Jomo Kenyatta University of
Agriculture and Technology

QUALITY ASSURANCE BULLETIN

Volume 4, 2010

Compiled by
Directorate of Academic Quality Assurance (DAQA)

Vision

A University of global excellence in Training, Research and Innovation for development.

Mission

To offer accessible quality training, research and innovation in order to produce leaders in the fields of Agriculture, Engineering, Technology, Enterprise Development, Built Environment, Health Sciences and other Applied Sciences to suit the needs of a dynamic world.

Prof. Francis Gichaga, PhD
Chancellor, JKUAT

Contents

A WORD FROM THE VICE CHANCELLOR

Jomo Kenyatta University of Agriculture and Technology (JKUAT) have placed much emphasis on quality of teaching, research and innovation high on its agenda so that its academic programmes can effectively compete locally, regionally and internationally. This has been achieved by encouraging academic staff to embrace change by shifting from the traditional research aimed at publishing to modern research focusing on inventions. Perhaps that is why during the launch of Intellectual Property Policy on Friday June 4, 2010, the Managing Director of Kenya Intellectual Property Institute (KIPI) Prof. James Otieno-Odeck lauded the University for having the highest number of inventions amongst Kenyan universities. The inventions which are mainly foods, chemicals, beauty products, agricultural and mechanical inventions are already protected by KIPI under intellectual property.

To continue encouraging the spirit of research, innovations and publications; the University has committed itself to providing research funds through its Research, Production and Extension (RPE) Division and organizing conferences and workshops in each academic year so as provide a platform for academic staff to present their research work. For instance during 2009/2010 academic year, the University provided Kshs. 35 million for research and Kshs. 15 million for innovations. In addition, the University sponsors its staff to present scholarly papers at national and international conferences. During the year, JKUAT in collaboration with the University of Hannover, Germany organized workshop on modeling post-harvest quality of high value crops in East Africa which was held on Saturday 15th May 2010 to Saturday 22nd May 2010 in African Institute for Capacity Development (AICAD). The climax of JKUAT research and innovation was through successful GICHERA conference held at Kenyatta International Conference Centre (KICC) that attracted renowned national and international researchers.

I take this opportunity to appreciate the consistent efforts taken by the staff in Directorate of Academic Quality Assurance (DAQA) for annually producing quality assurance bulletin. I also thank members of academic staff for their contribution in providing the compendium of on-going and completed research activities and compendium of publications for 2009/2010 academic year on time for this 4th bulletin. The objective of this bulletin is to consistently provide a broad spectrum of reference materials for research purposes for University staff and students; and to motivate the staff to conduct more research by annually publishing their innovations, research and publications.

Prof. Mabel Imbuga, Ph.D.

Vice Chancellor

MESSAGE FROM THE DEPUTY VICE CHANCELLOR ACADEMIC AFFAIRS

The University takes quality of teaching/learning seriously. This is emphasized through continuous improvement of programmes by ensuring that they comply with national and regional guidelines, Commission for Higher Education (CHE) and International University Council for East Africa (IUCEA) respectively. Academic quality assurance can not be complete without paying attention to research and innovation. It is through research and innovation that emerging academic challenges can be addressed. The need to ensure quality is triggered by customer changing needs and the environment. The University is keen to ensure that these needs are met and exceeded through quality research and innovation.

The emphasis on research and innovation is provided for in the University Vision, that is, 'A University of global excellence in training, research and innovation for development.' Achievement of this vision is through enhancing strategies and value-added research and innovation. The University recognizes the role of science, technology and innovation in the modern economy in which new knowledge plays a central role in enhancing wealth creation and social welfare. To support research, innovation and publication undertaken by JKUAT community, the University provides research funds to researchers. This support is for both staffs' and students' research projects. The funded research and innovations are monitored and evaluated for value-addition. The funding encourages new researcher and innovators to develop proposal. Researchers are also supported through development of policies that favour research. Supervision of undergraduates and postgraduate supervision by staff also supports research in the University.

