

# Tomato cultivation recommendation for the Kirinyaga area

Based on observations during a visit on 5-6 February, 2009

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Report 9



## The AfriVeg Programme Management

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If you think you could contribute to the goals of AfriVeg in any way, please contact the Programme management.

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## Inhoudsopgave

1	Introduction.....	5
2	Farmers meeting and field visits.....	6
3	Fertilizer recommendations .....	9
3.1	Nutrient elements required for plant growth.....	10
3.2	Fertilization of tomato.....	11
3.3	Prevention of Blossom end rot: .....	11
3.4	Recommended fertilisation schedule.....	12
4	Nematode control recommendations.....	14
5	Sanitation.....	15
6	Nursery recommendations .....	15
7	Pest and disease control.....	17
7.1	Blight control .....	17
7.2	Pyrethroids.....	18
7.3	White fly control .....	18
7.4	Technique .....	18
8	Crop management sheets .....	19
Annex I.	Farmer groups .....	21
Annex II.	Registration per farmer .....	22
Annex III.	Form to record inputs and labour per farm .....	44



# 1 Introduction

In 2007 the project Development of commercial field vegetable production, distribution and marketing for the East African market (BO-10-006-050-02) has been launched to improve the tomato supply chain in both Tanzania and Kenya.

In Tanzania a group of farmers has been identified for tomato production for exporting to Mombasa while in Kenya a farmers group has been identified to produce tomatoes for supplying Uchumi supermarket in Nairobi. This group is producing tomatoes in Kirinyaga and has about 25 members, each cultivating about 0.25 acres of tomato. The farmers have been grouped in sub-groups, with each sub group having a different sowing and planting date to supply year-round a same amount of tomatoes (Annex I). Arrangements with the trader Kamau and the Uchumi supermarket have been made to supply tomatoes. In order to ensure a steady year-round supply, to minimize losses and to reduce the risk of crop failures the cultivation of tomatoes needs to be optimized. .

Besides organizational issues, technical issues need to be addressed too. Therefore, this visit was planned to observe the problems in the cultivation and based on these observations some recommendations are formulated to improve yield and income levels.

The purpose of the visit was to assist the farmers with technical advice on tomato cultivation.

On February 5 and 6 the farms were visited and possible bottlenecks in the cultivation were observed. Based on the farmers meeting and discussion and on the field observation recommendations have been formulated which should improve the tomato cultivation in Kirinyaga. Special thanks to Rose Mwaniki for the excellent organization of the visit. Also special thanks to the farmers who were very willingly to receive me at their fields and to for sharing information on their practices. Finally the agronomist who advises the farmers, Mr. Robert Kinyua was very kind in giving all kind of information on pesticide use and current recommendations.



**Figure 1. Meeting with the farmers**

## 2 Farmers meeting and field visits

On February 5 a meeting with the farmers group was held. Per subgroup the leader was asked to tell about the cultivation and which problems were the main bottlenecks in the cultivation.

Conclusions of group 1 were:

- No financial resources were available for cultivation and therefore use of inputs was not optimal.
- Problems were present due to water shortage.
- Pesticides were not used or to a low extend to financial restrictions.
- Present pests and diseases in the crop were:
  - o Yellowing due to virus
  - o White fly
  - o Bollworm
  - o Blossom end rot
  - o Nematodes

Conclusions of group 2 were:

- At the start the crops looked very good but later on problems were present.
- Problems were present with water availability, since precipitation levels were low the past period.
- Blossom end rot was present especially in fruits of the 1<sup>st</sup> flowers. After rain no problems were present anymore.
- Present pests and diseases were limited due to thrips and wilting

Conclusions of group 3 were:

- No financial constraints were present so pesticides and fertilizers could be purchased when necessary
- Tomato grew well at all stages.
- The farmers felt that the variety Eden F<sup>1</sup> needs a lot more nitrogen compared to other varieties
- Due to rising temperature flower abortion was present (also in combination with low water availability)
- Fruits are big and heavy but as a result branches are breaking off.
- Main pest was whitefly and it seemed that pesticides did not had an effect on this.
- Another pest was bollworm
- Farmers had the feeling that maximum production was not yet reached and more production should be possible.
- Tomato leaves were showing a purple colour and were curled

After the meeting in total 7 tomato fields were visited and observed on presence of diseases and pests. The cultivation system per farm is not the same. In most cases plant holes are used with 2 plants per hole. At the start only one plant per hole was kept, but in that case the hole was too small and with irrigation the hole was filled up with sand. With bigger holes this problem is less and therefore it was decided to use bigger plant holes with 2 plants per hole. At other farms no holes were used but tomatoes were planted on ridges and furrow irrigation was used. Also planting distance varied substantially.



In general the crops looked good. In the early stage until blooming in general the plants are healthy and presence of pests and diseases was at a low level. At harvest stage some crops were heavily infested with white fly and blight. Perhaps at some stages the timing of spraying was wrong. Probably spraying in a young crop is also more effective due to a better coverage of plant parts with a pesticide as compared to an older crop where it is more difficult to get the pesticide at all plant parts due to the increased foliage of the plant.



**Figure 2. Planting in plant holes with 2 plants per hole.**



**Figure 3. Planting on ridges with furrow irrigation.**

Crop cultivation is considering the situation not too bad. Most plants look healthy and will give good yields. Pressure of blight and white fly is high, and are controlled by frequent spraying. However, problems are still present regarding:

- fertilizer use (calcium, phosphate, magnesium/iron, nitrogen)
- related to the fertilizer use also blossom end rot is a problem
- nematode control
- sanitation

- water (within the scope of this project this can not be solved but projects regarding irrigation and drip irrigation are useful)

Finally to reduce pest and disease pressure starting with healthy, pest and disease free transplants is important.

Next chapters will provide recommendations for these problems. It is advisable to test recommendations first on small scale before introducing them on a large scale.



**Figure 4.** Due to heavy pest and disease pressure this crop was given up. It is advisable to remove the plants then in order to avoid spread of pests and diseases to other crops.



**Figure 5.** A healthy crop with the potential of high yields.



### 3 Fertilizer recommendations

**Problem:**

- Yield levels are still low
- Blossom end rot is occurring at a high level.
- Phosphorus and Magnesium deficiency like symptoms are present

**Current practice:**

- Low levels of fertilisers are applied. Based on the records kept by the agronomist about 18 till 70 kg nitrogen per hectare is applied.
- Also Phosphorus and potassium applications are low
- In most cases ammonium containing nitrogen fertilizers are applied rather the nitrate nitrogen fertilisers.
- Irrigation is irregular and especially at the stage of the formation of the first flowers until the first fruits it is important to ensure a regular irrigation in order te reduce Blossom end rot.

