United Arab Emirates (4%); other countries include South Africa, Tanzania, Rwanda, Qatar, Norway, Lebanon and Ireland (HCDA Report, 2011). The export demand is driven by novelty purchasing. The Uganda market is supplied from a number of areas in Kenya, mainly rift valley region. The fruit is sold in the Owino market (an equivalent of the Kenya's Gikomba market) where the fruits are sold to small scale traders who make juice. Kampala town, capital of Uganda is a heavy consumer of juice and therefore the demand is very high as the juice is believed to have medicinal value and that there are public announcements on radio reminding people to take a glass of passion fruit juice.

VOLUMES

According to Fintrac statistic on domestic horticultural volumes and sales for passion fruit, between June and September 2011; 4,525 tons valued at Ksh 373 million was sold at an average price of Ksh 81.60; the ratio of purple to yellow passion fruit sales was 72 % to 28 %. The shows approximately 30 % goes into fresh domestic sales.

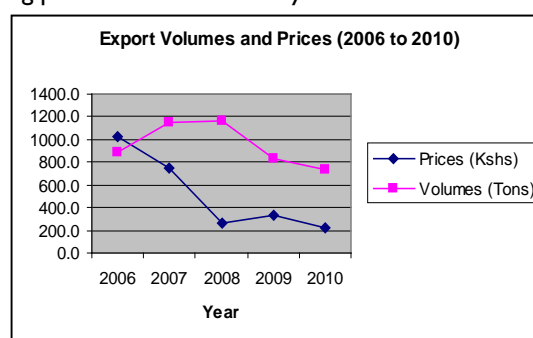
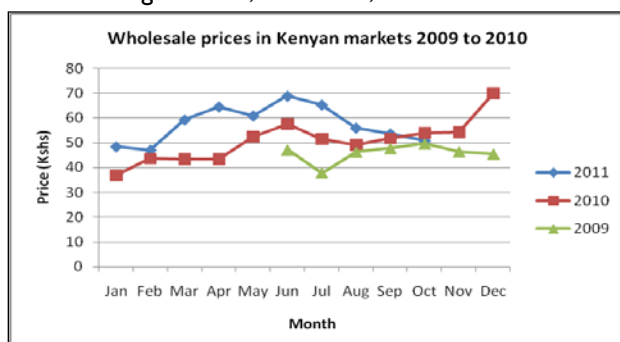
Passion fruit ranks amongst top five major fruits produced and exported in terms of volumes. Less than 4 % of production is exported. Export volumes and values exported from Kenya especially to the EU show a drop in volume in value from over 889 Metric tons (MT) valued at over Ksh 913 million in 2006 to over 728 MT valued at 165 million

Kshs (Source: HCDA website, 2011). This drop is possibly due to effect of pesticide maximum residue levels (MRLs) interceptions in the EU market and a devastating disease like Fusarium wilt.

Regional exports of passion fruit processed products like passion fruit juice between 2006 and 2010 amounted to approximately 3,252 MT worth around Ksh 160 million mainly to Tanzania, Uganda and Mauritius (Customs department).

PRICES

According to Eurostat, the EU website, passion fruit prices for export in 2010 fluctuated between 227 and 380 Kshs per Kg; prices in the export market have been declining since 2006 at Ksh 1028 to 227 per kg in 2010. According to the information obtained from exporters in Kenya, they buy one kg of purple passion from the farmers at a cost of Ksh 65 (as at August 2011) but buyers from Uganda occasionally buy at Ksh90. A kilo of passion fruit currently retails on average at Ksh 50, although it may go to Ksh 70 in the domestic markets. Wholesale prices in 2011, 2010 and 2009 were on average Ksh 57, 51 and 46; this shows a trend of increasing prices in the last three years.



COMPETITION

Colombia is currently the major competitor into the EU where Kenya exports much of its passion fruit. Columbia sells into the EU countries of Netherlands, France, UK and Belgium where it competes with Kenya's passion fruit. Columbia sells a lot of passion fruit to Ecuador just like Kenya sells to Uganda.

