UNIVERSITY OF EMBU

1st Annual Postgraduate Seminar

BOOK OF ABSTRACTS & PROGRAMME

25th May, 2017

Welcome message from the Director, Board of Postgraduate Studies

It is with great pleasure that I welcome you to the First Annual Postgraduate Seminar at the University of Embu (UoEm). It is envisaged that this Seminar will be held every year and will form part of the traditions of the postgraduate studies at UoEm. Research forms an important component of postgraduate studies in any university. Worldwide, most of the research in universities is done by postgraduate students. Since its inception, UoEm has made every effort to promote postgraduate research. Over the last three years, various activities aimed at uplifting the standard of postgraduate research have been held including training on proposal and thesis writing, E-resources and publishing. In this regard, Board of Postgraduate Studies remains committed to its motto of "*Transforming postgraduate students into scholars*".

Karibu!

Prof. Nancy Budambula
Director, Board of Postgraduate Studies

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SEMINAR PROGRAMME

THURSDAY, 25TH MAY 2017

TIME	ACTIVITY	ACTION BY
8:00 a.m. – 8:30 a.m.	Arrival and Registration - BPS Secretariat	
	OPENING SESSION	
8:30 a.m. – 8:35 a.m.	Opening Prayer	**Dr. Fredrick Njoka**
	Introduction and Announcements	**Prof. Nancy Budambula,** *Director, Board of Postgraduate Studies*
8:35 a.m. – 8:45 a.m.	Remarks	**Prof. Kiplagat Kotut,** *Deputy Vice-Chancellor, (Academics, Research & Extension), University of Embu*
8.45 a.m. – 9.00 a.m.	Remarks and Official Opening	**Prof. Daniel Mugendi,** *Vice-Chancellor, University of Embu*
9.00 a.m. – 10.30 a.m.	Presentations	
10:30 a.m. – 11:00 a.m.	**HEALTH BREAK**	
11.00 a.m. – 1.00 p.m.	Presentations	
1.00 p.m. – 2.00 p.m.	**HEALTH BREAK**	
2.00 p.m. – 3.30 p.m.	Presentations	
3:30 p.m. – 3:45 p.m.	Plenary	
3:45 p.m. – 3:55 p.m.	Analysis and Synthesis	**Dr. Romano Mwirichia** *Director Research and Extension*
3:55 p.m. – 4:00 p.m.	Closing Prayer	**Student**
4:00 p.m.	**HEALTH BREAK**	
GUEST LEAVE AT OWN PLEASURE		

ABSTRACTS

1. Performance ranking on mathematics teaching and learning: a case of secondary schools in Embu County, Kenya

Samson Muriithi

Performance ranking in Kenyan education system has been the norm since 1940, where students and schools were ranked based on their mean score in high stakes tests. Over the last two years, however, there has been intense lobbying by various stakeholders with some, on the one hand, advocating for the discontinuation of this practice of performance ranking, and the others backing its retention. Several research studies have shown that ranking of schools and students exclusively on the basis of standardized national examinations is unfair, and negatively affects students' academic performance. The bulk of these studies, however, have been conducted in the West. There have been very few studies investigating the effects of performance ranking on academic performance in such developing countries as Kenya, yet this phenomenon of ranking is alive and well in these countries. This study seeks to investigate effects of performance ranking on mathematics teaching and learning in secondary schools in Embu County, Kenya. The participants for the study are mathematics teachers and students in secondary schools in Embu County. The study adopts a mixed method research design. Data are being collected through one-on-one semi-structured interviews, focus group discussions, and questionnaires. Analysis of quantitative data was done using chi-square, with frequency charts generated using SPSS used to present findings. Cross tabulation will be used to test variation of responses according to gender. This presentation is based on the preliminary findings of the quantitative data which shows that performance ranking encourages positive competition among learners, promotes the practice of private tuition and encourages examination malpractices among students, teachers and schools.

***Keywords**: Performance ranking, mathematics teaching and learning, Embu, Kenya*

2. Student social identity development and academic achievement: A case of selected universities in Kenya.

Ann Gathigia Waruita

University students identify themselves and are identified by others as members of the social community within the university. The development of social identity is a process enhanced by engagement with the various activities and components of the university. This presentation will be based on preliminary findings of an ongoing qualitative study investigating the role of student social identity in creating the university image among University students in Kenya. The study adopted a qualitative research design. The study was conducted in four Universities; two public universities and two private universities. The target population for the study included all the fourth year students in the selected universities. Data was collected by use of interviews. The qualitative data collected was analyzed manually by first transcribing the gathered information. This was followed by development of codes and finally categorizing the codes into themes. The emerging themes on the analysis of the data show that student's identification with the university can be linked to student satisfaction. Students who were satisfied with the university were found to engage in various behaviors that benefited them and the university, such as engaging in co-curricular activities as well as positively interacting with the institution. In addition, the quality of relationships between students and their lecturers is largely determined by the class size. Student to student relationship on the other hand is determined by the student's level of interaction. The rules and regulations of the universities shape the students social identity. In some cases, students feel the rules are humane and they identify and align themselves to the rules. In other cases, students view the rules as rigid and they just comply and conform to avoid problems with the university. The conforming or non-conforming to the rules by the students dictates how they view their university.

