Improvement of Mango yield, quality and profitability on Bush Doctor Farms in Kintampo, Ghana

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Summary.

Kintampo is situated in the heart of Brong Ahafo, one of the most important mango producing area's in Ghana. Number and size of mango farms is rapidly increasing, due to government support and private investments. The mango's are mainly sold fresh on the local market and for processing to a couple of processors. Export of mango's is widely propagated. It is on the rise but facing huge sanitation problems. Kintampo is not ideally situated for export. Most farms are not on the main road with causes a lot of fruit damage during transport. Fortunately the local market is excellent and there is a growing demand for processing, provided that diseases are going to be controlled.

PROBLEM DEFINITION

The applicant's (Bush Doctor Farms) mango farm near Kintampo is located in the Brong Ahafo province, one of the major mango producing area's. Apart from erratic climate conditions (making flowering, fruitset and yield unpredictable), disease control is the major constraint to produce quality mango's.

The control of diseases like fruitfly, anthracnose , bacterial black spot and additional good

agricultural practices are crucial to achieve good yields, access to markets and successive profitability.

PROJECT DEFINITION

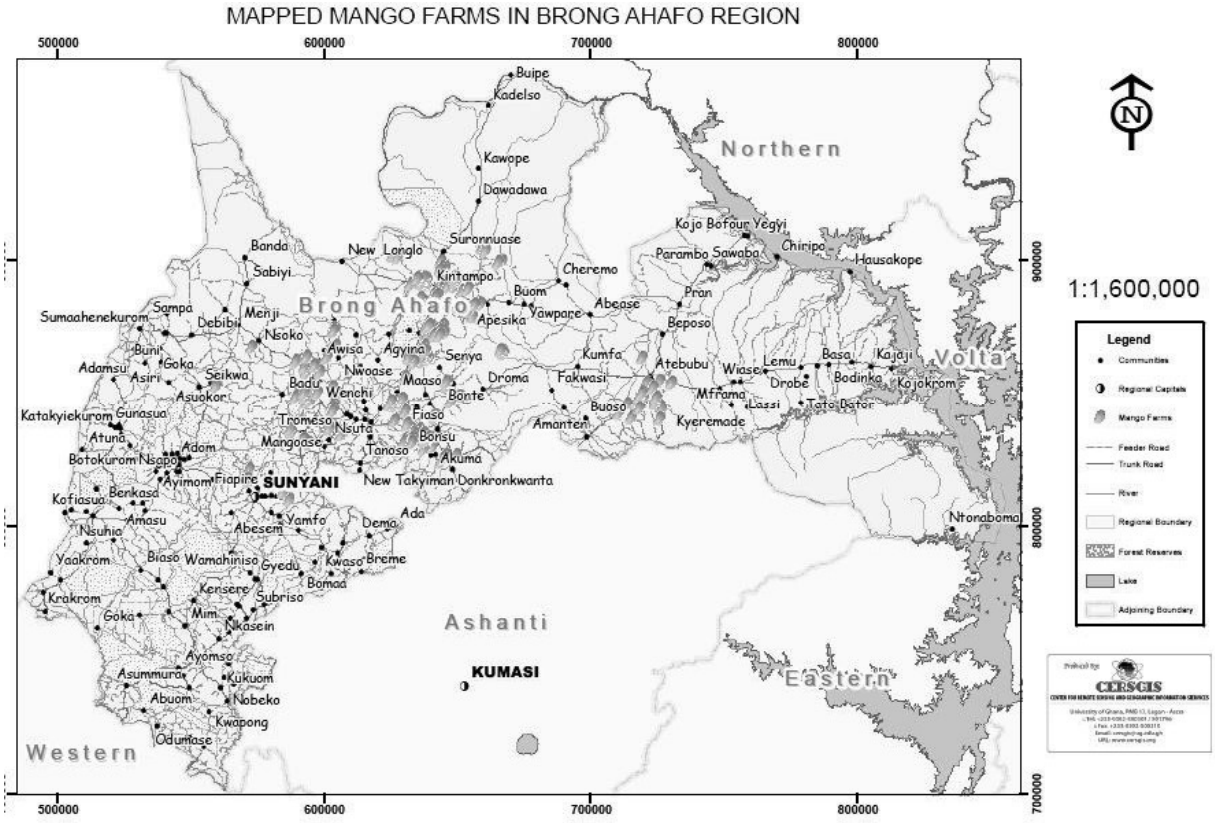
The PUM Expert is expected to design and install appropriate systems and strategies to enable us to achieve our stated project objectives, meaning bigger yield and better profitability trough better quality products.

