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## FOREWARD

The International e-Conference on Agricultural Biosciences (IeCAB) continues to provide a platform for scientists in developing countries to exhibit and publish their research outputs in an easy, facilitated and cost-effective manner. This is the 4<sup>th</sup> e-Conference since the launch of this initiative in 2008. As in the previous years scientists have an opportunity to present their papers as power point slides or posters and eventually to publish the outputs as full papers in peer reviewed journals. All materials submitted to the e-Conference are archived online permanently. This ensures sustained visibility and presence on the web, with free access and download. We encourage scientists to utilise this innovative platform as they endeavour to take their careers to the next level. The coordinators appreciate those who have submitted abstracts included in this volume. We welcome you to join us in the 5<sup>th</sup> e-Conference in mid-2012. You may also submit your papers for direct publications in the online journals (Journal of Applied Biosciences ISSN 1997-5902; Journal of Animal and Plant Sciences ISSN accessible at [www.m.elewa.org/journals](http://www.m.elewa.org/journals)).

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## SECTION 1

# AGRONOMY & CROP PRODUCTION

## **Correlation analysis of tuber yield and yield related characters in two cassava (*Manihot esculenta* Crantz) morphological-types grown under nine weed management systems in the Guinea savanna zone of Nigeria**

Abstract ID: IeCAB011-404

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### **ABSTRACT**

#### *Objective*

The interplay of weed management options and temporal environment on correlative responses in two cassava morphological-types were studied. This is to elucidate growth and yield correlations pattern under weed management and temporal environment.

#### *Methodology and result*

The two cassava morphological-types 'NR 8082' (short with profuse branching) and 'TMS 30555' (tall non-branching) were subjected to nine different weed management options in a split



plot design replicated three times. Data on weed biomass, cassava growth and yield parameters were subjected to multiple correlation analyses. Results revealed that weed dry matter had significant negative correlation with plant height ( $r = -0.975^{**}$ ), plant girth ( $r = -0.796^{**}$ ), tuber diameter ( $r = -0.841^{**}$ ), tuber weight ( $r = -0.929^{**}$ ), and average whole plant biomass yield ( $r = -0.921^{**}$ ) in 2008 cropping season for the branching cultivar. In 2009, a similar correlative response trend was also obtained, weed dry matter showed highly significant negative correlation with plant height ( $r = -0.984^{**}$ ), plant girth ( $r = -0.789^{**}$ ), tuber diameter ( $r = -0.822^{**}$ ), tuber weight ( $r = -0.911^{**}$ ), and average whole plant biomass yield ( $r = -0.901^{**}$ ). For the non-branching cultivar, weed dry matter also demonstrated strong and significant negative relationship with the following growth and yield parameters: plant height ( $r = -0.910^{**}$ ), plant girth ( $r = -0.763^{**}$ ), tuber diameter ( $r = -0.805^{**}$ ), tuber weight ( $r = -0.864^{**}$ ), and average whole plant biomass yield ( $r = -0.860^{**}$ ) in 2008. And in 2009, the data revealed strong and significant negative relationship between weed dry matter and plant parameters as follows: plant height ( $r = -0.966^{**}$ ), plant girth ( $r = -0.772^{**}$ ), tuber diameter ( $r = -0.898^{**}$ ), tuber weight ( $r = -0.940^{**}$ ), and average whole plant biomass yield ( $r = -0.928^{**}$ ). Irrespective of cultivar or cropping year, plant height was significantly and positively correlated with average tuber weight and average whole total plant biomass yield (in most cases, with  $r$ -values  $> 0.90^{**}$ ).

#### *Conclusion and application of findings*

The correlative responses obtained for the two cultivars expectedly suggest that weed interference limits genetic productive potentials of the crop. The implication is that, weed



management strategy that reduces weed dry matter will indirectly enhance genetic expression of the cultivar thereby improving yield.

*Key words*

Cassava morphological-types, correlative responses, multiple correlations, weed biomass



# Tobacco production baseline survey in Serengeti, Tarime and Rorya Districts, Mara region of Tanzania

Abstract ID: IeCAB011-406

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## ABSTRACT

### *Objective*

In Tanzania, tobacco is one of the major agricultural export crops. The crop is the main source of household income to smallholder farmers who are striving to get, or stay, out of poverty especially in the tobacco farming zones. Using 2009/2010 cropping season survey data from 181 randomly selected smallholder tobacco farmers from three districts, this study provides baseline information on tobacco farming in Mara region.

### *Methodology and results*

The analysis of quantitative and qualitative data from the survey was done using descriptive statistics such as mean, frequency, multiple responses, cross tabulation and correlation. Inferential



statistics such as independent sample t-test was also employed. The results indicate that tobacco production in Mara region has been taking place since 1992. Farmers adopted tobacco farming from tobacco farmers in Kenya. The major production constraints identified by farmers were drought, untimely as well as inadequate supply of inputs which was attributed to the existence of only one inputs supplier and distributor.

Other limitations were high incidence of pests and diseases, shortage of fire wood for curing leaves, poor extension services and hailstones in some seasons. Low selling price and contradicting grading systems were the major tobacco marketing constraints in the study area. The study also revealed that access to extension services was similar across study districts with over 65.7% of the respondents obtaining technical expertise mainly from Alliance One Kenya employees. Tobacco yield recorded in three districts were 658.1569kg/acre, 972.7672kg/acre and 785.8138kg/acre in Serengeti, Tarime and Rorya, respectively.

These yields are still below the yield potential of 1,012kg/acre. To counteract the problem of fire wood shortage, majority of farmers have already grown Eucalyptus and Grevillia sp. as their main source of fire wood for tobacco curing. Given the positive and negative impacts of tobacco farming, majority of the respondents (95.6%) were still willing to continue with tobacco farming as their main source of income. However, watermelon, maize and sunflower were ranked as first priority alternative cash crops to tobacco in Serengeti, Tarime and Rorya districts, respectively. Other alternative cash crops identified by farmers were coffee, cotton, tea and groundnuts.

### *Application of findings*





This study concludes that tobacco farming is still the main source of household income. Therefore, more investment needs to be undertaken to ensure sustainable economic development of rural communities in Mara region.

*Key words*

**Baseline, production, marketing, tobacco**



## Emergence and early growth of *Gongronema latifolia* in relation to sowing depth and date

Abstract ID: IeCAB011-409

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### ABSTRACT

#### *Objective*

This research was designed to determine the optimum sowing depth for *G. latifolia* at two planting seasons in 2007.

#### *Methodology and results*

Treatments comprised of 9 sowing depths. The experiment was arranged in a completely randomized design with 10 replications under 65 % shading. The first and second sowing dates were on 5 May and 5 September 2009, respectively. The results showed that sowing depths of 0-1.5 cm gave significantly ( $p=0.05$ ) higher level of emergence, ranging from 93 to 83 % respectively, than in deeper sowing, for the first planting period. In the same way, the coefficient of velocity of emergence (CVE %) for 0 and 0.5 cm sowing depth were the same and significantly



( $p=0.05$ ) higher than the CVE of seedlings emerging from depths beyond 1.5 cm during the former sowing period. The second sowing period led to low emergence rate of 53 % to 5 % at the sowing depths of 0 to 2.0 cm, respectively. Seeds sown at 2.0 cm depth gave significantly ( $p=0.05$ ) higher hypocotyls lengths in both sowing dates. The hypocotyls diameter was increasing with increasing depth up to 1.5 cm and it decreased thereafter.

#### *Conclusion and application of finding*

The findings revealed that *G. latifolia* must be sowed at a depth of 0 to 1.5 cm beyond this depth, emerging rate and CVE will be poorer.

#### *Key words*

Sowing depth; *G. latifolia*; hypocotyls growth; seedling vigour; time of sowing



## Application of intercropping to banana production in East Africa

Abstract ID: IeCAB011-422

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### ABSTRACT

Bananas are highly important in East Africa for domestic consumption and export. Uganda is the main producer of bananas in the region. They are extensively grown mainly intercropped with short season crops. The main constraints to increased banana production in East Africa are low soil fertility, pests and diseases and inappropriate cropping systems causing low yields. There has been an increase in growers' interest in using intercropping, i.e. growing two or more crops simultaneously on the same land, in the development of new cropping systems for their land. Intercropping could reduce the need for management inputs and result in sustainable systems that more effectively use and even potentially replenish natural resources used during crop production for long term management of farmland. While intercropping has been practiced more widely in the developing countries of Central America, Asia and Africa, developed countries have not adopted it well. Some benefits of intercropping to the grower are risk



minimization, effective use of available resources, efficient use of labor, increased production per unit area of land, erosion control and food security. This paper discusses the effects of intercropping on pest and disease control, physiology of the crops grown, cultural practices such as date of planting, spacing and plant density, soil fertility and time of planting among other effects and lastly banana production in East Africa in relation to intercropping and declining soil fertility in banana-based cropping systems.