Keywords*: social identity, engagement, identity development, university image, Kenya*

3. Effect of technology and information systems on revenue collection by the county government of Embu, Kenya

Harriet Karimi Gituma

Improvement of revenue collection in counties is the key to meeting their financial obligations leading to realization of their mandate to offer quality and timely services to the residents, the demand for which may exceed the available resources. Many counties have adequate revenue bases to finance the current level of services, but revenue collection levels are often low. According to reports by the Controller of Budget, revenue collection by 14 counties in Kenya fell below amounts generated by the former local authorities under their respective jurisdictions during the 2013/2014 financial year. In addition, the analysis showed that most counties failed to meet their local revenue collection targets. Several counties have been slammed with labour strikes and go-slows among their workforce due to delayed salaries and/or poor remuneration of employees working under the county governments. The purpose of this study was to establish the effect of technology and information systems on revenue collection by County governments in Kenya. The study was guided by technology acceptance theory. The study employed a descriptive survey research design. The target population of the study comprises all county government employees in Kenya. Purposive sampling and simple random sampling was used to select 102 respondents for the study. Content Validity was used as a validity test while Cronbach alpha coefficient was used for reliability test where a reliability coefficient of 0.7 was obtained and accepted. Data was collected using self-administered semi-structured questionnaires. Overall; it was found that technology and information systems had the effect on revenue collection. The study recommends a revision of the County's Act and the integration of information systems in the management activities of Embu County. The findings of this study shall be beneficial to county governments as they were in a position to establish corrective measures and formulate policies to harness revenue collection.

Keywords*: technology and information system, Revenue collection, County Governments in Embu, Kenya.*

4. Performance appraisal of employee performance: A case of senior management in public teacher training colleges in Kenya.

Justine Miriti Majau

Efficient service delivery to citizens, necessitated management reforms like performance appraisal (PA) being instituted by the government in public institutions. Study aimed to evaluate the effect of PA on senior management employee's performance in Public Teacher Training Colleges (PTTCs) in Kenya. The study employed a mixed method research design. The target population was 2448 administrators, senior, and middle level appraised employees from PTTCs. The sample size was selected using stratified random sampling. Data was collected from 556 respondents including 234 employees who appraise and are appraised and 322 appraisee's. Questionnaires, interview guides and checklists were used in data collection. The validity of the instruments was established through piloting and expert opinions. Reliability of research instruments was tested in a pilot study through test-retest technique. A Pearson's correlation coefficient of 0.714 was considered reliable. Data was analysed using descriptive statistics and processed using the SPSS Version 17 Scomputer programme. The data analysed indicated that PA had a 74.6% impact on achievement of performance targets among employees, although 21.8% of the employees were concerned by the social distance level between the appraiser and the appraisee. As a result 81.2% of the employees engaged in various programmes to reduce the social distance level or acquire skills in order to be effective in achieving performance targets. Despite 61.2% of the respondents viewing PA as unnecessary monitoring tool, departments and staff who have achieved their targets recognise the appraisal method as a motivating factor. PA facilitated administrators to identify training needs among the staff for effective performance. The results of this study highlights the importance of PA in achievement of targets, enhancing employee motivation, enhancing employee personal development and in identifying training needs among employees. The results indicate that there is need for a more refined policy on PA based on its diverse role.

Keywords*: Appraisers, Appraisee, Performance appraisal (PA), Kenya*

5. Diversity and structure of prokaryotic communities within organic and conventional farming systems in central highlands of Kenya

Edward Nderitu Karanja

Soil microbial communities play a critical role in global carbon and nitrogen cycles either through production and consumption of greenhouse emission in soils or availing nutrients present in soil to plants. Anthropogenic activities such as the conversion of forested land to agricultural use as well as the land use systems precipitate changes in soil microbial communities diversity and function in different ways. For example, it has been hypothesized that conventional farming system undermine diversity and function of soil microbial communities unlike organic farming system. Our understanding of soil microbial community diversity and function is limited due to the fact that over 99% of microorganisms in the environment cannot be cultured by standard techniques. This uncultivable diversity play roles that are yet to be understood. Culture independent methods have in the recent years helped us understand microbial genetic diversity, structure and ecological roles within ecosystems. In this study, illumina sequencing and analysis of amplicons of both total community 16S rDNA and 16S rRNA cDNA were used to determine the diversity and structure of prokaryotic communities within the long term experiment trial sites in central highlands of Kenya. Preliminary results showed comparable profiles of bacterial and archaeal communities using 16S rDNA and 16S rRNA cDNA derived datasets. Bacterial groups were the most dominant within both datasets where at phylum level, *Proteobacteria* was the most predominant phylum with a relative abundance between 19.46 - 62.17% and 17.57 - 53.29% within the Thika and Chuka sites respectively. In comparing prokaryotic diversity between treatments, active microbial diversity (16S rRNA cDNA) was found to be higher in organic high treatment. Other major phyla that scored high relative abundance were; *Actinobacteria* (5.28% conventional high and 30.06% organic high treatment) at Chuka and Firmicutes, (2.49% conventional high and 19.32% organic high treatment) at Thika site. In terms of prokaryotic species richness, Thika organic low was found to be the richest treatment with 34 taxa. This would be attributed to soil management practices and soil chemical characteristics especially carbon, nitrogen, zinc and manganese levels that were significantly high in organic treatment soil.