**Remarks:**

- Exact nutrient status and soil pH are not known. It would be good if some farmers plots could be sampled on nutrient content of the soil.
- Problems with blossom end rot are present leading to the conclusion that calcium levels are too low in the soil.



**Figure 6. Fruits with blossom end rot.**

### 3.1 Nutrient elements required for plant growth

Nutrients are required to ensure a good healthy plant growth and yield.

Nitrogen (N):

Required at all plant stages and is needed for plant growth. The plant mostly takes nitrogen up in the form of nitrate or ammonium. Nitrogen is used in proteins and therefore involved in all processes of plant growth, development, and yield.

In case of shortage growth is limited, leaves are turning yellow starting at older leaves, leaves are dropping.

Phosphorus (P):

Needed for strong stems, development root system, fruiting and seed development. Phosphorus plays an important role in energy transfer and plays a key role in photosynthesis and chemical physiological processes. Also for development of cell structure and growing points phosphorus is needed.

When phosphorus levels are low leaves are looking very dark green in combination with a purple, bluish reddish tone at mostly the underside of the leaves. Foliage may be reduced as well distorted and become mottled and bronzed.

Potassium (K):

Potassium is required for forming starch, protein and sugars and is important for fruit development.

When K levels are low plants look unhealthy, fruits are small and leaves are showing veinal and interveinal yellowing. The yellowing mostly starts at older leaves. Blossoms may be smaller than normal and also due to lack of potassium plant resistance against diseases may be reduced as is resistance to heat and cold.

Calcium (Ca):

Calcium is essential for cell wall formation. When calcium level in cells is low, the links/bridges between cells are weakened and under stress conditions cells may be disconnected from each other resulting in cracking or blossom end rot.

In case of calcium shortage young leaves are showing curled back leaf tips and leaves may be smaller and distorted as well. Also shoots may be stunted.

Magnesium (Mg):

Magnesium is a key element in the chlorophyll and needed for photosynthesis. Deficiency symptoms are similar to iron deficiency. However, in case of magnesium deficiency older leaves mostly at the bottom of the plant show marginal and interveinal reddening or yellowing with the leaf base and midrib remaining green. At a later stage also necrosis can occur. At lower temperatures due to mg shortage leaves can show a purple temperature.

Sulphur (S):

Needed for protein building and for plant growth.

In case of low levels of sulphur leaves are pale yellow at all development stages.

## 3.2 Fertilization of tomato

A tomato crop with high yield levels need a fair amount of fertilisation.

Nutrient demand of a tomato crop with a yield of 24 ton per hectare is approximately:

N = 180 kg/ha

P<sub>2</sub>O<sub>5</sub> = 46 kg/ha

K<sub>2</sub>O = 319 kg/ha

MgO = 43 kg/ha

CaO = 129 kg/ha

Recommended fertilizer rates for tropical conditions are:

20 ton per hectare organic matter

200 kg/ha N in split applications

225 kg/ha P<sub>2</sub>O<sub>5</sub>

300 kg/ha K<sub>2</sub>O

By the farmers only a fraction of these levels are applied. It is recommended to increase fertilizer levels. Also it is more efficient to use normal fertilisers and with the use of broadcast applications then using foliar fertilisers. Not only higher amounts of nutrients can be applied but also they are much cheaper then foliar fertilisers per nutrient. In case of Bayfolan when 1 l is applied per 0.25 acre this means that about 10 litre Bayfolan per hectare is applied. With only 11% nitrogen this means that 1.1 kg nitrogen is applied. Seeing that 200 kg is required this amount is very limited. Only in case when deficiencies with trace elements are expected to occur, it can be useful to apply a foliar fertilizer.

See section 4.4 for recommended fertiliser amounts.

## 3.3 Prevention of Blossom end rot:

- Ensure sufficient calcium levels in the soil. If calcium levels are in order it will reduce the risk on blossom end rot since this is related to calcium deficiency. In case lime is available it is recommended to incorporate lime 3 months before planting to increase calcium levels. Recommended rate for dolomitic lime is 3 kg per 100 m<sup>2</sup>, for gypsum (CaSO<sub>4</sub>) the recommended rate is 1 to 1.5 kg per 100 m<sup>2</sup>
- Enhance a steady growth. When growth is irregular the risk on Blossom end rot will increase. Especially from flowering onwards it is important to irrigate frequently.
- Apply mulch at the planting hole to reduce dehydration of the soil to ensure a good moisture status around the root zone.
- Use nitrate nitrogen rather than ammonia containing nitrogen fertilizers. Urea and ammonia increases problems with blossom end rot. Also foliar fertilizers contain usually a lot of urea or ammonia and be careful with applying these when expecting blossom end rot.
  - o Calcium ammonium nitrate consists roughly of equal parts of ammonia and nitrate.
  - o Di ammonia phosphate (DAP) only contains ammonia nitrogen.
  - o N-P-K 17-17-17 fertilizer contains more ammonia (10%) than nitrate (7%).
  - o Foliar fertilizers contain in most cases urea and ammonia since this form is easily ready for the plant. For instance Bayfolan contains 11% nitrogen of which 2.75% is in the form of ammonia, 1.6% as nitrate and 6.7% as urea.

### 3.4 Recommended fertilisation schedule

The following recommendation is based on a planting distance of 60 x 60 or 28,000 plants per hectare, which is an optimal density. At the farmers the density is ranging from 10,000 to 22,000 plants per hectare. With different planting distances amount per hectare remains the same but amount per plant will be different.

#### ***At planting***

Farm yard manure incorporated in plant hole at 0.4 kg per hole ( is about 1 kg per m<sup>2</sup> or 10 ton per hectare).

280 kg/ha TSP (126 kg/ha P<sub>2</sub>O<sub>5</sub>)

10 g/plant incorporated in bed just before transplanting

#### ***10 - 15 days after planting:***

560 kg/ha NPK 17-17-17 (95.2 kg/ha N + 95.2 kg/ha P<sub>2</sub>O<sub>5</sub> + 95.2 kg/ha K<sub>2</sub>O)

(20 g/plant placed at 10 cm from stem and incorporated in soil).

#### ***At start of visible stage of flower buds:***

280 kg/ha Calcium ammonium nitrate (CAN) (75.6 kg/ha N)

(10 g/plant at 20-30 cm from stem and incorporated).

At this stage it is important not to over fertilize in order to reduce growing shocks which can enhance risk on blossom end rot.

#### ***At fruitset:***

280 kg/ha NPK 17-17-17 (47.5 kg/ha N + 47.5 kg/ha P<sub>2</sub>O<sub>5</sub> + 47.5 kg/ha K<sub>2</sub>O)

(10 g/plant at 20-30 cm from stem and incorporated).