Domestically the demand for passion fruit is not met at certain times of the year and therefore prices can be very high at those times of the year. Exporters such as Myner, Woni, Sunripe, Vegpro and EAGA are major buyers for the export market; while Coca-Cola, Sun Mango Ltd, Millie fruits, all fruit ETZ limited, Frikogen limited, Britannia Company of Uganda and Kevian processors are big buyers for domestic and regional markets and therefore are competitors to each other.

PRODUCTION AREAS

The most suitable altitude for passion fruit production ranges from 1200 to 2000 m above sea level. Temperature affects pollination and flowering. The production areas in Kenya are Rift valley regions of Uasin-Gishu, Trans-Nzoia, Baringo, Marakwet, Bureti, Sotik, Nakuru and West Pokot; Eastern regions of Embu and Meru; Nyanza regions of Kisii, Nyamira, Homa Bay, Nyando, Suba, Rachuonyo, Kisumu East, Kisumu West and Kuria West; Central regions of Kiambu, Thika, Muranga South, Kirinyaga and Nyeri South; Western regions of Kakamega, Vihiga, Bungoma West and Bungoma East; Coast regions of Lamu, Kwale, Malindi, Kilifi, Mombasa and Tana River. The area under production has been increasing over the last five years from 4,454 Ha in 2005 to 5,418 Ha in 2010. Coast and Eastern regions are the leading producers of passion fruit in the country with Eastern having most purple passion fruit while the Coast region being the major producer of yellow passion fruit. Below is the regional analysis of production area and volumes:

Table I: Passion Fruit production statistics for the period 2006-2010

Region	Area (Ha)					Production (MT)				
	2006	2007	2008	2009	2010	2006	2007	2008	2009	2010
Eastern	1,098	1,311	1,429	1,553	1,587	16,470	19,665	17,148	21,537	21,729
Coast	97	96	102	489	1,681	788	1,000	1,734	5,921	11,824
Rift valley	1,027	1,180	751	1,091	1,057	13,864	14,750	11,265	10,033	9,663

Table 1: Passion Fruit production statistics for the period 2006-2010

Region	Area (Ha)					Production (MT)				
	2006	2007	2008	2009	2010	2006	2007	2008	2009	2010
Nyanza	1,054	1,054	522	206	548	13,175	13,175	7,830	2,275	6,916
Central	967	1,317	608	345	372	14,505	19,755	9,120	2,760	3,059
Western	211	235	171	151	173	2,638	2,938	2,565	1,611	1,903
Total	4,454	5,193	3,583	3,835	5,418	61,440	71,283	49,662	44,137	55,094

PASSION FRUIT PROPAGATION

Planting Material

Production is concentrated on two varieties the yellow, *Passiflora edulis* var. *flavicarpa* mainly grown in the coastal strip and low lands; the yellow passion varieties include KP4, KPI1, and KPI2. The purple passion fruit, *Passiflora edulis* var. *purple Sims* is grown in the cooler higher lands and the varieties are: Black Knight, Edge hill, Frederick, Kahuna, Paul Ecke, Purple Giant and Red Rover. Propagation of passion fruits is by seed, stem cuttings, or grafted propagules. Grafting is an important means of perpetuating hybrids and reducing nematode damage and diseases by utilizing the resistant yellow passion fruit rootstock. It is highly recommended to grow purple passion fruit grafted on yellow passion rootstocks.

Land Preparation

Deep ploughing before planting is done to open up the soil for aeration and good water infiltration and crop rotation done to avoid buildup of soil borne diseases. Planting holes of 45 cm x 45 cm x 45 cm should be dug. At planting it recommended that 175 g of Triple super phosphate (TSP) or NPK and one 'debe' of well decomposed farmyard manure (20 tons per hectare) is added to each hole and mixed well. A yearly soil test is recommended to assess soil properties like pH and nutrient levels before ground preparation.

CROP MANAGEMENT

Transplanting of grafted propagules is done at the beginning of the rainy season preferably early in the morning or late in the afternoon unless irrigation is available. Passion fruit production is normally rain fed. During the dry season and in dry areas, the crop has to be irrigated for maximum yield and high quality fruits. Regular watering will ensure continuous vine flowering and fruiting. However, careful attention must be paid to watering since over-watering can encourage diseases such as collar rot while under watering can leave the shallow roots too dry and produce shriveled fruit. Overhead irrigation is not recommended as this can encourage fungal diseases.

