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Mango Production Survey and Cluster Analysis

By Ezekiel Esipisu

USAID Kenya Business Development Services Program (Kenya BDS)

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Prepared by the Emerging Markets Group, Ltd.

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ACCRONYMS

KBDS – Kenya Business Development Service

MOA – Ministry of Agriculture

SPSS – Statistical Package for Social science

EXECUTIVE SUMMARY

This report presents the findings of a rapid mango mapping survey commissioned by the Kenya Business Development Services Program (KBDS). The main purpose of the study was to conduct a rapid survey to identify and map all mango production clusters in Makueni District and conduct a tree census of mangos in each production cluster identified in the District. The findings of the survey would provide necessary tree concentration information needed by Kenya BDS for effective market linkages and penetration of service providers in Makueni District.

The study was conducted by the Principal Researcher (Ezekiel Esipisu) in close collaboration with the Ministry of Agriculture (MOA) staff in the District. The study started with a meeting that was held at the District Headquarters attended by all MOA Divisional heads, 10 Divisional based Agriculture Extension staff, District Horticulture, Crops and Monitoring and Evaluation officers (3), the District Agriculture Officer. An officer from KBDS introduced the consultant and highlighted the purpose of the study. This meeting mapped out the mango production areas within the divisions. Data collection was conducted in late August and early September using 40 frontline extension workers and 215 enumerators. The enumerators and frontline extension workers were trained on the data collection instrument by the Consultant and his assistants. The enumerators were supervised by the MOA divisional staff while the consultant provided oversight. Data was analyzed using SPSS.

From the brainstorming meeting held with the MOA staff in Makueni at the start of the study, it was agreed, a cluster would be defined as geographical zone with a high concentration of mango trees (more than 5,000). The study shows that Makueni has 16 mango clusters (if the population of export indigenous variety is considered). The study shows that Makueni District has 227,994 mango trees of which 139,450 are indigenous variety. It is notable that the apple variety, which is the dominant export variety, accounted for 79,350 of the trees. Given that the study identified 39,322 farmers, the study suggests that on average, each farmer has just 6 mango trees. This seems to be consistent with further analysis of the data that showed close to 49% of the farmers have less than 6 mango trees. Obviously, from a business perspective, it is less economical to deal with micro farmers since you do not capitalize on economies of scale.

The leading clusters are Kisau with close to 34,000 mangos, followed by Kibwezi with about 33,000 and finally Mbitini with approximately 28,000.

Apple remains the single dominant improved/export variety mango accounting for close to 90% of the export market share. Discussions with MOA staff revealed that this was the preferred variety for top working and grafting. A distant second is Ngowe which commands about 8 per cent of the share. The other export varieties are insignificant.

A significant proportion (40%) of the mangoes, are below 3 years. What that means is that they are not yet in the production category and therefore are not a source of income for the family. It is also striking that approximately 20% of the mangoes are 9 years and above. That means they are mature and their mango fruit production is optimal. However, a majority of the mango trees over 9 years are the indigenous variety (64%).

The survey found that those mango trees between 3 – 5 years were producing averagely 218 fruits per tree per season. The yield increased as the tree matured. Those between 6 – 7 years were producing averagely 616 fruits per tree per season, while those over 8 years were producing averagely 693 fruits per tree per season. The trees in the fruit bearing age were on average producing 422 fruits per tree in a season. This is the more reason why concerted efforts must be put in place to ensure that the indigenous varieties undergo top working. Given the large number of trees that are indigenous, there is huge potential for increased production if they are improved to export variety.

Summary of Production Clusters and the major varieties in the District

.DIVISIO N	Apple			Ngowe			Others			Indigenous			GRAND TOTAL
	Mature	Young	TOTAL	Mature	Young	TOTAL	Mature	Young	TOTAL	Mature	Young	TOTAL	
Mbitini	5400	7794	13,194 (16.6%)	135	141	276 (5.3%)	15	27	42 (1.1%)	6814	7960	14,774 (10.6%)	28,286 (12.4%)
Kasikeu	840	1230	2,070 (2.6%)	30	42	72 (1.4%)	15	30	45 (1.1%)	8164	6264	14,428 (10.3%)	16,615 (7.3%)
Kibwezi	9846	11730	21,576 (27.1%)	486	852	1,338 (25.7%)	303	252	555 (13.9%)	5562	4468	10,030 (7.2%)	33,499 (14.7%)
Mtito Andei	1338	844	2,182 (2.7%)	85	94	179 (3.4%)	40	34	74 (1.9%)	2748	3506	6,254 (4.9%)	8,689 (3.8%)
Nguu	1471	2223	3,694 (4.7%)	42	120	162 (3.1%)	36	60	96 (2.4%)	1920	2328	4,248 (3%)	8,200 (0.4%)
Kaiti	1486	1947	3,433 (4.3)	156	285	441 (8.5%)	87	78	165 (4.1%)	4662	3840	8,502 (6.1%)	12,541 (5.5%)
Kee	952	452	1,404 (1.8%)	3	3	6 (0.1%)				2838	1140	3,978 (2.9%)	5,388 (2.4%)
Kilungu	112	280	392 (0.5%)		7	7 (0.1%)				2086	742	2,828 (2%)	3,227 (1.4%)
Kilome	464	535	999 (1.3%)	60	51	111 (2.1%)		1	1 (0.02)	4550	2740	7,290 (5.2%)	8,401 (3.7%)
Matiliku	1610	1788	3,398 (4.3%)	224	140	364 (7 %^)	27	45	72 (1.8%)	3304	3786	7,090 (5.1%)	10,924 (4.8%)
Wote	2226	3153	5,379 (6.8%)	330	191	521 (10%)	105	105	210 (5.3%)	6294	6726	13,020 (9.3%)	19,130 (8.4%)
Mbooni	336	192	528 (0.7)	12	10	22 (0.4%)	66	36	102 (2.6%)	2868	2476	5,344 (3.8)	5,996 (2.6%)
Kisau	5853	8660	14,513 (18.3%)	534	604	1,138 (21.8%)	1246	858	2,104 (52.9%)	9696	6568	16,264 (11.7%)	34,019 (14.9%)
Kathonzw eni	246	384	630 (0.8%)	47	69	116 (2.2%)	11	14	25 (0.6%)	2496	2864	5,360 (3.8%)	6,131 (2.7%)
Tulimani	260	1654	1,914 (2.4%)	18	117	135 (2.6%)	39	216	255 (6.4%)	3810	3330	7,140 (5.1%)	9,444 (4.1%)
Makindu	2526	1518	4,044 (5.1%)	112	214	326 (6.3%)	103	131	234 (5.9%)	5200	7700	12,900 (9.3%)	17,504 (7.7%)
Total	34,966	44,384	79,350 (100%)	2,274	2,940	5,214 (100%)	2,093	1,887	3,980 (100%)	73,012	66,438	139,450 (100%)	227,994 (100)

