

**COLLECTION, CHARACTERIZATION AND
EVALUATION OF VEGETABLE COWPEA
ACCESSIONS AND RESPONSE OF SELECTED
ACCESSIONS TO ORGANIC AND INORGANIC
SOURCES OF NITROGEN IN COASTAL
KENYA**

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INTRODUCTION

- Cowpea (*Vigna unguiculata* L. Walp.) is the most important indigenous leafy vegetables in Kenya
- The area under cowpea leaf production in 2012 was 27,663 ha.
- Fresh leaf yield was 570,62 MT
- Estimated value of 6,258m KES
- Contributed 61% of domestic value of indigenous leafy vegetables
- Main producing counties are: Makueni, Kwale, Kilifi, Kisii and Kisumu

Performance of Leafy vegetables 2010-2012

| No | Crop | 2010 | | | 2011 | | | 2012 | | | % Share |
|----|---------------------------------|---------------|----------------|----------------------|---------------|----------------|----------------------|---------------|----------------|----------------------|-------------|
| | | Area_Ha | Qty (MT) | Value (Million Kshs) | Area_Ha | Qty (MT) | Value (Million Kshs) | Area_Ha | Qty (MT) | Value (Million Kshs) | |
| 1 | Cow peas | 6,241 | 36,374 | 511.6 | 6,630 | 51,587 | 984 | 27,663 | 570,162 | 6,258 | 61% |
| 2 | African nightshade | 3,768 | 24,582 | 791 | 3,070 | 22,419 | 700.2 | 3,440 | 22,791 | 1,431 | 14% |
| 3 | Pumpkin fruit | | | | | | | 1,225 | 15,321 | 680 | 7% |
| 4 | Spider plant | 3,306 | 28,222 | 821.6 | 3,303 | 28,167 | 795.5 | 2,409 | 15,137 | 613 | 6% |
| 5 | Leaf Amaranth | 1,893 | 17,457 | 287.9 | 2,162 | 24,152 | 442.6 | 1,679 | 17,445 | 524 | 5% |
| 6 | Russian comfrey/ mafaki | 1 | 5 | 0.1 | 1 | 4 | 0.1 | 402 | 6,535 | 263 | 3% |
| 7 | Grain Amaranth | 0 | 0 | 0 | 0 | 0 | 0 | 682 | 3,068 | 202 | 2% |
| 8 | Malaborgourd/ kahurura | 8 | 120 | 5.4 | 37 | 150 | 9 | 276 | 5,209 | 165 | 2% |
| 9 | Pumpkin leaves | 431 | 3,305 | 76 | 494 | 14,124 | 363.4 | 597 | 2,561 | 82 | 1% |
| 10 | Jutemallow | 337 | 925 | 32.7 | 305 | 898 | 33.5 | 284 | 1,362 | 49 | 0% |
| 11 | Slender leaf/ Rattle pod/ Mitoo | 504 | 2,814 | 119.2 | 446 | 2,481 | 95.1 | 308 | 1,099 | 45 | 0% |
| 12 | Vine Spinach | 64 | 531 | 12.1 | 69 | 593 | 14.5 | 132 | 1,108 | 24 | 0% |
| | Total | 17,200 | 120,878 | 2,714 | 17,390 | 149,944 | 3,500 | 39,097 | 661,798 | 10,337 | 100% |

INTRODUCTION

- Cowpea is the most important leafy vegetable in the coastal region of Kenya
- Is a major source of dietary protein, especially for the rural and urban poor
- Cowpea leaves are most commonly served boiled to accompany maize meal (ugali) and other starchy foods such as cassava
- Dried cowpea leaves are sometimes stored for use in the dry season when fresh leaves are not available

