REPORT OF FRENCH BEAN FARMER'S FIELD SCHOOL TRAINING AND GRADUATION IN EMBU

Enhancing Production, Value Addition and Marketing of Indigenous Vegetables (cowpea, spider plant, nightshades, amaranth, pumpkin), French Beans and Mushrooms among Smallholder Farmers in Kenya

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KAWANJARA, EMBU

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EXECUTIVE SUMMARY
Snap bean (*Phaseolus vulgaris* L.) is the leading export horticultural crop in Kenya. Promotion of the crop is a strategic entry-point for revitalization of socio-economic development, especially in rural areas. However, there is low French bean productivity in smallholder farms and there are high volumes of reject beans generated at the farm level due to poor crop management and postharvest practices, leading to loses of up to 60%. Additionally, lack of local awareness on utilization to consume the surplus exacerbates the wastage. In order to address this snap bean productions constrains and improve profitability in the region, promising integrated crop management (ICM) technologies and utilization strategies have to be validated for dissemination to the end users. Therefore, this project intended to validate and accelerate the dissemination of integrated crop management options for the management of French bean pests, diseases and soil fertility to enhance capacity of snap bean growers and extension service providers through a farmer’s field school at Kawanjara Location of Embu County. 27 members of Kawanjara Farmers group were identified to participate in the validation trials. The farmers were invited twice a month to learn about best crop management practices and to share their knowledge and experience on French bean crop management. Analysis of the cost of the candidate ICM technologies and varieties were carried out and the most cost effective management options and varieties recommended for adoption by the farmers. Simple recipes were made to educate farmers on utilization of French beans.
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1. KAWANJARA FARMER FIELD SCHOOL TRAINING, EMBU JAN-MAY 2014

1.1 Objectives
   i. To establish production potential of French bean varieties- Salima and Star under different treatments.
      - Manure + DAP + CAN - normal recommended rates
      - Manure + 23:23:0 + 17:17:17 - normal recommended rates
      - DAP + CAN - Normal recommended rates
      - 23:23:0 + 17:17:17 - Normal recommended rates
      - Manure only - at normal rates
   ii. To establish cost benefit analysis of French beans under different treatments as outlined in (i) above
   iii.

1.2 Training topics
   i. Farm records and farm business plan
   ii. Rotational plan for horticultural enterprises
   iii. Scouting for pests and disease attack in French beans
   iv. Importance and use of Personal Protective Equipment (PPE)
   v. IPM in French beans
   vi. Best Practices in French bean farming
   vii. French bean utilization and recipes
**1.2.1 Farm Planning (Nehemiah Njiru, MoA)**

### Farm Layout requirements and considerations

<table>
<thead>
<tr>
<th>Access / transport</th>
<th>Farm produce must be transported from the farm to markets and silos while inputs are brought onto the farm. Consider the distance that must be travelled and the condition of the roads. Make sure access roads can be used in wet weather conditions to prevent damage to vehicles and produce.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Livestock shed</td>
<td>Close the other cattle facilities (kraal). Ensure safe handling and movement for animals and handlers during a working (e.g. milking) process.</td>
</tr>
<tr>
<td>Homestead</td>
<td>In an unproductive area, but centrally located on the farm to save on transport costs. Ideally also placed for good visibility, such as to look out for fires.</td>
</tr>
<tr>
<td>Input stores (food, farm equipment&amp; implements, chemicals, firewood)</td>
<td>Closest to where it will be used. Consider storage requirements of materials, e.g. temperature, humidity, etc. OHS act in handling of chemicals and flammable products</td>
</tr>
<tr>
<td>Kitchen garden</td>
<td>If appropriate, nearest the farmhouse.</td>
</tr>
<tr>
<td>Fence</td>
<td>Separating specific activities on the farm, different grazing camps and security. Consider live fence for homestead</td>
</tr>
<tr>
<td>Toilet/ Bathroom/Pit latrine</td>
<td>Set away from water sources</td>
</tr>
<tr>
<td>Water tank/point</td>
<td>Access to water is crucial for success of any farm.</td>
</tr>
<tr>
<td>Woodlot</td>
<td>Keep away from fire hazards.</td>
</tr>
</tbody>
</table>