Source: Kenya BDS Makueni District Mango Cluster Census, September 2005

INTRODUCTION

Background

Kenya BDS is a five year micro enterprise development program that combines the sub sector approach with business development services market development. Over the five year period, the program will work in product development markets of high growth potential, and identify market inefficiencies along the supply chain. As critical constraints are identified, the program will facilitate the delivery of appropriate business development services on a commercial basis. This approach will be replicated in three sub sectors over the life of the project. To date Kenya BDS is working in 2 sub sectors – tree fruits, with a focus on avocado, Mango and Passion fruit; and Lake Victoria fish focusing on Nile Perch, Dagaa, and Tilapia.

Makueni District was carved from Machakos in 1992 and is one of the thirteen districts that form Eastern Province and one among the four that comprise the Ukambani region. The district borders Kajiado to the west, Taita Taveta to the South, Kitui to the East and Machakos to the north. The major land formation in Makueni District includes the volcanic chyullu, mbooni and Kilungu hills. The southern part of the district is low lying grassland, which receives little rainfall but has an enormous potential for ranching. The northern part of the district is hilly and has a potential for food crop production.

The district experiences two rainy seasons, namely: the long rains occurring in March/April while the short rains occur in November/December. The Hilly parts of the district receive 800- 1200mm of rainfall per year. The high temperatures experienced in the low lying areas cause high evaporation.

Athi River, which is perennial, is joined by tributaries such as Kambu, Kiboko, and Mtito Andei, which drain from various parts of the district. A few other perennial streams flow from the Mbooni and Kilungu hills but their flow becomes irregular as they move to the low lying areas. These rivers have the potential for both large and small scale irrigation.

According to the 1999 population and housing census, Makueni District registered a total population of 771,545 people, which is projected to be 839,155 people by the beginning of 2002. The district is generally sparsely populated, except in Mbooni and Kilungu Divisions which have fairly high population densities of over 4000 persons per square kilometer. Mbooni Division has the highest population density followed by Kilungu, Tulimani, Mbitini, Kaiti and Kisau. The least populous divisions are Nguuu, Makindu, Mtito Andei, Kathonzweni, Kalawa, and Kibwezi. The high population density and consequent scarcity of land have tended to push people out of their ancestral land in search of settlement in the lower regions of the district. This has forced the government to open up new settlement schemes in Kibwezi, Makindu, Mtito Andei and Nguu Divisions.

Residents of the district suffer three types of poverty; food poverty which afflicts 71.43 per cent, absolute poverty 73.51 per cent and hard core poverty 58.59 per cent. Poverty in

Makueni is severest in Kalawa, Nguu and Kathonzweni Divisions. Certain pockets of these divisions are very dry and are only suitable for small stock rearing.

Objectives

The main purpose of the study was to conduct a rapid survey to identify and map all mango production clusters in Makueni District and conduct a tree census of mangos in each production cluster identified in the District.

The specific tasks of the consultant were to:

- i) Design survey methodology and data acquisition tools – The consultant designed a survey methodology for collecting data to:
 - Identify mango production clusters in Makueni District
 - Identify the number of mango trees in each cluster, disaggregated by variety and maturity; and
 - Identify number of mangos in each identified cluster
- ii) Liaise and coordinate participation of Ministry of Agriculture – the consultant will coordinate and liaise with the ministry of agriculture in the district – District Agriculture Officer and Divisional Agricultural Officers (for all divisions in the district) – to seek participation of the Ministry staff in the survey, agree on levels of facilitation required (as per budget) and work out a work plan for delivery of outputs to be expected from ministry staff.
- iii) Conduct Primary and Secondary Research to determine broad mango production clusters in Makueni District – Consultant will personally conduct a rapid analysis of the mango production clusters in Makueni District. It is expected that that this activity may involve interviews/discussions with buyers of mangos, Ministry of Agriculture officers in the various divisions of Makueni District as well as any development agencies with mango/fruit development programs in the district.
- iv) Conduct a tree census of mango production clusters in Makueni district – consultant coordinated and supervised Ministry of Agriculture staff identified as Research Assistants for the activity and Enumerators to collect data on the number of mango trees in the identified clusters in the district.
- v) Analyzed, synthesized data and prepared report – the consultant analyzed, synthesized and prepared a concise report mapping mango production clusters in Makueni District and providing detailed information on number of mango trees in each cluster (by variety and maturity) and holding per farmer (trees per farmer).