*Key words*

Sustainable, cultural, food security, crops, efficient, cropping system

## SECTION 2

# PLANT BREEDING, GENETICS & - BIO- TECHNOLOGY



## Investigation of callus formation and regeneration of Coker-312 cotton cultivar *in vitro*

Abstract ID: IeCAB011-401

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### *Objective*

Cotton is an important agricultural and industrial crop plant in Iran. However, cultivation has been on the decrease in Iran in the recent past. To improve cotton breeding efforts, tissue culture methods can be applied. Unfortunately, cotton is faced with considerable regeneration difficulties that demand the development of an optimized regeneration method. This study was conducted to develop an optimized protocol for cotton regeneration *in vitro*.

### *Methodology and results*

The effect of various hormonal combinations of naphthalene acetic acid (NAA) and kinetin on MS basal medium on callus formation and regeneration of different explants was investigated. Explants were excised from 7-days old seedling of Coker- 312 cotton cultivar. The trial was laid out a completely



randomized design with three replications. Analysis of variance showed significant differences among the hormonal combinations and their interaction on callus formation and regeneration of explants. The highest and the lowest percentage of callus formation was obtained from hypocotyls and meristem explants, respectively. The highest percentage of regeneration (65.2%) was obtained from meristem explant. The interaction of explant \* hormonal combination of medium showed that explants from hypocotyls in the non-hormonal MS medium and containing 1 mg/l NAA had the highest percentage of callus formation. The higher concentrations of auxins decreased callus formation frequency while high concentration of NAA decreased regeneration of explants from meristems.

#### *Application*

The results show it is possible to improve callus formation and regeneration in cotton by varying media composition.

#### *Key words*

Cotton, Regeneration, Callus formation, *in vitro*, Hormonal combination.





## Numerical variation of plant characters among long cayenne pepper accessions (*Capsicum frutescens* L.)

Abstract ID: IeCAB011-402

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### ABSTRACT

#### *Objective*

This study aimed to assess variation of plant traits among cayenne pepper accessions to identify means of improving productivity through breeding.

#### *Methodology and results*

Nine quantitative characters were observed on 31 accessions of Long Cayenne pepper (*Capsicum frutescens* L.) collected from 7 States in Southwestern Nigeria. The trials were evaluated at the National Horticultural Research Institute (NIHORT), Ibadan, during the first and second cropping seasons of 2008. Experimental design was randomized complete block with three blocks. Accession × season interaction was significant for fruit yield. Correlation between fruit yield in the first and second season was very low ( $r = 0.004$ ) and not significant. Average fruit yield in the first season ranged from 26.0 g/plant for the



accession from Sango to 118.7 g/plant for Akure while it ranged from 60.8 g/plant for Offa to 207.5 g/plant for Ifon in the second season. Most of the accessions, with the exception of Ado-Ekiti, Aramoko, Offa and Akure, had higher fruit yield in the second season compared to the first season. WCA summarized the relationships among the accessions at various levels of similarity into a dendrogram to optimize the minimum variance within clusters given percentage similarity between some groups, suggested some degree of phenetic. The intra-accession variability observed for fruit length suggests that the accessions are heterogeneous. Akure accession with yield not lower than 100g per plant in each of the two seasons shows stable, high performance and could be selected for further studies. Number of fruits per plant was a major determinant of fruit weight per plant ( $r = 0.85$ ).

#### *Application*

An improvement in fruit weight per plant may be achieved through the breeding of Long Cayenne pepper varieties with high number of fruits per plant. The second season is more promising for Long Cayenne pepper production in Ibadan, Nigeria.

#### *Key words*

Long Cayenne pepper, variation, correlation analysis.



# Selection of adaptable tomato varieties for production and breeding in an era of changing climatic conditions in Nsukka, Nigeria

Abstract ID: IeCAB011-410

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## ABSTRACT

### *Objective*

Tomato yield is relatively low in southern Nigeria during rainy season because of the present excessive rainfall and its attendant problems. The study was conducted to select adaptable tomato varieties for production and breeding in an era of changing climatic conditions.

### *Methodology and results*

The study was conducted in a randomized complete block design with three replications and comprised of six exotic, three cultivated and one wild variety. It was designed to select adaptable varieties over two seasons for production and breeding in Nsukka. The wild variety (*Lycopersicon*



*pimpinellifolium*) significantly ( $p < 0.01$ ) performed higher than other varieties in plant growth and yield attributes: plant height, number of branches/plant, number of flowers / truss/ plant and number of fruits/ plant in the two seasons. The wild had a significantly ( $p < 0.01$ ) higher fruit number but lower fruit yield of 4.34 tonnes/ha in the early season because of the smallness of the fruits. Three exotic varieties: Grosso, Insulata and Petomech had significantly ( $p < 0.01$ ) higher fruit yield of 6.44 tonnes/ha, 4.7 tonnes/ha, 5.65 tonnes/ha respectively, above other varieties in the two seasons. Insect pest and disease load on the varieties were significantly ( $p < 0.01$ ) lower in the first season probably because of the lower and evenly distributed rainfall and moderate temperature (195 mm, 26.02°C, respectively) as opposed to the second season of concentrated and excessive rainfall and lower temperature (202.76, 24.89 °C respectively). The three exotic varieties that had higher yields over the two seasons and the wild showed higher adaptation to the environment above others, including the cultivated. Grosso and Insulata had significantly bigger fruit sizes while Petomech, had significantly thicker pericarp.

#### *Conclusion and application of finding*

It could be concluded that the varieties with higher fruit yield and quality and have higher adaptation could be selected for production and breeding.

#### *Key words*



Adaptation, tomato, high rainfall, selection, high temperature.

## **Varietal differences of two cassava varieties (*Manihot esculenta* Crantz) in response to low cost tissue culture technology**

Abstract ID: IeCAB011-412

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### **ABSTRACT**

#### *Objective*

One impediment to adoption of tissue culture technology is the differential response of various crop varieties to the process necessitating development of protocols that target specific varieties or focus on a few varieties that respond better. The varietal differences in response to tissue culture can be attributed to genotypic differences among the various cultivars. In this study the morphogenetic response of nodal explants from two cassava varieties to low cost



tissue culture medium was determined with the aim of optimizing a low cost medium that can be used to regenerate a number of cassava varieties.

### *Methodology and results*

Nodal cuttings from cassava varieties Muchericheri and KME 1 were initiated on a developed low cost medium in which locally available fertilizers were used as alternative sources for MS macro- and micronutrients. Subsequent growth, elongation and production of leaves, nodes and roots was monitored and compared weekly between the two varieties. There was no significant difference in response to the low cost medium between the two varieties but Muchericheri had a superior performance producing a higher number of leaves, nodes and roots than KME 1

### *Key words*

Varietal differences, nodal explants, low cost medium



# Investigation on callus formation and regeneration of different explants of cotton cultivars *in vitro*

Abstract ID: IeCAB011-432

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## ABSTRACT

### *Objective*

Cotton is one of the important agricultural and industrial crop plants in the world. The crop has experienced decreased cultivation in Iran in the recent past. For improved productivity of cotton breeding programs, tissue culture methods can be used. However, because of the high dependence of regeneration on genotype in the *Gossypium* cultivars, and tissue culture difficulties in this crop, an optimized regeneration method is necessary. Therefore, this study was conducted in Cotton Research Institute of Iran to develop an optimized protocol for cotton regeneration *in vitro*.

### *Methodology and results*

Three explants of cotyledonary leaves, hypocotyls and meristem were excised from 7-days old seedling and also from immature



embryo explants 3-4 days after pollination, from 2 cotton cultivars. The effect of hormonal combinations of BAP and 2,4-D on MS basal medium on callus formation and regeneration of cotton explants was investigated. The experiments were laid out as completely randomized design with three replications. Analysis of variance showed significant differences among the hormonal combinations and their interaction on callus formation and regeneration of explants. The highest percentage of callus formation was obtained in Sahel cultivar and embryo explant, respectively, but the highest percentage of regeneration (79.1%) was obtained for explants from meristem. Also, results of hormonal combinations, explants and cultivars interaction showed that cotyledon and hypocotyl explants of Sahel cultivar in the MS medium containing 2 mg/l BAP and 0.5 mg/l 2,4-D had the highest percentage of callus formation.

#### *Application*

These results show that it is possible to increase callus formation and regeneration of cotton by manipulating media composition and careful choice of the source of explants.

#### *Key words*

Cotton, Callus formation, Regeneration, *in vitro*, Hormonal combination





## Potential challenges facing macropropagation technique in banana

Abstract ID: IeCAB011-416

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### ABSTRACT

#### *Objective*

Bananas (*Musa spp*) are an important crop for food security, income for small holders and fodder among other uses. Banana production is greatly constrained by lack of affordable clean planting material. Macropropagation technique has been proposed as a more cost effective method for producing healthy seedlings. This paper reports on some factors that could pose challenges to adoption of this technology in Kenya.