Cowpeas thrives in dry areas with few alternative vegetables



Introduction

- Cowpea is an important legume, used as grain and leaf
- Cowpeas withstands drought
- Has short growing period
- Multi-purpose use
- Attractive alternative for farmers in marginal, drought-prone areas with low and erratic rainfall in coastal Kenya
- Cowpea produced mainly for its protein-rich grains
- The production of cowpea as a leafy vegetable has increased in recent years as farmers shift to more drought-tolerant vegetable crops
- Due to repeated droughts

Cowpeas in zei pits in dry areas



Introduction

- Two main production systems for vegetable cowpeas
 - uprooting the entire plant at the 3-5 true leaf stage before the leaves become too mature and fibrous-common in peri-urban areas
 - dual-purpose production where sequential leaf harvests are made during the vegetative phase of plant growth, followed by seed production at the end of the season-common in peri-urban areas

Vegetable cowpeas production systems



Uprooting the entire plant



Sequential leaf harvests



Problem statement and justification

- The major constraints facing the production of cowpeas in the coastal region include
 - ✓ low awareness of their potential
 - ✓ lack of quality seed
 - ✓ lack of technical production packages
 - ✓ lack of utilization packages
 - ✓ poor marketing system

Problem statement and justification

- Many studies carried on cowpea as a grain
- Little attention on cowpea as leafy vegetable
- Recently research has been carried out on African leafy vegetables
- Cowpea research has continued to focus on grain and/or the entire herbage for animal feed

Problem statement and justification

- Most varieties developed for high yield of grain
- There are many accessions being grown by farmers which have not been characterized
- Their leaf yield potential has not been evaluated
- There are few varieties recommended for use as vegetable cowpea
- Most soils in coastal lowland of Kenya are deficient in nitrogen and organic matter
- No studies carried out on the effect of nitrogen application and sources of nitrogen for vegetable cowpea in the region
- No recommendation on suitable levels of inorganic and organic sources of N for optimal leaf yield and quality.
- This study is intended to contribute to the improvement of production of vegetable cowpea in the coastal region of Kenya through suitable varieties and appropriate production practices.

Objectives

- To collect and conduct morphological (phenotypic) characterization of vegetable cowpea accessions in Mombasa and Kilifi counties of Coastal Kenya
- To assess the leaf yield potential of collected accessions
- To evaluate response of four vegetable cowpea accessions to organic (cattle manure) and inorganic (CAN) nitrogen sources

Materials and methods

- Cowpeas accessions grown and consumed in coastal Kenya were collected from Kilifi and Mombasa counties within two major agro-ecological zone where the crop is grown-CL3 and CL4
- In Kilifi County areas covered: Kilifi, Malindi, Magarini and Ganze districts
- In Mombasa County collection was be done in Likoni and Mombasa districts.
- The collected accessions were planted at KARI Mtwapa Research station to produce seed for variety evaluation.
- Morphological characterization was carried out using International Board of Plant Genetic Resources descriptors for cowpeas (IBPGR, 1983)
- 28 accessions were selected for screening in a replicated evaluation

Vegetable cowpeas accession in coastal Kenya



Materials and methods

- The evaluation was conducted in randomized complete block design with three replications
- The varieties were planted in 4m x 3m plots at a spacing of 60cm x 30 cm. Each plot had 67 plants.
- The following data was collected:
 - Days from sowing to germination
 - Days from sowing to flowering
- The following morphological characteristics were recorded:
 - Terminal leaflet shape:
 - Leaf texture
 - Growth pattern
 - Hairiness on leaves
 - Plant vigour
 - Leaf marking
 - Growth habit
 - Pod and seed characteristics

Materials and methods

- Single harvest yield assessment was done 6th week after sowing
 - 6 plants from each plot were uprooted and the following data collected:
 - Root length (cm)
 - Plant height (cm)
 - Canopy width (cm)
 - Number of branches
 - Number of leaves
 - Fresh weight of leaves (g)
 - The leaves were dried in an oven at 57 °C for 72 hours and their weight taken (g)
- .