***Keywords**: community structure, microbial diversity, soil, conventional farming, organic farming*

6. Performance contracting and employee service delivery at Kirinyaga University, Kenya

Petronilla Serebwa Shivachi

The potential to increase service performance and delivery through performance contracting have seen accelerated effort in research in this relatively new concept of management in Kenya. Most studies have focused on performance management, performance measurement, commitment, and target meeting. The research sort to understand effects of performance contracting on employee service delivery at Kirinyaga University. The study adopted descriptive cross-sectional research design. The study population was 272 staff members of Kirinyaga University. Primary data was collected using a structured questionnaire that included both closed and open-ended questions. Secondary data was collected from journals. Pilot study was conducted in order to determine validity and reliability of research instruments. The Statistical Package for Social Science package was used in the data analysis. Descriptive statistical tools including the mean, mode standard deviation, and variance were used to analyze qualitative data. Inferential statistics was done by use of correlation and multiple linear regression analysis in order to establish the relationship between independent variable and the dependent variable. Analyzed data was presented inform of frequency tables, charts and graphs. The results revealed that performance contacting parameters significantly ($t = 3.407$, $p < 0.05$) affected service delivery of the University. It was also revealed that target implementation significantly ($t = 4.313$, $p < 0.05$) influenced service delivery. However, it was established that target setting ($t= 1.816$, $p<0.05$), and, monitoring and evaluation ($t=0.617$, $p<0.05$) did not significantly influence service delivery at the Kirinyaga University. In conclusion, proper target setting, monitoring and evaluation, and target implementation are necessary in achieving employees and organizations' goals as well as satisfactory delivery of services to customers.

Keywords: *Performance Contracting, Target Setting, Target Implementation, Target Evaluation, Service Delivery, Kirinyaga University.*

7. Pyramiding resistance genes for major bean diseases occurring in western Kenya through marker assisted selection.

Allan Shivachi

Common bean production is severely constrained by anthracnose, common bacterial blight, bean common mosaic and necrotic viruses. The seed borne nature and high pathogen variability complicates the management of these diseases. This study therefore, purposed to phenotype and genotype sources of resistance to these diseases and pyramid resistant genes into a common background aided by marker assisted selection (MAS). Parental genotypes; G2333, VAX 3 and MCM 2001 were phenotyped for their resistance to anthracnose, CBB and BCM/NV respectively in screen house at KALRO and disease severity scored on CIAT 9 – point scale. Genomic DNA was extracted using FTA method followed by PCR amplification using SCAR marker, and PCR product separated on agarose gel followed by ethidium staining. Parallel backcrossing scheme was used to combine the resistance genes into a common background with market-class qualities (KKCAL-194) aided by linked markers. The donor parents evaluated indicated that they carried the required resistance for CBB, anthracnose, BCM/NV and thus, could be used as donors for resistance in dry bean breeding programmes. The parents carrying resistance genes also have good combining ability with the market-class genotype to be improved for resistance to the diseases. Therefore, the development of varieties with broad resistance would offer a lasting solution to management of these problematic diseases.

Keywords: *Dry beans, anthracnose, common bacterial blight, bean common mosaic and necrotic virus, gene pyramid, MAS.*

8. The effects of different fertilizer combinations on napier grass (Pennisetum purpureum) productivity in Embu County, Kenya

Bridget Wanjiru Ndwiga

Declining soil fertility is one of the major factors affecting crop production including pastures and is closely linked to declining agricultural productivity. It has been identified as the root cause of a declining *per capita* food production. The objective of the study was to investigate the effect of different combinations of fertilizers on Napier grass (*Pennisetum purpureum*) productivity. The experimental design was a Randomized Complete Block Design (RCBD) with three replicates per treatment. The treatments were as follows: Di Ammonium Phosphate (DAP); rabbit manure; rabbit manure and rabbit urine; DAP and Calcium Ammonium Nitrate (CAN); DAP and rabbit urine, Zero fertilizer and Conventional method. The Napier was established at the onset of the season 2015 using "Tumbukiza" method with pits measuring 90 cm length by 60 cm width by 60 cm breadth. The experiment was monitored for two seasons. Each pit was planted using 5 plants (canes containing 3 nodes). Data that was collected included: plant height, number of nodes, chlorophyll content, fresh and dry matter weight determined. Combination of DAP and rabbit urine fertilizer had the highest recorded levels of plant height and number of nodes. Plant height treatment means ranged between 85.21cm to 94.76 cm while number of nodes treatment means ranged between 3 to 5. Rabbit manure and Rabbit urine combinations had highest dry matter levels, the DM ranged between 0.15 t/ha to 1.21 t/ha across all the treatments. Soils where Rabbit urine was used as a top dress had higher increased levels of nitrogen and potassium while from where CAN was used there were high levels of Phosphorous. The most cost effective fertilizer combination on Napier production in Embu County was found to be DAP and rabbit urine combinations. Effect of different fertilizer combination had a significant effect on the dry matter yield of Napier grass. This study can help improve extension service through provision of an appropriate package to small holder farmers in increasing their production cost effectively.

Keywords: *Tunbukiza, Organic & inorganic fertilizer, Rabbit wastes*

9. Assessment of financial factors that affect liquidity of savings and credit cooperative societies in Kirinyaga County, Kenya

John Mwangi Githaka

Savings and Credit Co-operative Societies (SACCOs) are quasi financial institutions that mobilize savings, provide loans as well as other products to their members. Liquidity is considered as one of the serious concern and challenge for the modern era SACCOs. A SACCO having good asset quality, strong earnings and sufficient capital may fail if it is not maintaining adequate liquidity. The objective of the study was to assess the effect of financial factors on liquidity of Savings and Credit Co-operatives Societies in Kirinyaga County, Kenya. Descriptive survey research design was used in this study. The target population consisted of all the 60 registered SACCOs in Kirinyaga County from which a sample size of 18 SACCOs was drawn. The study employed stratified random sampling technique. Primary data was collected by use of self-administered semi-structured questionnaires while secondary data was collected using audited financial statements of the SACCOs and regulator (SASRA). The data was analyzed using SPSS with the help of descriptive statistics and inferential statistics tools. The study findings will be of great importance to the SACCO management to formulate proper policies. Academicians and future scholars will get literature basis. The study will also help the regulator and the government to improve on the framework for regulation of SACCO's. The study indicated that the effect of liquidity management, net cash flows, credit lending and investment in non-core business on liquidity of SACCOs was positive and significant. The study concluded that it was critical for SACCOs to have adequate liquidity in order to ensure that they meet short term maturing obligations. The SACCO management must put in place financial strategies to ensure that liquidity is effectively managed on a regular and timely basis and that appropriate policies and procedures are established to limit and control material sources of liquidity risk.