#### *Methodology and results*

As part of a wider study to evaluate the feasibility of introducing macropropagation to banana growers in central and Eastern Kenya, observations were made on farmer perceptions and other factors encountered during implementation. Farmers appreciate that macropropagation is an inexpensive technology that can



produce large quantities of good quality seedlings. However, one factor that could limit its adoption in the target areas is unavailability of corms for propagation. It was noted that farmers are not willing to remove the maiden corms for macropropagation because they perceive this as a loss of the bunch that would have been harvested. Currently many farmers in the target region are not in dire need of planting materials as the plantations that have been managed well are in a good state with little need for replanting. Limited availability of land also implies demand for seedlings to expand plantations is low. The labor required for the macropropagation procedure is an additional challenge in some areas. Some tasks such as soil and sawdust sterilization, chamber construction and maintenance, corm handling, among others, require considerable amounts of labor. In some areas competition of the available labor with other higher wage activities is a hindrance to successful uptake of this technology. For example men prefer to participate in loading trucks with banana bunches or operating motorcycle taxis, rather than the relatively less paying menial tasks in nurseries.

Although macropropagation is a low skill technology, improper removal and manipulation leads to rotting of the corms after placement in the propagation medium. Weevil infestation of corms in some areas is also an additional constraint as infested corms have to be discarded, even though the cost of obtaining them has been incurred.

One of the low cost aspects of the macropropagation technology is due to the fact that the nurseries are constructed using locally available materials. However, these materials are prone to rapid damage by termites and the roof can easily collapse during heavy rains or strong winds. Extra measures are therefore required to treat or protect the wood from destruction



by termites and to better secure the polythene sheet roofs so as to minimize the need for regular repairs.

*Application of findings*

These challenges need to be looked into and feasible solutions provided. For example, corms that are not heavily infested with weevils can be cured for several days after the sheaths have been removed to ensure the eggs, larvae and adult forms have been killed. They can also be treated with chemicals that control weevils. The materials used to build the chambers can be treated with preservatives. To avoid disillusionment, the technology should be better explained to stakeholders so that they appreciate its benefits vis-a-vis other propagation methods, even though it has its limitations.

*Key words*

Banana, Macropropagation, challenges



# **Structural morphology of cassava (*Manihot esculenta* Crantz) genotypes influences yield and yield components and responses to weed management in the Guinea savanna zone of Nigeria**

Abstract ID: leCAB011-403

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## **ABSTRACT**

### *Objective*

The effects of nine weed management options on the yield and yield components of two cassava (*Manihot esculenta* Crantz) morphological-types were evaluated for two cropping seasons in a guinea savanna site of Nigeria.

### *Methodology and results*

Field experiments were carried out during the cropping seasons of 2008 and 2009 at the Teaching and Research Farm of the Department of Crop Production, Kogi State University, Anyigba (Lat 7° 29' N and Long 7° 11' E), Nigeria. The experiment was laid out in a split-plot in randomized complete block design



replicated three times. The main plots consisted of the two cassava morphological-types ('NR 8082' (short with profuse branching) and 'TMS 30555' (tall non-branching). Nine weed control strategies (i.e. application of 3.0, 3.5 and 4.0 kg a.i./ha of Primextra (atrazine x metolachlor), 2.0, 3.0 and 4.0kg a.i./ha of Taxastomp (atrazine x pendimethalin), three-time manual weeding, weedy and weed-free checks were the subplot treatments. The experimental site were infested predominantly with *Cynodon dactylon*, *Panicum maximum*, *Andropogon gayanus*, *Chloris pilosa* and *Bracharia deflexa* constituting about 80% of the weed mass in the field. Besides the weedy check, weed fresh biomass (1.03 - 1.19 t/ha) and weed dry matter (0.06 - 0.09 t/ha) were highest in plots to which 2.0kg a.i./ha of taxastomp was applied. Expectedly the two cassava morphological-types exhibited significant ( $P < 0.05$ ) differences in plant height across the two-year trials and weed management system, with the highest plant stem height (153.5cm) obtained from the non-branching variety in the P3.0 treated plot. The highest cassava biomass (12.1 - 14.1 kg) was obtained from the P3.0 treated plots across morphological-types and year; and closely followed by plants in the T3.0 plots. However, harvest index was highest in the T2.0 treated plot irrespective of cassava morphological-types. Of all the treatments, P3.0 and T3.0 (i.e. 3.0 a.i. kg/ha) gave the highest root tuber yield (119.7 and 117.0 t/ha, respectively) from the non-branching type in both years as against 100.67 and 103.67 t/ha for the branching morphological type.

#### *Conclusion and application of findings*

Variable response pattern of the two cultivars to the weed management options evaluated suggested that morphological differences of the cultivars may have influenced effectiveness of

herbicides applied. However, the application of Primextra and Taxastomp at 3.0 a.i. kg/ha seemed most appropriate for weed control in cassava fields in the guinea savanna zone of Nigeria.

*Key words*

Cassava morphology, Yield and yield components, Weed management

## **Evaluating initial performance of macropropagated seedlings as compared to tissue culture and naturally regenerated suckers**

Abstract ID: IeCAB011-418

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### **ABSTRACT**

#### *Objective*

Banana is an important crop for food security and income generation in Kenya. It is also used as fodder especially during the dry season when feed resources are less available. Production of the crop faces many challenges, among them poor seedlings supply systems. Tissue culture was introduced in Kenya about ten years ago but its adoption is still low, largely due to high cost of seedlings as a result of high production cost. There are also few private sector players in the tissue culture sector. As a result farmers have continued to rely on natural regeneration methods to obtain planting suckers. This method is slow and in most cases does not yield adequate planting materials. Macropropagation technology was introduced in Kenya in 2008, but has had only limited evaluation in the country. An ongoing study is evaluating this technology,



partly to compare the performance of seedlings from different propagation methods.

#### *Methodology and results*

Ten seedlings of each method were planted and their establishment evaluated in a field at Kenyatta University Kenya. Initial growth parameters are to be monitored over a period of six months. Data is being recorded on the number of leaves, diameter of the stem from a point initially ten centimeters above the ground, and height of the plantlets recorded at two weeks interval. Results showed that tissue culture seedling have high growth rate initially while naturally regenerated suckers have the least growth rate. The growth rate of macropropagated seedlings was not significantly lower compared to tissue cultures, and maintained a consistent trend over time.

#### *Applications of findings*

The preliminary findings of this study show that macropropagated seedlings respond the same as tissue cultured seedlings during the early stages of establishment after transplanting. The slow establishment of naturally regenerated suckers was to an extent due to absence of leaves that had been pruned when transplanting.

#### *Key words*

Banana, macropropagation, tissue culture, natural regeneration





## SECTION 3

# CROP PROTECTION

## Studies on complexity of the dieback disease of passion fruit in Kenya

Abstract ID: leCAB011-413

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### ABSTRACT

#### *Objective*

Dieback disease is the most important biotic constraint to passion fruit production in Kenya. The disease was first recorded in 2004 in central Kenya, but is currently widespread in all passion fruit producing areas in the country. This research was conducted in 2011 in Mathioya and at Kenyatta University to study the complexity of the disease in its symptomatology, pathogenicity and epidemiology.

#### *Methodology and results*

For symptomatology, a representative sample of diseased passion fruit plants was selected and plants tagged. Observations on the selected plants were made after every 3 weeks. Data collected and recorded included size, location and color of wounds exhibited. Photographs of diseased tissue were also taken to document progression of infection. To establish dieback's pathogenicity, diseased plant materials were collected from the field and details on the part of the plant from which the sample was obtained, symptoms exhibited and region from which the samples were collected were recorded. Pathogens were isolated under aseptic conditions in the laboratory.



Pathogens isolated were characterized to genus level. In regard to epidemiology, details of the two sites where disease spread studies were carried out were recorded. These included history of crops grown on the land, sources of planting materials, vicinity of the sites to other passion fruit orchards, topography of the land and farmer practices carried out while the land was under passion fruit cultivation.

Results showed that there are several symptoms associated with dieback. These include; Gradual death of shoots, vines, leaves, fruit and tendrils from the tips backwards which is generally referred to as “dieback”; Occurrence of dark wounds on both main vines and auxiliary vines which is referred to as “point death”, these may occur singly along the vines or may enlarge and coalesce to form severe wounds which are as long as 60cm and girdle the vine; Occurrence of “brown spot” symptoms on main and auxiliary vines. These are usually small and numerous but they also enlarge and coalesce to form large, rough, brown colored formations on the vine surface; Discoloration of the vascular system of the plants with the exception of the root stock on grafted passion fruit plants. Pathogens isolated from materials exhibiting the above symptoms include; *Alternaria* sp., *Phytophthora* sp. and different strains of *Fusarium* sp. No specific pathogen isolated and could be linked to a specific symptom except *Fusarium* for the vascular discoloration. Most cultures yielded multiple isolates. Epidemiology revealed various dissemination pathways. These include soil, wind, water, infected planting materials and inappropriate farmer practices.

#### *Application of findings*



These results have added to the available information on occurrence of dieback disease on passion fruit. The information will be useful for developing effective control measures.

*Key words*

Dieback, disease, complexity, passion fruit

## **Assessment of status, perception of weed infestation and methods of weed control adopted by cassava farmers in Kogi state, Nigeria**

Abstract ID: IeCAB011-405

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### **ABSTRACT**

#### *Objective*

As a prelude to advancing an appropriate weed management strategy for cassava production in Kogi State, Nigeria, it was necessary to ascertain the weed management practices and weed management knowledge base of the farmers.