The University is keen on providing information on research and innovation activities through a Bulletin compiled by Directorate of Academic Quality Assurance charged with academic quality assurance mandate. The objective of the research information is to inform experienced and up coming researchers on the research activities so that knowledge is shared. Through the information new ideas can be generated from the existing to continuously improve research activities in the University. The University believes that sharing research information will create links with other researchers in the region and beyond.

Finally my gratitude goes to DAQA for compiling the Bulletin. My appreciation is to the members whose research and publications make up this Bulletin. I am also grateful to the Vice Chancellor, Prof. Mabel Imbuga for initiating the Bulletin in 2006/2007 and continual support of the Directorate.

Prof. Romanus Odhiambo, Ph.D.

Deputy Vice Chancellors Academic Affairs

MESSAGE FROM THE DIRECTOR

The Directorate of Academic Quality Assurance (DAQA) has been in existence for two years and has grown steadily with respect to human and physical resources. Currently we have seven personnel in place ranging from the Director to messenger/cleaner. This quality assurance bulletin is the fourth volume to be rolled from DAQA. It contains the research activities that are on-going, the finished research works and the publications in peer refereed journals/ conferences.

During the short period, the V.C. appointed the Academic Quality Assurance Board (AQA) chaired by Prof. Hamadi I. Boga. The others include; Dr. Suleman Oketch, Dr. Fred Wamunyokoli, Mr. Moses Muchina, Mr. Cyrus Chege Kamau, Mr. Richard W. Wamalwa, Dr. Marangi Mbogho, and Prof. David M. Mulati. The Board is to facilitate the realization of the University Vision and Mission; to develop and implement AQA strategies in line with the University Strategic Plan; and to enhance quality standards of the University programmes.

The Directorate has developed, published and implemented an academic quality assurance policy that was launched on 30th-June 2009. This is the only University in East Africa to have in place a published AQA policy document. Directorate monitors academic quality standards at the University, University Campuses and affiliated institutions. In developing research competences among Departments, Institutes, Faculties, Schools, and Campuses; the office compiles the quality assurance bulletin annually. The Directorate is fully involved with ISO 9001:2008 quality management system in sustaining the quality of the University products and services with a view to promoting the University's core business of teaching/ learning, training, research, innovation and community service.

Prof. David M.Mulati, Ph.D.

Director, Directorate of Academic Quality Assurance

SECTION A: COMPEDIUM OF ON-GOING RESEARCH ACTIVITIES

1. FACULTY OF SCIENCE

1.0 DEPARTMENT OF STATISTICS AND ACTUARIAL SCIENCES

Topic:	Boostrap of Kernel Smoothing in Quantile Autoregression Processes.
Researcher(s):	**Peter N. Mwita** and J. Franke**.**
Status of Research:	On-going.
Topic:	Prediction of the Likelihood of Households Food Insecurity in the Lake Victoria Region of Kenya.
Researcher(s):	Peter N. Mwita and **Romanus O. Odhiambo.**
Status of Research:	On-going.
Topic:	Bayesian analysis of correlated Binary data.
Researcher(s):	V. Andika, S. Mwalili and **P. Mwita.**
Status of Research:	On-going.
Topic:	Using ordinal regression to find out the factors influencing degree classification.
Researcher(s):	**S.M.Mwalili,** H.M.Humphreys and W.R.Muchangi.
Status of Research:	On-going.
Topic:	Modelling Food Production in the Presence of Contigent Factors that affect Crop Production with Specific Application to Maize Farming.
Researcher(s):	**J. C. Chelule.**
Status of Research:	On-going.
Topic:	Modelling the Dependence Structure between Multiple lines of Business using Copulas.
Researcher(s):	**J.K. Mung'atu.**
Status of Research:	On-going.
Topic:	Sensitivity Analysis based on Longitudinal Data.
Researcher(s):	**J.M. Wekesa.**
Status of Research:	On-going.
Topic:	Multistate models for the analysis of time to event data.
Researcher(s):	**C. W. Mugo.**
Status of Research:	On-going.

Topic:	A Bayesian analysis of Political Popularity; Learning from Kenyan Experience.
Researcher(s):	**J.K. Kiingati.**
Status of Research:	On-going.