ANALYSIS

A. General

Stimulated by Government and private parties Mango production is gaining prominence all over Ghana. The ultimate goal is to develop the mango export into one of Ghana's most important export crops. However, it seems that with the growth of the mango area and the mango market, the problems to grow quality mango's are growing exponential, (See article annex 1) which is, unfortunately, not unique.

The Brong Ahafo area is one of the major mango growing area's in Ghana. Lately farmers are planting commercial varieties (mainly Keitt) all over the place stimulated by Government based programs and/or private initiative. (like ITFC in Tamale) The following map is showing only part of the mango farms, but indicated the province as an important growing area for mango's



Even without access to the export market due to quality and transport problems, the growers are blessed with a good local market, both for fresh products and for processing (ITFC in Tamale). The main constraint however is the production of good quality fruits. As mentioned in the article (annex 1), the allover present disease is fruitfly infestation, followed by anthracnose

and bacterial black spot. As usual, the cause of these problems is quite complex

1. The lack of farm sanitation creates an ideal breeding ground for the fruitfly.
2. Disease control is often not executed following the recommendations or by non availability of the right pesticides/fungicides.[1]
3. The most important mango variety Keitt matures relatively late. As a consequence fruitfly population and infestation is high, due to earlier fruiting trees (Mainly wild mango seedlings)
4. Because of the late ripening of Keitt, mature fruits are harvested after the onset of the rainy season, causing an additional threat trough the infestation of anthracnose.
5. Apart from these diseases, the whole area is facing the risk of loosing the whole crop or even the trees by the existence of frequent bush fires during the dry season, provoked trough the practice of shifting agriculture.

B. Farm specific

The Bush Doctor Mango farm is situated about 45 minutes drive from Kintampo. There are a few other farms in the vicinity.

Although the total farm has a size of 155 acre (about 65 ha), only 30 acres (about 13 ha) has been planted with mango trees of the Keitt variety at a density of 100 trees per acre. (240 trees/ha) on a slope of about 10 degrees. The whole farm is rain fed but there is a permanent source of water on the premises, creating possibilities for irrigation.

The farm locates 3 permanent labors and additional hands from a nearby village (>10)

The first trees have been planted in 2007, producing their first accountable yield of 3 MT in 2011, followed by 10 MT (value GH 3500) in 2012 and 4 MT in 2013. (Value GH 1600) (In spite of bigger trees, the yield in 2013 was much lower due to weather conditions (strong winds and severe drought) and infestation of fruitfly in the whole area.

All the challenges as mentioned in the general part of this analysis are applicable for this particular farm.

On top of that, due to the remoteness of the farm, the non-availability of sufficient labor during harvest peek periods but also for regular maintenance is another constraint so there is a need for mechanized actions for maintenance and sanitation.

CONCLUSIONS

The outlook for this and other farms in the area is very positive. There is a good and growing demand on both the local market and the processing market, provided that problems and challenges are tackled in the right way (see recommendations). However, this needs an orchestrated approach of the problem by organized farmers. The newly installed KIMFA (Kintampo Mango farmers Association) could and has to play an important role here. So in fact the recommendations below for Bush Doctors Farm count for all the mango growers in the applicable area, which creates a need to set up an experimental farm or area to study and judge the effect of some of the recommended measurements.

[1] The European union recently released a brochure regarding methods (including the use of pesticides for fruitfly control).Recognizing the problem, the EU accepts the use of certain pesticides, even in organic farming. (Annex 2)

RECOMMENDATIONS

General

As mentioned before, the planted Keitt variety is ripening late in the season. This increases the risk of fruitfly and anthracnose infestations. It would therefore be worthwhile to introduce earlier and/or more resistant fruiting varieties. This would at least create the possibility of producing quality fruit for the fresh market. Unfortunately the processing industries is mainly focused on Keitt or Keitt-like varieties (Kent, Zill) There is however existing literature citing the variety July being resistant against fruitfly. This variety seems to be available from the mango collection of the agricultural university in Kumasi.

It would also be worthwhile to manipulate trees to produce fruits earlier in the season when fruitfly population is low and fruits can be picked before the onset of rain, thus preventing anthracnose disease. (See annex 3)

Farm Specific

1. Keep the farm clean of weeds, and other debris, especially under the trees.
This will allow intercropping between mango rows, which will result in additional income and increased cleanness, diminishes the risk of damage by bushfires and facilitates better picking of fruits.
2. Farm equipment should be in good working order (Tractor, Napsacksprayer etc.) Broken equipment should be repaired or removed from the farm.

