1. MANGIFERA INDICA

Extent of adoption

A study by Musvoto & Campbell (1995) on mango trees as components of agroforestry systems in Mangwende, Zimbabwe, indicates that out of 121 farmers interviewed, 82% had mango trees and most were planted in the homestead. Fruits were acknowledged as the most important product from the mango trees. In the same study, about 4% of mango trees were planted on garden boundaries and 11% were planted in gardens, homesteads and home fields for shade.

A study by FAO (2004) on value chain analysis of mangoes in Kenya shows that in 2003, mango production was estimated at more than 183 000 tonnes. Eastern Province accounted for 54 percent, Coast Province for 22 percent and Nyanza Province for 8 percent. The FAO study further indicates that two types of mango are grown in Kenya, the local and the exotic or improved varieties. The latter are usually grafted on local mangoes and are grown for the export market. Most local varieties tend to have high fibre content, commonly referred to as "stringy", and this characteristic makes them unpopular for fresh consumption. The local mango varieties are usually left to grow naturally without much crop husbandry.

Economics of production

A study by Bakhsh et al (2006) on the profitability and cost in growing mango in orchards in Punjab, Pakistan, shows that the average annual total cost for the establishment year of mango plantation is USD 330 per acre. For the second section (2- 6 years), capital cost was USD 1154 and the main component of total cost was fertilizer and manure application. The second most important one was labour. For the third section (7-12 years), total cost was USD 786 and irrigation, labour and fertilizer and manure were the major constituents during this period. A total of USD 3915 was estimated as costs for the period from 13-40 years. During this period, the crucial costs were irrigation, labour, miscellaneous, fertilizer and manure respectively (Table 1).

Table 1: Estimated Cost of Mango (USD/ acre)

Particulars	Years				Total
	1	26	712	1340	
Planting material and transplanting cost	33.67				33.67
Fertilizer and manure	11.67	334.50	142.50	816.67	1305.33
Plant protection measures		25.00	33.30	69.07	127.37
Fencing	93.33				93.33
Irrigation	80.00	280.00	240.00	1120.00	1720.00
Labour	95.00	305.00	220.70	976.27	1596.97
Miscellaneous	16.67	210.00	150.00	933.33	1310.00
Total	330.33	1154.50	786.50	3915.33	6186.67

Source: Bakhsh et al 2006

Output and returns were considered from the start of 7th year and onward because during that period, output was produced in such amount that it could be marketed. The average number of trees per acre was estimated to be 46. From these 46 mango trees, output produced was 20,424 kg per acre during years 7 to 12 and undiscounted value was USD 2,972 per acre. During second cycle that started from year 13 and ends on year 40, output increased substantially and it was 224,112 kg per acre and total value was USD 32,608 per acre.

Bakhsh et al (2006) estimated the present worth of costs and benefits using a 10 percent interest rate or discounting rate. Net present worth was estimated to be USD 2,594 per acre over the life time of mango trees. The Benefit Cost Ratio (BCR) was 2.61 showing that investment in mango cultivation can be considered substantial and economically justifiable.

A study by Kaminchia (2006) on mango production in Kenya shows that establishment costs vary from one district to another as do the annual maintenance costs (Table 2).

Table 2: Establishment cost and annual maintenance cost

District	Establishment cost (1st year) Ksh.	Annual Maintenance costs Ksh.	Cost per fruit (average of 6 production years) Ksh.
Maragua	25,962	35255	3.3
Meru Central	68,391	37,763	1.45
Makueni	20,923	17,390	1.5
Kitui	48,625	13,537	2,7
Muranga	20,324	13,537	1.9

Source: Kaminchia 2006
1 USD = Ksh 67

The difference observed in terms of establishment costs is attributed to levels of management of the crop. Meru Central district has the highest number of exotic trees whose seedlings cost more than the local varieties. Exotic varieties require frequent spraying as they are prone to diseases and pests. The cost of an exotic mango seedling in Meru Central is USD 165 per acre, in Muranga it is USD 125, and in Makueni USD 61.