#### *Methodology and result*

A survey of cassava farmers in fifteen (15) Local Government Areas (LGAs) in Kogi State, Nigeria was carried out in 2008 to study the perception of farmers with regards to weed infestation and control method adopted on cassava farms. The study was undertaken in five LGAs from each of the three senatorial districts of the state. In each LGA, five villages were selected; and



in each village, six cassava farmers were selected. Stratified random sampling technique and structured questionnaires were used to sample 450 cassava farmers in the study area. The survey indicated that majority of the farmers were males (73%) and aged between 31 - 50 years (88%). Highest frequency of female cassava farmer were found in Kogi east (42%) with Kogi central having the highest occurrence of unmarried farmers (21%). Farm size was smaller in Kogi central (< 1 ha) compared with 1 - 3 hectares and 4 - 6 hectares in Kogi west and Kogi east, respectively. Cassava farmers (59%) in Kogi west were better educated than their counterparts in Kogi east (39%) and Kogi central (49%). Majority of farmers (68%) indicated that grasses were the dominant weed species on cassava farms in the state. Manual weeding was the commonest practice (66%) followed by herbicide application (30%). Herbicide used for control of weeds in cassava farms in Kogi State included 'primetra', 'sarosate', 'roundup', 'delsate' and 'touchdown' with 'roundup' (47%) being the most commonly used. Majority of farmers in Kogi State weeded their cassava field three times (63%) manually before the crop attained maturity period.

#### *Conclusion and application of findings*

The implication of this study is that farmers in the study area had limited knowledge on the superlative benefit of chemical weed control; thus, need more encouragement to adopt chemical weed control option. Adoption and use of chemical weed control will save cassava crop from early weed interference which could result in considerable yield reduction.

#### *Key words*

Cassava farmers, Guinea savanna, Survey, Weed management practices.



# Seasonal incidence of *Plutella xylostella* (Lepidoptera: Plutellidae) and its associated natural enemies in major crucifer growing areas of Kenya

Abstract ID: IeCAB011-411

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## ABSTRACT

### *Objective*

Seasonal incidences of *Plutella xylostella*, diamondback moth (DBM) and its associated natural enemies were investigated in two agro-ecological zones of the major crucifer growing areas of Kenya in 2005 and 2006.

### *Methodology and results*

DBM larvae and pupae were collected from the cabbage and kale crops grown in farmers' fields and maintained in the laboratory for the emergence of parasitoid or DBM. Four larval, one larval-pupal and one pupal parasitoid species were recorded from diamondback moth. The parasitoids recovered were *Diadegma semiclausum*, *D. mollipla*, *Itopectis* spp., *Cotesia plutellae*, *Apanteles* spp., *Oomyzus sokolowskii* and *Brachymeria* species. *Diadegma semiclausum* was the most dominant species throughout with highest parasitism rates of over 70% recorded in the highlands. *Cotesia plutellae*, *Apanteles* and *Brachymeria* were recovered from mid-altitude semi arid areas. Generally, parasitism was significantly higher on *B. oleracea* var.





*capitata*. *Diadegma semiclausum* displaced the indigenous parasitoids from *Brassica oleracea* var. *capitata*.

*Key words*

*Brassica oleracea*, parasitoids, diamondback moth, seasons, agro-ecological zones



## Proposed disease severity assessment scale for dieback disease of passion fruit in Kenya

Abstract ID: IeCAB011-414

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### ABSTRACT

#### *Objective*

Dieback disease is a major constraint to passion fruit production in Kenya. The disease gained epidemic status within 4 years of its first recording in 2004. It is estimated that the disease contributes about 70% of total fruit loss due to pre-harvest diseases in the country. Dieback exhibits a high level of complexity in its symptomatology, pathogenicity and epidemiology. The disease is new in Kenya and literature search does not show reports of its presence in other parts of the world where passion fruit is cultivated. These factors coupled with the lack of preparedness to natural calamities often seen in many African countries' agricultural settings have made it difficult to successfully manage dieback. In an effort to contribute to knowledge, upon which foundations of effective dieback management programs will be laid, a dieback disease severity assessment scale (scoring chart) was developed.

#### *Methodology and results*

The severity assessment scale was arrived at aided by data gathered through rigorous observations carried out by trained



personnel for a period of time. Photographs were taken and documented to support the findings. The information was obtained from orchards in Eastern and Central Kenya which are among the highest passion fruit producing regions in the country as well as being the major areas where dieback disease is most prevalent. Data on disease development were also collected from controlled experiments carried out at Kenyatta University. The controlled experiments simulated and provided evidence for the natural disease development trends observed under field conditions.

The assessment scale developed comprises of 5 scoring levels assigned over a range of disease severity as determined based on dieback disease symptoms.

At level 1, there are no symptoms observed hence plant is scored as 'healthy'.

At level 2, the disease is at the initial visible stages of establishment and its status is low. Infection is observed as discolored spots emerging along the vines; tendrils dry off at the terminals and spots may start appearing on the fruits.

At level 3, the disease status is moderately high, with spots on vines expanding into lesions that elongate but not yet encircle to girdle the bark on the vine. The proportion of brown spots on the fruits has increased significantly to cover between 25 and 50 % of the fruit surface. The tendrils have dried off in a dieback fashion (towards the vine) and some infected flowers exhibit wilting symptoms, withering before fruit formation.

At level 4, disease is at an advanced level with entire branches often on one side of the vines wilting, drying and dying off. The lesions on the vines have extended substantially to more than one inch long and have encircled the vine along the circumference in some parts, thus limiting the exchange of plant



materials along the bark (phloem). If plant has been grafted on resistant yellow rootstock, infection is observed spreading downwards along the vine upto the graft union and in some cases spreading upwards on the opposite vine. At least 50% of leaves on infected vines are wilted and drying up. Intense premature fruit drop is observed and few flowers mature to fruit initiation stage.

At level 5, over 75% of the foliage is wilted and dried up; the lesions along the vines have developed into open wounds with rotting of stem tissue and drying of bark observed around the oldest lesions. The plant is completely dead, or will soon be dead, and there are no chances of recovery regardless of measures taken.

#### *Application of findings*

This is the first published chart for scoring the important dieback disease on passion fruit. The scoring chart will assist researchers to assess the effectiveness of disease management measures and also help farmers to monitor spread of disease on their farms. The chart can be used to design informed disease forecasting and monitoring schedules that will be important in guiding the management options applied. It will be an important tool in effective dieback disease management programs to revive the passion fruit industry in Kenya.



## SECTION 4

# SOIL FERTILITY

&

# PLANT

# NUTRITION

## Effect of fertilizer types on nutritional quality of two cabbage varieties before and after storage

Abstract ID: IeCAB011-423

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### ABSTRACT

#### *Objective*

To determine the effect of fertilizer types on the nutritional compositions of two cabbage varieties before and after storage.

#### *Methodology and results*

The treatments involved 8 fertilizer types (NPK, neem, alesinloye organomineral, sunshine organomineral, sunshine organic, cassava peel compost, alesinloye organic and pacesetter organomineral fertilizers) applied at 60kg/ha and a control, each to two cabbage varieties (Copenhagen market and F1 milor). The treatments were laid out in randomized complete block design fitted into split plot with variety as the main plot factor and fertilizer types as sub plot factor, replicated three times. Data were collected on the number of rottened leaves, degree of rottenness and nutritional compositions of cabbage before and after storage. The nutritional compositions of cabbage head before and after storage was significantly ( $p = 0.05$ ) influenced by



the applied fertilizers and variety. Higher K and vitamin C contents were obtained from Copenhagen market while F1 milor recorded better P, Ca and crude protein compositions before storage. The two varieties had same average value of Mg content in the cabbage head before storage. Organomineral fertilizers recorded the highest phosphorus, potassium and crude protein contents of cabbage head before storage while NPK had more vitamin C. Although, there was inconsistency in the nutritional compositions of cabbage after storage F1 milor retained most of the minerals more than Copenhagen.

#### *Conclusion and application of findings*

Organomineral fertilizers such as pacesetter followed by sunshine and alesinloye, compared with NPK (15:15:15) enhanced optimum nutritional compositions of cabbage varieties before and after storage. Neem fertilizer improved the storability of cabbage varieties. Despite the pre and post-harvest constraints encountered by the cabbage varieties used, F1 milor had better nutritional values than Copenhagen market with or without fertilizer, therefore can be recommended as the better variety among the two in Ogbomoso, South West, Nigeria.

#### *Key words*

*Brassica oleracea L*, nutritional values, organomineral, storage losses, minerals, organic





# The effect of method, rate and time of urea application on nitrogen use efficiency and yield of wetland rice in Rwamagana district of Rwanda

Research Abstract ID: IeCAB011-431

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## ABSTRACT

### *Objective*

Rice is the staple food for more than half of the world population and for many low income people in developing countries. In Africa, over 50 million people depend on rice farming for their livelihoods. In Rwanda, this number is nearly half a million individuals. Rice is often very responsive to nitrogen fertilization and the high yield potential of modern varieties cannot be realized without adequate Nitrogen supply during the entire growing period. Recovery of applied nitrogen by lowland rice with reliable water supply is invariably low and hardly exceeds 30-50%. This low recovery is attributed to several loss processes operating in the rice fields such as volatilization, nitrification, denitrification, leaching, seepage and  $\text{NH}_4^+$  fixation by clays. Reports suggest that Nitrogen use efficiency is optimized when Nitrogen is applied in a single



basal application at four-to-five leaf stage. Multiple, or split applications may be employed to fertilize tall, lodging-prone cultivars or semi dwarf cultivars grown on some clay soils that require high Nitrogen rates. Deep placement method has also been reported to be well protected from various Nitrogen loss mechanisms at the placement sites in the soil. This study will evaluate the effect of mode of application, rates, and timing of urea on rice productivity in Rwamagana marshland, Rwanda.