**Other points to consider in farm layout planning**

- Trees along boundaries/within the farm
- Permanent crops lot
- Rotational crops lot
- Riverbank protection
- Water conservation structures/measures
- Soil conservation structures/ measures
1.2.2 Farm layout

Homestead

Retention Ditch

French beans

NAPPIER GRASS

\( \frac{1}{4} \) ACRE

TC BANANAS

XXXXXXX  F.J & Nappier grass XXXXXXXXXXX

Green maize

BUTTERNUTS

XXXXXXXXXXXXX F.J & Nappier grass XXXXXXXXXXX

Coffee  Maize/beans (Food crops)

RIVER BANK PROTECTION

RIVER

1.2.3 Farm business Plan

Layout of a business plan

- Cover page
- Personal information
- Farm sketch (current farm use)
- Introduction
• Assumptions
• SWOT analysis (Strength, Weakness, Opportunities & Threats)
• Organizational management
• Enterprise to be considered for business
• Market information
• Input prices
• Suggested rotation plan for horticultural crops
• Gross margins for various enterprises in the farm
• Farm business
• Intervention for farm development (per enterprise)
• Notes-important information and contacts

1.2.4 Crop rotation
Suggested rotation plans

1.2.4.1 Rotation A
Divide the garden/field into five plots

• Plot 1-Brassicae: Cabbages, Kales, Sweet potatoes
• Plot 2-Solanaceae: eggplant, tomatoes, peppers/chillies, potatoes
• Plot 3-Curcubits: melons, pumpkins, cucumbers, green maize
• Plot 4-Roots: carrots, onions, turnips
• Plot 5-Legumes: beans, peas, French beans

1.2.4.2 Rotation B
Divide the garden/field into four plots

• Plot 1-Legumes: Dry beans, French beans, peas
• Plot 2-Curcubits: Melons, Pumpkins, Cucumber
• Plot3-Roots&Solanacea: carrots, onions, eggplant, Tomatoes, pepper
• Plot4-Brassicaceae: cabbages, kales, sweet potatoes, green maize

1.2.4.3 Rotation C
Divide the garden/field into three plots
Plot 1-Legumes&Curcubits: peas, beans, cucumbers, melons, pumpkin, French beans
Plot 2-Roots&solanacea: carrots, onions, eggplant, tomatoes, peppers, potatoes
Plot 3-Brassicaceae: Cabbages, kales, sweet potatoes, green maize

1.2.5 Safe Use of Pesticides (Stephen Njagi, MoA Embu)

1.2.5.1 Pest and pesticides
Pesticides are a range of products that are used to control insects, diseases and weeds. They include pesticides which you use in your home and garden such as slug pellets, weedkillers and ant powders, as well as those used by farmers.
Farmers use pesticides to:
• protect crops from pests, weeds and diseases
• prevent rats, mice, flies and other insects from consuming and contaminating foods when they are being stored
• protect human health, by stopping crops being contaminated by harmful microbes and moulds

What farmers should do to improve crops and support pest management?
a) Land preparation
   • Soil type/characteristics in relation to suitability for green bean
Snap bean is sensitive to growing conditions, especially soil humidity. Research has shown that the bean crop will die if it is kept flooded for 24 hours. The soil condition is a very important factor in determining its yield. Some soil-borne diseases, such as bacterial wilt and root rot will be more serious if the plants are flooded.
Preparation

Characteristics of good soil in relation with soil cultivation methods

The green bean root system develops and absorbs nutrients poorly, thus its requirement for the soil type is stricter than other crops. Sandy loam or sandy soils with pH level of 5.5-6.5 are suitable for growing bean because it absorbs heat faster than other soils in the cold season and its small particle structure helps prevent seedlings from collapsing due to rain and wind.

b) Crop rotation

Importance in relation to nutrient availability in the soil

Crop rotation reduces fertility degradation and nutrient deficiency. When the same crop is planted in the same field every season, there will be a continuous consumption of the same nutrients from the soil. Adding chemical fertilizers will supply only part of the nutrients that are consumed, mostly N, P and K. Adding chemical fertilizers containing the deficient nutrients will not solve the problem. It is necessary to introduce crop rotation and supply organic matter to the soil. Rotating with green manure and nitrogen fixing crops to the rotation schedule is therefore recommended.