With this schedule an amount of:

218 kg N per hectare

269 kg P<sub>2</sub>O<sub>5</sub> per hectare

143 kg K<sub>2</sub>O per hectare

is applied.

Remarks on the schedule:

- Based on the nutrient demand the P<sub>2</sub>O<sub>5</sub> amount is quite high but since P deficiency symptoms were observed it is recommended to apply higher rates to improve the soil status. After a couple of years when phosphorus levels are at a right level P fertilization can be reduced.
- Potassium (K) amount is on the low side, but with higher amounts problems with calcium uptake and magnesium uptake can be worsen. Also K is only applied with N-P-K and higher K amounts also implicate higher N and P amounts which is not needed. In case a potassium fertilizer is available this can be used at planting. Or in case a N-P-K fertilizer 12-10-18 or 7-14-28 is present this can be used at planting instead of 17-17-17.
- Also at start of visible flower buds in case calcium nitrate (16% N) or potassium nitrate (13% N) is available this can be used in stead of CAN in order to reduce risk on blossom end rot. This because these fertilisers only contain nitrate nitrogen. Also with potassium nitrate the amount of applied K will increase. However, this all depends on availability and

prices. In case these fertilizers are very expensive compared to the already used fertilisers, it is probably not profitable to use these.

- During cultivation a magnesium fertilizer is also recommended to apply in case magnesium deficiency is observed. In case magnesamon is available (22 % nitrogen + 7 % magnesium) and magnesium deficiency symptoms occur, it can be used instead of calcium ammonium nitrate.



**Figure 7. A very healthy crop at fruiting stage, with almost no pests and diseases present.**



## 4 Nematode control recommendations

### Problem:

During the field visits wilting of plants was observed. When uprooting these plants in most cases roots were showing symptoms of nematode presence. Although nematodes were not identified it seems that in most cases *Meloidogyne* spp are responsible for the damage. In Tanzania it was found that of all *Meloidogyne* species mostly *M. javanica* was present in tomato fields.

### Possible solutions to reduce wilting due to nematodes:

Start with at least nematode free planting material. Apply a nematicide in the nursery beds and use nematode free irrigation water.

#### Crop rotation

To reduce risk on *meloidogyne* nematodes it is recommended to rotate crops although this nematode has a wide range of hosts, amongst which are banana, cucurbits, beans, passion fruit, soybean and cow pea. Hosts can be tolerant to the nematodes but can still increase the population. Possible population are reduced when the land is not cultivated and kept barren. This will be difficult as also weed species can be a host and without any crops risk of erosion is present.

Possible rotation scheme is tomato (susceptible), grasses or cabbage (tolerant), onion, (resistant) and dry fallow or with marigold (*Tagetes* spp.). Also nematodes populations will be reduced by repetitive plowing under dry hot conditions. Finally, interplanting of marigold (*Tagetes patula* or *Tagetes erectus*) reduces nematode populations.

After finishing a tomato crop it is recommended to uproot the plants and to remove all infected roots and burn them.

#### Use of Mocap

Mocap 15% or 20% can be used at the nursery and at planting. Apply respectively 3 or 2.25 g per square meter. To reduce the amount of Mocap needed it can also be placed in the planting holes only.



Figure 8. Deformed root system probably caused by nematodes.



## 5 Sanitation

In order to reduce the spreading of pests and diseases it is recommended to remove old crops and debris as soon as possible. Also select nursery sites not nearby tomato fields. With removing and burning of old crop debris a reduction in nematodes, white fly, red spider mite, late blight and other pests and diseases can be achieved.

## 6 Nursery recommendations

Starting with pest and disease free plants can result in lower pressure during cultivation and a better growth.

Select the site for the nursery at a place not nearby a tomato field, this in order to reduce the pest and disease pressure. If possible, use insect nets to build a construction over the nursery beds.

### Before sowing

- Treat the soil with Ridomil (metalxyl -M ). In case seeds are treated with thiram this is not needed.
- Incorporate fertilizer in the nursery bed, N-P-K 17-17-17 at a rate of 30 g per 1 m<sup>2</sup> .
- To control nematodes and cutworm Mocap 20 G (ethoprop) can be used.

### Sowing

- Sow seeds at equal distances instead of broadcasting. Place seeds in rows 3-4 cm apart within a row. Distance between rows is about 15 cm. A more uniform plant is raised in this way and less competition is present between plants for available space and nutrients.

### After seedlings have emerged

- Actara ( thiamethoxam) can be applied to control whitefly as a drench. This can be repeated shortly before transplanting. It seems unnecessary to apply Confidor (imidacloprid) as well since the working spectrum of both insecticides is similar.
- In order to avoid resistance perhaps it is better to drench with Confidor and later on Actara can be used as a foliar spray or as a drench just before transplanting.
- Ridomil can be used to control early blight.

### Transplanting

- Transplant late afternoon to reduce transplant shock. Uproot seedlings rather than pulling them out of the nursery beds in order to reduce root damage.

If the situation allows it, it is perhaps an option to introduce tray transplants. The advantage is that success of a good seedling is higher when compared to using nursery beds. With trays about 70 to 80% of the used seeds results in a good transplant, while with nursery beds this is about 50%. Especially when using expensive hybrid seeds this is a substantial difference. Also with trays soil borne pests, diseases and nematodes are eliminated when using the right filling substrate for the trays. Besides, in a sheltered environment, where the transplants are raised, pest and disease pressure is low resulting in a more healthier plant. Finally transplant shock is lower compared to

bare root transplants obtained from a nursery bed resulting in higher percentage successful plants in the field.



**Figure 9.** Transplant raising in a nursery bed.



**Figure 10.** Transplant raising in a “greenhouse” in trays.

## 7 Pest and disease control

In general the control of present pests and diseases is done well. When a pest or disease is observed a proper pesticide is selected and right rates are applied. Based on the records and observations some recommendations are still formulated.



**Figure 11. Boll worm in tomato.**

### 7.1 Blight control

For late blight control, try to reduce the use of Ridomil to a minimum and use it only when a curative spraying is required. Try to not to use Ridomil preventive but only curative since resistance of blight against metalaxyl can occur quite easily. For preventive spraying against blight it is better to use mancozeb based fungicides like Oshothane/Dithane/Farmcozeb or Curzate or Milraz which also contains cymoxanil with a slight curative effect. Recommended then is to alternate mancozeb and Antracol with Milraz, Mistress and Curzate, with the latter used in periods of high risk on blight and finally use Ridomil as a curative measurement. Favourable blight conditions are present when:

- night temperatures do not drop below 7 °C.
- temperatures between 15 and 21 °C are the most favourable for lesion development and sporulation, whereas at temperatures over 29 °C the pathogen does not develop.
- leafwet periods (dew and rain) over 6 hours are favourable for new infections.
- leafwet periods over 8 hours are very critical.