Topic:	A Garch option pricing model for exchange options in an incomplete market.
Researcher(s):	**J.A. Akinyi.**
Status of Research:	On-going.

Topic:	Hierachical Bayesian Analysis of repeated binary data with application to caries research in Kenya.
Researcher(s):	**V. Andika.**
Status of Research:	On-going.

Topic:	Application of Nonparametric Variables in Energy Demand in Kenya.
Researcher(s):	L.N. Mbugua, **P. Mwita** and S. Mwalili**.**
Status of Research:	On-going.

Topic:	Copula Risk Modelling with application to General Insurance.
Researcher(s):	**J. Mung'atu** and S. Mwalili.
Status of Research:	On-going.

1.1 DEPARTMENT OF PURE AND APPLIED MATHEMATICS

Topic:	Rotating Flow over stretching Media with heat transfer
Researcher(s):	**Kang'the Giterere.**
Status of Research:	On-going.

Topic:	Hydro magnetic thrust bearing by a ferrofluid with a temperature dependent viscosity.
Researcher(s):	**P. R. Kiogora**, M. Kinyanjui and D. Theuri.
Status of Research:	On-going.

Topic:	Study of free convectional heat and mass transfer in 2-D laminar flow in presence of an immersed fluid body.
Researcher(s):	**M. Kinyanjui** and D. Theuri.
Status of Research:	On-going.

Topic:	Analysis of wind in induced response of different streamliner.
Researcher(s):	**M. Kinyanjui** and D. Theuri.
Status of Research:	On-going.

Topic:	MHD rotating flow in porous media over stretching with heat transfer.
Researcher(s):	**M. Kinyanjui** and D. Theuri.
Status of Research:	On-going.

Topic:	Detaining of the most hydraulically efficient charnels.
Researcher(s):	**M. Kinyanjui** and D. Theuri.

Status of Research:	On-going.
Topic:	Numerical study of Buoyancy driven natural convection in an enclosure.
Researcher(s):	**B. Menge**, J.K Sigey and F.K.Gatheri.
Status of Research:	On-going.
Topic:	Buoyancy driven free convection turbulent heat transfer in an enclosure.
Researcher(s):	**J.K Sigey** and J.K.Gatheri.
Status of Research:	On-going.
Topic:	Bouyance Driven Newtorian fluid flow.
Researcher(s):	**J.K. Sigey**, B. Menge and M. Kinyajui.
Status of Research:	On-going.
Topic:	A mathematical model of turbulent convective flow past a vertical infinite plate with hall current.
Researcher(s):	**J.K.Kwanza**, W. Mukuna and M. Kinyanjui.
Status of Research:	On-going.
Topic:	Hydro magnetic free convection current effects on boundary layer thickness.
Researcher(s):	**K.Kwanza**, E. Marigi and M. Kinyanjui.
Status of Research:	On-going.
Topic:	Boundary layer thickness and frictional.
Researcher(s):	**J.K.Kwanza**, E. Mugambi and M. Kinyanjui.
Status of Research:	On-going.
Topic:	P_0 Matrix completion problem.
Researcher(s):	**P. W. Kamaku**, B. Kivunge and C. Mwathi.
Status of Research:	On-going.
Topic:	Boundary layer thickness and frictional drag on a submerged curved plate.
Researcher(s):	**J.K.Kwanza**, J.K Mugambi and M.Kinyanjui.
Status of Research:	On-going.
Topic:	The Spectrum of the Norturd Q matric on C space.
Researcher(s):	**J.R.Akanga.**
Status of Research:	On-going.
Topic:	Non-linear fluid structure interaction of rigid structures under aerodynamics load.
Researcher(s):	**J. Luvaha**, M.Kinyanjui, J.K.Kwanza and R.N.Mutuku.
Status of Research:	On-going.
Topic:	Effects of a varying magnetic field on Hydromagnetic incompressible fluid flow between two parallel porous plates under suction and injection.
Researcher(s):	**A.W.Ndengwa**, M. Kinyanjui and J.K.Kwanza.
Status of Research:	On-going.