Keywords: *liquidity, liquidity management, net cash flows, credit lending, non-core business, savings and credit co-operative societies (SACCOs)*

10. Performance of indigenous dairy goat up-grades in Manyatta and Runyenjes sub counties, Embu County

Augustus Musili Kiema

A study was carried out in Manyatta and Runyenjes Sub Counties, to determine performances of filial upgrades realized from cross breeding indigenous goats and German alpine buck. Upgrades milk yield performance has never been evaluated, hence no available data to enable farmers make decisions on the best dairy goat upgrade to adapt. 236 filials performance data was extracted from recording cards provided by 64 farmers. Parameters considered included daily milk yield, lactation length, age at first kidding, birth weight and weaning weight. Data was analyzed using Analysis of Variance and mean milk yields separated using least significant difference at 5% level of confidence. Results showed significant differences in milk yield among upgrades ($p<0.0001$). F_5 had higher milk production per lactation (740±57.4 litres in Manyatta and 660±40.6 litres in Runyenjes). Manyatta had significantly higher milk yield in all filial types (452±20.6 lit/lactation) compared to Runyenjes 382±15.7 lit/lactation. A high positive correlation between milk yield per day and weaning weight ($r = 0.603$, $p=0.0001$) and lactation length ($r=0.395$, $p=0.0001$) was observed. Filials mean birth and weaning weight slightly higher in Manyatta (3.12 ± 0.015, 9.86 ±0.083 kg respectively) compared to Runyenjes (3.04 ± 0.015 and 9.12 kg respectively). Significantly high difference in lactation yield ($p=0.0001$) in high potential zone (530 ±24.4) compared to medium potential zone (426±15.7) was noted. Mean birth weight in high potential area was significantly higher (3.11±0.015 kg) compared to medium zone (3.05 ±0.015kg) ($p=0.024$). The superior performance of higher filial genotypes supports the aim of the upgrading program in using Alpine buck to upgrade local goats in Embu County. Information on upgrade milk performance is expected to assist farmers in selection of best filial generation for milk production stock.

Keywords: *Goats, Filials, Milk yield*

11. Strategic determinants of intrapreneurial orientation at the Kenya Institute of Management, Kenya

Zephania Rwanda Mbaka

The global business environment is today faced with uncertainty and various complexities. While it is an uphill task to initiate the idea of intrapreneurship within organizations, ignoring the idea is suicidal to the survival of firms. In the quest to address the causation for intrapreneurial orientation in organisations, the present study investigated five independent variables namely; management support, work discretion, rewarding intrapreneurial efforts, time availability and organizational boundaries against one dependent variable (intrapreneurial orientation). The study, therefore, sought to address the strategic determinants of intrapreneurial orientation at the Kenya Institute of Management. The main objective of the study was be to establish the strategic determinants of intrapreneurial orientation at the Kenya institute of management. The study population comprised of employees with strategic roles at the Kenya Institute of Management. Census survey was used in the study, data was gathered from every member of the population. Primary data was collected through a structured questionnaire measured on a five point Likert type scale. Inferential analysis was performed to determine the relationship among the variables. The study conducted correlation analysis to test the strength of association between the research variables using Pearson's Product Moment Correlation Coefficient (r) statistical tool to help arrive at conclusions. The study established that intrapreneurial orientation is largely composed of three indicators. These are; proactiveness, innovation and risk taking. The study, also, established that the main strategic determinants of IO are; management support, rewarding intrapreneurial effort, work discretion, time availability and organizational boundaries. The findings agreed with previous study results. From the regression model, these five determinants contribute 61% of IO at KIM. Based on the findings of the study, it was concluded that Management support, work discretion, rewarding intrapreneurial efforts and time availability are the key determinants of intrapreneurial orientation in organizations.

Keywords: *Entrepreneurial orientation, intrapreneurship, entrepreneurship, strategic determinants, competitive advantage.*

12. Product innovations and financial performance of savings and credit cooperatives societies in Kirinyaga County, Kenya

Francis Kimani Ngure

Product innovations are crucial to sustain organizations' financial performance and raise their competitive strengths. SACCOS are the main drivers of economic and social development in rural areas of developing countries. In Kenya 81% of the population rely on the SACCOs to access financial services. However the use of SACCOs by Kenyans as a financial service provider has been declining. The SACCOs are faced with challenges of survival due to decline of members. The decline is attributed to the competition from banks which have embraced financial innovations. The study therefore investigated the effect of product innovations on financial performance of SACCOs in Kenya. The study adopted cross sectional descriptive survey research design. The target population was 60 SACCOs registered by SASRA to operate in Kirinyaga County. Stratified simple random sampling technique was used to obtain the sample size of fifty two SACCOs for the study. Primary data was collected using self-administered questionnaires while secondary data was obtained from audited financial statements. Primary and secondary data was analyzed using SPSS. The findings of the study revealed that product innovations were positively correlated to financial performance. The study will be of great importance to Policy maker in developing SACCO's financial innovations regulatory framework. SACCO Managers will be able to adopt the product innovations that will improve financial performance of the SACCOs and their competitiveness. The study will further enlighten researchers with relevant information regarding product innovations. The study recommends that SACCOs should embrace product innovations in order to improve their financial performance. SACCOs should therefore introduce new deposit accounts in order to increase the amount of deposits. The SACCOs should also introduce credit cards and debit cards in order to increase their revenue. Similarly, the SACCOs should introduce electronic fund transfer since they have a positive effect of increasing commission fee based income.