## 7.2 Pyrethroids

When using pyrethroids take into account that with increasing temperatures, especially with Decis, efficacy rapidly decreases.

At one farm alpha-cypermethrin was sprayed preventive against thrips and aphids. Recommended is to spray only when pests like aphids and thrips are observed. Effect of preventive sprays against those pests is limited.

## 7.3 White fly control

White fly control with Actara or with Confidor should be effective enough. The use of methomyl to control white fly should be strongly discouraged since it is highly toxic to the user and to the environment. Furthermore methomyl has a very disruptive effect on beneficials. In case leafminers are also present in the crop at the time of application, the situation will become worse. This because leaf miners show a high grade of resistance against methomyl while the natural enemies of leaf miners will be killed by methomyl.

It is also not advisable to use chlorpyrifos (Dursban) and dimethoate. Use these only as a last resource since both pesticides are showing a high disruptive effect on beneficials. Dursban was used to control beetles. Not known is what kind of beetles were controlled, in case of flea beetles Actara or Confidor are very effective. In case of other beetles species these two pesticides are also effective as are abamectin and spinosad (SpinTor or Tracer). The latter being effective against a broad spectrum of insects, (thrips, caterpillars, flies and beetles) while not affecting beneficials.

## 7.4 Technique

Spraying it self was not observed, but perhaps it is good to take a better look at the spraying technique and timing as well. At other locations it has been noted that spraying pattern of the pesticide was not right due to worn out nozzles. Also observed was that pesticides were applied when it was raining.

For controlling diseases it is important to cover the whole plant thoroughly with fine droplets. Mostly insects are hidden underneath leaves, therefore it is important to apply the pesticide also at the underside of leaves. Best time for spraying is early in the morning, which is already done by the farmers in Kirinyaga or in case it was not possible to apply a pesticide then the crop spray took place in the evening. Always an application was carried out when no strong winds were present.

## 8 Crop management sheets

The agronomist Mr. Robert Kinyua was asked to keep records of all used inputs (Annex II). The reason for this was twofold. In the first place data was collected for improvement of cultural practices and in the second place for calculation tomato cultivation profitability per farm. The intention was to send these data before the actual visit, but due to technical problems with e-mail the overview could not be send. As a result it was not possible to formulate recommendations beforehand and present them to the farmers during the visit.

Furthermore in order to calculate profitability per farm more data is required. Next to used fertilisers and pesticides also data on labour, prices of used materials and harvest data is required. In Annex III a format for recording the data is presented. In this way per farm a good registration of all used inputs is achieved and based on those records a cost-benefit analysis per farm can be drafted for comparing results between crops.

Per farm it is required to collect data per date on:

- Activities per date (e.g. sowing, transplanting, irrigation, ploughing, spraying, harvesting etc.)
- Used inputs e.g. seeds, fertiliser, pesticides, sticks, water, crates needed for picking etc. per activity (description of input, used amount, unit and unit price)
- Labour (hours needed for an activity and wages per hour or if labour is done per acre wages per acre are needed)
- Harvest results, per harvest date it is required to record the number of harvested crates and the received price.
- Other costs like transport costs and broker fees.

Based on the collected data it is then possible to draft crop management sheets and to calculate the profitability per cultivation.



**Figure 12.** A good tomato cultivation starts with observing and learning.

## Annex I. Farmer groups

### Group 1

name	Plot size (acre)	Sowing date	Transplant date	First harvest	Last harvest
Rose Wambura	0.25	8-Dec-2008	14-Jan-2009		
Sarah Wanijuka & James Gachoki	0.25	8-Dec-2008	15-Jan-2009		
Esther Mutoni	0.25	8-Dec-2008	19-Jan-2009		
Elijah Muriuku & James Gitari	0.25	8-Dec-2008	15-Jan-2009		

### Group 2

name	Plot size (acre)	Sowing date	Transplant date	First harvest	Last harvest
Harun Njambogo	0.25	1-Oct-2008	4-Nov-2009		

### Group 1&2

name	Plot size (acre)	Sowing date	Transplant date	First harvest	Last harvest
Charles Njuki	0.25		4-Nov-2008		
Eunice Njeru	0.25		4-Nov-2008		
Phyllis Wangu	0.25		4-Nov-2008		
Grace Weru	0.25		4-Nov-2008		
Cyrus Mutahi	0.25		4-Nov-2008		

### Group 3

name	Plot size (acre)	Sowing date	Transplant date	First harvest	Last harvest
John Kinyua	0.125	21-Oct-2008	3-Dec-2008		
Faith Ndungu	0.25	21-Oct-2008	3-Dec-2008		
Evanson Muchira	0.25	21-Oct-2008	3-Dec-2008		
Cyrus Mbogo	0.25	21-Oct-2008	3-Dec-2008		
Robinson Njuguna	0.25	21-Oct-2008	3-Dec-2008		

## Annex II. Registration per farmer

Data collected by Rob Kinyua and Rose Mwaniki

### Group 1 records (1<sup>st</sup> round)

#### Nursery

Date	activity	used inputs	amount	unit	price per unit
8-Dec-09	Sowing	seeds	...	g	??
		labour	...	hr	... Ksh/hr or acre?
8-Dec-09	drenching against soil pests	Confidor 200 SL (imidacloprid 200 g/l)	...	ml	??
		Actara 25 SC (thiamethoxam 250 g/kg)	...	g	??
		labour	...	hr	... Ksh/hr or acre?
??	foliar spray ??	Citishooter (rooting hormone)	20	ml	
	with 20 liter of water	labour	...	hr	... Ksh/hr or acre?



**Rose Wambura**Plot size: 0.25 acres (0.1 hectare = 1000 m<sup>2</sup>) (approx 11,800 plants /ha)

Date	activity (C = curative use; P= preventive use)	used inputs	amount	unit	price per unit
??	Land preparation/ploughing	labour	....	..	..
14-Jan-09	transplanting	transplants from nursery	1180	pcs	not applicable
		labour	...	hr	... Ksh/hr or acre?
19-Dec-08	fertilization	DAP (18 % N+ 46 % P <sub>2</sub> O <sub>5</sub> )	14	kg	....
		labour	...	hr or acre	... Ksh/hr or acre?
??	irrigation	water	...	l	...
		labour	...		
-	Sticking	sticks	1150	pcs	....
		labour	.....	hr or acre	..Ksh/hr or Ksh per acre??
??	weeding	labour	....	...	..
??	Foliar spray against cut worms and early blight	Dimethoate 40 EC (dimethoate 400 g/l)	40	g	..
		Oshothane 80 WP (mancozeb 800 g/kg)	50	g	..
		Foliar fertilizer (% N +...% P <sub>2</sub> O <sub>5</sub> +...% K <sub>2</sub> O)	...	g	....
	with 20 liter water	Labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Foliar spray against cut worms and early blight	Dimethoate 40 EC (dimethoate 400 g/l)	40	g	..
		Oshothane 80 WP (mancozeb 800 g/kg)	50	g	..
		Foliar fertilizer (% N +...% P <sub>2</sub> O <sub>5</sub> +...% K <sub>2</sub> O)	...	g	....
	with 20 liter water	Labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Harvesting	used crates	...	pcs	...
		labour	...		
		Harvested product in crates of ... kg (40 or 60?)	...	pcs	... market price

Etc.