Materials and methods

- Multiple leaf yield harvest assessment started 6th week after sowing
- Leaves from selected nine plants per plot were harvested weekly and weighed
- After weighing, the leaves were dried in an oven for 72 hours for dry matter determination.
- Seed yield assessment was done from plants where leaves were not be harvested.
- Data was analyzed using SAS Programme.
- 10 varieties with highest leaf yield were selected for further evaluation
- The ten were presented to a farmer group involved in cowpea production to give their opinion on there acceptability as vegetable and grain.
- The best four from famers perspective were selected four agronomic package development

Materials and methods

- An Experiment was set up to evaluate response of the four selected varieties to inorganic and organic sources of nitrogen.
- Four varieties of vegetable cowpea were evaluated.
- Three levels of Calcium Ammonium Nitrate and three level of cattle manure will be tested.

Materials and methods

- The plot sizes and spacing were as described above for variety evaluation.
- Single and multiple leaf yield were assessed as above
- Before planting soil samples were taken for analysis
- Nutrient composition of cattle manure was analysed to establish its nitrogen level
- Nutrient analysis for dried samples will carried out.
- Data will be analyzed using SAS Programme.
- The agronomic experiment will be repeated in October 2013

RESULTS

COLLECTION OF VEGETABLE COWPEA ACCESSIONS IN KILIFI AND MOMBASA COUNTIES

- Cowpeas accessions were collected on 4-13th April 2012 from Kilifi and Mombasa counties within 2 agro ecological zone- Coastal Lowland 3 and Coastal Lowland 4)
- The areas covered in Kilifi County were Malindi, Magarini, Lango Baya, Bamba, Ganze, Vitengeni, Chonyi, Bahari, Kikambala
- In Mombasa County collection was done in Likoni division
- 36 cowpea accessions were collected

Cowpeas thrives in dry areas with few alternative vegetables



COWPEA ACCESSION COLLECTED IN KILIFI AND MOMBASA

| | |
|-----------------------------------|----------------------------|
| 1 Kunde kubwa ya Kigiriama | 19 Usimpe mtu mdogo |
| 2 Simpe mtu | 20 MM - 01 |
| 3 Kunde Nyekundu | 21 MM - 02 |
| 4 Mwandatu | 22 MM - 03 |
| 5 Kaima koko | 23 MM - 04 |
| 6 Mwakipipi | 24 MM - 05 |
| 7 Mnyenze madamada | 25 MLB - 1 |
| 8 Mnyenze | 26 MLB - 2 |
| 9 Simpe mtu | 27 MLB - 3 |
| 10 Katatariko | 28 MLB - 5 |
| 11 Mtsemeri | 29 MLB - 6 |
| 12 Mesonje | 30 White - MLB |
| 13 Charika | 31 Red - MLB |
| 14 Kiringongo mawe | 32 MG - 01 |
| 15 Mrahai | 33 VT - 01 |
| 16 Sura mbaya | 34 VT - 02 |
| 17 Katsetse | 35 MLK - 01 |
| 18 Usimpe mtu kubwa | 36 MLK - 02 |

Preliminary screening and seed multiplication of vegetable cowpea accessions

- 32 cowpea accessions were planted in at KARI Mtwapa to generate material for variety characterization.
- Planting was done on 7th and 8th May 2012
- Out of the 32, 28 were selected for further screening.
- The four discarded were found to be duplicates

Coded unknown local varieties

-
- MM - Malindi Magarini
-
- MLB - Malindi Lango Baya
-
- MLK - Mombasa Likoni
-
- VT - Vitengeni
-
- MG - Ganze

CHARACTERIZATION AND EVALUATION OF VEGETABLE COWPEA ACCESSIONS

- Twenty eight varieties of vegetable cowpeas collected from Kilifi and Mombasa counties were planted on 16 October 2012 at KARI Mtwapa farm
- The design was randomized complete block design with 3 replicates.
- The spacing was 60cm x 60 cm.
- For single harvest 6 plants were uprooted 38 days after planting.
- The leaves were removed, weighed and mean fresh weight of the six plants calculated.
- For multiple harvest leaves from 9 plants were harvested weekly for six weeks.
- The total was computed for the six harvests. The fresh leaves were oven dried for 72 hours at 57°C and weighed.
- The data was analyzed by SAS programme.