### *Methodology*

Rice variety Gakire will be used in the trials. The study is being implemented in two separate experiments; the first one will assess the effect of application method and at different rates, designed as a factorial experiment arranged in Completely Randomized Design with two factors; application method with 2 levels (types) and rate of Nitrogen fertilizer with 4 levels giving a total of eight treatments. The second experiment will assess the effect of time and application rate of Nitrogen fertilizer applied on surface; laid out in a CRD with 11 treatments with three replicates each. Data will be analyzed by SAS software and Fischer's protected LSD at the 5% significance level will be used for means separation.

### *Application of expected results*

The generated information will be used to advise farmers on proper fertilizer management which will lead to increased rice yields as a part of food security and



improved income for better livelihoods of small scale farmers in Rwanda.

### *Acknowledgements*

Project implementors acknowledge the support of the Alliance for a Green Revolution in Africa (AGRA), Rwanda Agricultural Board and Kenyatta University.

## **Influence of rates of organic manure and frequency of application on growth, yield and some biochemical composition of *Solanum melongena* L (cv, Ngwa local)**

Abstract ID: leCAB011-408

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### **ABSTRACT**

#### *Objective*

Field and laboratory studies were carried out to ascertain the optimal rate of organic manure and the frequency of its application on the growth, yield, and some vitamins and mineral composition of the fruits of *Solanum melongena* L.

#### *Methodology and results*

Four rates of organic manure (0, 10, 20, and 30 t/ha) were applied at three varying frequencies namely: single, split, and split-split. The field study was a 3 X 4 factorial laid out in a randomized complete block design while the laboratory biochemical analysis was laid out in a completely randomized design with three replications. Data



were collected on the growth, yield and some vitamins and minerals attributes of the crops. Days to flowering, plant height, number of trusses per plant, and number of leaves per plant increased with increase in rate of organic manure. At maturity 30 t/ha gave the highest mean value on number of leaves per plant, and plant height which was not significant ( $P<0.05$ ) when compared with 20 t/ha. Increase in frequency of application increased both the fresh and dry weight of the fruits, and leaves per plant of *Solanum melongena*. The application of 30 t/ha gave significant higher number and weight of fruits from the second month of harvest (July) to the last month (October). Single and split-split application of manure gave significantly higher number and weight of fruits in the months of June, July and September, October respectively. Manure rate of 30 t/ha applied as split-split dosage gave significantly higher levels of most of the vitamins and minerals determined.

#### *Conclusion and application of finding*

We conclude that Split-split application of 20 t/ha is recommended in favor of 30 t/ha in production of *Solanum melongena* (cv Ngwa local) since there was no significant ( $p<0.05$ ) difference between the rates in most of the attributes measured.

#### **Key words:**

Manure rate, frequency of application, yield, vitamins, *Solanum melongena*



# Effects of bio-slurry and inorganic fertilizers on soil properties and maize yield in Kicukiro district, Rwanda

Abstract ID: IeCAB011-425

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## ABSTRACT

### *Objective*

Continuous cropping without nutrient restitution under smallholder farms in Rwanda has led to serious nutrient depletion and reduced maize yields. This is further exacerbated by low soil organic matter and soil erosion. The smallholder farmers in Rwanda either do not obtain the necessary returns from fertilizer use to justify the costs or cannot afford to use inorganic fertilizers resulting in low inorganic fertilizer use. It is hypothesized that bio-slurry organic fertilizers are affordable, are of high quality and can be used to increase fertilizer use efficiency and crop yields for farming community in Rwanda. This study is being carried out to: (i) determine the nutrient contents of bio-slurry as an organic fertilizer; (ii) to determine the effect of bio-slurry on soil physical, biological and chemical properties; (iii) and to compare the effect of bio-slurry and inorganic fertilizers on maize yield.

### *Methodology*



A one year field study is being carried out in Rubilizi farm, Kicukiro District in Rwanda to test four levels of N fertilizers (0, 50, 100, 200 kg/ha) and three levels of bio-slurry (0, 5,10 tons/ha) and their interactions. This constitutes 12 treatment combinations laid out as a factorial experiment and arranged as a randomized complete block design (RCBD) with 3 replications using maize crop (*Zea mays*) as the test crop. Slurry chemical analysis was done before planting to determine its nutrient content. Soil samples were taken before planting and will be taken afterwards to determine the following properties: organic carbon, total N, available N, available P, soil pH, CEC, soil texture, water retention, aggregate stability, and microbial biomass. Maize yield will be determined.

#### *Application of expected results*

It is expected that the results of this study will be used by extension staff and farmers to promote and implement interventions for improving soil fertility to increase production of maize to reduce food insecurity in Rwanda.

#### *Acknowledgements*

Author acknowledges the support of AGRA, Kenyatta University.

## Evaluation of different local lime sources on soil properties and yield of Irish potatoes (*Solanum tuberosum* L.) in Burera District, Rwanda

Abstract ID: IeCAB011\_426

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### ABSTRACT

#### *Background and objective*

Agriculture is the most important sector of the Rwandan economy. Irish potato (*Solanum tuberosum* L.) underpins Rwanda's food security but its production is threatened by widespread acidity in many parts of Rwanda. The problems of acid soils (pH less than 5) is widespread in the country occupying approximately 45% of the total arable land or covering about 60% of the highland areas (Beenart, 1999), which are the major growing areas of Irish potatoes.

Potato requires a considerable amount of Nitrogen, and the continuous widespread use of Ammonium or urea based N fertilizers in a high rainfall environment contributes to



acceleration of soil acidification (Brett et al., 2005). Acidity limits the fertility of soils through nutrient deficiencies (P, Ca and Mg) and the presence of phytotoxic nutrients such as soluble Al and Mn (Awad et al., 1976). Application of lime has been shown to reduce Al toxicity, improve pH, Ca, Mg and increase both P uptake in high P fixing soil and plant rooting system (Black, 1993).

The use of liming materials in Rwanda (Yamoah et al., 1992) demonstrate that even small locally produced travertine and liming materials can be used to increase crop production on acidic soils. In some areas of Rwanda, the use of 2-4 tonnes per hectare of local limestone or dolomite resources has proved to be agronomically effective, significantly enhancing the yield of wheat, beans and potatoes (Yamoah et al. 1992). Locally available carbonates are relatively common in many countries of sub-Saharan Africa and are well suited for small-scale mining and processing. There are several good sources of lime in Rwanda and some local production of this lime is currently done using artisanal technologies.

Despite this potential, there is limited use of these alternatives by smallholder farmers. However, the serious limiting factor to the widespread use of lime in Rwanda is the lack of awareness among farmers and the lack of appropriate recommended application rates. The efficiency of lime utilization for acid soils amelioration depends on its chemical interactions with soil particles and therefore its solubility (Huang et al., 2007). In Rwanda not much work has been done to characterize the solubility of these lime sources. This information is vital for lime selection and uses recommendations, and would spur farmer uptake of the liming technology. This research therefore aims to fill this gap and will focus on the evaluation of different local



lime sources for improved productivity of the acid soils and Irish potatoes in Burera district, Rwanda. The specific objectives of the study are: (i) to determine the effects of three local lime sources (Musanze travertine, Karongi travertine and Rusizi travertine) on soil properties and yield of Irish potatoes; (ii) to determine and compare the solubility of three main local lime sources with the recommended agricultural lime in Rwanda; (iii) to determine the appropriate rate of different local lime for increased Irish potato production and soil properties improvement in acidic soils.

### *Methodology*

The study will analyze local lime and soil samples, and evaluate their effect on yield of Irish potato. The experiment is designed as an RCBD with 48 treatments and two factors; the first factor is lime from four sources (Musanze travertine, Karongi travertine and Rusizi travertine and control), while the second factor is lime rate at four levels (0, 1.5, 3 and 4.5tons/ha).

The study is being carried out in Burera district, one of the Irish potatoes producing area of Rwanda. Burera district lies in the northern region of Rwanda where farming is done continuously on the hills and mountains; this region also has high rainfall and high rate of erosion. The average annual rainfall in Burera district is estimated at 1200 mm, mean monthly temperature is 13 °C, but temperatures as low as 5 °C is possible. The soils are classified in the USDA system as Oxisols (Franzel et al., 1985). Soils of the experimental station are typically acidic with the following characteristics: pH=4.7; exchangeable aluminum (Al) =2.9meq/100g, effective cation exchange capacity (ECEC) =7.1meq/100 g and Bray 1 Phosphorous (P) = 5.2ppm. The soil chemical and physical properties changes will be analyzed and Irish potato yield evaluated. The soil chemical



analyses (soil pH changes, soil organic C, total N, and available P, Ca and Mg content changes in soil solution, Fe and Al variability in soil solution, Mo and Zn availability in the soil, soil CEC, Exchangeable acidity ( $H^+$  and  $Al^{3+}$ ) and base saturation ( $Ca^{2+}$ ,  $Mg^{2+}$ ,  $K^+$  and  $Na^+$ ) and physical properties (soil moisture content, soil aggregate and soil texture), will be assayed by conventional methods. Data will be analyzed appropriately.