**Sarah Wanjiku & James Gachoki**Plot size: 0.25 acres (0.1 hectare = 1000 m<sup>2</sup>) (approx 12,000 plants /ha)

Date	activity (C = curative use; P= preventive use)	used inputs	amount	unit	price per unit
??	Land preparation/ploughing	labour	....	..	..
15-Jan-09	transplanting	transplants from nursery	1200	pcs	not applicable
		labour	...	hr	... Ksh/hr or acre?
??	irrigation	water	...	l	...
		labour	...		
19-Dec-08	fertilization	DAP (18% N + 46% P <sub>2</sub> O <sub>5</sub> )	15	kg	....
		labour	...	hr or acre	... Ksh/hr or acre?
??	weeding	labour	....	...	..
-	Sticking	sticks	1200	pcs	....
		labour	.....	hr or acre	..Ksh/hr or Ksh per acre??
??	Foliar spray against cut worms and early blight	Dimethoate 40 EC (dimethoate 400 g/l)	40	g	..
		Farmcozeb 80 WP (mancozeb 800 g/kg)	50	g	..
		Foliar fertilizer (% N +...% P <sub>2</sub> O <sub>5</sub> +...% K <sub>2</sub> O)	...	g	....
	with 20 liter water	Labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Harvesting	used crates	...	pcs	...
		labour	...		
		Harvested product in crates of ... kg (40 or 60?)	...	pcs	... market price

Etc.

**Esther Muthoni**Plot size: 0.25 acres (0.1 hectare = 1000 m<sup>2</sup>) (approx 12,500 plants /ha)

Date	activity (C = curative use; P= preventive use)	used inputs	amount	unit	price per unit
??	Land preparation/ploughing	labour	....	..	..
19-Jan-09	transplanting	transplants from nursery	1250	pcs	not applicable
		labour	...	hr	... Ksh/hr or acre?
??	irrigation	water	...	l	...
		labour	...		
??	weeding	labour	....	...	..
??	fertilization	DAP (18 % N + 46% P2O5)	15	kg	.....
		labour	...	hr or acre	... Ksh/hr or acre?
??	Foliar spray against cut worms and early blight + downy mildew	Dimethoate 40 EC (dimethoate 400 g/l)	40	ml	..
		Ridomil ??? (metalaxyl- M... g/kg + .....g/kg)	50	g	..
		Foliar fertilizer (% N +...% P <sub>2</sub> O <sub>5</sub> +...% K <sub>2</sub> O)	...	g	....
	with 20 liter water	Labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Foliar spray against cut worms and early blight + downy mildew	Dimethoate 40 EC (dimethoate 400 g/l)	40	ml	..
		Ridomil ??? (metalaxyl – M ... g/kg + .....g/kg)	50	g	..
		Foliar fertilizer (% N +...% P <sub>2</sub> O <sub>5</sub> +...% K <sub>2</sub> O)	...	g	....
	with 20 liter water	Labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
–	Sticking	sticks	1250	pcs	....
		labour	.....	hr or acre	..Ksh/hr or Ksh per acre??
??	Harvesting	used crates	...	pcs	...
		labour	...		
		Harvested product in crates of ... kg (40 or 60?)	...	pcs	... market price

Etc.

**Elijah Muriuki & James Gitari**Plot size: 0.25 acres (0.1 hectare = 1000 m<sup>2</sup>) (approx 12,000 plants /ha)

Date	activity C = curative P = preventive	used inputs	amount	unit	price per unit
??	Land preparation/ploughing	labour	....	..	..
15-Jan-09	transplanting	transplants from nursery	1200	pcs	not applicable
		labour	...	hr	... Ksh/hr or acre?
??	irrigation	water	...	l	...
		labour	...		
??	weeding	labour	....	...	..
??	fertilization	DAP (18% N + 46% P <sub>2</sub> O <sub>5</sub> )	10	kg	.....
		N-P-K (20-10-10)	5		
		labour	...	hr or acre	... Ksh/hr or acre?
??	soil drench against soil pests + white fly with 40 liter water	Actara 25 WG (thiamethoxam 250 g/kg)	16	g	..
		Labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Foliar spray early blight + downy mildew with 20 liter water	Ridomil ??? (metalaxyl -M... g/kg + .....g/kg)	50	g	..
		Labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
-	Sticking	sticks	1200	pcs	....
		labour	.....	hr or acre	..Ksh/hr or Ksh per acre??
??	Harvesting	used crates (empty crate price)	...	pcs	...
		labour for harvesting	...		
		nr of crates with Harvested product in crates of ... kg (40 or ... 60?)	...	pcs	... market price
Etc.					

**Group 2 records (1<sup>st</sup> round)**

## Nursery

Date	activity	used inputs	amount	unit	price per unit
1-Oct-08	Sowing	seeds	...	g	??
		labour	...	hr	... Ksh/hr or acre?
1-Oct-08	drenching against soil pests	Confidor 200 SL (imidacloprid 200 g/l)	...	ml	??
		Actara 25 WG (thiamethoxam 250 g/kg)	...	g	??
		labour	...	hr	... Ksh/hr or acre?
??	foliar spray against white fly + early blight	Actara 25 WG (thiamethoxam 250 g/kg)	8	g	??
		Ridomil Gold MZ (metalaxyl ... g/kg + .....?? )	50	g	??
		Citishooter (rooting hormone)	20	ml	
	with 20 liter of water	labour	...	hr	... Ksh/hr or acre?
??	watering	water	..	l	..
		labour	..		
??	watering	water	..	l	..
		labour	..		

Etc.