Pests

There are a number of pests such as insects, nematodes and disease that affect passion fruit economically, these are detailed below. Due to prevailing "Good Agricultural Practice" (GAP) standards such as GlobalGAP and KenyaGAP, crop protection is governed by these standards which provide general recommendations of commercial references. International regulations on food safety and social accountability in the production of fresh produce are crucial. Challenges in the international markets linked to exceeded MRLs, means passion fruits should comply with the maximum pesticide residue limits established by the Codex Alimentarius Commission. Insects include broad mite or yellow tea mite – it is one the most important mite pest of passion fruit in Kenya; Mealy Bugs (serious in the warm season); Fruit Flies, Aphids, Leaf Miner, Fruit Suckers – mainly stinkbugs. The pests feed on the plant, sucking sap from the growing tips or from developing fruits. Bug attack (by both nymphs and adults) is sporadic and coincides with warm weather. Nematodes - can cause severe problems in passion fruit, but only in the purple varieties, as the yellow ones are completely resistant. Diseases - Brown spot (the most important disease on passion fruit favoured by warm and moist weather); Septoria Spot; Fusarium Wilt - this disease is now very serious in Kenya; Passion Fruit Woodiness Potyvirus (PWV) - an important disease of passion fruit; Phytophthora Blight.

Fertility Management

To obtain high yields, regular fertilization is necessary. Apply 100 g of calcium ammonium nitrate (CAN) per plant/year distributed in two applications of 50 g each at the beginning of each rainy season. Spraying with foliar feed to supply micro nutrients like magnesium, manganese, copper, zinc and iron every three months is also recommended. Passion fruit should always be monitored for deficiencies, particularly of potassium and calcium. At the beginning of the third year of production, well decomposed farm yard manure should be incorporated in each planting hole at a rate of 20 tons per hectare.

HARVESTING AND YIELD

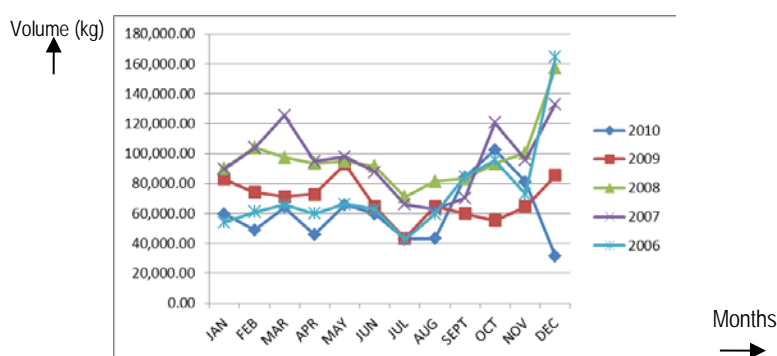
Time to First Harvest and Seasonality

The first fruits will be mature eight to twelve months after transplanting. For the fresh market, fruits should be picked carefully when they change colour from green to purple, and when the calyx has dried up, leaving a short stalk attached.

For processing, the fruits should preferably be allowed to drop onto clean mulch. They should not be plucked from the plant. Normally fruits, which have dropped, are collected once or twice a week.

The average yield of purple passion fruit is 25 tons per hectare per year although this varies from 10 to 40 tonnes per hectare per year depending on the variety grown and the conditions of growth; although higher or lower yields are obtained from various production sites in the country. National annual production averages are around 12 to 13 tons per hectare. Domestic supply tends to be least in supply in June, October, November and December; an agri-entrepreneur selling into the domestic market should focus on selling in these months.

Seasonality review (as in figure here) of volumes exported from Kenya, showing passion fruits are most in December, except 2010; there are also peaks in March and October; there is always a dip in July.



Post-harvest handling, storage and product specifications

To store passion fruit, wash and dry them gently and place them in crates. They should last 2 to 3 weeks at 10° C; both the fruit and the juice freeze well at this temperature. Note that the fruit is sweetest when slightly shriveled.