#### *Application of expected results*

The results from this study will be helpful to the smallholder potato farmers who possess small land parcels; lack adequate cash to afford inputs and face difficulties in managing soil fertility to carry out agricultural production sustainability. In addition, information generated will be used by the regional agricultural field staff and/or agricultural extension officers to advise farmers on better soil management. The awareness among potatoes farmers on the importance of applying lime and increased usage of the most effective local lime will reduce the production cost and consequently increase the yield and profitability of Irish. This will help to alleviate hunger and poverty among potato farmers in Rwanda.

## Mineral deficiency in production of banana seedlings

Abstract ID: leCAB011-415

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### ABSTRACT

#### *Objective*

Banana (*Musa* spp.) is one of the most important fruits for food security and income. It fruits all year round thus providing a continuous supply of food. Bananas require nutrients so as to give high yields and good quality fruits. They require nutrients high in Nitrogen (N) and Potassium (K). K is important for promoting early shooting and reduces the amount of time the fruit takes to mature while improving size of the fingers and quality. Therefore, soil fertility must be maintained by continuously replenishing the soil with nutrients in form of either organic or inorganic nutrients. Nitrogen deficiency is shown by small and pale green leaves. Potassium deficiency is shown by the leaves turning brown, curling and drying up starting with the older leaves, the midrib breaks at two thirds of the stem. Nutrients are important in all stages of growth of



bananas. This paper reports on observed nutritional deficiency on macropropagated banana seedlings.

*Methodology and results*

Seedling production was carried out in farmers' field by macropropagation technology. This is mass production of seedlings from the banana corm using sterile sawdust as the propagation medium. During transplanting of the sprouted suckers, the soil was mixed with organic manure. After 2 weeks, the bigger, faster growing seedlings started showing symptoms of nutrient deficiency, characterized by symptoms similar to those of K. This was successfully rectified by adding a fertilizer rich in K.

*Application of findings*

To ensure proper growth and development of plants, banana seedlings should be provided with nutrients having high N and K. Lack of these nutrients can lead to reduction of leaf area, decline of photosynthesis and constrained growth of plants. Farmers and nursery operators need to be familiarized with symptoms associated with nutrient deficiency and the appropriate ways of managing them.

*Key words*

Minerals, Seedlings, Macropropagation



# Effect of BNF, lime and inorganic fertilizer on soil nitrogen and grain yields of soybean-maize intercrop on acidic soils of Kakamega County

Research Abstract ID: IeCAB011-427

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## ABSTRACT

### *Objective*

Low crop responses to fertilizer application among small holder farms are common phenomena in degraded acidic soils of western Kenya. Soil acidity and continuous cropping have led to low legume and cereal yields and the majority of farmers are not aware of the soil acidity problem and the use of lime to solve this problem is minimal. Prohibitive and variable costs of mineral N and P fertilizers have discouraged their adequate use by the resource poor smallholder farmers. Moreover, continuous applications of DAP fertilizers with low addition of organic inputs and lime also aggravates the soil acidity problem. It is hypothesized that a combination of liming will improve soil



productivity by reducing soil acidity, improving soil P availability and crop yields in a soybean-maize mixed crop. The objectives of this study are to determine the effect of agricultural lime on soil properties, yields of soybean and maize, evaluate the effect of inoculation on BNF and yield of soybean, to quantify the dynamic changes in soil mineral N in the root zone (0-40cm) during plant growth period and relate it to maize yield and to calculate the gross returns of maize and soybean yields under different treatments.

### *Methodology*

The first season trial is being carried out at KARI Kakamega Research Station, to test BNF as a main plot factor, 2 lime levels as a sub-plot factor (0, 4t/ha) and 3 inorganic N levels as a sub-sub-plot factor (0, 25, 50Kg N/ha). Blanket application of P at 26kg P/ha and starter P at 30Kg P/ha on maize and beans respectively will be done. This will constitute 12 treatments combinations laid out as a split-split plot experiment and arranged as a randomized complete block design (RCBD) with 3 replicates.

The second season will be conducted on-farm within three farms in Mumias District. Partial Budget Analysis of different fertility treatments will be used to calculate the gross returns on maize and soybean crops. The treatments will include 2 lime levels (0, 2.5t/ha), 2 levels of p fertilizer (0,26kg P/ha) on maize crop and BNF laid out as a factorial experiment in RCBD. The data will be statistically analyzed using SAS (JMP 8.1 version) software. Turkey's honestly significant test will be used to separate the means. Regression and coefficient of correlation (r) between changes in soil mineral N and maize yield.



*Application of expected results*

The results obtained from this study will be used by extension staff and farmers to promote and implement interventions to increase production of soybean and maize to reduce food insecurity in Kenya.



## **Efficiency of integrated incorporation of manure and mineral fertilizers on maize yield in acidic soils of Beira Corridor, Mozambique**

Abstract ID: IeCAB011-428

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### **ABSTRACT**

#### *Objective*

Currently, Mozambique lags behind all other Southern and Eastern African countries in maize productivity. Soil nutrient depletion resulting in high soil acidity has been identified as a main cause of the declining crop yields. Maize yield in small scale farming systems in Beira Corridor can be increased by optimum utilization of mineral fertilizers and locally available organic resources through combined incorporation of mineral fertilizers and cattle manure. This study will assess the efficiency of manure and mineral fertilizers on maize yield in acidic soils of Nhamatanda and Barue districts, central region of Mozambique. The objectives are to (1) determine the effect of combined cattle manure and mineral fertilizers (CAN, TSP and DAP) on soil structure and maize yield; (2) to determine optimum rate of



manure-inorganic fertilizer interactions for increased fertilizer use efficiency; and (3) to assess the profitability of combined application of cattle manure and mineral fertilizers for small scale farmers.

### *Methodology*

The experiment consists of combination of four types of inorganic fertilizers and three levels of cattle manure. The total treatments to be tested are twelve and will be arranged in RCBD with four replications. Analysis of Variance (ANOVA) will be used for biophysical data analysis. Treatment means will be compared at probability  $p=0.05$  using Fischer's LSD and regression will be used to estimate the interaction between manure and inorganic fertilizers.

### *Application of expected results*

The study will: (i) contribute to identifying and recommending the sustainable fertilizer combination options that suit the study areas; (ii), assist in the progress of the governmental Action Plan for Food Production specifically in the process of cattle allocation to the small-scale farmers in the central region, and (iii) assist extension services providers to design effective and efficient programs and projects.

# Determination of effects of phosphorus sources and starter nitrogen on soil properties and soybean yield in Central highlands of Kenya

Abstract ID: IeCAB011-429

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## ABSTRACT

### *Objective*

Farmers in central highlands of Kenya are experiencing low soil fertility that is affecting land productivity and incomes. Their attempt to address the situation has been hampered by high fertilizer prices. By using legumes that fix atmospheric nitrogen farmers' cost of production can be minimized. To function effectively, legumes require more P for nitrogen fixation, which is inadequate in the central highland farms. Soybean has huge potential for improving soil fertility and socioeconomic benefits of agriculture. This study aims to: (1) determine the effect of sources of phosphorus on yields of soybean and on soil properties; (2) to assess the effect of these sources on soybean N fixation potential and soil N balance. The study will also assess the effect of applying starter N on soybean yields and their N fixation potential.



### *Methodology*

The study areas are Kigogo in Meru south district and Kamujine in Tigania District. The study purposes to enhance soybean production and improve soils through use of appropriate source of P and small amount of starter N. The main treatments are six sources of P with or without Nitrogen source. DAP is the reference input as it has both P and N. The experimental design is randomized complete block design (RCBD) with four replications. Data will be analyzed by Analysis of variance (ANOVA) and means separated using Tukey's Least Significant Difference (LSD) ( $p=0.05$ ).

### *Application of expected results*

The study results will contribute to existing body of knowledge on soybean production whose use may translate to improved soil fertility, higher yields, sustainable farming systems and better farm incomes for the farmers in the central highlands of Kenya.

## Effect of fertilizer types on the growth and yield of two cabbage varieties.

Abstract ID: IeCAB011-424

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### ABSTRACT

#### *Objectives*

To determine the effect of fertilizer types on the growth and yield of two cabbage (*Brassica oleracea* L.) varieties.