Table 1: Cowpea morphological characteristics: Terminal leaflet shape, leaf texture, growth pattern and hairiness of leaves

| Variety Name | Variety Code | Terminal leaflet shape | Leaf texture | Growth pattern | Hairiness on leaves |
|---------------------|---------------------|-------------------------------|---------------------|---|----------------------------|
| USIMPE MTU KUBWA | 10 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| MWANDATU | 3 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| MWAKIPIPI | 27 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| MM-01 | 12 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| MRAHAI | 2 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| MM-03 | 22 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| KIRINGONGO MAWE | 4 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| KUNDE KUBWA | 14 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| VT-01 | 17 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |

Table 1: Cowpea morphological characteristics: Terminal leaflet shape, leaf texture, growth pattern and hairiness of leaves

| Variety Name | Variety Code | Terminal leaflet shape | Leaf texture | Growth pattern | Hairiness on leaves |
|-----------------------|--------------|------------------------|--------------|---|---------------------|
| MM-05A | 20 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| USIMPE MTU | 5 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| MNYENZE MADAMADA | 24 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| VT-02 | 18 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| KATSETSE | 25 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| MM-05B | 21 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| KUNDE ZA KIGIRIAMA | 13 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| CHARIKA | 26 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |

Table 1: Cowpea morphological characteristics: Terminal leaflet shape, leaf texture, growth pattern and hairiness of leaves

| Variety Name | Variety Code | Terminal leaflet shape | Leaf texture | Growth pattern | Hairiness on leaves |
|---------------------|--------------|------------------------|--------------|--------------------------------------|---------------------|
| MTSEMERI | 9 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| KVU | 28 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| KATATARIKO | 7 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| MNYENZE | 8 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| MESONJE | 23 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| MLB-07 | 1 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| SURA MBAYA | 6 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| MG-01 | 15 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| USIMPE MTU NDOGO | 19 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |
| MLK-02 | 11 | Sub-globose | Cariaceous | Indeterminate spreading not climbing | Glabrescent |

Table 2: Cowpea morphological characteristics: Leaf marking, leaf colour and growth habit

| Variety Name | Variety Code | Leaf marking | Leaf Colour | Growth habit |
|------------------|--------------|--------------|--------------------|--------------------|
| USIMPE MTU KUBWA | 10 | Abscent | Intermediate green | Semi- erect |
| MWANDATU | 3 | Present | Intermediate green | Acute erect |
| MWAKIPIPI | 27 | Present | Intermediate green | Acute erect |
| MM-01 | 12 | Present | Intermediate green | Intermediate erect |
| MRAHAI | 2 | Present | Intermediate green | Intermediate erect |
| MM-03 | 22 | Abscent | Intermediate green | Acute erect |
| KIRINGONGO MAWE | 4 | Present | Dark green | Acute erect |
| KUNDE KUBWA | 14 | Present | Pale green | Semi-erect |
| VT-01 | 17 | Present | Intermediate green | Intermediate |
| MM-05A | 20 | Present | Intermediate green | Semi-erect |
| USIMPE MTU | 5 | Present | Intermediate green | Acute |
| MNYENZE | 24 | Present | Intermediate green | Intermediate |
| MADAMADA | | | | |
| VT-02 | 18 | Present | Intermediate green | Acute erect |
| KATSETSE | 25 | Present | Intermediate green | Semi-erec t |