Keywords: *Financial Innovations, Product Innovations, Financial Performance, Savings and Credit Co-operative Societies (SACCOs)*

13. Investigation on alternative and locally viable method for extraction of copper from their ores using hydrazine prepared from chicken waste

Peterson Mutembei Kugeria

In Kenya, mineral data shows several deposits of copper minerals yet the country continues to import copper products from other countries. Currently there are no locally established copper extraction industries despite having viable deposits. Copper minerals in Tharaka Nithi County, for example, contain mineral composition in excess of 4 % CuO. These minerals have never been earmarked for extraction because the common methods known for extraction are expensive. The objective of the study was to investigate on alternative and localized viable method for extraction of copper from their ores. The method yielded over 32 % by mass of copper from the ores. The extract had over 60 % by mass of copper. The results show that the *in situ* prepared hydrazine from chicken waste is a viable method of copper extraction.

Keywords: *Hydrazine from chicken waste, copper extraction.*

14. Organizational factors that influence implementation of strategic plans in private secondary schools in Nairobi County, Kenya.

Abel Nyagemi

The study sought to find answers to the questions on implementation of strategic decision whereby it focused on Private Secondary Schools in Nairobi County. Specifically, the study aimed at determining the effects of top management commitment, coordination of activities, employee skills and responsibilities and organization culture on implementation of Strategic Plans in Private Secondary Schools in Nairobi County. A descriptive study was used since it was seen by the researcher as a more appropriate design for answering research questions which ask 'how' and 'why' and which do not require control over the events. The study population consisted of 119 staff of different cadres employed at various Private Secondary Schools in Nairobi. Simple probability sampling technique was used and out of 101 private secondary schools in Nairobi, 50 schools were randomly selected. In each of the selected schools, Directors, Principals or Deputies, Head of Departments, Teachers or support staff had an equal probability of being selected. The researcher administered a survey questionnaire individually to employees who were the Target population. Data was analyzed using both inferential and descriptive statistics such as frequencies; percentages and graphs. Exploratory factor analysis was used in determining the influencing factors. The study established the following group of organizational factors as having an influence on implementation of strategic plans in private secondary schools in Nairobi: resource constraints (e.g. human and financial), overlapping activities, interference from the local government, work pressure, conflict of interest, poor attitude, overlapping plans and tight timeframes. The conceptual model was tested and found to be statistically significant relationship among the implementation of strategic plans, top management commitment, coordination of activities, employee skills and responsibilities and organizational culture. The study recommends a further study on the specific factors should be done in particular sub-counties to explicate on how those factors affect implementation of strategic management plans in Private Schools at the sub county level.

Keywords*: Strategy, Strategic Plan, Stakeholders, Organizational Culture, Management, Implementation, Culture, Communication*

15. The Tomato Leaf Miner (*Tuta absoluta) prevalence* and farmer management practices in Kirinyaga County, Kenya

Peris Wangari Nderitu

Tomato leaf miner *Tuta absoluta* (Meyrick, 1997) (Lepidoptera: Gelechiidae), is an invasive pest of tomato. It was detected in Kenya early 2014 however; there is limited information on the level of invasion of the insect pest in tomato producing areas. This study was aimed at assessing the level of invasion of *T. absoluta* and farmer management practices in Kirinyaga County. Tomato farmers were interviewed using questionnaires aimed at identifying management practices used by farmers to control *T. absoluta* and their knowledge on the insect pest. An extensive field sampling was further carried out on a set of 15 tomato farmers fields located in three locations aimed at assessing the existence and damage caused by *T. absoluta.* The presence of *T. absoluta* was confirmed by Delta traps (Koppert Biological Systems, Kenya) which were used to monitor incidence of *T. absoluta* across farmer's fields. 93% of farmers that were interviewed rated *T. Absoluta* as a major pest of tomato causing average fruit losses of 40.3%. Across the farmers fields mining damage caused by the insect pest on the lower, intermediate and upper leaves showed an increase in damage as the crop advanced in growth from 25% leaf mining damage at early stage of growth to 50-75% mining damage during the fruiting and harvesting stage. The results further showed that 94% of the respondents use synthetic chemicals in the control of *T. absoluta* with an average frequency of 12 times per growing season and the highest frequency at 16times per growing season. Increased use of synthetic insecticides has been found to negatively impact on the natural enemies. Our findings show that 52% and 46% of respondents stated that after chemical spraying natural enemies disappear and are killed respectively, while 2% did not know what happened to them. It is therefore imperative to design an integrated pest management program that is environmentally sound for sustainable management of *T. absoluta* populations.