**Harun Njambogo**Plot size: 0.25 acres (0.1 hectare = 1000 m<sup>2</sup>) (approx. 20,000 pl/ha).

Date	activity C = curative P = preventive	used inputs	amount	unit	price per unit
??	Land preparation/ploughing	labour	....	..	..
4-Nov-08	transplanting	transplants from nursery	2000	pcs	not applicable
		labour	...	hr	... Ksh/hr or acre?
4-Nov-08	fertilization	DAP ( 18 % N + 46% P <sub>2</sub> O <sub>5</sub> )	18	kg	.....
		Farm Yard manure	5	ox	.....
		labour	...	carts hr or acre	... Ksh/hr or acre?
??	irrigation	water	...	l	...
		labour	...		
??-Dec-08	fertilization	CAN (27% N)	...	kg	.....
		labour	....	hr or acre??	.....Ksh/hr or Ksh/acre??
??	weeding	labour	....	...	..
??	Foliar spray against white fly (C) and early blight + downey mildew(C)  with 40 liter water	Actara 25 WG (thiamethoxam 250 g/kg) Ridomil ??? (metalaxyl-m ... g/kg + .....?? ) Foliar fertilizer (% N +...% P <sub>2</sub> O <sub>5</sub> +...% K <sub>2</sub> O) Labour	16 100 ... ...	g g g hr or acre??	.. .. .... ..Ksh/hr or Ksh per acre??
??	Foliar spray against blight (P)  with 60 liter water	Cupro caffaro 50 WP (Copper oxychloride 500 g/kg) Foliar fertilizer (% N +...% P <sub>2</sub> O <sub>5</sub> +...% K <sub>2</sub> O) Labour	150 ... ...	g g hr or acre??	.. .... ..Ksh/hr or Ksh per acre??
??	Foliar spray against red spider mite + leaf miner (C) + leaf spot (C)  with 60 liter water	Dynamec 1.8 EC (abamectin 18 g/l)  Ortiva 25 SC (Azoxystrobin 250 g/l) Foliar fertilizer (% N +...% P <sub>2</sub> O <sub>5</sub> +...% K <sub>2</sub> O) labour	30  60 ... ...	ml  ml g hr or acre??	....  .... .... ..Ksh/hr or Ksh per acre??
??	Foliar spray against thrips + white fly (C)	Karate 5 EC (Lambda-cyhalothrin 50 g/l)	100	ml	

	+ boll worms (P)	Match 5 EC (Lufenuron 50 g/ml)	125	ml	
		Foliar fertilizer (% N +...% P <sub>2</sub> O <sub>5</sub> +...% K <sub>2</sub> O)	...	g	....
	with 100 liter water	labour	....	hr or acre	..Ksh/hr or Ksh per acre??
-	Sticking	not used			
??	Harvesting	used crates	...	pcs	...
		labour	...		
		Harvested product in crates of ... kg (40 or 60?)	...	pcs	... market price
Etc.					

**Group 1 and 2 records (2<sup>nd</sup> round)**

Nursery ?? No records in original paper found or similar to Harun Njambogo???

Date	activity	used inputs	amount	unit	price per unit
??	Sowing	seeds	...	g	??
		labour	...	hr	... Ksh/hr or acre?
??	drenching against soil pests	Confidor 200 SL (imidacloprid 200 g/l)	...	ml	??
		Actara 25 WG (thiamethoxam 250 g/kg)	...	g	??
		labour	...	hr	... Ksh/hr or acre?
??	foliar spray against white fly + early blight	Actara 25 WG (thiamethoxam 250 g/kg)	8	g	??
		Ridomil ??? (metalaxyl -M ... g/kg + .....?? )	50	g	??
		Citishooter (rooting hormone)	20	ml	
	with 20 liter of water	labour	...	hr	... Ksh/hr or acre?
??	watering	water	..	l	..
		labour	..		
??	watering	water	..	l	..
		labour	..		

Etc.



**Charles Njuki, Eunice Njeru, Phyllis Wangu, Grace Weru and Cyrus Mutahi (5 plots)****Inputs for all farmers were identically.**Plot size per farmer: 0.25 acres (0.1 hectare = 1000 m<sup>2</sup>) (approx. 22,000 pl/ha).

Date	activity C = curative P= preventive	used inputs	amount	unit	price per unit
??	Land preparation/ploughing	labour	...	..	..
4-Nov-08	transplanting	transplants from nursery	2200	pcs	not applicable
		labour	...	hr	... Ksh/hr or acre?
4-Nov-08	fertilization	DAP (18% N + 46% P2O5)	12	kg	.....
		Farm Yard manure	2	ox	.....
				carts	
		labour	...	hr or acre	... Ksh/hr or acre?
??	irrigation	water	...	l	...
		labour	...		
??-Dec-08	fertilization	CAN (27% N)	10	kg	.....
		labour	....	hr or acre??	.....Ksh/hr or Ksh/acre??
??	weeding	labour	....	...	..
??-Dec-08	fertilization	NPK 17-17-17	12	kg	.....
		labour	....	hr or acre??	.....Ksh/hr or Ksh/acre??
??	Foliar spray against white fly (C) and early blight + downey mildew(P)  with 20 liter water	Actara 25 WG (thiamethoxam 250 g/kg) Antracol 70 WG (propinep 700 g/kg) Foliar fertilizer bayfolan (11% N + 5% P <sub>2</sub> O <sub>5</sub> + 8% K <sub>2</sub> O) Labour	8 50 50 ...	g g ml hr or acre??	.. .. .... ..Ksh/hr or Ksh per acre??
??	Foliar spray against blight (C) red spider mite + leafminer (C)  with 40 liter water	Ridomil ??? (metalaxyl-M ...g/kg + ???...g/kg) Dynamec 1.8 EC (abamectin 18 g/ml) Foliar fertilizer bayfolan (11% N + 5% P <sub>2</sub> O <sub>5</sub> + 8% K <sub>2</sub> O) Labour	150 20 100 ...	g ml ml hr or acre??	.. .. .... ..Ksh/hr or Ksh per acre??
??	Foliar spray against Boll worm (C)	Polytrin 44 EC (profenofos "Q" 400 g/l + cypermethrin 40 g/l)	90	ml	....

	+ blight (C)	Milraz WP (propinep 580 g/kg + cymoxanil 48 g/kg)	120	g	....
		Foliar fertilizer bayfolan (11% N + 5% P <sub>2</sub> O <sub>5</sub> + 8% K <sub>2</sub> O)	150	ml	....
	with 60 liter water	labour	...	hr or	..Ksh/hr or Ksh per acre??
??	Foliar spray against beetles	Bulldog 2.5 EC (Beta- cyfluthrin 25 g/l)	60	ml	
		Foliar fertilizer bayfolan (11% N + 5% P <sub>2</sub> O <sub>5</sub> + 8% K <sub>2</sub> O)	200	ml	....
	with 80 liter water	labour	....	hr or	..Ksh/hr or Ksh per acre??
				acre	
-	Sticking	sticks	1000	pcs	
		labour	...	hr	..
??	Harvesting	used crates	...	pcs	...
		labour	...		
		Harvested product in crates of ... kg (40 or 60?)	...	pcs	... market price

Etc.