Methodology

Both qualitative and quantitative research methods were used

i. Qualitative study

In this project, we applied 2 stages of qualitative study

- i) Broad cluster identification

In this census, we invited the Divisional heads of Ministry of Agriculture in 17 Divisions in the district, 3 District Headquarter based Senior Agriculture officers, 10 divisional based assistant Agriculture Extension Officers, and the District Agriculture Officer to a briefing on the project and then we requested them to identify areas they felt had high concentration of mango trees (both the improved and indigenous varieties).

Both the project briefing and identification of the broad mango cluster was done at the DANIDA MAP Hall in Makueni. All the Ministry of Agriculture staff in attendance participated in the mapping and cluster identification exercise. We placed a large map of Makueni District with clear boundaries for Divisions and Locations on the wall in the MAP hall.

Participants

District Agriculture Officer (1)
Divisional Agriculture Heads (17)
District Crop Officer (1)
District Horticultural Officer (1)
District Agriculture Monitoring and Evaluation Officer (1)
Divisional based Assistant Agriculture Extension Officers (10)

ii) Process of identifying the broad clusters

The process of arriving at broad clusters started with a brief discussion on the level of production of mangos. The participants also discussed and agreed on what would constitute an area to be considered a “mango cluster area”. They were in agreement that the cut off for number of trees for an area to be considered as a cluster should be not less than 5,000 trees. They also were agreed on the fact that the clusters would include both improved and indigenous variety mangos.

But for the purpose of this study, we have identified mango cluster areas as those with a population of more than 5,000 export variety mangoes. Though we recognize that indigenous variety mangoes have a possibility of being improved in future, our focus now is to identify those areas that currently have a “critical” mass of the export variety.

The forum also brainstormed and identified all possible improved mango varieties that are likely to be found in the District. They are as follows:

- i. Apple
- ii. Ngowe
- iii. Kent
- iv. Van Dyke
- v. Tommy Atkins
- vi. Sensation
- vii. Boribo
- viii. Haden
- ix. Alfonsio
- x. Dodo
- xi. Keitt
- xii. Pervin

The participatory process of identifying the clusters concluded with the selection of 16 Divisions and 33 cluster areas. The broad clusters are distributed as follows.

MAKUENI CLUSTERS

DIVISION	PRODUCTION CLUSTERS
1. Kathonzweni	Kathonzweni/Mavinduni
2. Kibwezi	Masongaleni/Kinyambu/Kibwezi Utithi/Nthange/Kikumbulyu
3. Mtito Andei	Muthingiini/Nzambani/Ndarajani/Mangelete
4. Kisau	Kiteta/Kisau/Kithungo/Waia
5. Mbitini	Maatha/Ng’etha/Mutyambua/Mulala
6. Matiliku	Kilili/Kalamba/Kithumba/Nzani
7. Wote	Wote/Kako
8. Tulimani	Tulimani/Nzeveni
9. Kasikeu	Kasikeu/Kayata/Kiongwani/Maiani
10. Nguu	Kikumini/ithumba/Nguu/Masumba
11. Kaiti	Kaumoni/Kilala/Ukia
12. Kee	Kee/Kivani/Watema
13. Makindu	Kiboko/Kai/Kaunguni
14. Kilome	Kiongwani/Maiani/Kitaingo
15. Kilungu	Wautu/Ndolo/Kyamuso/Musalala
16. Mbooni	Nzeveni/Kaliani

Please Note: the clusters within the divisions are comparatively the same size with locations

1.3.2 Quantitative study

Two Structured questionnaires were used during the study (refer to appendix 1 and 2) to gather quantitative data on tree and farmer population in all identified clusters. Data enumeration was done by enumerators and Ministry of Agriculture¹ Officers - MOA (based at the Divisional headquarters). The table below shows the distribution of the MOAs and enumerators who participated in data enumeration.

¹ Initially, it was envisaged that the data enumeration would be done by the Ministry of Agriculture Extension staff only. However, the amount of data that was going to be collected, the large size of the District (and the Division), the logistical obstacles in covering such a large area, the absence of Agriculture Extension staff at the Locational levels and the time frame within which to collect data all contributed to a decision being made during the meeting with District Ministry of Agriculture staff to recruit enumerators to carry out most of the actual data collection with support from the frontline ministry staff. The research team (through the Divisional Ministry of Agriculture staff) hence recruited 215 enumerators. The enumerators and staff were provided with a one day training on the data collection instruments.