Keywords*: Delta traps, environmentally sound, Tuta absoluta, integrated pest management*

16. Participatory epidemiology of Foot and Mouth Disease amongst the Maasai pastoralists living in wildlife-livestock interfaces, Maasai Mara, Kenya

Daniel Mutiso Nthiwa

A participatory epidemiological survey was conducted to assess the ethno-veterinary knowledge, attitudes, perceptions and practices amongst the Maasai pastoralists towards the major cattle diseases that limited their livestock production between September 2015 and October 2016, with major reference on foot and mouth Disease (FMD). A cross sectional study design was implemented in six villages that were selected depending on their locations relative to the park and livestock grazing practices used. Data collection was through focus group discussions that consisted of 8-13 farmers and used tools such as proportional piling, pairwise ranking, seasonal calendars and disease impact matrix scoring. The study revealed that the relative populations of sheep and cattle were higher compared to other domestic species and both were perceived important to household's livelihoods. The median scores, 10^{th} and 90^{th} percentiles for sheep and cattle were 39.5 (34.3, 44.7) and 27.5 (21.3, 32. 7) respectively. The results of disease impact scoring matrix indicated that Malignant Catarrhal Fever, East cCoast Fever, Foot and Mouth Disease, Contagious Bovine Pleuropneumonia, Anthrax and trypanosomiasis were the six important diseases that constrained livestock livelihoods in the area. The Kendall's coefficient of concordance for all discussants for the ranked diseases, showed strong agreement ($W = 0.49$, $p < 0.001$, $n = 12$) confirming that they were common diseases in the selected villages. FMD was perceived to impact mostly on milk production than any other disease with median score of 4.5% (range: 1-11). FMD annual incidence was significantly associated with cattle age group ($r = 0.66$, $p=0.000$) and highest in those above four years, median score of 32.5 (range: 10, 50). The median annual age specific mortalities associated with FMD was reported highest among calves with median score of 4.5% (range: 2, 15) compared to other age groups. Results from this study will assist in the design of effective FMD control strategies.

Keywords*: Participatory epidemiology, foot and mouth disease, Maasai pastoralists, Kenya*

17. Predictors for HTLV and HIV among intravenous drug users in Malindi, Kenya

Caroline Chepkorir Koech (JKUAT)

Human T-cell lymphotropic. Virus type one and two (HTLV1/2) infections are highly prevalent among Human immunodeficiency virus (HIV) infected intravenous drug users (IDUs).Currently no published data addressing the burden of HIV and HTLV-1/2 co-infection among IDUs in Kenya exists. HTLV and HIV share similar routes of transmission and tropism for T-lymphocytes; as a result co-infection is common. This study determined the prevalence and predictors of HTLV-1/2 and HIV mono and co-infections among IDUs. A cross-sectional study was conducted using structured questionnaires and laboratory testing of blood samples from 351 consented adult IDUs in Malindi sub-county. HIV-1 serology was carried out using VironostikaHIVAg/Abdirect enzyme-linked immunosorbent assay (ELISA) protocol (Biomerieux Diagnostics, France) while HTLV serology was done using HTLV1/2 sandwiched Elisa (Sunlong, China). Of the 351 recruited IDUs (mean age 33.1years), 34 (9.7%) were positive for HIV, 20 (5.8%) were HTLV1/2 positive while 3(0.9%) were HTLV-HIV co-infected. Prevalent HIV infection was significantly associated with being homeless (OR=2.5, P=0.009), needle sharing (OR=2.1,P=0.042) and previous history of gonorrhea and syphilis (OR=3.7, P=0.000). On the other hand, prevalent HTLV-1/2 infection was significantly associated with residing in Malindi town (OR=7.9, P=0.043), unprotected anal sex (OR=3.1, P=0.029) and previous history of gonorrhea and syphilis (OR=2.9, P=0.021).No factors were significant for HTLV/HIVco-infection. These results show that high risk injection and sexual behaviors are significant markers for HIV and HTLV1/2 infections. Routine testing of HTLV should be done in outpatient IDU clinics.Fast-tracking integrated public health intervention approaches and adoption of harm reduction strategies could help to alleviate the burden of blood-borne infections among IDUs.

***Keywords**: IDUs, HIV, HTLV, Malindi*

18. Characterization of Human Herpes Virus type 8 among Female Sex Workers in Malindi, Kenya

Mirriam Mbithe Nzivo (JKUAT)

Human Herpes Virus type 8 (HHV-8) is not ubiquitous as it displays an extremely unusual distribution pattern around the world. The prevalence of HHV-8 in sub-Saharan Africa is about50-60% in general population. The risk factors associated with HHV-8 range from socioeconomic to geographic and behavioral characteristics. Its prevalence is high among high-risk groups such as female sex workers (FSWs). Documented studies on HHV-8 in Kenya are very few and data on the virus is scanty. This study aimed at determining the prevalence of HHV-8, risk factors associated with the virus and its co-infection with Human Immunodeficiency virus (HIV) and subtypes present among FSWs population in Malindi sub-County. A cross-sectional survey involving 268 participants was conducted and blood samples were screened for antibodies against HHV-8 using enzyme linked Immunosorbent assay (ELISA). Socio-demographic characteristics were documented using a questionnaire. The prevalence of HHV-8 mono-infection was determined at 25% (67/268), 16.4% (44/268) for HIV mono-infection whereas syphilis mono-infection accounted for 2.24% (6/268). Of those infected with HHV-8, a co-infection of 12% (8/67) was observed with HIV. Of the risk factors evaluated, marriage was a significant risk factor in HHV-8 infection (OR 2.90; p=0.043). There was no significant association between HHV-8 and HIV seropositivity (OR 0.62; p=0.257) or syphilis positivity (OR 1.52; p=0.636). HHV-8/HIV co-infection was associated with increased age (OR 11.21; p=0.027) and syphilis infection (OR 21.33; p=0.001). Unlike HIV and HHV-8/HIV co-infection, HHV-8 was not associated with age. In conclusion, as opposed to HIV infection, this study presents no association of HHV-8 with high-risk sexual behavior. The lack of association of HHV-8 with high-risk sexual behavior suggests that sexual route may not play a significant role in transmission of HHV-8 in this population. There is an urgent need for health education for sex workers and the general population on the various modes of transmission of HHV-8.