2. Fight **fruitfly** and other diseases systematically, globally as mentioned in the EU and other brochures.
   a. Since the infestation grows trough a growing population of fruitfly maggots in the soil, keeping the soil under the trees clean and collecting dropped fruits intensively is of at most importance.
   Destroy the fruits immediately as mentioned in the brochure in annex 2. (Complete brochure is provided)
   Drenching the soil with Neem extract or other means will decrease maggot population.
   b. Use fruitfly traps (at least 1 per 10 trees) to observe the development of the population. Numbers of fruitfly collected every week determine the need and mode of treatment.
   c. Use the following insecticides: lambda-cyhalothrin at 25 g/ha (1 kg/ha of Karate Max 2.5 WG ® produced by Syngenta) or bifenthrin at a dose of 50 g/ha (0.5 m/ha of Talstar 100 EC ® produced by FMC) and apply at recommended intervals. (Repeat treatments within 10 days, see EU brochure)
   d. Use fruitfly bait combined with insecticide to decrease existing fruitfly population in trees.

3. Irrigation. Can be used at new plantings and in dry periods. Especially in the case of fruit manipulation irrigation might be needed during dry spells. To much irrigation has a negative influence on fruit quality, especially with the Tommy Atkins variety.

4. Long term experiments to find out the best way to manipulate fruiting, in order to get pre- season or post- season fruits.
   a. Small trials with different varieties. Recommended are Zill (commercial), Tommy Atkins (bears out of season) and Julie (Fruit fly resistant.)

b. The influence of the rootstock on a specifioc mango variety has hardly been studied, although in many other types of fruit (Citrus, Apple, Pear) the knowledge of rootstocks brought a whole new dimension in fruit growing.

It would be interesting to study the influence of the rootstock on the variety in terms of

1. Time of fruiting
2. influence on biennial bearing

c. Deminishing fruitfly infestations by natural means. Information about a natural way of fighting insects in plantations by the use of Tephrosia vogelii. (See annex 4)

Annex 1

ECOWAS-TEN Value Chains Newsletter October 2012

Market News

Mango imports from the EU: 52% increase for West African countries

Good news for ECOWAS mango exporters. The latest data relating to January to June 2012provided by Eurostat show a significant recovery for countries supplying mangoes in the sub-region to the European Union.
Indeed, the West African receipts have increased from about 15 000 to over 22 000 tonnes, i.e. a rise of about 7000 t. mostly due to a significant recovery of Ivorian shipments. It is important to note that the period under consideration does not take into account Senegal's crop year, starting from July until late August.

In 2012, € 2.8 million losses for ECOWAS exporters due to fruit flies

Over 90 interceptions! This is what is revealed by the statistics compiled via Europhyt, the European Union's information system on phytosanitary interception. Fruit flies once again heavily handicapped mango exports in the sub-region.

The cost is estimated at € 2.79 million (FCFA 1.83 billion) at a rate of € 30,000 per interception. Côte d'Ivoire still ranked first with 34 interceptions in Europe, followed by Ghana (28) and Mali (15). June and July were the months particularly affected by the presence of flies (Bactrocera invadens, ceratitis cocera, Tephritidae) as part of sub-regional shipments.

Origins Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
Cote d'Ivoire				3	12	18	1	34
Mali					3	11	1	15
Burkina Faso					3	8		11
Ghana	3	1	4	10	8	2		28
Senegal						1	1	2
Togo					1	1		2
Gambia						1		1
Total	**3**	**1**	**4**	**10**	**12**	**21**	**39**	**3**	**93**

For nearly 10 years, the fruit fly threats the whole production of West African mango, affecting its quality and disrupting trade, reducing sources of income and food security of thousands actors.

ECOWAS-TEN: ECOWAS Trade and Enterprise Network Experts (ECOWAS/TEN) is a regional association established in Accra in March 2010 and headquartered in Abidjan. The general objective of ECOWAS-TEN is to contribute to social and economic development of the West African region through the promotion and development of exports in order to ensure a better integration into the multilateral trading system.

To complete all its activities successfully, ECOWAS/TEN relies on a number of mechanisms, including the Permanent Technical Secretariat based in Cotonou, its National Focal Points across all Member States of ECOWAS responsible for mobilizing support from national institutions, both public and private, and its information network -INFONET- on value chains covering all countries of the region. In addition, ECOWAS-TEN is gradually acquiring specialized resource centers, including the one based in Accra which is tasked to develop the network's market intelligence capacity.

Annex 2

How?