DIVISION	PRODUCTION CLUSTERS	MOAs	ENUMERATORS
1. Kathonzwani	Kathonzwani Mavinduni	2	10
2. Kibwezi	Masongaleni/Kinyambu/Kibwezi Utithi/Nthange Kikumbulyu	4	20
3. Mtito Andei	Muthingiini/Nzambani Ndarajani Mangelete	3	15
4. Kisau	Kiteta Kisau/Kithungo Waia	3	20
5. Mbitini	Maatha Ng'etha Mutyambua Mulala	3	20
6. Matiliku	Kilili Kalamba/Kithumba Nzani	3	15
7. Wote	Wote Kako	4	20
8. Tulimani	Tulimani Nzeveni	1	10
9. Kasikeu	Kasikeu Kayata Kiongwani Maiani	2	10
10. Nguu	Kikumini/ithumba/Nguu/Masumba	2	5
11. Kaiti	Kaumoni/Kilala Ukia	2	10
12. Kee	Kee/Kivani Watema	2	15
13. Makindu	Kiboko Kai/Kaunguni	3	15
14. Kilome	Kiongwani/Maiani/Kitaingo	2	10
15. Kilungu	Wautu/Ndolo/Kyamuso/Musalala	2	10
16. Mbooni	Nzeveni/Kaliani	2	10
TOTAL		40	215

The MOAs and enumerators conducted the interviews from household to household within the cluster areas with supervision from the Divisional heads and oversight from the Research supervisors and Principal Researcher.

The first questionnaire was administered to all households within the cluster areas. It had questions on number of improved variety mango trees within the household farm and the locality of the farm (village, sub location, location and division). The questionnaire also had questions on the number of indigenous mangos and seedlings (nursery).

The second questionnaire (supplementary questionnaire) was used to generate further information from selected households on the total number of mango trees they have (both improved and indigenous varieties), the maturity of the trees under each category, and the variety of Mangoes by age. The supplementary questionnaire also sought for a realistic estimate of production of the farmers' improved/export variety trees per year. A simple

random sampling approach was applied in determining the households to be interviewed using this questionnaire. We decided that every enumerator would have to administer 5 supplementary questionnaires. The enumerator interviewed every 20th respondent using the supplementary questionnaire. They carried out the interview immediately they finished administering the main questionnaire. In the event that the respondent did not have the improved variety mangos, the enumerator skipped until they got one with such a variety.

Data was analyzed using the SPSS. The findings have been deduced from frequency and cross tabulation tables.

1.3.4 Challenges

We faced several challenges during the data collection process. However, we tried as much as possible to resolve them.

Initially, we had not envisaged that we would require enumerators other than the Ministry of Agriculture officials that had been designated. Makueni is such a vast district and during the planning meeting with Ministry of Agriculture officials, it became apparent that they would not be able to carry out the census on their own. A decision was made to hire more enumerators for the task. This was unbudgeted for and also required delays in the process because the enumerators had to be sourced for. Given the low remuneration for the enumerators, we were able to attract mainly secondary school dropouts with no experience in data collection. This put extra pressure on the supervisors in ensuring that the quality of the information collected was not compromised. Obviously, this is an area that needs to be addressed in future to ensure high standards of data collected.

The terrain in some parts of the district is difficult. In certain areas, roads have been cut off. This required traveling for long distances to be able to reach the enumeration sites and provide support to the MOA staff and enumerators.

The time allocated for the exercise was short for a census of this magnitude. The MOA staff and enumerators had to work for long hours to be able to cover their clusters. In circumstances where time was a real limitation, we have factored in a projected adjustment to cover for the trees that might not have been counted.

2. MANGO PRODUCTION CLUSTERS

In this section, we present the results of the survey for the whole of Makueni District. Later in section three, we shall present more elaborate cluster per cluster analysis. As mentioned earlier in the methodology section, we utilized two questionnaires during data collection. The supplementary questionnaire enriches the findings of the main questionnaire. The analysis of the supplementary questionnaire is presented in this section.

2.1 Tree and Farmer population

General Findings

The findings of the study demonstrate that Makueni is one of the leading (if not the leading) mango producing district in the country. As seen in appendix 3, Makueni has a high population of mango trees, estimated at 227,994 (both export and indigenous varieties) spread in the 16 cluster areas identified during the planning session with Ministry of Agriculture staff as high potential areas. There is a huge potential for the continued expansion of mango growing in those areas and those in the neighbourhood. There are exporters already working with some of the farmers. However, deepening of outreach by the exporters is required if the huge market is to be effectively captured.

Out of the 227,994 mango trees in the clusters, 61% (139,450) are the indigenous variety. That is illustrative that in high production concentration areas, a sizeable number (39%) of the farmers are using the improved variety as an alternative to the indigenous one. One of the motivating factors as explained by the farmers and Agricultural officers for this trend was its potential for market penetration.

Out of the 18 divisions in Makueni, 16 were identified as having spots with mango production concentration. Kisau Division was identified as having the highest concentration of mango production clusters.

Kisau (Mukwani/Muthwani/Kakuswi/Ngiluni/Ndituni/Kiambwa) has a production estimated at 34,019 trees. The second largest cluster with 33,499 is Kibwezi. This was not largely unexpected due to the fact that this area is home to several large scale farmers and research institutions. Mbitini came a close third with 28,286 trees. Other notable areas with high production are Wote, Kaskeu, Kaiti and Matiliku.

Kisau had the highest number of farmers (4,612), followed by Mbitini (4,473) and Kibwezi (4,305). The total number of farmers in the 16 production areas was 39,322. However, for a more detailed description, please refer to appendix 3 (Mango production clusters)

Export variety Cluster findings

The study identified 4 clusters as high concentration areas with the export variety mangoes. The 4 clusters were identified as having more than 6,000 export variety mango trees. The 7

clusters are Kibwezi, Kisau, Mbitini, Wote, and the particular spots within those clusters are identified in Table 1 below.