Kaminchia (2006) also carried out a cash flow analysis in various districts in Kenya to determine profitability of growing mangoes, and indicated that the break-even return is realized in the 5th or 6th year of production, where the cumulative out flow is about the same as maintenance costs (Table 3)

Table 3: Cash Flow analysis for mango production per acre (23 trees) by district (USD)

Maragua	**Activity**	**1st year**	**2nd year**	**3rd year**	**4th year**	**5th year**	**6th year**	**7th year**	**8th year**	**9th year**
	Total establishment costs	387.49	104.58	91.97						
	Total maintenance costs				511.27	511.27	511.27	511.27	511.27	511.27
	Gross returns	0.00	0.00	0.00	340.30	895.52	1486.57	2382.09	2982.09	3868.66
	Net returns	-387.49	-104.58	-91.97	-170.97	384.25	975.30	1870.82	2470.82	3357.39
	Cost per fruit	-	-	-	0.16	0.06	0.04	0.02	0.02	0.01
	Cumulative in/out flows	**-5.78**	**-1.56**	**-1.37**	**-755.01**	**-370.76**	**604.54**	**2475.36**	**4946.18**	**8303.57**

Meru Central	Activity	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year
	Total establishment costs	1020.76	47.42	47.42						
	Total maintenance costs	0.00	0.00	0.00	563.63	563.63	563.63	563.63	563.63	563.63
	Gross returns	0.00	0.00	0.00	1327.61	2862.43	1731.34	1611.94	1640.15	2341.49
	Net returns	-1020.76	-47.42	-47.42	763.99	2298.80	1167.72	1048.31	1076.52	1777.87
	Cost per fruit				0.03	0.01	0.02	0.02	0.02	0.02
	Cumalative out/in flows	**-1020.76**	**1068.18**	**-1115.60**	**-351.61**	**1947.18**	**3114.90**	**3416.94**	**4493.46**	**6271.33**

Makueni	Activity	1st year	2nd year	3rd year	4th year	5th year	6th year	7th year	8th year	9th year
	Total establishment costs	312.28	6.03	6.03						
	Total maintenance costs	0.00	0.00	0.00	259.55	259.55	259.55	259.55	259.55	259.55
	Gross returns	0.00	0.00	0.00	528.06	1563.90	2609.88	4173.79	5219.78	6783.69
	Net returns	-312.28	-6.03	-6.03	268.51	1304.34	2350.33	3914.24	4960.22	6524.13
	Cost per fruit				0.07	0.03	0.01	0.01	0.01	0.01
	Cumulative In/out flow	**-312.28**	**-318.31**	**-324.34**	**-55.84**	**1248.51**	**3598.84**	**7513.07**	**12473.30**	**18997.43**

Source : Kaminchia 2006 (1 USD = Ksh 67)

Marketing

A study by Wekesa et al (2005) on marketing of ecological resource products included a profitability analysis of the production and marketing of fruits. The study showed that it was profitable to produce and market local and grafted mangoes (Table 4). One was able to earn back the investment and make a profit of USD 0.05 and 0.33/kg in producing and marketing local mangoes and grafted mangoes, respectively.

Table 4: Profitability of fruit production and marketing in Mbeere, Tharaka and Kitui Districts in Kenya

Fruit Species	Production and marketing cost/kg of fruits (USD)	Fruit selling price/kg (USD)	Profit/kg of fruit (USD)	Value cost ratio
Local mango	0.03	0.08	0.05	0.04
Grafted mango	0.07	0.40	0.33	0.08
Citrus	0.03	0.10	0.07	0.04
Pawpaws	0.02	0.13	0.12	0.12

Source: Wekesa et al 2005

Krain et al (2006) carried out an enterprise budget for market oriented mango farming in Embu and Mbeere districts in Kenya. The report compares mangoes cultivated as a sole crop with intercropping systems. The budget shows that market-oriented mango farming is more economical under intercropping (Table 5).

Table 5: Economic Indicators of Mango Producion (24 trees per hectare over 25 year investment plan)

Economic Indicator	Mango - Monocropping	Mango - Intercropping
1. Internal Rate of Return (IRR)	23%	47%
2. Capital Requirement for establishment, 1st year	283.26	193.81
3. Mean Net Income per Year	376.54	637.84
4. Mean Gross Income per Year	571.46	896.04

Source: Krain et al 2006
1 USD = 67 Ksh

Further reading

Bakhsh,K. et al (2006). Profitability and Cost in Growing Mango Orchards. Journal of Agriculture & Social Sciences Vol. 2. No.1 pp 46-50.

Kaminchia, N. (2006). Mango production in Kenya. Kenya National Federation of Agricultural Producers (KENFAP)

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Wekesa, L. et al (2005). Marketing Study of Ecological Resource Products. Intensified Social Forestry Project in Semi-arid Areas (ISFP)

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