#### *Methodology and results*

The treatments involved 8 fertilizer types (NPK, neem, alesinloye organomineral, sunshine organomineral, sunshine organic, cassava peel compost, alesinloye organic and pacesetter organomineral fertilizers) applied at two rates (0 and 60kg/ha) each to two cabbage varieties (Copenhagen market and F1 milor). The treatments were laid out in randomized complete block design fitted into split plot with variety as the main plot factor and fertilizer types as sub plot factor, replicated three times. Data were collected on growth parameters and yield attributes of cabbage. The growth parameters and yield attributes were significantly influenced by fertilizer types and variety. At 12 weeks after sowing, Copenhagen market had higher mean number of leaves (17.50), taller plant height



(7.39cm) and better yield attributes over F1 milor. The highest growth parameters (number of leaves and plant height) were obtained from plant that received cassava peel compost in Copenhagen while NPK and neem produced the best in F1 milor. Organomineral fertilizers (sunshine, aleshinloye and pacesetter) gave the highest head length, diameter, and marketable yield in both varieties. The highest yield (34.8 t/ha) was recorded from plants treated with sunshine fortified fertilizer while control gave the least (14.8 t/ha).

#### *Conclusion and application of findings*

Organomineral fertilizers (pacesetter followed by sunshine and aleshinloye), compared with NPK (15:15:15) enhanced optimum yield of cabbage varieties. Copenhagen market produced better head yield than F1 milor with or without fertilizer therefore can be recommended as the better variety among the two in Ogbomoso, South West Nigeria.

#### **Key words**

*Brassica oleracea L, organomineral, mineral, organic, head yield*

## Study of the mineralogy of Africa's soils as a predictor of soil fertility

Research Abstract ID: IeCAB011-430

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### ABSTRACT

#### *Objective*

Methods for rapid estimation of soil properties are needed for quantitative assessment of land management problems. Soil health surveillance systems can be used to achieve information on soil functional properties (SFP) at fine spatial resolution across a wide range of environmental conditions and scales. A key challenge to their implementation is how to measure soil functional properties on large numbers of geo-referenced soil samples in a consistent and cost-effective way. To solve this problem, the Africa Soils Information Services (AfSIS) provides a statistical sampling framework, which employs spectral diagnostics - low cost, high throughput analytical techniques based on reflectance of electromagnetic radiation. The data generated by these high-throughput techniques can be treated as spectra and used as input to pedo-transfer functions for prediction of soil functional properties that are expensive or time-consuming to measure. Until now infrared spectroscopy has



been used as the key soil screening tool in soil health surveillance systems. However given the importance of soil mineralogy as a determinant of soil functional properties, and soil fertility and fertilizer response in particular, new developments in instrument capability for high- throughput X-ray diffraction (XRD) and steady improvements in mineral identification databases and software could provide a powerful complementary tool and open up new opportunities for quantitative determination of mineral phases on large sample numbers. The recent launch of bench-top XRD technology opens up the technology as a routine high throughput technique in soil science. Until now use of XRD has been largely confined to detailed analysis on small sample sets and the links between soil function and soil mineralogy have remained largely descriptive. This study is evaluating the ability of X-ray diffraction (XRD) technique to rapidly predict soil functional properties, and to develop pedo-transfer functions for Africa's soils.

### *Methodology*

This study will take advantage of the methods employed in the soil health component of the AfSIS project developed at the World Agro forestry Centre (ICRAF), and referred to as the Land Degradation Surveillance Framework (LDSF). In this work, the amounts of individual soil mineral phases and their distribution for ten sampling locations with a wide range of soil types in Africa will be measured, identified and quantified. A classification for Africa soil mineralogy in terms of weatherable and nutrient-rich soil minerals, and soil fertility potential will also be proposed. Relationships between soil mineralogy and conventional soil fertility variables will be investigated and XRD data on mineralogy will be combined with data from infrared





spectroscopy and that from conventional laboratory tests, which characterizes soil mineral and organic properties, to provide powerful diagnostic capabilities. Samples will be collected by a randomization of 10 sentinel locations stratified by climate and based on the LDSF sampling design.

*Key words*

Soil, spectral diagnostics, infrared spectroscopy, mineralogy, X-ray diffraction, pedo-transfer functions



## SECTION 5

# AGRICULTURAL EXTENSION

&

# ECONOMICS

## Adoption and impact of tobacco recommended varieties among smallholder farmers in Tabora region

Abstract ID: leCAB011-407

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### ABSTRACT

#### *Objective*

Adoption of technology is an imperative factor in economic development. Successful introduction of technology in the developing countries requires an understanding of the priorities and concerns of the smallholder farmers at the grassroots. Distinctively, this research examines the status of adoption of improved tobacco varieties that are recommended among smallholder farmers with a view to assessing the impact of tobacco production on household income in the region, identify factors affecting adoption and associated constraints.

#### *Methodology and results*



A survey approach was used to collect data from a sample of 160 tobacco farmers selected through multi-stage, purposive and random sampling techniques using structured questionnaires. Collected data was analyzed using descriptive statistics and logistic regression model which was used to determine the factors affecting the adoption of recommended varieties of tobacco. The results showed that farmers have responded appreciably to intervention programmes that promote the use of the recommended tobacco varieties with an adoption rate of 61.6%. Information flow from various tobacco companies was the significant factor influencing the decision of farmers to adopt the recommended varieties. Constraints in the adoption noted include poor germination of seeds, high demand of inputs (i.e. pesticides and fertilizers), unreliable availability of seeds and inadequate knowledge on tobacco production. The mean household income from tobacco production (4,232,415 Tshs per annum) was significantly higher than the mean income of other income sources cumulatively (211,333Tshs per annum) with an income advantage of 4,021,082Tshs. White gold and K51E were the most demanded tobacco varieties although currently these varieties are not readily available in the study area. With regard to the main constraints to adoption and adoption rate, it is recommended that farmers and local cooperative societies be offered support both internal and external in the form of technical advice and financial assistance, recruitment of more extension staffs with the necessary technical skills on tobacco production, and further research especially in the area of tobacco breeding. This will ensure development of tobacco varieties which are socially acceptable and affordable to the tobacco farming communities.

*Application of findings*



The study concluded that tobacco production has brought significant improvement in household income in the study area.

*Key words*

Adoption, Impact, logistic regression, tobacco varieties



## Banana farming and rural livelihoods in central and eastern regions, Kenya

Abstract ID: leCAB011-417

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### ABSTRACT

#### *Objective*

Banana (*Musa spp.*) is an important crop in the world and has very high nutritional value. The crop serves as food, income resource; animal feed in addition to its environmental benefits. In Kenya the crop is mostly grown and managed by small scale farmers in rural areas. It has provided income and substance for both rural and urban populations. Bananas are cultivated in a wide range of ecological zones. The fact that after establishment harvesting of the crop continues throughout the year adds to its importance as a food security crop. In addition, bananas are suitable for intercropping making it more attractive to small scale farmers who often grow different crops at the same time. This study reports on banana



production systems and the crops contribution to livelihoods in the study area.

### *Methodology and results*

A survey was conducted in July 2010 in six districts: Imenti South, Meru Central, Embu East, Kirinyanga, Mathioya and Murang'a from Central and Eastern regions of Kenya. Results showed that majority of rural households >80% only cultivate few banana plants and 100% of the households intercrop. For more than 90% of the farmers' banana was not the primary crop. Over 80% banana production in the selected districts is rain-fed except in Imenti South where production is almost entirely under irrigation. Pests and diseases, drought, limited land and poor markets were noted to be among the leading challenges affecting banana production in the study areas.

### *Application of findings*

Besides being a source of food, banana production has improved the rural livelihood since surplus production provides a reliable source of income. However the crop faces numerous challenges that require intervention to ensure sustainable production.

### *Key words*

Banana, rural livelihood, priority



# Challenges of livestock projects implementation by communities: The case of Meru goat breeding project

Abstract ID: leCAB011-420

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## ABSTRACT

### *Objective*

A study on a community-based goat-breeding initiative was carried out to investigate the challenges faced in implementation. The objective was to identify and document handicaps in various management aspects with a view of making recommendations for improved performance and to guide similar future projects aimed at poverty reduction. The study was motivated by concerns raised by stakeholders on the declining project performance after take-over by the community, which was a threat to sustainability of the initiative that had started contributing to increased incomes locally and also stimulated increased demand for dairy goats from the same foci throughout the country.

### *Methodology and results*

Primary data were collected through a descriptive survey that involved administration of structured questionnaires to selected respondents. The sample size was derived using the Fischer's





formula while the respondents were selected through a random sampling method. The collected data was edited, coded, and analyzed using the Statistical Package for Social Sciences (SPSS). Descriptive statistics were used to summarize the data through frequency distributions. The study established that though a community can democratically elect its own leaders, it could not ensure delivery of the expected outputs by those leaders. The Meru dairy goat project was found to face leadership, financial management, and information communication challenges.

#### *Application of findings*

The study recommended that the government develops a policy to ensure sustainability of rural development community-based livestock projects; and the putting in place of support structures for monitoring, supervision and backstopping as necessary.

#### *Key words*

Community project management, dairy goats, Meru

# The impact of marketing factors on profitability of smallholder dairy farmers in Nyeri County

Abstract ID: leCAB011-421

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## ABSTRACT

### *Objective*

Dairy farmers in Nyeri County are realizing different profit margins yet they are within the same ecological zones and facing almost similar production constraints. The objective of this study was to identify factors within milk marketing chain that contributes to low profitability by small scale dairy farmers in the area.