Harvest results should be collected separately per farm.

**Group 3 records (1<sup>st</sup> round)**

## Nursery

Date	activity	used inputs	amount	unit	price per unit
21-Oct-08	Sowing	seeds	...	g	??
		labour	...	hr	... Ksh/hr or acre?
21-Oct-08	drenching against soil pests + damping off	Actara 25 WG (thiamethoxam 250 g/kg)	...	ml	??
		Ridomil ??? (metalaxyl –M .... g/kg + .....)	...	g	??
		Citishooter (rooting hormone)	...	ml	...
		labour	...	hr	... Ksh/hr or acre?
??	watering	water	..	l	..
		labour	..		
??	watering	water	..	l	..
		labour	..		

Etc.

**John Kinyua**Plot size: 0.125 acres (0.05 hectare = 500 m<sup>2</sup>) (approx. 17,600 pl/ha).

Date	activity C = curative P= preventive	used inputs	amount	unit	price per unit
??	Land preparation/ploughing	labour	....	..	..
3-Dec-08	transplanting	transplants from nursery	880	pcs	not applicable
		labour	...	hr	... Ksh/hr or acre?
3-Dec-08	fertilization	DAP (18% N + 46% P <sub>2</sub> O <sub>5</sub> )	18	kg	.....
		Farm Yard manure	2	ox	.....
		labour	...	carts hr or acre	... Ksh/hr or acre?
??	irrigation	water	...	l	...
		labour	...		
??-Dec-08	fertilization	DAP (18% N + 46% P <sub>2</sub> O <sub>5</sub> )	15	kg	.....
		labour	....	hr or acre??	.....Ksh/hr or Ksh/acre??
??	weeding	labour	....	...	..
??	drench against soil pests (C) with 40 liter water	Confidor 200 SL (imidacloprid 200 g/kg)	20	g	..
		Labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Foliar spray against blight (P) + white flies (C)	Mistress WP ( cymoxanil 60 g/kg + mancozeb 700 g/kg)	80	g	..
		Decis 2.5 EC ( deltamethrin 25 g/l)	60	ml	
		Omex fertiliser (% N +...% P <sub>2</sub> O <sub>5</sub> +...% K <sub>2</sub> O)	....		
	with 40 liter water	Labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Foliar spray against aphids (C) + late blight (P)	Dimethoate (dimethoate ... g/l)	60	ml	....
		Ridomil ??? (metalxyl-M .....g/l + ... .. g/l)	100	g	....
		Omex fertiliser (% N +...% P <sub>2</sub> O <sub>5</sub> +...% K <sub>2</sub> O)	....		
	with 40 liter water	labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
-	Sticking	sticks	880	pcs	
		labour	...	hr	..
??	Harvesting	used crates	...	pcs	...

labour	...		
Harvested product in crates of ... kg (40 or 60?)	...	pcs	... market price

Etc.

**Faith Ndungu**Plot size: 0.25 acres (0.1 hectare = 1000 m<sup>2</sup>) (approx. 10,000 pl/ha).

Date	activity C = curative P = preventive	used inputs	amount	unit	price per unit
??	Land preparation/ploughing	labour	....	..	..
3-Dec-08	transplanting	transplants from nursery	1000	pcs	not applicable
		labour	...	hr	... Ksh/hr or acre?
3-Dec-08	fertilization	DAP (18% N + 46% P2O5)	10	kg	.....
		Farm Yard manure	2	ox	.....
		labour	...	carts hr or acre	... Ksh/hr or acre?
??	irrigation	water	...	l	...
		labour	...		
??	fertilization	CAN (27 % N)	13	kg	.....
		labour	....	hr or acre??	.....Ksh/hr or Ksh/acre??
??	weeding	labour	....	...	..
??	fertilization	NPK 17-17-17	13	kg	.....
		labour	....	hr or acre??	.....Ksh/hr or Ksh/acre??
??	soil drench against nematodes (P) with 40 liter water	Achook 1.5 % EC (azadirachtin 15 g/kg) ????	60	g	..
		Labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Foliar spray against white flies (C) + red spider mites (P) + leaf spot (P)	Actara 25 WG (thiamethoxam 250 g/kg)	16	g	....
		Polythrin 44 EC (profenofos Q 400 g/l+cypermethrin 40 g/l)	60	ml	....
		Ortiva 25 SC (azoxystrobin 250 g/l)	20	ml	
		booster grow (% N +...% P <sub>2</sub> O <sub>5</sub> +...% K <sub>2</sub> O)	...		
	with 40 liter water	labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Foliar spray against boll worms (C) + blight (P)	Polythrin 44 EC (profenofos Q 400 g/l+cypermethrin 40 g/l)	90	ml	....
		Cupro caffaro 50 WP (copper oxychloride 500 g/kg)	120	g	....
		easy grow (% N +...% P <sub>2</sub> O <sub>5</sub> +...% K <sub>2</sub> O)	...		

	with 60 liter water	labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Foliar spray against blight (C)	Ridomil ??? (metalaxyl-M ...g/kg + .... g/kg easy grow (% N +...% P <sub>2</sub> O <sub>5</sub> +...% K <sub>2</sub> O)	200	g	....
	with 80 liter water	labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
–	Sticking??	sticks	1000	pcs	
		labour	...	hr	..
??	Harvesting	used crates	...	pcs	...
		labour	...		
		Harvested product in crates of ... kg (40 or 60?)	...	pcs	... market price
Etc.					