Table 2: Cowpea morphological characteristics: Leaf marking, leaf colour and growth habit

| Variety Name | Variety Code | Leaf | | |
|--------------------|--------------|---------|--------------------|--------------|
| | | marking | Leaf Colour | Growth habit |
| MM-05B | 21 | Present | Dark green | Acute erect |
| KUNDE ZA KIGIRIAMA | 13 | Present | Intermediate green | Intermediate |
| CHARIKA | 26 | Present | Intermediate green | Acute erect |
| MTSEMERI | 9 | Present | Dark green | Intermediate |
| KVU | 28 | Present | Dark green | Acute |
| KATATARIKO | 7 | Present | Dark green | Intermediate |
| MNYENZE | 8 | Present | Intermediate green | Intermediate |
| MESONJE | 23 | Present | Intermediate green | Erect |
| MLB-07 | 1 | Present | Dark green | Intermediate |
| SURA MBAYA | 6 | Present | Intermediate green | Intermediate |
| MG-01 | 15 | Present | Dark green | Erect |
| USIMPE MTU NDOGO | 19 | Present | Intermediate green | Intermediate |
| MLK-02 | 11 | Present | Intermediate green | Acute |
| MLB-06 | 16 | Present | Intermediate green | Acute |

Table 3: Cowpea morphological characteristics: Plant Vigour

| VARIETY | CODE | PLANT HEIGHT | CANOPY WIDTH | PLANT VIGOUR |
|------------------|-------------|---------------------|---------------------|---------------------|
| USIMPE MTU KUBWA | 10 | 65.2 | 114.8 | Vigorous |
| MWANDATU | 3 | 107.3 | 217.8 | Very Vigorous |
| MWAKIPIPI | 27 | 48 | 89.3 | Vigorous |
| MM-01 | 12 | 63.3 | 109 | Very Vigorous |
| MRAHAI | 2 | 39.3 | 89.6 | Vigorous |
| MM-03 | 22 | 132.4 | 210.6 | Very Vigorous |
| KIRINGONGO MAWE | 4 | 59.4 | 108.4 | Very Vigorous |
| KUNDE KUBWA | 14 | 63.5 | 120.2 | Very Vigorous |
| VT-01 | 17 | 52.1 | 83.8 | Vigorous |
| MM-05A | 20 | 69.6 | 117.6 | Very Vigorous |
| USIMPE MTU | 5 | 39.8 | 69.3 | Intermediate |
| MNYENZE MADAMADA | 24 | 67.2 | 114.3 | Very Vigorous |
| VT-02 | 18 | 59.5 | 106.6 | Very Vigorous |
| KATSETSE | 25 | 57.3 | 102.1 | Very Vigorous |

Table 3: Cowpea morphological characteristics: Plant Vigour

| VARIETY | CODE | PLANT HEIGHT | CANOPY WIDTH | PLANT VIGOUR |
|--------------------|------|--------------|--------------|---------------|
| MM-05B | 21 | 61.9 | 111.6 | Very Vigorous |
| KUNDE ZA KIGIRIAMA | 13 | 63 | 114.1 | Very Vigorous |
| CHARIKA | 26 | 40 | 70.5 | Intermediate |
| MTSEMERI | 9 | 108.3 | 157.4 | Very Vigorous |
| KVU | 28 | 129.6 | 186.7 | Very Vigorous |
| KATATARIKO | 7 | 60.3 | 111.9 | Very Vigorous |
| MNYENZE | 8 | 231 | 489.9 | Very Vigorous |
| MESONJE | 23 | 53 | 101.1 | Very Vigorous |
| MLB-07 | 1 | 154.8 | 352.8 | Very Vigorous |
| SURA MBAYA | 6 | 60 | 119.9 | Very Vigorous |
| MG-01 | 15 | 157.5 | 324.5 | Very Vigorous |
| USIMPE MTU NDOGO | 19 | 139.3 | 290.9 | Very Vigorous |
| MLK-02 | 11 | 58.1 | 135.8 | Very Vigorous |
| MLB-06 | 16 | 56.8 | 113.2 | Very Vigorous |