Prior to treatment, it is important to decide on the application method, then select and properly adjust the most appropriate treatment equipment.
Use a pneumatic – knapsack, towed, or carried – sprayer with a centrifugal pump to ensure homogeneous distribution of the product on all parts of the tree. A preliminary test with water can be used to determine the number of trees that can be treated with a full tank. This information, together with information on the plantha density, is needed to calculate the volume of mixture to prepare and the product dilution rate that respects the required dose of active ingredient per hectare. The volume of the mixture generally varies between 400 and 700 l/ha for mature orchards.
Apply each product using good agricultural practices, in particular with regard to recommended doses and preharvest intervals (PHI) indicated on the label of the packages. This will make the treatment more effective, avoid problems of phytotoxicity, and ensure compliance with maximum residue limits (MRLs).

For further information contact:

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How to Control the Mango fruit fly

Full brochure is in possession of the applicant and downloadable at

http://www.anancy.net/documents/file_en/mangofruit_flies.pdf

Annex 3

Manipulation of flowering and fruiting in Mango.

There is ample literature regarding manipulating mango fruiting by chemical or other means, provoking off season flowering. (before or after the main season) Delaying flowering of trees in the Kintampo area will enable fruit yielding later than August, which will improve market price. However, the later the season, the more risk there is for fruitfly and anthracnose infestation. Therefore it is recommended to manipulate trees in such a way that early yielding will be possible. The goal is enable harvest in March, April. This is after the harvest and marketing of the (wild) local fruits and before the main season of improved varieties.
It requires however a turn around in the natural flowering cycle of the trees, which will usually start by the end of January.

How to manipulate trees.
To enable yielding in March, April, flower induction should start in September, October. This interferes however with existing fruit production in that particular period. Therefore trees should be pruned after their natural fruit set in February, March and April, removing actual flush and existing fruit bunches in order to prepare the tree for treatment later on.

The induction of flowering is largely discussed in literature. However, most of the information is both area and variety specific, and no specific information is available regarding manipulating mango trees in the Kintampo area. There are some experiments on local farms, but nothing is documented.

The main product used to induce flowering is Potassium nitrate, at a solution rate of 1-2%, followed by Calcium nitrate at the same rate. Both treatments are recommended to be applied twice, with an interval of 2 days. Trees should be sprayed until the solution runs of the leaves. Potassium sulphate is also mentioned at a drastic rate of 5%, killing existing flushes and inducing flowering on dormant branches only (verbal info ITFC)
Paclobutrazol has also been used, not as a spray but as a soil drench. Other chemical flower inducers are available on the local market, mainly as a foliar spray.

Since fruiting will move from the wet season to the dry season, additional irrigation might be needed. This irrigation however should stop about two weeks before harvesting in order to preserve quality.

It is recommended that flower induction experiments are executed on a limited number of trees, (5-10) until results are repeatable and satisfactory. To be able to treat trees in different periods, (say August, September October) a number of 15-30 trees has to be prepared: Skip pruning in July)
An experiment like this (see annex for trial form) requires precise recording of:
location of trees, nr. of trees and data collection regarding moment of treatment, first flowering, fruitset and final date of harvest (including quantity and quality records) All necessary measurements

regarding disease control should also be recorded. Disease control of these trees is of at most importance, because if not treated well, they could become a breeding ground for fruitflies attacking the non manipulated trees later on.

Annex 4

FLOWER INDUCTION TRIAL FORM

Country: Ghana
Trial nr:…….
Location: Bush Doctors farm

Tree variety used:……..

Location of trees:…….
Nr. of trees:……..
Age of trees:……..
Spacing of trees:…….
Date(s) of treatment:……
Mode of treatment (drench or spray)
Product used:…….
Concentration used:……..
Irrigation used; (yes or no, when, how much)
Trial supervisor:……..

Objective of the trials

Observations on individual trees

1.First flowers (date)
2 First fruitset
3.Final yield date
4.Final yield in kg
5.Average weight per fruit.

Annex 5


Tephrosia is a fast growing shrub, providing nitrogen and anti insecticidal components (see annex 4)