Table 1: Production Clusters

DIVISION	PRODUCTION CLUSTERS
1. Kibwezi	Masongaleni/Kinyambu/Kibwezi Utithi/Nthange/Kikumbulyu
2. Kisau	Kiteta/Kisau/Kithungo/Waia
3. Mbitini	Maatha/Ng'etha/Mutyambua/Mulala
4. Wote	Wote/Kako

Table 2: Export Variety Mango Production Clusters

DIVISION	Number of Farmers	Apple		Ngowe		Tommy		Kent		Van Dyke		Boribo		Dodo		Others		Total
		Mature	Young	Mature	Young	Mature	Young	Mature	Young	Mature	Young	Mature	Young	Mature	Young	Mature	Young	
Kibwezi	4305	9846	11730	486	852	52	65	25	32	136	95	12	9	30	22	48	29	23,469
Kisau	4612	5853	8660	534	604	245	142	112	65	417	285	75	52	268	262	129	52	17,755
Mbitini	4473	5400	7794	135	141	15	27											13,512
Wote	2581	2226	3153	330	191	42	33	26	21	35	25				26			6,108
Total	15,971	23,325	31,337	1,485	1,788	354	267	163	118	588	405	87	61	298	310	177	81	60,844

Source: Kenya BDS Makueni District Mango Cluster Census, September 2005

2.2 Distribution of tree varieties

An important finding of this survey is that Mango production in Makueni District is still heavily dominated by the indigenous variety (it accounted for 61% of the total production). At face value, this could be worrying because that particular variety is not known to attract any serious export market due to their fibrous nature. They are utilized locally with very poor returns on investment. But this should possibly not set off alarm bells since there seems to be progress on the ground. In parts of the district, the survey team encountered farmers carrying out top working on their indigenous trees. This is aimed at grafting the tree and transforming it into an improved variety. The economic importance of the transformed variety would be realized within 2 – 3 years. It was also notable that in certain clusters, the growing of the indigenous variety is diminishing and is being overtaken by the export variety especially Apple.

Among the export variety trees, Apple are grown by more farmers in more clusters. As seen from the table below, Apple variety accounts for 34.8% of the total production. (though it accounts for 90% of the total export variety production). Certain clusters have a disproportionately higher concentration of the Apple variety. Leading is Kibwezi (21%), Kisau (18%) and Mbitini (16.6%). Kibwezi has arguably benefited from Nairobi University's research in the area (and other large scale farmers), while top working has been utilized mostly by the farmers in Mbitini. Kisau has some model farmers who have inspired the rest to adopt the new variety by grafting. The research team was also told that some exposure visits have been organized and undertaken by farmers in this area hence their receptiveness to improved variety mangoes.

2.3 Size of Mango trees

The survey sought to determine the approximate ages of the various mango trees. As can be seen from Table 4 below, a significant proportion (40%) of the mangoes, are below 3 years. What that means is that they are not yet in the production category and therefore are not a source of income for the family. It is also striking that approximately 20% of the mangoes are 9 years and above. That means they are mature and their mango fruit production is optimal. However, it is not encouraging business wise that a majority of the mango trees over 9 years are the indigenous variety (64%).

Table 3: Types of Mango Trees by Age

Age (Yrs)	Apple	Ngowe	Kent	Tommy	VanDyke	Sensation	Boribo	Haden	Alfonso	Dodo	Keitt	Sabine	Indigenous	Total
1	495	90	24	42	12	6	0	9	3	9	3	6	546	1,245
2	570	111	69	66	27	6	6	6	0	9	12	12	372	1,266
3	705	183	84	105	36	6	15	3	0	15	3	3	327	1,485
4	453	126	75	66	9	6	9	0	0	15	3	3	213	978
5	432	102	39	69	9	9	9	3	0	3	3	3	189	870
6	270	63	30	24	0	3	3	3	3	3	0	3	123	528
7	243	60	15	33	6	3	3	0	3	15	0	3	120	504
8	360	120	54	78	9	12	6	9	6	12	3	3	324	996
9 <	336	162	54	54	9	9	15	15	12	36	0	12	1,272	1,986

Source: Kenya BDS Makueni District Mango production Cluster census. September 2005

As table 4 indicates, most of the farmers in the district (48%) have only 1 – 5 trees. Obviously, such micro farmers might not be attractive to serious exporters who are interested in economies of scale. Such small farmers do not provide that kind of scale that exporters would be looking for. It is more costly trying to mobilize farmers with just a few trees as opposed to a scenario where the farmers had more trees. This is an area that seriously needs to be looked at by the respective farmers if they have to be attractive to potential export partners. Aggressive mobilization and capacity building of the farmers on the need to increase production is paramount. Perhaps this is an area that could be of interest to interested stakeholders.

Table 4: Distribution of Mango Trees per farmer

Number of Trees	Number of farmers	Per cent
1 – 5 trees	18,953	48
6 – 10 trees	10,896	27.9
11 – 20 trees	6,566	16.7
21 – 30 trees	1,258	3.2
31 – 60 trees	786	2.0
61 – 100 trees	550	1.4
100 – 200 trees	235	0.6
200 < trees	78	0.2
	39,322	100.0

Source: Kenya BDS Makueni District Mango production Cluster census. September 2005

2.4 Production Estimates

It is apparent that most of the improved mango trees are high yielding. The survey found that those between 3 – 5 years were producing averagely 218 fruits per tree per season. The yield increased as the tree matured. Those between 6 – 7 years were producing averagely 616 fruits per tree per season, while those over 8 years were producing averagely 693 fruits per tree per season. The trees in the fruit bearing age were on average producing 422 fruits per tree in a season. This is the more reason why concerted efforts must be put in place to ensure that the indigenous varieties undergo top working. Given the large number of trees that are indigenous, there is huge potential for increased production if they are improved to export variety.