Importance in relation to pest and disease occurrence

Some of the more common serious pests and diseases which live in the soil attack a range of plants within the same botanical family - but not others. If the kinds of plants they attack are continuously grown in the same field, the pests and diseases can build up to serious populations. Once a soil-borne disease has entered a field it is very difficult to get rid of. If there is a break of several seasons or even several years when other crops (of a different crop family) are grown, the pest populations or disease incidence may be reduced and eventually disappear. This is the main reason for rotating crops.

Rotation is most effective against diseases that attack only one crop. However, controlling many diseases that infect several crops in the same plant family requires rotation to a crop from an entirely different family. Unfortunately, some pathogens such as those causing wilts and root rots, attack many families and rotation is unlikely to reduce the disease.

Resistant, long-lived reproductive structures as well as the immediately infectious forms are produced by some fungi. For example, the black sclerotia produced by the
fungus *Sclerotinia* can survive for years. *Pythium* and *Phytophthora* can also produce long-lived resting spores. Such spores help these fungi to survive during a long time without a host. How long such pathogens can survive without a host plant depends on factors like environment, temperature, ground water, etc. Some indications on disease “survival rates” are mentioned later in sections on individual diseases.

c) Seed preparation  
**Healthy seed**

Like some other crops, French bean and other beans are propagated by seed, therefore seeds play a very important role in determining fruit yield. Farmers have some criteria for selecting seeds for sowing such as seed purity and percentage of germination.

The requirements for bean seeds are: seed purity is 99%, percentage of mixture is 0.05% and no weed seeds. The seeds are light yellow, weight of 1000 seeds (P< 1000 seeds) should range from 200-300 grams, and number of seeds/fruit is 15 - 50. The germination percentage of bean seeds is 85%. To check germination ability of bean seeds, the following simple method can be used. Lay out about 100-500 seeds on wet tissue (or cotton) on a small dish. Cover the seeds with cloth or filter-paper. Count the number of seeds that have germinated after 24 hours. Observe seed germination for three days.

d) Weed management  
**Impact of weeds on crop development**

Weeds in a bean field are usually unwanted because they affect crop growth, development and yield. The competition of bean and weeds are fierce in the vegetative stage and the growing process. Yields are higher when the field is weed free.

Weeds may harbor insect pests and diseases or form breeding places for insect pests, vectors and diseases. The plant *Trianthema portulacastrum* is host of chili mosaic virus that infects potato, tomato and other vegetable crops. Aphid, the vector of virus Y causing potato disease resides on *Solanum nigrum* plant.

**Timing of weeding**

Weed control should be done early in the growing period from week 1 to week 3 after sowing. In the first 2-3 weeks, hand weeding by hoe or other tools is very effective to control weeds and break the scum layer on the upper soil surface. In addition, hand weeding reinforces activities of microorganisms, increases nutrient absorption of the
plant, limits root development so that plant nutrients are concentrated for development of leaves and branches, and increase crop yield. Only if necessary, herbicides can be applied before or after sowing to control weeds.

**Methods of weed management**

Breaking up the soil is a good technique for controlling weeds. Hilling-up the soil should be done before plants climb on the trellis or when the plant is 10-15 cm high.

As such, the plant can produce new roots and avoid from collapsing or crawling on the ground. At this time, hilling-up meets the requirements of plants for maintaining air circulation in the field, breaking the scum on the soil surface and controlling weeds. When the plant is 30 cm high, hilling-up the soil again is done before establishing the trellis. Hilling-up can be done 2-3 times. Hilling-up should not be done after staking. During this period, weed control can be done by hand or knife.

Mulching is a very commonly used method for weed control. Mulch is any material placed on the surface of the soil. It can be organic matter such as straw or plastic sheets. Organic matter is more available and cheaper than plastic sheets. If straw is used, be sure that it is weed-free. Mulching can be done before or after sowing seeds. Weeds can also be controlled by spraying herbicides. However, beans are very sensitive to chemicals. Therefore, if the use of chemicals is needed, be sure that the herbicide is suitable to the crop and will not cause leaf burn or tip curling. Herbicides use to control weeds in bean fields will depend on cultivation conditions in each area. It must be remembered that negative effects of herbicides are recorded in many places in the world.