TEPHROSIA VOGELII FOR INSECT CONTROL AND GREEN MANURE

From: http://www.echonet.org/tropicalag/aztext/azch8pla.htm

Several members of our network wrote us about this plant for different reasons.
Beth Adams wrote from Malawi, "I planted several rows of leucaena trees on the edges of terraces, for green manure and erosion control. They are doing well and beginning to flower. I've found a shrub that seems to be much better though, fish bean or Tephrosia vogelii. It produces an incredible amount of leaf matter, grows very quickly, and is very easy to establish.. I planted them about 2 feet apart and now, 7 months later, they are almost a solid wall. They are not used as fodder."
"I have been very impressed with fish bean as an insecticide. Some of my students told me they had used the leaves to kill caterpillars, so we tried it. It killed every caterpillar overnight. It was incredible since most natural insecticides don't seem to work that quickly. We did an experiment on an okra cropthat was full of aphids using Malathion, tephrosia bean extract, soap (1 teaspoon per liter) and a tephrosia/soap mixture. The latter had the best results, tephrosia and Malathion were about the same, and soap was least effective. We've not been able to use neem because the trees planted in 1992 keep dying back and then regrowing. So I am encouraging students to plant tephrosia since it is much easier to establish here and can be used as a green manure as well."
Emmanuel Soko in Tanzania is an extensionist working with Fr. Rupper, who has frequently written and shared seeds. Emmanuel shared how tephrosia is used for insect control in grain storage. "Take fresh leaves and dry them under the sun. Grind the dried leaves into a powder. Mix 100 grams of powder with 100 kg of maize to control maize weevils and the larger grain borer; with 100 kg of beans to control the bean bruchids. The chemical is effective up to three months. After that time the process must be repeated.
"The plant has many other uses. To control ticks, lice and flies, animals (cattle, sheep, goats, pets) are washed with the extract of the plant. To make the extract, fresh leaves and branches are pounded in a mortar. This is diluted with five times that volume of water before applying to the animals.
"To make an insecticide, allow the above mixture to soak overnight or boil it for 30 minutes. Add a bit of soap to help the spray stick to the leaves. It can be used with garden vegetables, fruits and field crops, to control termites, ants, beetles, aphids, cutworms, various bugs and weevils, stalk borers, flies etc.
"In the evening the walls of the room, especially corners, are beaten with fresh tephrosia branches to repel mosquitoes, lice, ticks, cockroaches, etc. It is fed to animals for intestinal problems."
Roland Lesseps sent a copy of a fact sheet written by his colleague Andy McDavid at the Kasisi Agricultural Training Center in Zambia, from which a few excerpts follow.

"It has been used as a fish poison for hundreds of years and an insecticide for over a hundred."
"Cattle deaths have been reported as a result of drinking water of poisoned fish ponds. Also, reports have been made from one village of people getting sick after eating fish poisoned with the extract. I do not advise its use as a fish poison.
"The shrub may grow as rapidly as 2-3 meters in 7 months. The compound leaves contain the highest concentration of rotenoids, which are responsible for its insecticidal effectiveness. ...Its compounds are effective against a number of different pests (tested at least 90% effective against termites, citrus aphids, red spider mites). They break down in about 7 days (2-3 days in bright sunlight)." Seeds should "be soaked in water for about 24 hours for good germination (about 90%). Plant about 1 meter apart."
If very large numbers are planted, use 35,000 seeds per ha for greatest leaf yield.
"In harvesting, only the leaves need to be taken off the shrub. ... If removed carefully, the shrub will continue to produce leaves for ... extract or mulch. The most effective concentration for killing insects was found to be 20 g of leaves for every 100 ml of water. If a scale is not available, take the amount of leaves equal to the weight of an empty 300 ml coke bottle, then add 7 coke bottles full of water. ...The crushing of leaves does not need to be done perfectly; a plastic feed bag and large rock can be used."
After soaking for 2 hours (NOT in direct sunlight) filter the suspension through a cloth and use directly in the sprayer.
"It is important that the spray have contact with the pest. If the pest is underneath the leaves, be sure to actually hit the pests. ...If all the spray is not used immediately, it will still be approximately 70% effective 24 hours later, IF kept out of direct sunlight." Beyond that its potency drops quickly. The "used" leaves may be reused for a second extract. Tests have not determined concentrations to use but have shown that effective chemicals are left. "The leaves contain an anti feedant, so termites will not eatit. In areas of heavy termite infestation this mulch can be very helpful."

There is much more information available with the applicant and on the internet. (AvP)

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Annex 6.

On November 21/11 a farmers meeting was organized by Stephen Apanga (the applicant) with KIMFA. (Kintampo Mango Farmers Association)

All issues discussed in this report have been discussed thoroughly during the meeting, which was organized at the Yakam Hotel.

Following people were attending the meeting:

1.David Opoku Sarfo	President of KIMFA
2.Samuel E.Nimoh	Secretary of KIMFA
3.Nana Gyasi Akosah	Vice Chairman
4.Bernasko Cyamfi	Nursery operator
5.Mercy Adiebea	Treasurer KIMFA
6.Kwasi Etu-Bonde	Nucleus farmer
7.Daniel Taw Ofasi	Ass. Secretary KIMFA
8.Patrick Tawicki	Farmer
9. Dr.Stephen Apanga	Bush Doctors Farm
10. Ab van Peer	Pum expert