Table 5: Production Estimates for Improved Variety

Age of fruit bearing Trees	Number of Farmers	Total Number of Trees	Total Number of pieces	Average number of pieces per tree
3 – 5 years	346	2,604	569,425	218
6 – 7 years	611	789	486,728	616
8 < (Mature)	215	1,386	960,713	693
Total	1,172	4,779	2,016,866	422

Source: Kenya BDS Makueni District Mango production Cluster census. September 2005

3. PRODUCTION CLUSTERS SUMMARY

In this section, we make a brief presentation of the results of the survey for each of the clusters

3.1 KIBWEZI CLUSTER

This was found to be the second leading cluster in terms of mango production. The cluster is divided into 4 locations; Kinyambu, Kikumbulyu, Masongaleni, and Utithi. All these locations have high production concentration majorly because of three major rivers that serve the division. The rivers cut through each of the locations hence enabling many of the “big” farmers to practice irrigation farming. The three main rivers that are actually a lifeline of the division are Kibwezi, Thange and Athi. Due to uncertain weather conditions in the rain fed parts of the division, most of the farmers practice mixed farming; rearing livestock and growing crops. The division is served by a relatively good road network. The main Mombasa – Nairobi highway borders the division. There is also an all weather road that is relatively well maintained that cuts through the division to Kitui. The other smaller roads that serve the local markets are passable during the dry season (but could be a challenge during rainy season).

Kibwezi covers an area of 944.8 square kilometers and has 4 locations and 14 sub-locations respectively. Its population density was 92 persons per square kilometre in 2002. It is considered as one of the least populous divisions in the district. Indeed, because of its initial low population, the Government has opened up new settlement schemes in Kibwezi.

Table 6: Kibwezi

Location	No. Farmers	Apple			Ngowe			Others		
		Mature	Young	TOTAL	Mature	Young	TOTAL	Mature	Young	TOTAL
Masongaleni	1,232	3,415	4,006	7,421	155	300	455	165	116	281
Utithi	1,076	2,016	2,613	4,629	71	184	255	20	28	48
Kinyambu	893	1,202	861	2,063	55	112	177	16	12	28
Kikumbulyu	1,104	3,213	4,250	7,463	205	256	461	102	96	198
TOTAL	4,305	9846	11730	21,576	486	852	1,338	303	252	555

Source: Kenya BDS Makeni District Mango production Cluster census. September 2005

As can be seen from the table above, in Kibwezi most of the mangoes (56%) are young.

3.2 KISAU CLUSTER

This is the leading cluster in production. The cluster consists of Mukiwami, Muthwani, Kakuswe, Ndituni, Ngiluni and Kiambwa sub locations. This area has a very high number of both improved and indigenous mango varieties. Discussions with ministry of agriculture officials confirmed that some of the improved varieties have been as a result of top working or grafting. In discussions with the SITE field staff, we also discerned that some of the farmers in this cluster have benefited with from exchange visits to foreign countries like South Africa that are renowned mango farmers. Such exposure has the effect of trickling down to the community. This is one of the clusters that Kenya BDS are already working through SITE. That kind of support is still required since the farmers are keen to improve their crop and reap maximum benefits.

The cluster is served with good all weather roads. They link the various markets and trading centres in the cluster to other towns and markets like Masii, Wote, Kalawa, Machakos, and Tulimani. Trading centres in the Division like Mbumbuni, Tawa are well established.

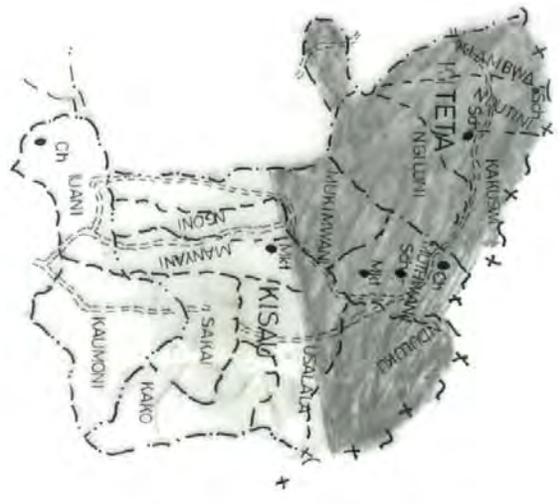
Table 7: Kisau

Sub Location	No. Farmer	Apple			Ngowe			Others		TOTAL
		Mature	Young	TOTAL	Mature	Young	TOTAL	Mature	Young	
Mukiwani	511	966	1,005	1,971				100	65	165
Muthwani	555	700	1,200	1,900				138	182	320
Kakuswi	765	917	1,217	2,134				312	216	528
Ndituni	587	883	1,444	2,327	179	251	430	68	66	134
Ngiluni	1,083	1,175	1,876	3,051	155	188	343	211	151	362
Kiambwa	1,111	1,212	1,918	3,130	200	165	365	417	178	595
	4,612	5853	8660	14,513	534	604	1,138	1246	858	2,104

Source: Kenya BDS Makueni District Mango production Cluster census. September 2005

KISAU

Reference
DIVISION BOUNDARY ————
ROAD ————
DISTRICT BOUNDARY - - - - -
REGION OF HIGH MANGO CONC. [shaded box] + + + + +



3.3 WOTE CLUSTER

The cluster comprises of Kamunyolo, Unoa, Kambi Mawe and Kako sub locations. Mango production is a key economic activity in this cluster. Other agriculture based activities include livestock, apiculture, horticulture, and cotton. Though the cluster has a significant number of the improved variety mango trees, the indigenous variety are still many. But certain interventions are already being put in place and most of the farmers are having their indigenous trees go through grafting and top working to transform them into improved variety. Most of the trading centres in the cluster are well served with all weather roads and therefore there is no significant transport problem.