Product must conform to set conformity and commercial standards like OECD, KEBS and others, which define produce quality aspects in detail. Passion fruits are classified in three classes defined below: “Extra” Class (superior quality); Class I (good quality); Class II (meet minimum requirements). The passion fruits must have reached an appropriate maturity level and ripeness in accordance with criteria proper to the variety and should be carefully picked. It is an obligation for all food sector operators (producers, processors, exporters, importers etc) to guarantee consumer safety. KEPHIS does analysis to check on pesticide residue and heavy metals in the fruits to ensure that they do not exceed the maximum residue limits (MRLs). When there is exceedance of MRLs, heavy metal and other contaminants, presence of banned pesticides, phytosanitary non-compliance and non-conformity to market requirements in the destination markets, the produce is intercepted and this may result in a ban on Kenyan produce in the international market.

INVESTMENT: GROSS MARGIN ANALYSIS*All values in Kenyan Shillings***Table 2: Passion fruit gross margin analysis**

ITEM	Year and cost (Kshs) - per Ha			Year and cost (Kshs) - per Acre		
	Year 1	Year 2	Year 3	Year 1	Year 2	Year 3
No. of vines	1,667	1,667	1,667	667	667	667
Total Yield (kg)	19,800	33,000	24,750	7,920	13,200	9,900
Return per year (@ sh.50)	990,000	1,650,000	1,237,500	396,000	660,000	495,000
Total Returns	990,000	1,650,000	1,237,500	396,000	660,000	495,000
Planting Material and sleeves	15,000	0	0	6,000	0	0
Fertilizer:						
Manure - 20 tons per ha and 8 tons per acre @ 2000 per ton	40,000	0	40,000	16,000	0	16,000
Planting - NPK/TSP (175 kg per ha or 70 kg per acre)	8,750	0	0	3,500	0	0
Top dress - CAN (175 kg per ha or 70 kg per acre)	7,350	7,350	7,350	2,940	2,940	2,940
Pesticides	12,500	12,500	12,500	5,000	5,000	5,000
Labour	39,000	12,500	12,500	5,000	5,000	5,000
300 posts per ha or 120 posts per acre at Ksh. 250	75,000	0	0	30,000	0	0
20 Kgs per ha or 8 kg per acre Galvanized wire gauge Ksh 400	8,000	0	0	3,200	0	0
Sisal twine-2 kg	500	0	0	500	0	0
U-nails 3kgs per ha or 1.5 kg per acre at Ksh.250/Kg	750	0	0	375	0	0
Secateurs	1,500	0	0	1,500	0	0
Drip Kit	62,500	0	0	25,000	0	0
Total Cost/year	270,850	32,350	72,350	99,015	12,940	28,940
Cash flow/year	719,150	1,617,650	1,165,150	296,985	647,060	466,060
TOTAL GROSS MARGIN FOR THREE YEARS			3,501,950			1,410,105
TOTAL YIELD FOR THREE YEARS			77,550			31,020
AVERAGE YIELD PER YEAR			25,850			10,340
MARGIN PER KG			45			46
AVERAGE MONTHLY INCOME (60 months)			58,366			23,502

For farmers that may want to process; two kilos of passion fruit makes five liters of juice that sells for Sh250, compared to Sh100 one could have earned by selling the fruits in the domestic markets such as Eldoret Municipal Market (as at August 2011).

INVESTMENT RETURNS: REGIONAL ANALYSIS

The average income as reported by farmers could be in the range of Ksh 1.3 to 1.5 million per acre within the economic lifespan of 3 years of an orchard. Cases of up to Ksh 2 million incomes during the economic lifespan of 3 years of a passion fruit have been reported for orchards under irrigation. The table below summarizes regional returns on investment on passion fruit enterprises:

Table 3: Investment returns per region for passion fruit

Region	Value (Ksh '000)				
	2006	2007	2008	2009	2010
Central	435,150	592,650	218,880	96,600	97,351
Coast	23,625	30,000	52,020	177,638	354,720
Eastern	494,100	589,950	514,440	642,750	648,510
Western	79,125	88,125	76,950	96,680	114,180
Nyanza	395,250	395,250	313,200	91,000	276,640
Rift valley	415,935	442,500	337,950	331,089	382,524
Total	1,843,185	2,138,475	1,513,440	1,435,757	1,873,925