Table 4: Cowpea morphological characteristics: Twinning tendency, number of nodes, number of days to flowering and terminal leaf length

| VARIETY | CODE | TWINNING TENDENCY | NUMBER OF NODES | NUMBER OF DAYS TO FLOWERING | TERMINAL LEAF LENGTH |
|------------------|-------------|------------------------------|----------------------------|--|---------------------------------|
| USIMPE MTU KUBWA | 10 | Slight | 9 | 41 | 133.5 |
| MWANDATU | 3 | Slight | 9 | 45 | 110.5 |
| MWAKIPIPI | 27 | None | 9 | 47 | 150.5 |
| MM-01 | 12 | Slight | 8 | 36 | 134 |
| MRAHAI | 2 | None | 9 | 47 | 127 |
| MM-03 | 22 | None | 10 | 47 | 110 |
| KIRINGONGO MAWE | 4 | None | 9 | 36 | 132.5 |
| KUNDE KUBWA | 14 | None | 9 | 36 | 118.5 |
| VT-01 | 17 | None | 9 | 41 | 123.5 |
| MM-05A | 20 | Slight | 9 | 41 | 137 |
| USIMPE MTU | 5 | Slight | 9 | 41 | 131 |
| MNYENZE MADAMADA | 24 | None | 10 | 44 | 123.5 |
| VT-02 | 18 | None | 9 | 36 | 111 |
| KATSETSE | 25 | None | 10 | 41 | 133.5 |

Table 4: Cowpea morphological characteristics: Twinning tendency, number of nodes, number of days to flowering and terminal leaf length

| VARIETY | CODE | TWINNING TENDENCY | NUMBER OF NODES | NUMBER OF DAYS TO FLOWERING | TERMINAL LEAF LENGTH | |
|--------------------|------|-------------------|-----------------|-----------------------------|----------------------|-------|
| MM-05B | 21 | Intermediate | | 9 | 41 | 130 |
| KUNDE ZA KIGIRIAMA | 13 | Slight | | 9 | 41 | 137.5 |
| CHARIKA | 26 | None | | 9 | 47 | 112.5 |
| MTSEMERI | 9 | None | | 8 | 44 | 153 |
| KVU | 28 | None | | 8 | 52 | 127.5 |
| KATATARIKO | 7 | None | | 9 | 41 | 132.5 |
| MNYENZE | 8 | Slight | | 9 | 45 | 131 |
| MESONJE | 23 | None | | 9 | 47 | 128 |
| MLB-07 | 1 | None | | 9 | 44 | 131.5 |
| SURA MBAYA | 6 | None | | 10 | 52 | 139 |
| MG-01 | 15 | Slight | | 9 | 41 | 130 |
| USIMPE MTU NDOGO | 19 | Slight | | 9 | 47 | 128 |
| MLK-02 | 11 | None | | 9 | 41 | 151.5 |
| MLB-06 | 16 | Intermediate | | 9 | 41 | 126.5 |

Table 5: Cowpea morphological characteristics: Plant height (cm), Canopy width, root length, number of branches and number of leaves of 28 cowpeas varieties