Wote covers an area of 362.7 square kilometers with 2 locations and 8 sub-locations. Its population density was 176 persons per square kilometre.

Table 8: Wote

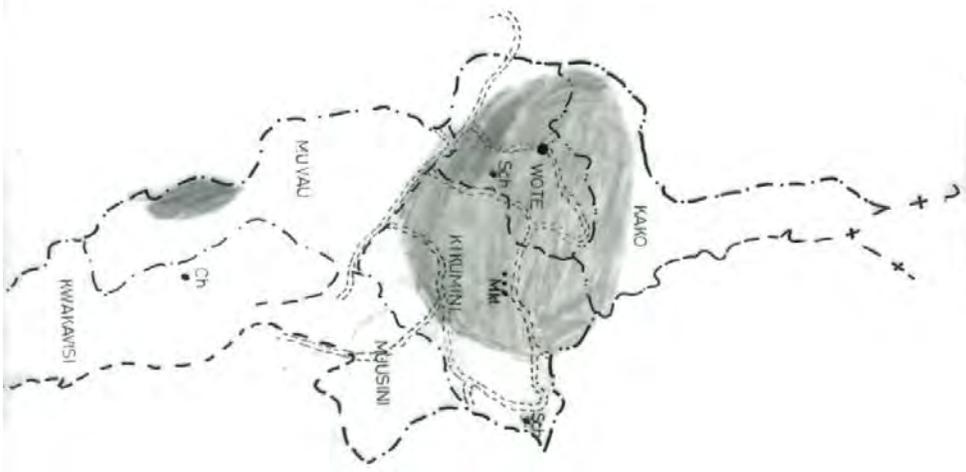
Sub Locations	No. Farmers	Apple			Ngowe			Others		
		Mature	Young	TOTAL	Mature	Young	TOTAL	Mature	Young	TOTAL
Kamunyolo	912	700	1,038	1,738	155	100	255	105	105	210
Unoa	816	654	812	1,466	175	91	266			
Kambi Mawe	621	556	788	1,354						
Kako	232	316	515	831						
	2,581	2226	3153	5,379	330	191	521	105	105	210

Source: Kenya BDS Makueni District Mango production Cluster census. September 2005

NOTE

Reference

- DIVISION BOUNDARY - - - - -
- ROAD - - - - -
- DISTRICT BOUNDARY - - - - -
- REGION OF HIGH MANGO CONC. + - - - - +



3.4 MBITINI CLUSTER

The cluster which consists of Mutyambua, Maatha, Ngetha Sub locations is the third leading mango producer in the district. It is notable that though this cluster has a high concentration of indigenous mangoes, efforts through the intervention of Kenya BDS and its implementing partner, Ideal Business Links, to improve the variety through top working are already bearing fruit. Several community resource people have been trained and are already implementing the top working mechanism. In our discussions with the farmers and Ministry of agriculture officials, they all appreciated the great work being done by Kenya BDS through Ideal Business Links and noted that even most of the improved varieties that the farmers currently have are as a result of top working and grafting. There is still considerable demand for that service given the large number of indigenous mangos available in the cluster.

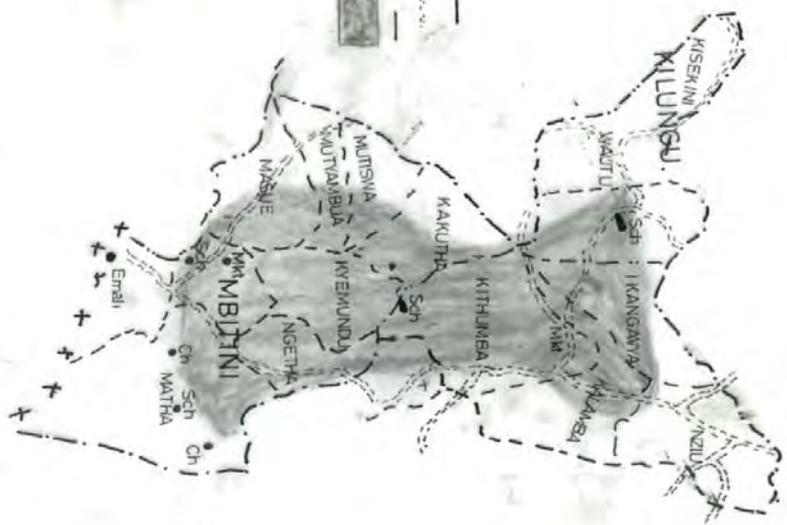
The area is served with good all weather roads that link the cluster to all neighbouring towns. Accessibility is not an issue in this cluster since all major markets that could serve as collection points are linked to a functional all weather road.