**Evanson Muchira**Plot size: 0.25 acres (0.1 hectare = 1000 m<sup>2</sup>) (approx. 12,000 pl/ha).

Date	activity C = curative P= preventive	used inputs	amount	unit	price per unit
??	Land preparation/ploughing	labour	....	..	..
3-Dec-08	transplanting	transplants from nursery	1200	pcs	not applicable
		labour	...	hr	... Ksh/hr or acre?
	fertilization	Farm Yard manure	4	ox carts	.....
		labour	...	hr or acre	... Ksh/hr or acre?
??	irrigation	water	...	l	...
		labour	...		
??	fertilization	CAN (27 % N)	4	kg	.....
		labour	....	hr or acre??	.....Ksh/hr or Ksh/acre??
??	weeding	labour	....	...	..
??	fertilization	NPK 17-17-17	12	kg	.....
		labour	....	hr or acre??	.....Ksh/hr or Ksh/acre??
??	soil drench against soil pests (C) with 40 liter water	Actara 25 WG (thiamethoxam 250 g/kg)	16	g	..
		Labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Foliar spray against beetles (P) + blight (C) with 40 liter water	Dursban 75 WG (chlorpyrifos 750 g/l) ??? Ridomil ??? (metalaxyl - M ...g/kg + .... g/kg)	60 100	ml g	.... ....
		labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Foliar spray against thrips + aphids (P) with 60 liter water	Alphatox ... EC (alpha cypermethrin....g/l)	15	ml	....
		labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Foliar spray against blight (C) + thrips (P) with 80 liter water	Ridomil ??? (metalaxyl-M ...g/kg + .... g/kg)	200	g	....
		Alphatox ... EC (alpha cypermethrin....g/l)	20	ml	....
		labour	...	hr or acre??	..Ksh/hr or Ksh per acre??



				acre??	
–	Sticking	sticks	1200	pcs	
		labour	...	hr	..
??	Harvesting	used crates	...	pcs	...
		labour	...		
		Harvested product in crates of ... kg (40 or 60?)	...	pcs	... market price
	Etc.				

**Cyrus Mbogo**Plot size: 0.25 acres (0.1 hectare = 1000 m<sup>2</sup>) (approx. 12,500 pl/ha).

Date	activity C = curative P = preventive	used inputs	amount	unit	price per unit
??	Land preparation/ploughing	labour	....	..	..
3-Dec-08	transplanting	transplants from nursery	1250	pcs	not applicable
		labour	...	hr	... Ksh/hr or acre?
	fertilization	Farm Yard manure	5	ox carts	....
		DAP (18% N + 46% P <sub>2</sub> O <sub>5</sub> )	13	kg	...
		labour	...	hr or acre	... Ksh/hr or acre?
??	irrigation	water	...	l	...
		labour	...		
??	weeding	labour	....	...	..
??	Foliar spray against white fly and thrips (C)	Actara 25 WG (thiamethoxam 250 g/kg)	16	g	..
	+ blight (P)	Cupro caffaro 50 WP (copper oxychloride 500 g/kg)	80	g	....
		Omex + easy grow calcium fertiliser (% N + ...% P <sub>2</sub> O <sub>5</sub> + ...% K <sub>2</sub> O)			
	with 40 liter water	Labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Foliar spray against spider mites and leaf miner (C)	Dynamec 1.8 EC (abamectin 18 g/l)	30	ml	....
		Omex + easy grow calcium fertilizer (% N + ...% P <sub>2</sub> O <sub>5</sub> + ...% K <sub>2</sub> O)			
	with 60 liter water	labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
	foliar spay flowering hormone with .... liter water	Anatone (.....)	....	...	
		labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Foliar spray against thrips (C)	Actara 25 WG (thiamethoxam 250 g/kg)	24	g	..
	+ blight (P)	Cupro caffaro 50 WP (copper oxychloride 500 g/kg)	120	g	....
		Zipper (sticker)	...	ml	...

	with 60 liter water	Omex + easy grow calcium fertilizer (% N +...% P <sub>2</sub> O <sub>5</sub> +...% K <sub>2</sub> O) Labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Foliar spray against boll worms (C) + blight (C)	Match 5 EC (lufenuron 50 g/l) Ridomil ??? (metalaxyl-M ...g/kg + .... g/kg Omex + easy grow calcium fertilizer (% N +...% P <sub>2</sub> O <sub>5</sub> +...% K <sub>2</sub> O)	100 200	ml g	.... ....
	with 80 liter water	labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Foliar spray against leaf spot(C)	Ortiva 25 EC (azoxystrobin 250 g/l) Omex + easy grow calcium fertilizer (% N +...% P <sub>2</sub> O <sub>5</sub> +...% K <sub>2</sub> O)	100	g	....
	with 80 liter water	labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Foliar spray against powdery mildew (C)	Thiovit 80 WP (sulphur 800 g/kg) Omex + easy grow calcium fertilizer (% N +...% P <sub>2</sub> O <sub>5</sub> +...% K <sub>2</sub> O)	400	g	....
	with 100 liter water	labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
-	Sticking	sticks labour	1250 ...	pcs hr	..
??	Harvesting	used crates labour	... ...	pcs	...
		Harvested product in crates of ... kg (40 or 60?)	...	pcs	... market price

Etc.

**Robinson Njuguna**Plot size: 0.25 acres (0.1 hectare = 1000 m<sup>2</sup>) (approx. 11,800 pl/ha).

Date	activity C = curative P = preventive	used inputs	amount	unit	price per unit
??	Land preparation/ploughing	labour	...	..	..
3-Dec-08	transplanting	transplants from nursery	1180	pcs	not applicable
		labour	...	hr	... Ksh/hr or acre?
	fertilization	Farm Yard manure	2	ox carts	....
		DAP (18% N + 46% P <sub>2</sub> O <sub>5</sub> )	12	kg	...
		labour	...	hr or acre	... Ksh/hr or acre?
??	irrigation	water	...	l	...
		labour	...		
??	weeding	labour	...	...	..
	fertilization	CAN (27% N)	12	kg	...
		labour	...	hr or acre	... Ksh/hr or acre?
??	Soil drench against soil pests (C) with 40 liter water	Confidor 200SL (imidacloprid 200 g/ml)	20	ml	..
		Labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Foliar spray against spider mites and leaf miner (C) + blight (P)	Actara 25 WG (thiamethoxam 250 g/kg)	16	ml	....
		Cupro cuffaro (copper oxychloride .....g/kg)	100	g	....
	with 40 liter water	booster grow (% N + ...% P <sub>2</sub> O <sub>5</sub> + ...% K <sub>2</sub> O)	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Foliar spray against boll worms (C) + blight (C)	Match 5 EC (lufenuron 50 g/l)	75	ml	....
		Ridomil ??? (metalaxyl-M ...g/kg + .... g/kg)	150	g	....
	with 60 liter water	booster grow (% N + ...% P <sub>2</sub> O <sub>5</sub> + ...% K <sub>2</sub> O)	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Foliar spray against whitefly(C)	methomex 20 LS (methomyl 200 g/kg)	40	g	....

	with 80 liter water	booster grow ( ...% N +...% P <sub>2</sub> O <sub>5</sub> +...% K <sub>2</sub> O) labour	...	hr or acre??	..Ksh/hr or Ksh per acre??
??	Harvesting	used crates labour	... ...	pcs	...
		Harvested product in crates of ... kg (40 or 60?)	...	pcs	... market price
	Etc.				

### Annex III. Form to record inputs and labour per farm

Farm: ..... Plot size:.....

[illegible]