**1.2.6 Responsible use of pesticide**

**1.2.6.1 Scouting**

Is the first line of defense in the battle against pests. There are several types of scouting patterns.

**1.2.6.2 Responsible use of pesticide**

2.2.6.2.1 Pesticide label

It’s the primary source of information about a pesticide. It has all the basic information that is needed.
HOW TO READ A PESTICIDE LABEL

Important pointers to look out for:

1. Always seek advice before using any pesticide and always read the label instructions carefully before use. Never buy a pesticide which is in an unsealable or unlabelled container.

2. Pay particular attention to the recommended rates. Exceeding the rates will not make your spraying more effective but just waste chemical. Using less than the recommended rate might make your pest problem worse instead of helping it.

3. The manufacturer’s information tells you when a product was manufactured and when it expires. Do not buy more pesticide than you need for a single season.

4. The colour coding and pictograms are a simple way to assess what the product is and how you can protect yourself and the environment from the hazard. A green colour band means that the product should be handled carefully. A blue colour band means that extra caution is needed.

5. Always look for the logo of the Agrochemicals Association of Kenya, a guarantee of quality.

6. The Pesticide Registration Number is an assurance that the product has been properly tested and registered.

7. The quantity of chemical must be clearly marked on the reverse panel of the label.

8. The label instructions must always be in both English and Swahili. If they are not, reject the packaging as it has not been approved by the Pest Control Products Board.
2.2.6.2.2 Classification of Pesticides by hazard
1.2.6.3 How a pesticide can enter the human body
There are four common ways in which pesticides can enter the human body: through the skin, the mouth, the lungs, and the eyes.

The chances of pesticide entry into the body is affected by the state of the chemical, i.e., as a solid, liquid, or gas. Liquids or gasses can penetrate the body via any of the four routes. Solids tend to have a lower chance of entry through the lungs or eyes, but if solid particles are small enough or if they remain on the skin long enough, entry is possible in the same ways that liquids or gasses can enter.

1.2.6.4 Personal Protective Equipment
1.2.6.5 Storage of pesticides

*SAFE STORAGE OF PESTICIDES*

Store only products on good condition and keep them in their original packaging.

Products should always be safely stored out of reach of children or any person not aware of their content.

Keep pesticides dry, away from fires and out of direct sunlight.

Do not store pesticides with foodstuffs, animals, and water supplies. Keep pesticides separate from other commodities.

Keep stores Well ventilated
1.2.6.7 First Aid/How to handle emergency

**Acute pesticide poisoning**

If a person suffers acute pesticide poisoning do the following **immediately**:

a. Find out if possible the way the poison entered the body. This may either be through the mouth, nose, skin or eyes.
   - If the pesticide has been inhaled, move the person to fresh air.
   - If the pesticide is in the person's eyes, quickly wash the eyes for 15 minutes with clean, gently running water. If there is no running water, bathe eyes from a container, frequently changing the water.
   - If the pesticide is on the skin, remove all contaminated clothing and wash the affected area thoroughly with soap and water.

b. If the patient is not breathing, apply artificial respiration if possible.

c. Read the label on the pesticide container for any first aid instructions and keep the label for the doctor. It is very important to be able to tell the doctor the name of the pesticide.

d. If the pesticide is swallowed, and only if the person is conscious, rinse the mouth with plenty of water and read the label on the pesticide container for further instructions.
e. Quickly arrange for the doctor, or Community Nurse or Health Worker to be called or take the person to the doctor, clinic or hospital immediately.

f. Keep the patient warm and comfortable.

1.2.6.8 How to handle empty pesticide containers

1.3 Agronomy (crop husbandry)(Alex Kinyua, MoA-Embu)

1.3.1 Varieties
Varieties commonly grown in Embu County include Amy, Julia, Serengeti, Salima and Star

1.3.2 Seed acquisition and preparation
- Use healthy clean seeds
- Certified seed are available from registered seed agents (Agroshops) or Buying (Exporting) companies
- Treat seeds with moncerene at planting time
1.3.3 Seed rate
Single rows of 30 x 15 cm (1 seed per planting hole) or double rows 60x30x10 cm are used. For single rows it is advisable to plant in blocks of 4 single rows separated by a path of 50 cm for ease of management. Seed rate is 50-60 kg per hectare. For good pest and disease management avoid planting French beans too close. A spacing of not less than 30x15 cm between the rows and within the row is recommended in Kenya. New plantings should be sited up-wind where continuous bean cropping is practiced. Plant maize, cereals or sunflower between French bean fields to minimise the spread of wind-borne diseases such as bean rust. Irrigate three times a week during the dry season.