***Keywords**: HHV-8, Female sex workers, Prevalence, subtypes, HIV co-infection, risk factors*

19. Enhancing soil water productivity using selected soil management technologies in the central highlands of Kenya

Nathan Okoth Oduor

Water unavailability due to scarcity, poor distribution and high variability of rainfall in the Central highlands of Kenya (CHK) and decline in soil fertility have contributed to continuous decrease in water productivity. The study sought to establish the effects of selected soil management technologies on water productivity in Tharaka-Nithi and Murang'a Counties. The experiment was laid out in randomized complete block design with tillage and soil inputs as combined treatments. The Tillage practices used were minimum and convectional tillage while soil inputs included mineral fertilizer, crop residues, animal manure, *Tithonia diversifolia*, rock phosphate, legume intercrop. The data collected include weekly soil moisture, daily weather data, 19 years historical rainfall data, yield data and soil samples for physical properties. The yield, soil physical properties and moisture data under different treatments were subjected to analysis of variance using Mixed Procedure Model in SAS 9.3 software. Differences between treatment means was examined using Duncan's Multiple Range Test at p=0.05. For rainfall characterization RAIN software was used to analyze historical rainfall data for onset and cessation dates. Cumulative departure index and rainfall anomaly index (RAI) was used to analyze long term trends of annual and seasonal variability. Treatments had significant effect on soil water content but had no significant effect on soil physical properties. Onset dates varied highly for both short and long rain seasons in the two counties while cessation date remained constant in both rainy seasons in the two counties. Rainfall variation across the years was high on the short rains then longs rains with the annually rainfall variation being the least. The result of the experiment will be useful to various stakeholders in agriculture for planning and decision making purposes in regards to water productivity. It will also provide a baseline for further research and development work.

20. Effect of integrated soil nutrient management technologies on maize (*Zea mays* l.) productivity in farmer-managed trials in the central highlands of Kenya

Eric Oduor Otieno

Declining soil fertility is a serious threat to food and livestock productivity systems in Sub-Saharan Africa. Maize (*Zea mays* L.) productivity in Central Highlands of Kenya is affected by the declining soil fertility. A study was conducted during the 2016 long and 2017 short rains to determine effects of selected integrated soil nutrients management technologies on maize productivity under on-farm conditions. The experiment was laid out in unbalanced block design combining two tillage methods with fertility inputs. The data were subjected to analysis of variance using General Linear Model in SAS version 9.2. Treatment means separation was done using Duncan Multiple Range test. There were significant decrease in bulk density only in two treatments under conventional tillage and none under minimum tillage. The highest grain yields (2.4629 Mg/ha and 0.29326 Mg/ha, long and short rain seasons, respectively) were observed under a combination of minimum tillage, crop residues, mineral fertilizer and animal manure (MINRMfM) during the two seasons in Meru South compared to conventional tillage-control (CON-C) (0.7605 and 0.02756 Mg/ha) and minimum tillage-control (MIN-C) (1.1169 and 0.06007 Mg/ha). Minimum tillage, crop residues, *Tithonia diversifolia* and rock phosphate (MINRTiP) and minimum tillage, crop residues, animal manure and legume intercrop (MINRML) had the highest yields (2.7371 and 0.1195 Mg/ha) in Gatanga during long and short rain seasons, respectively, relatively the yields observed CON-C (0.2384 and 0.00621 Mg/ha) and MIN-C (1.154 and 0.0123 Mg/ha). Stover yields increased by 0.33193 and 0.32809 Mg/ha from CON-C and MIN-C, respectively in Meru South and by 0.16981 and 0.14171 Mg/ha in Gatanga to MINMf during the long season while MINRMfM (0.222 Mg/ha) and CONRMf (0.20963 Mg/ha) performed the best in Meru South and Gatanga, respectively during the short rain season. In conclusion, integration of resources offers a suitable solution to declining maize productivity.

21. Production constraints and impact of shubhodaya- mycorrhizal bio-fertilizer on banana (*Musa spp*) productivity in Embu County