| VARIETY | CODE | PLANT HEIGHT | CANOPY WIDTH | ROOT LENGTH | NUMBER OF BRANCHES | NUMBER OF LEAVES |
|------------------|-------------|---------------------|---------------------|--------------------|---------------------------|-------------------------|
| USIMPE MTU KUBWA | 10 | 65.2 | 114.8 | 21 | 7 | 79 |
| MWANDATU | 3 | 107.3 | 217.8 | 40.4 | 15 | 181 |
| MWAKIPIPI | 27 | 48 | 89.3 | 18 | 8 | 76 |
| MM-01 | 12 | 63.3 | 109 | 18.3 | 6 | 77 |
| MRAHAI | 2 | 39.3 | 89.6 | 14.9 | 6 | 59 |
| MM-03 | 22 | 132.4 | 210.6 | 44.2 | 21 | 255 |
| KIRINGONGO MAWE | 4 | 59.4 | 108.4 | 18 | 7 | 84 |
| KUNDE KUBWA | 14 | 63.5 | 120.2 | 20.2 | 8 | 88 |
| VT-01 | 17 | 52.1 | 83.8 | 15.9 | 7 | 79 |
| MM-05A | 20 | 69.6 | 117.6 | 20 | 10 | 97 |
| USIMPE MTU | 5 | 39.8 | 69.3 | 13.2 | 5 | 53 |
| MNYENZE MADAMADA | 24 | 67.2 | 114.3 | 20.9 | 9 | 101 |
| VT-02 | 18 | 59.5 | 106.6 | 19.2 | 8 | 90 |
| KATSETSE | 25 | 57.3 | 102.1 | 18.8 | 8 | 98 |

Table 5: Cowpea morphological characteristics: Plant height (cm), Canopy width, root length, number of branches and number of leaves of 28 cowpeas varieties

| VARIETY | CODE | PLANT HEIGHT | CANOPY WIDTH | ROOT LENGTH | NUMBER | |
|--------------------|------|-----------------|-----------------|----------------|----------------|---------------------|
| | | | | | OF BRANCHES | NUMBER OF LEAVES |
| MM-05B | 21 | 61.9 | 111.6 | 20.1 | 9 | 86 |
| KUNDE ZA KIGIRIAMA | 13 | 63 | 114.1 | 18.7 | 8 | 87 |
| CHARIKA | 26 | 40 | 70.5 | 17 | 7 | 70 |
| MTSEMERI | 9 | 108.3 | 157.4 | 45.2 | 21 | 141 |
| KVU | 28 | 129.6 | 186.7 | 37.7 | 17 | 160 |
| KATATARIKO | 7 | 60.3 | 111.9 | 18.5 | 7 | 76 |
| MNYENZE | 8 | 231 | 489.9 | 87.5 | 32 | 314 |
| MESONJE | 23 | 53 | 101.1 | 19.3 | 7 | 73 |
| MLB-07 | 1 | 154.8 | 352.8 | 63.5 | 21 | 214 |
| SURA MBAYA | 6 | 60 | 119.9 | 17.5 | 8 | 89 |
| MG-01 | 15 | 157.5 | 324.5 | 51.1 | 19 | 221 |
| USIMPE MTU NDOGO | 19 | 139.3 | 290.9 | 47.3 | 23 | 197 |
| MLK-02 | 11 | 58.1 | 135.8 | 19.1 | 7 | 93 |
| MLB-06 | 16 | 56.8 | 113.2 | 21.3 | 7 | 79 |
| LSD | | 124.8 | 244.1 | 46.3 | 18.8 | 185.4 |

Table 6: Cowpea fresh and dry leaf yield for single and multiple harvests at Mtwapa