1.3.4 Fertilizers
Basal (planting)-20kg in ¼ Acre plot of D.A.P

Top dressing (2 splits)

- 1st leave stage 10kg in ¼ Acre plot of CAN
- Onset of flowering 10kg in ¼ acre plot of CAN

Apply foliar feed at fortnightly intervals from the 4th week post planting to mid-podding phase increases yield

1.3.5 Manure
Use of Farm Yard Manure (FYM) is recommended. Apply in the planting furrows and work into the soil before planting use 1 ton, well rotten (cured) manure in ¼ acre plot.

1.3.6 Weeding
Timely and thorough weeding is very essential. 1st weeding done 2-3 weeks after emergence followed by a second weeding 2-3 weeks later.

- Weed carefully to avoid damaging shallow roots especially during the 1st weeding
- Do not weed at flowering time and when the field is wet to avoid flower shedding, spread of diseases and soil compaction.

1.3.7 Soil testing analysis
This should be done once per year to establish the type of fertilizers to use and the amounts. Soil analysis will guide on any other intervention required on the farm (soil).

1.3.8 Harvesting
Picking of pods begins 6-8 weeks after planting and continues for about 1 month.
Pick at regular intervals three times a week to maintain export quality.

Transport produce immediately after picking to the grading shed to avoid shriveling and deterioration of quality.

1.3.9 Yield, Grading, Marketing
Under good management yields of 1ton per ¼ Acre plot is achievable. French bean is graded into two categories.

- Extra fine grade
- Fine grade

1.4 Pest and Disease Control (Stephen Muita, MoA Embu)
1. Bean fly – The bean seed fly, also known as seed corn maggot, resembles small houseflies. It is about 1cm long. Female flies are attracted to recently disturbed open soil, where they lay eggs, especially where there are plant residues or when
large amount of manure has been applied. The maggots bore into germinating bean seeds or the cotyledons (first seed leaves) of the young plant eating them. This causes patchy emergence of seedlings. If damaged plants emerge, they are stunted, weak and fail to develop into productive plants. Pupation takes place in the soil, 2-4 cm under the soil surface. What to do: Limit the amount of organic matter before planting in areas with a known history of bean seed flies. Avoid sowing into recently ploughed land in areas where this fly is a problem. Control by protecting the seed by seed dressing or young plants in the field by spraying on the soil surface at emergence or just before emergence.

2. Thrips – scout the plants starting at vegetative (2 leaf) stage. If any thrips noticed on the leaves or flowers control should commence. Three per flower or per leaf should lead to control measures. Feeding by flower thrips causes scars and blemishes on leaves and pods. Flower thrips can be found feeding on young plants. They are less than 2 mm long. As soon as the plants start flowering, however, most thrips would be found in the flower buds, flowers and on the young pods. Heavy thrips feeding causes flower abortion and flower malformation. French bean pods become scarred (having a rough silvery surface) and malformed and are not marketable. What to do: Monitor the crop regularly. Early detection is particularly important at the onset of flowering. Whenever necessary spray the crop with botanicals (e.g. some plant extracts: garlic, rotenone, neem, pyrethrum, etc.).
3. White fly – Feeding by flower thrips causes scars and blemishes on leaves and pods. Flower thrips can be found feeding on young plants. They are less than 2 mm long. As soon as the plants start flowering, however, most thrips would be found in the flower buds, flowers and on the young pods. Heavy thrips feeding causes flower abortion and flower malformation. French bean pods become scarred (having a rough silvery surface) and malformed and are not marketable. What to do: Monitor the crop regularly. Early detection is particularly important at the onset of flowering. Whenever necessary spray the crop with botanicals (e.g. some plant extracts: garlic, rotenone, neem, pyrethrum, etc.). large population build up before flowering requires control. Not possible to do spray once crop has flowered due to PHIs
4. Spider mites – Spider mites feeding on bean plants may cause reduction in plant growth, flowering, number and length of pods, and number of seeds per pod. Damage is most severe when mites attack young plants. Mite damage may be particularly severe during the dry season. What to do: Avoid planting next to infested fields. Avoid frequent use of broad-spectrum pesticides, particularly pyrethroids; this may lead to spider mite outbreaks. Use overhead irrigation or wash plants with a strong jet of water to knock off mites and to destroy their webs. Be sure to spray the underneath of the leaves. However, this should be done early in the day to allow the foliage to dry. Wetness of the foliage for an extended period is conducive to development of fungal diseases. Serious infestation before flowering requires control to be started.