### *Methodology and results*

The research focused on causes of profit differentials amongst small scale dairy farmers, hence marketing chains were chosen as the unit of analysis. The study was exploratory, and used both qualitative and quantitative methods including a document review, structured questionnaire, and focus groups to gather data. The use of multiple methodologies necessitated triangulation to improve the validity of the findings, and to enable greater inferences from the results.

The components of the analysis included: (i) Functional analysis to identify the agents involved in the milk market chain



and their roles; (ii) Flow analysis to provide insights into the different sub-channels and the flow of the milk through the different channels; (iii) Technical analysis to provide information on the constraints and technical gaps at all the levels in the marketing chain; (iv) Micro analysis at operator level to provide a detailed description of the activity at each level in the chain; and (v) analysis of the Economic and social impact of the chain to give the value of the chain from the perspective of the importance of this sector in the economy. This analysis highlighted the total number of households dependent on dairy, the employment and total value generated, distribution of the value generated among the participants, and the degree of vulnerability of the households in this chain.

The study established that a total of eight milk marketing chains exist in the area. Even though 86 % of respondents stated highest returns as their main reason of joining any marketing chain, 59 % have remained in the same marketing chain for over five years, with 51% having alternative buyers while 49% are bound to a particular buyer. Information flow between buyers and farmers was quite low with 66% of the respondents meeting only once per year.

A total of 10 financial institutions operate in the area but 90% of the respondents' main source of investment is from sales of their produce. A total of 85 % affirmed the need for additional funding but only 56% of them have approached financial institution with the rest afraid of repayment rates and risk involved. The result of chi-square test of significance ( $X^2 = 37.25$ ;  $df 28$ ;  $p 0.113$ ) indicated that there was a significant relationship between farmer age and choice of market chain. The relationship between farmer education and choice of



marketing chain was also found to be significant ( $X^2 = 32.97$ ;  $df=35$ ;  $p = 0.566$ ).

It was established that differences in relative performance are due to differential transaction costs stemming from asymmetric access to assets and information, differences in choice of marketing channel, farm gate prices or differences in environmental and human social factors as well as management of respective market chains.

#### *Application of findings*

Farm gate prices can be improved if information flow between farmers and buyers can be improved and competition between buyers improved. When farmers individually sell their milk to many buyers they will not benefit from economies of scale. However, big marketing groups tend to cloud out competitors and eventually negatively impact on the farmers.

#### *Key words*

Dairy farming, marketing, profitability, Nyeri

## Characterization of dairy cow farms in the eastern central highlands of Kenya

Abstract ID: IeCAB011-419

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### ABSTRACT

#### *Objective*

A study was carried out to characterize dairy cow farms in the eastern central highlands of Kenya. The objective was to assess and document practices of the dairy cow farmer and farm characteristics in the study area. The study was motivated by concerns raised by stakeholders and particularly policy makers on the country's inability to produce milk that is affordable locally and able to sustainably penetrate the readily available regional market.

#### *Methodology and results*

Primary data was collected through a cross-sectional survey by administering both questionnaires and pre-determined checklists to sampled respondent farmers and other identified stakeholders, respectively. Secondary data was collected from



existing reports relevant to the study. A sample size of 135 farmer respondents was derived using the Fischer's formula, and these were randomly selected with the help of livestock extension officers. Data was analyzed using the statistical package for social sciences (SPSS) Version 11.5.

Results indicated that dairy cow farmers are mostly smallholders; engage in mixed livestock-crop farming; a few engage in retail businesses, or are in salaried employment. A total of 55.6% of farmers had only one cow lactating. Friesians, Ayrshires, and their crosses were the main breeds kept. These animals received relatively low levels of both roughage and concentrate feeds, as well as mineral supplements.

About 60% of the farmers had land sizes less than 2 acres. Labor per cow per day was relatively low, at an average of 2.2 hours. Only about a quarter of the farmers owned a chaff-cutter, though its ownership had no apparent impact on productivity. The average milk yield per cow was 8.85Kg, and 14.32 Kg per farm, selling at an average price of Ksh.24.27/Kg. The cows had an average of 588 days calving interval. Engaging in dairying was ranked first as a source of household income when compared to other enterprises.

Most farmers indicated longterm commitment to dairy cattle farming. The average age of the farmers was 36-45 years; 77% of them had received either primary or secondary school level of formal education, with only 32.6% having received further specialized training in dairy cow management. Farmers who were members of groups were generally performing poorer than non-members. High costs of breeding stock and animal feeds were identified as the most serious constraints. Other constraints were limited land size, labor resources and inconsistent quality of inputs, which they could not control.



*Application of findings*

Based on the results, it is recommended that the farmers should specialize in what they can do best, rather than engage in a multiplicity of farm activities. A new land policy should also be developed to address land consolidation and utilization. Land productivity through research on high yielding fodder is proposed as a short term measure.

*Key words*

Characterization, smallholder, calving interval, challenges

## SECTION 3:

### *additional abstracts*

# CROP PROTECTION





# Susceptibility of four mango varieties to the Africa Invader Fly, *Bactrocera invadens* Drew, Tsuruta & White (Diptera: Tephritidae) in Ghana

Abstract ID: IeCAB011-433

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## ABSTRACT

### Objectives

The susceptibility of four mango varieties (Kent, Keith, Palmer and Haden) that are economically important in Ghana to attack by *Bactrocera invadens* was assessed through a series of laboratory-based choice and no-choice experiments. Some fruit quality parameters and the developmental periods of immature stages of flies in the varieties were also determined.



### **Methodology and results**

Susceptibility was determined by counting and comparing the number of puparia recovered from the different varieties after exposure to the flies in cages. Cv Kent was found to be the most susceptible, followed by cv. Palmer, Haden and Keith. Flies took significantly longer periods to complete development on the least susceptible variety (Keith) ( $25.53 \pm 2.3$  days), than on the most susceptible variety (Kent) ( $19 \pm 2.3$  days). Significant differences ( $P \leq 0.05$ ) were also observed in the peel thickness and firmness, percent titratable acidity (%TA) and total soluble solids (TSS) of the four varieties.

### **Application of findings**

The differences observed in varietal susceptibility suggest that potentials exist for further genetic improvement to develop mango varieties that are more tolerant to *B. invadens*. Varietal differences could also be incorporated into an integrated management strategy against the pest.

### **Key words**

Mango, *Bactrocera invadens*, fruit flies, Ghana.



# The effect of fruit fly larval density on some quality parameters of mango

Abstract ID: IeCAB011-434

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## ABSTRACT

### Objective

Three varieties of mango, Jaffna, Palmer and Kent were infested with different first instar larval densities (10, 20 and 30) of the invasive fruit fly species, *Bactrocera invadens* to determine the effect of each of the densities on three fruit quality parameters.

### Methodology and results



The parameters assessed included Total soluble solid (TSS), Percentage titratable acidity (% T.A) and pH. The shelf-life was determined as the period from the first day of treatment until signs of damage were observed. TSS and pH showed decreasing trends while % T.A. increased over time. In the controlled treatments where fruits were either held intact or punctured but with no introduction of larvae, there was an increase in pH and TSS and a decrease in %T.A. with regard to shelf-life, the three varieties infested with 10 larvae lasted up to 6 days, while fruits infested with 20 and 30 larvae lasted for 3 days. The shelf life of the controlled treatments for all the varieties lasted till the 15<sup>th</sup> day.

### **Application of findings**

These findings have potential applications in postharvest treatment strategies for mangoes.

### **Key words**

*Bactrocera invadens*, larval infestation, Total soluble solid, Percentage titratable acidity, pH

# Species composition of fruit flies from mango orchards in three ecological zones in Ghana

Abstract ID: IeCAB011-435

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## ABSTRACT

### Objective

This study was carried out to assess the range of fruit fly species from mango orchards in three agro-ecological zones in Ghana (Coastal Savanna (CS), the Transitional (TT) and Guinea Savanna (GS) zones) where mango is commercially grown.

### Methodology and results

A trapping exercise was undertaken for two successive fruiting seasons in 2009 and 2010, using traps baited with



three different attractants (Methyl eugenol (ME), Terpinyl acetate (TA) and Trimedlure (TML). A total of 39, 011 fruit flies were collected during the period, with 9,398 (24.1%) and 29,613 (75.9%) flies collected during the 2009 and 2010 seasons, respectively. Five fly species (in two genera), *Bactrocera invadens*, *B. cucurbitae*, *Ceratitis cosyra*, *C. ditissima* and *C. capitata* were identified. The highest relative fly densities (number of flies per trap per day, F/T/D) ranged from 1.86-31.40 and 16.25-121.39 for the 2009 and 2010 seasons, respectively. The most abundant flies in all six localities of the three zones were *B. invadens*, followed by *C. cosyra* and *C. capitata*. Even though all three zones had three species in common, the proportions varied.

### **Application of findings**

These findings have applications in formulating management strategies to mitigate the fruit fly menace in Ghana.

### **Key words**

Species range, agro-ecological zones, fruit flies, attractants, relative fly density, Ghana



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