CASE STUDIES

Case Study 1: Mr. Koech, a farmer in Mosop Constituency, Kericho County

With the new varieties, farmers can harvest 50 tons of passion fruit per hectare, instead of between 20 and 25 tons from the same acreage. Disease and pests are the major challenges he has had to contend with in her first attempt at horticulture. When we visited him, we found him spraying his crop; some had their leaves turning yellow. He explained that a team from KARI had taken soil samples to determine the disease afflicting the fruits. To increase his earnings, Mr. Koech is adding value to his produce by making juice, instead of just selling the fruits. From two kilos of passion fruit, he makes five liters of juice that sells for Sh250, compared to Sh100 he could have earned by selling the fruits. A kilo of passion fruit currently retails at Sh50 in the Eldoret Municipal Market and also sells to the visitors in the Eldoret International Airport. Unfortunately, with the cost of a single seedling at between Sh15 and Sh20, most farmers have been using seeds from mature fruits, thus compromising on productivity and the possibility of disease transmission. To avoid much chemical contamination the farmer used manure instead of fertilizers to his fruit trees. Main diseases encountered by the farmer during production - Fusarium wilt; Woodiness; Phytophthora blight and Brown spot. While the major pests were - Leaf miners and Broad mite From his 15 acres purple passion fruit farm he is capable of producing 800 -1400 Kg of fruits.

Case Study 2: Mr. Franklin Kiplagat, Eldoret East District, Uasin Gishu County

The variety in cultivation was purple passion with the seedling being raised in the nursery by obtaining mature and ripe seedlings and then drying them and planting them to obtain seedlings. Mr. Kiplagat usually depends on rain for water and during our visit we found him weeding on the plantation using a fork jembe taking care not to disturb the roots to avoid the plants drying. During the transplanting or when he is establishing new plants he usually uses boma manure which he obtains from his animals although it never enough and he has to buy from other farmer at a cost of Ksh.50 per wheelbarrow and uses one spade per planting hole. The main diseases experienced are blight and woodiness and the main pesticides are tatamaster (72), ogor and dudutrine. According to the farmer the crop takes 5 months from planting to the harvesting and harvesting is done weekly for the next 3 years where only the purple ripe fruits are picked since they are the most preferred in the market. The farmer usually obtains about 50-100 kg of fruits per week from the 1 acre and sells the produce to the middlemen who then sell the fruits to the retailers in the Eldoret municipal market and other neighboring markets. The middlemen usually buy the fruits at varying price of between Ksh 50 - 70 per kg according to ripeness of the fruits determined by the fruit color, and pack them in 50 kg sacks ready for

transport to the market. The main challenges that the farmer experiences are diseases, lack of a stable market, lack of manure for planting and dressing the plants and lack of constant source of water to do irrigation for his plants during the dry season.

IMPORTANT CONTACTS

Service provider	Service	Contact
KARI	Production of planting material	The Director, KARI
		P.O. Box 5781 I-00200, City Square, Nairobi, Kenya
		Email: resource.center@kari.org
		Fax: +254-020-4183344
		Tel No(s): +254-020-4183720, 4183301-20
		GSM: +254 733 333223/333224, +254 722 206986/206988
HCDA	Licenses commercial nurseries with planting material	Director, Horticultural Crops Development Authority (HCDA)
		Nairobi Horticultural Centre
		Airport Road, Opp. JKIA
		P.O. Box 42601-00100 Nairobi, Kenya (E.A) Telephone: +254-20-2088469, +254-20-2031560; Fax: +254 -20-3235898; Email: md@hcda.or.ke
KEPHIS	Inspects and certifies planting material nurseries; Does pesticide residue analysis tests	Director, KEPHIS, P.O. Box 49592-00100, Nairobi, Kenya; Tel.: +254-20-3536171/2; Fax: + 254-20-3536175; Email: director@kephis.org; Website: www.kephis.org

Kenya Horticulture Competitiveness Project

USAID-KHCP is a five-year project designed to increase smallholder farmer incomes through enhanced productivity, crop diversification and improved market access.

Visit www.GrowKenya.org for more information on upcoming activities and to read our monthly bulletins and success stories.

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