5. Powdery mildew – A white powdery mould appears on the upper leaf surfaces. Severely diseased leaves turn yellow and die. Leaf petioles, stems and pods can also be affected. What to do: Plough under bean debris after harvest. Practise a 2-3 year crop rotation without legumes. Avoid continuous bean cropping. Early infection can be controlled by chemicals. Best at vegetative stage with protective fungicides. If chemical control is done at flowering one must observe the PHI before use.

6. Angular leaf spot (ALS) – Symptoms consist of small dark brown spots with angular edges and are often numerous to give the foliage a checker-board appearance. The spots may increase in size, join together, and cause yellowing and necrosis of the affected leaves. This may lead to premature defoliation. When humid, the fungus produces a grey mould on the lower surface of the spots.
Infected pods have brown blotches. The disease is favoured by high moisture and moderate temperatures (20-25°C). The disease is seed-borne. What to do: Use certified disease-free seed. Plough under bean debris after harvest. Practice a 2-3 year crop rotation without legumes. Do not work in bean fields when the plants are wet. Start at vegetative stage with protective/eradicants chemicals once any slight signs of disease is noticed on the leaves.

7. Common bean rusts – control if infection is noticed before full flowering. Check PHI of the chemical once flowering has commenced.

8. Bean common mosaic virus – Symptoms of bean common mosaic virus (BCMV) are cupping and twisting of leaves with a light and dark green mosaic pattern. The dark green tissue is often bubbled and/or in bands next to the veins. Affected plants produce smaller, curled pods with a greasy appearance, and yields are reduced. The virus is seed borne. It can be transmitted by several aphid species. What to do: Use certified and disease-free seeds. Plant resistant varieties (e.g. French bean variety 'Paulista') Control attacks by aphids. Remove infected plants from the field not controllable once noticed in the field. Prevention is through rotation, use of clean seed, rogueing, seed treatment to control vectors.

9. Fusarium root rots – They cause stunting and yellowing of plants with a tendency to wilt in hot weather. If infested plants are pulled out from the soil, the roots can be seen to be distorted, swollen and bearing knots of various sizes. Infested roots under severe infestation decay. These knots should not be confused with legume nodules, which are normally small and round, and are attached to the outside of the roots, whereas swellings of root-knot nematodes are within the body of the root. When active nodules are sliced, they are pinkish in colour. What to do: Practise a 2-3 year crop rotation with cereals, maize or grasses. Direct surface irrigation water from new to old bean fields. Maintain fields weed-free. Uproot and destroy entire plants after harvest. Amend soil with neem cake or green manure of marigold or sunnhemp. Maintain high levels of organic matter in the soil. Crop rotation and field sanitation, ensuring good draining, avoid flood irrigation, plant on top of hills of furrows where flood irrigation is used.
1.5 Simple farm records & Accounts (Nehemiah Njiruh, MoA-Embu)

1.5.1 *Why we keep records?*
- To keep track/traceability of the produce
- To manage farm business
- Provide figures for planning
- For food safety

1.5.2 *Types of records*
These include among others;
- Tools/equipment inventory
• Individual enterprise records
• Details included in enterprise records
  ◆ Name of enterprise and acreage
  ◆ Date
  ◆ Activity/item description
  ◆ Unit and cost
  ◆ Cost
  ◆ Produce sale amount