Table 9: Mbitini

Sub Location	No. Farmers	Apple			Ngowe			Others	
		Mature	Young	TOTAL	Mature	Young	TOTAL	Mature	Young
Mutyambua	1,540	1,965	2,598	4,563	57	61	118	15	27
Maatha	1,460	1,785	2,500	4,285	43	55	98		
Ngetha	1,473	1,650	2,696	4,346	35	25	60		
Total	4,473	5,400	7,794	13,194	135	141	276	15	27

Source: Kenya BDS Makueni District Mango production Cluster census. September 2005

MBITINI



Reference

- DISTRICT BOUNDARY + - - +
- ROAD ———
- DIVISION BOUNDARY - - - - -
- REGION OF HIGH MANGO CONC. [shaded area]

Appendix 1 Questionnaire

Makueni Mango Cluster Mapping and Tree Census

Name of farmer	Division	Location	Sub-location	Village	Number of Improved mango trees										# of Indigenous trees		Whether farmer has a nursery	
					Apple		Ngowe		Kent		Tommy		Other		Mature	Young	Y/N	# seeds
					Mature	Young	Mature	Young	Mature	Young	Mature	Young	Mature	Young				
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Appendix 2 – Supplementary Questionnaire

Ministry of Agriculture/Kenya BDS
MANGO CLUSTER MAPPING AND TREE CENSUS OF MAKUENI DISTRICT
SUPPLIMENTARY QUESTIONNAIRE

SECTION A: To be completed directly AFTER conducting interview.

NO.	QUESTIONS	ANSWER CATEGORIES AND CODES	CODE
A.01	Enumerator name		
A.02	Division		
A.03	Location		
A.04	Sub-Location		
A.05	Village		
A.06	Date of interview	[]/[]/2005	

SECTION B: HOUSEHOLD SCREENING SECTION

B.01	What is the total number of mango trees you have?	[]																																																																																																																																																																																																	
B.02	Please indicate the varieties you have and the maturity of the trees under each category																																																																																																																																																																																																		
	<table border="1"> <thead> <tr> <th rowspan="2">Variety</th> <th colspan="9">Variety of Mangoes by Age</th> <th rowspan="2">Total</th> </tr> <tr> <th>1 yr</th> <th>2 yrs</th> <th>3 yrs</th> <th>4 yrs</th> <th>5 yrs</th> <th>6 yrs</th> <th>7 yrs</th> <th>8 yrs</th> <th>9 + yrs</th> </tr> </thead> <tbody> <tr> <td>Improved varieties</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td> Apple</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td> Ngowe</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td> Kent</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td> Tommy Atkins</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td> Van Dyke</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td> Sensation</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td> Boribo</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td> Haden</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td> Alfonso</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td> Dodo</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td> Keitt</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td> Pervin</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td> Sabine</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> <tr> <td>Indigenous</td> <td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td> </tr> </tbody> </table>										Variety	Variety of Mangoes by Age									Total	1 yr	2 yrs	3 yrs	4 yrs	5 yrs	6 yrs	7 yrs	8 yrs	9 + yrs	Improved varieties											Apple											Ngowe											Kent											Tommy Atkins											Van Dyke											Sensation											Boribo											Haden											Alfonso											Dodo											Keitt											Pervin											Sabine											Indigenous										
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B.03	Please give us a realistic estimate of production of your improved/export variety trees per year		<table border="1"> <thead> <tr> <th>Age of fruit-bearing tree</th> <th>Number of pieces (fruits)</th> </tr> </thead> <tbody> <tr> <td>3 – 5 years</td> <td></td> </tr> <tr> <td>6 – 7 years</td> <td></td> </tr> <tr> <td>8 + years (mature)</td> <td></td> </tr> </tbody> </table>		Age of fruit-bearing tree	Number of pieces (fruits)	3 – 5 years		6 – 7 years		8 + years (mature)																																																																																																																																																																																								
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Appendix 3 Mango Production clusters

DIVISION	Number Farmers	Apple		Ngowe		Others		Indigenous		TOTAL
		Mature	Young	Mature	Young	Mature	Young	Mature	Young	
Mbitini	4473	5400	7794	135	141	15	27	6814	7960	28,286
Kasikeu	3426	840	1230	30	42	15	30	8164	6264	16,615
Kibwezi	4305	9846	11730	486	852	303	252	5562	4468	33,499
Mtito Andei	3006	1338	844	85	94	40	34	2748	3506	8,689
Nguu	1638	1471	2223	42	120	36	60	1920	2328	8,200
Kaiti	3507	1486	1947	156	285	87	78	4662	3840	12,541
Kee	1509	952	452	3	3			2838	1140	5,388
Kilungu	1124	112	280		7			2086	742	3,227
Kilome	2267	464	535	60	51		1	4550	2740	8,401
Matiliku	2297	1610	1788	224	140	27	45	3304	3786	10,924
Wote	2581	2226	3153	330	191	105	105	6294	6726	19,130
Mbooni	1753	336	192	12	10	66	36	2868	2476	5,996
Kisau	4612	5853	8660	534	604	1246	858	9696	6568	34,019
Kathonzweni	724	246	384	47	69	11	14	2496	2864	6,131
Tulimani	2100	260	1654	18	117	39	216	3810	3330	9,444
Makindu	3302	2526	1518	112	214	103	131	5200	7700	17,504
Total	39,322	34,966	44,384	2,274	2,940	2,093	1,887	73,012	66,438	227,994

Source: Kenya BDS Makueni District Mango Cluster Census, September 2005