Arphaxard Muthee Ireri

Banana (*Musa spp*) is one of the most nutritious fruits in the world and with medicinal value. Bananas accounts for 20% of cash crops grown in Embu County. However, its production potential has not been fully realized which stands at 1.52 tons per hectare against international yield levels of 40-50 tons per hectare per annum. A survey and field trials were carried out to determine banana production constraints and evaluate the effect of Mycorrhizal bio-fertilizer on banana productivity in Embu County. To evaluate the effect of Shubhodaya-Mycorrhizal bio-fertilizer on banana productivity, field trials were conducted in farmers' fields in five sites namely Nthambo, Njukiri, Runyenjes, Ugweri and Riandu. This was preceded by soil tests and analysis to determine soil fertility components and the soil pH in the target areas. Six treatments designated as T_1 - 5gm NPK fertilizer alone (control); T_2 - 5gm NPK + 20gm bio-fertilizer;T_3 - 5gm NPK + 30gm bio-fertilizer; T_4 - 5gm NPK + 40gm bio-fertilizer;T_5 - 5gm NPK + 50gm bio-fertilizer; and T_6 -50gm bio-fertilizer alone, were applied on twenty four seedlings of Gal banana variety laid out in a randomized complete block design replicated four times. Growth data was collected on girth of the pseudo-stem, plant height, leaf length and number of suckers per plant at 3, 6 and 9 months after planting. Data on yield components was collected on days to flowering, number of hands per first bunch per stool and weight of the first bunch. Socio-economic analysis established poor husbandry practices, poor soil fertility management practices, low pests and disease management skills, inadequate water utilization and conservation, poor adoption of technologies and poor banana marketing systems as some of the factors associated with the low banana productivity. Soil analysis indicated that soil acidity and low soil fertility are major constraints of banana production in sampled areas. The highest plant growth rate and yields were recorded in treatment T_5 (5gm Multi- K NPK: 13:12:44 + 50gm bio-fertilizer) though it was not significantly different from treatment T_6 (50gm bio-fertilizer alone). This study therefore recommends regular soil analysis to confirm the soil status and integration of 5gm NPK fertilizer with 50gm of Mycorrhizal bio-fertilizer for increased banana productivity in Embu County.

Keywords: *banana, production constraints, soil analysis, mycorrhizal-biofertilizer*

22. Agronomic performance of selected chickpea varieties in Mbeere, Embu County, Kenya

Judith Wafula Katumo

Chickpea is a legume rich in proteins, improves soil fertility through nitrogen fixation and survives under limited soil moisture. A wide gap exists between the worldwide potential production of 5ton ha^{-1} and the the average Kenyan production of 0.3 ton ha^{-1}. Human population is rapidly increasing and this necessitates increase in food production through use of optimum plant spacing, selecting chickpea varieties with high genetic potential and through heterosis. Soil fertility level are also changing hence need to determine optimum N and P_2O_5 application rates. The main aim of the study will be to optimise on agronomic performance of selected chickpea varieties in Mbeere, Embu county, Kenya. An experiment will be carried out at Mbeere, Embu County to determine effect of spacing and N rates on growth, nodulation, yield and protein content of selected chickpea varieties grown in Mbeere. The experiment will be a split split plot arrangement in a randomized complete block design with three replicates over two seasons. Main factors will be spacing in three levels (S1: 50 x 10; S2: 50 x 20 and S3: 50 x 30 cm), followed by N fertilizer rates in four levels of 0- L_0, 5.4- L_1, 10.8 L_2- and 16.2- L_3 kg/ha and P_2O_5 (0 -L_0, 13.8- L_1, 27.6-L_2 and 41.4- L_3) kg//ha . The four chickpea varieties will form the sub-sub factors and will be assigned to the sub-sub plots. An independent intervarietal hybridisation in three replicates will also be done to determine heterosis levels. All intercultural operations will be done when necessary. Physiological traits will be observed from germination to 50% physiological maturity. The soils shall be tested at beginning and harvest time to note variability during experimentation. Data collected will be subjected to a two-way analysis of variance according to the Generalized Linear Model of statistical analysis System at 5% level of significance. The mean separation will be done using least significant difference test at 95% confidence level using SAS edition 9.2 for study factors. It is anticipated that this study will identify superior chickpea varieties adapted to Kenyan conditions especially Mbeere region and similar ecological zones, provide data on optimal growth conditions and recommend the best varieties under study that farmers and researchers can use to improve the crop's production potential. It will also recommend the best N and P_2O_5 fertilizer rates and spacing of chickpea for enhanced nodulation and grain protein content.

Keywords: *Chickpea, spacing, heterosis, nitrogen levels, Mbeere, Kenya*

23. Mycorrhizal fungi associated with *Aspilia pruliseta* on phosphorus availability to sorghum plants

James Peter Muchoka

Global reserves of phosphorus (P) are getting depleted and this poses an enormous challenge to food production. Phosphorus is one of the major limiting nutrients for plant productivity. Use of inorganic fertilizers is currently the main way of correcting this situation but is constrained by the high costs of the fertilizer that most farmers cannot afford. Use of plant/mycorrhizal fungi relationship to replenish phosphate is one of the biological techniques being considered. In this study, association of *Aspilia pruliseta* Schweif with mycorrhiza fungi (MF) and their role in enhancing P availability to Gadam sorghum (*Sorghum bicolor* L.) will be investigated. It is hypothesized that co-association of mycorrhizal fungi and *Aspilia pruliseta* enhance availability of phosphate to sorghum. The main objective of this study will be to determine effects of mycorrhiza in the rhizosphere of *Aspilia pruliseta* on phosphorus availability to sorghum crop. Field and green house experiments will be carried out. The green house experiments will be conducted at the University of Embu while field experiments will be done in Tunyai and Gakurungu in Tharaka Nithi county and Karurumo in Embu county. The green house experiments will involve the use of potted plants in the green house with four treatments; *Aspilia pruliseta* vegetation covered soils; soil types; soil depth and mycorrhiza fungi (MF) inoculated gadam sorghum. The treatment combinations will be carried out in a series of four experiments on a randomized complete block design (RCBD) on a split -split model replicated thrice. Data collected will be subjected to analysis of variance (ANOVA). The effects of various treatments given will be compared using multi t-test and any differences between treatments will be examined using least significant difference (LSD) at $P \leq 0.05$. The expected outcome of this study will be mass production of MF spores to be used as seed inoculum for the manufacture of inexpensive and sustainable biophosphate fertilizer.

Keywords*: mycorrhizal fungi, Aspilia pruliseta, inoculum*

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