French bean ¼ Acre records

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity/item/Description</th>
<th>Unit and cost</th>
<th>cost</th>
<th>Produce sale amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>5/4/2014</td>
<td>Land preparation</td>
<td>4MD@250/=</td>
<td>1,000/=</td>
<td>4,070/=</td>
</tr>
<tr>
<td>8/4/2014</td>
<td>Planting seed</td>
<td>5kg@1000/=</td>
<td>5,000/=</td>
<td>6,600/=</td>
</tr>
<tr>
<td>15/6/2014</td>
<td>Harvesting</td>
<td>75kg@10/=</td>
<td>750/=</td>
<td></td>
</tr>
<tr>
<td>20/6/2014</td>
<td>Payment of sales</td>
<td>75kg@55/=</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15/7/2014</td>
<td>Payment of sales</td>
<td>120kg@55/=</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>TOTAL</td>
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1.6 Farmer Field School (FFS) analysis (Nehemiah Njiru, MoA-Embu)
Activity period-One season: Feb-May 2014

Frequency of training-Twice per Month

Start; input sourcing and land preparation

End; harvesting and marketing (sales)

Variety in use; *Salima* and *Star*

Treatments;

❖ Manure+DAP+CAN
❖ Manure+23:23:0+17:17:17
- DAP+CAN
- 23:23:0+17:17:17
- Manure only

### 1.6.1 Summary Results
Income from two varieties (*Salima* and *Star* var) of French beans under different nutritional treatments

| Plot 1 | Manure+23:23:23+17:17:17  
*Salima* variety  
Gross sales=49,735  
Inputs=54,800  
Margin=-5,065 | Plot 2 | Manure+DAP=CAN  
*Salima* var  
Gross sales=76,270  
Inputs= 60,775  
Margin=15,495 | Plot 3 | 23:23:0+17:17:17  
*Salima* var  
Gross sales=6,525  
Inputs=29,950  
Margin=-23,425 | Plot 4 | DAP+CAN  
*Salima* var  
Gross sales=57,420  
Inputs=46,400  
Margin=11,020 | Plot 5 | Manure only  
*Salima* var  
Gross sales=13,340  
Inputs=31,400  
Margin=-18,060 |
| Plot 6 | Manure+23:23:23+17:17:17  
*Star* var  
Gross sales=103,820  
Inputs=68,475  
Margin=35,345 | Plot 7 | Manure+DAP+CAN  
*Star* var  
Gross sales=99,760  
Inputs= 63,575  
Margin=36,185 | Plot 8 | 23:23:0+17:17:17  
*Star* var  
Gross sales=10,440  
Inputs=31,750  
Margin=-21,310 | Plot 9 | DAP+CAN  
*Star* var  
Gross sales=51,040  
Inputs=46,750  
Margin=4,290 | Plot 10 | Manure only  
*Star* var  
Gross sales=31,030  
Inputs=43,575  
Margin=-12,545 |

#### 1.6.2 Recommendation
- i. Soil sampling to determine nutritional requirements and types of fertilizer to apply
- ii. Best option
  - Use manure (1 ton in ¼ Acre), DAP fertilizer and CAN top dress 2 splits
  - Or
  - Use manure (1 ton in ¼ Acre), 23:23:0 +17:17:0- 2 splits
- iii. Not recommended (Can lead to losses)
  - Use of manure alone
• Use of 23:23:23 +17:17:17 alone

1.7 French beans Utilization (Food fair) (Lily Njiru, MoA-Embu) held at Kavangua Catholic Church Grounds on 12/06/2014

Nehemiah Njiru, Ward Agricultural Officer, Kagaari South ward, Embu County, welcomes participants to the field day and FFS Graduation.
1.7.1 Products prepared for French bean utilization training

1.7.1.1 Samosa

Ingredients; French beans, Onions, salt, wheat flour and Cooking oil

Preparation method

- Heat the oil in a small non-stick pan and fry the snap beans for about five minutes, or until they are soft.

- Add the onion and French beans and cook for 2-3 minutes over a high heat. Add the salt and a splash of water. (If using lemon juice, add this instead of the water.) Cook for 1-2 minutes. Taste and adjust the seasoning.

- Preheat the oven to 200C/400F/Gas 6.

- Unroll the pastry and cover with cling film and a damp tea towel. Peel off one piece and keep the rest covered so that it doesn't dry out. Lay the pastry sheet flat on a clean surface and brush with cooking oil. Fold in one third of the pastry lengthways towards the middle. Brush again with the cooking oil and fold in the other side to make a long triple-layered strip.