| <u>Variety Name</u> | <u>Variety Code</u> | <u>Single Harvest Fresh weight(g)</u> | <u>Single Harvest Dry Weight (g)</u> | <u>Total Multiple Harvests Fresh Weight(g)</u> | <u>Total Multiple Harvest Dry Weight(g)</u> |
|---------------------|---------------------|---|--|--|---|
| USIMPE MTU | | | | | |
| KUBWA | 10 | 560 cdefghij | 73.33 abcde | 2910 abcdef | 383.33 abc |
| MWANDATU | 3 | 306.7 j | 30 f | 1846.7 ghi | 226.67 de |
| MWAKIPIPI | 27 | 640 abcdefghi | 76.67 abcd | 3370 abc | 403.33 abc |
| MM-01 | 12 | 586.7 cdefghi | 76.67 abcd | 2926.7 abcdef | 346.67 abc |
| MRAHAI | 2 | 400 ghij | 46.67 def | 1546.7 hi | 210 de |
| MM-03 | 22 | 620 abcdefghi | 73.33 abcde | 2870 abcdef | 363.33 abc |
| KIRINGONGO | 4 | | | | |
| MAWE | | 646.7 abcdefgh | 83.33 abc | 2680 cdefg | 386.67 abc |
| KUNDE KUBWA | 14 | 680 abcdef | 83.33 abc | 3036.7 abcdef | 376.67 abc |
| VT-01 | 17 | 573.3 cdefghi | 73.33 abcde | 2446.7 defg | 343.33 abc |
| MM-05A | 20 | 386.7 hij | 40 ef | 1503.3 i | 180 e |
| USIMPE MTU | 5 | 433.3 efghij | 63.33 bcdef | 2136.7 fghi | 290 cde |
| MNYENZE | 24 | | | | |
| MADAMADA | | 880 a | 96.67 ab | 3163.3 abcde | 383.33 abc |
| VT-02 | 18 | 586.7 cdefhi | 70 abcde | 2850 bcdef | 366.67 abc |
| KATSETSE | 25 | 853.3 ab | 103.3 a | 3646.7 ab | 440 a |

Table 6: Cowpea fresh and dry leaf yield for single and multiple harvests at Mtwapa

| <u>Variety Name</u> | <u>Variety Code</u> | <u>Single Harvest Fresh weight(g)</u> | <u>Single Harvest Dry Weight (g)</u> | <u>Total Multiple Harvests Fresh Weight(g)</u> | <u>Total Multiple Harvest Dry Weight(g)</u> |
|---------------------|---------------------|---|--|--|---|
| MM-05B | 21 | 600 bcdefghi | 70 abcde | 3036.7 bcdefg | 403.33 abc |
| KUNDE ZA | 13 | | | | |
| KIGIRIAMA | | 613.3 bcdefghi | 83.33 abc | 2766.7 bcdefg | 376.67 abc |
| CHARIKA | 26 | 380 ij | 40 ef | 2403.3 efghi | 300 bcd |
| MTSEMERI | 9 | 420 fghij | 50 cdef | 2926.7 abcdef | 343.33 abc |
| KVU | 28 | 506.7 defghij | 56.67 cdef | 2773.3 bcdef | 363.33 abc |
| KATATARIKO | 7 | 620 abcdefghi | 76.67 abcd | 3010 abcdef | 366.67 abc |
| MNYENZE | 8 | 700 abcd | 80 abcd | 2873.3 abcdef | 363.33 abc |
| MESONJE | 23 | 646.7 abdcefg | 73.33 abcde | 3773.3 a | 436.67 a |
| MLB-07 | 1 | 653.3 abcdefg | 76.67 abcd | 3483.3 abc | 423.33 a |
| SURA MBAYA | 6 | 700 abcd | 80 abcd | 3673.3 ab | 433.33 a |
| MG-01 | 15 | 686.7 abcde | 80 abcd | 2873.3 abcdef | 383.33 abc |
| USIMPE MTU | 19 | | | | |
| NDOGO | | 673.3 abcdef | 76.67 abcd | 3240 abcde | 413.33 ab |
| MLK-02 | 11 | 793.3 abc | 70 abcde | 3336.7 abcd | 400 abc |
| MLB-06 | 16 | 533.3 cdefghij | 70 abcde | 2836.7 bcdef | 376.67 abc |

RESPONSE OF SELECTED ACCESSIONS TO ORGANIC AND INORGANIC SOURCES OF NITROGEN IN COASTAL KENYA

- An Experiment was set up in June 2013 to evaluate response of the four selected varieties to inorganic and organic sources of nitrogen.
- Four varieties of vegetable cowpea were evaluated.
- Three levels of Calcium Ammonium Nitrate and three level of cattle manure will be tested.

THANK YOU