- Place one rounded teaspoon of the filling mixture at one end of the strip, leaving a 2cm/1in border. Take the right corner and fold diagonally to the left, enclosing the filling and forming a triangle. Fold again along the upper crease of the triangle. Keep folding in this way until you reach the end of the strip. Brush the outer surface with more cooking oil. Place onto a baking sheet and cover while...
you make the rest of the samosas. Bake in the centre of the oven for 30-35 minutes, or until golden and crisp, turning halfway through the cooking time.

- To serve, place the samosas onto a large serving plate

1.7.1.2 French bean Stew
Ingredients; French beans, Carrots, Onions, Tomatoes, cooking oil and Salt

- In large pot, heat oil over medium heat. Add onion and cook, stirring often, until softened, about 5 minutes. Stir in diced carrots and cook, stirring, until onion is golden, about 3 minutes.

- Stir in tomatoes (with liquid), 1/2 cups water. Bring to a boil. Reduce heat to low, cover and simmer until the carrots are tender but still firm, 10 to 15 minutes.

- Stir in the French beans and simmer gently, uncovered, until heated through, about 5 minutes. Add salt to taste. Serve hot

1.7.1.3 Salad (Kachumbari)
- Ingredients; French beans, carrots, onions, Tomatoes and salt
1.7.1.4 Githeri
- Ingredients: Green maize, beans, carrots, tomatoes, onions, cooking oil and salt

Preparation

- Soak beans overnight, rinse and put them into a pan. Add the maize. Add enough water to cover everything and sprinkle some salt. Boil them until tender. Drain but reserve the water they were cooked in as it contains a lot of flavour/nutrients and you can use this in place of plain water when cooking the githeri later.

- Heat the oil in a pan, add the chopped onions and fry until translucent (but not brown). Add the freshly chopped French beans and diced carrots followed by the chopped tomatoes. Cook on low heat until the tomatoes are mushy, stirring regularly and breaking up the tomato pieces with your spoon as you stir. If the mixture begins to stick to the bottom of the pan, add some of the water leftover from cooking the beans, a little bit at a time. Once the tomatoes are cooked, add the cooked beans/maize (Githeri) and stir. Add salt to taste. Allow the githeri to gently simmer on low heat, giving an occasional stir until the mixture thickens and the flavours are well combined. Taste and adjust salt and spice.
1.7.1.5 French bean Pilau
Ingredients; Rice, French beans, carrots, Tomatoes, onions, cooking oil and salt

Participants taste French Bean-pilau during the field day

- Heat oil in saucepan over medium-high heat. Add rice and sauté 3 to 4 minutes, or until beginning to brown. Add green onions, spices of choice, diced carrots and sauté 1 minute.

- Add diced tomatoes. Add enough boiling water to make 2 cups, and stir to combine. Add salt. Reduce heat to medium-low, add chopped French beans, cover, and simmer 15 minutes, or until all liquid is absorbed. Remove from heat, and fluff with fork just before serving.

1.8 Participants preference for French bean recipe
Sampled youth preferred samosa, stew, salad in that order, Old men preferred salad, stew and githeri while aged women preferred githeri, samosa then stew.

1.9 Farmers Reaction
i. More training is required; Farmers from other areas such as Kiringa sub-location that had recently been connected with irrigation water request for an FFS training to address their needs in French bean Production.

ii. Soil testing is a major requirement in French bean production areas but expensive for individual farmers and request donor intervention.
iii. Value addition trainings are required on French beans to cover a wider population and include more recipes.

iv. Training under FFS mode to include watermelon, courgettes and cucumbers which are also important horticultural crops in the irrigation areas.
2. ACHIEVEMENTS OF THE TRAINING

Twentty Primary school pupils (4K club members) integrated and trained in French bean husbandry and utilization.

Farmers trained on French bean utilization and simple French bean recipes shared with farmers.

New French bean marketing organization (Meru Greens) brought on board to provide French bean market for farmers.

Capacity building for post graduate students: 2 students identified and undertaking research at study site.

Provided platform for different French bean value chain actors (farmers, agro-dealers, exporters, researchers and MoA extension officers) to interact and share information.
3. FIELD DAY &FFS GRADUATION PARTICIPANTS

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