1.2 DEPARTMENT OF CHEMISTRY

Mixing of reagents at chemistry laboratory to get desired products.

Topic:	Enviromentally cleaner utilization of CNSL in industry.
Researcher(s):	**Dr. Patrick M. Mwangi**, Prof. George T. Thiong'o and Dr. Patrick Kareru.
Status of Research:	On-going.

1.3 DEPARTMENT OF BIOCHEMISTRY

Topic:	Identification and characterization of novel EST-SSRs Markers and Screening for Polymorphism in selected Cassava Germplasm
Researcher(s):	M. Furgerson**,** T. Mureithi and **E. Magiri.**
Status of Research:	On-going.
Topic:	Improving Kenyan basmati rice quality and production through physico-chemical and molecular characterization
Researcher(s):	**E. Magiri,** Ojijo, Njogu, V. Matiru.
Status of Research:	On-going.
Topic:	Prospecting for a biofertilizer in banana bacterial endophytes.
Researcher(s):	V. Matiru**,** C. Muthuri, **E. Magiri** and Jennifer Thompson.
Status of Research:	On-going.

Topic:	Screening of selected medicinal plants for antifungal activity, in vitro cytotoxicity and acute toxicity
Researcher(s):	L. Cherotich, **E. Magiri**, and C. Bii.
Status of Research:	On-going.
Topic:	Prevalence of artemisinin and sp resistance gene markers inplasmodium falciparum and gene flow patterns in malarial zones of Kenya.
Researcher(s):	L. Wangai, **G. Magoma** and Omar Sabah.
Status of Research:	On-going.
Topic:	Diversity and pesticide degradation potential by microorganisms from Horticultural farms in Kenya.
Researcher(s):	**G. Magoma,** Kelvin Omolo, Kamau Ngamau and M. Tsanuo.
Status of Research:	On-going.
Topic:	Global gene expression profiling of mucinous ovarian tumors and cystadenomas
Researcher(s):	**F. Wamunyokoli,** Y.L. Lee, R.W. Welch, J. Braydy and M.J. Birrer.
Status of Research:	On-going.
Topic:	Comparative and functional Analysis of an aquaporin gene from tsetse flies.
Researcher(s):	**F. Wamunyokoli,** D. Masiga and J. Bargul.
Status of Research:	On-going.
Topic:	Evaluation of anti - diabetic properties and Molecular characterization of opuntia species in found in Kenya.
Researcher(s):	Kibiti C.Mwiti, **Kariuki D.W.**, Muthuri C, Imbuga M, and Ngeranwa J.
Status of Research:	On-going.
Topic:	Developing a portable biosensor for oxidative stress.
Researcher(s):	**D.W. Kariuki.**
Status of Research:	On-going.
Topic:	Experimental and in silico drug design against African trypanosomiasis
Researcher(s):	**J. Kinyua,** J. Nganga and D.W. Kariuki.
Status of Research:	On-going.
Topic:	Safety and efficacy of a class II antifolate methotrexate in baboon models of malaria.
Researcher(s):	J.M. Ichagichu, **S. Karanja,** J. Mwatha, H. Ozwara.
Status of Research:	On-going.
Topic:	Proximate composition and phyto-chemical screening of crude extracts of leaves of African indigenous vegetables and their antioxidant and in vitro activity against some microorganisms.
Researcher(s):	M.E. Kibiwott, **S. Karanja,** J. kinyua and J. Ojijo.
Status of Research:	On-going.
Topic:	Evaluation of loop mediated isothermal DNA amplification in

	characterization of Trypanosoma b. rhodesiense infection.
Researcher(s):	L.C. Mwagandi, **S. Karanja,** N. Maina and J. Ouma.
Status of Research:	On-going.
Topic:	Evaluation of the impact of community based health education on the knowledge, practice and behavior change by comminites in Busia District with regard to malaria control.
Researcher(s):	Njenga, R.W and **Karanja, S.M.**
Status of Research:	On-going.
Topic:	In search of markers for safe and simple diagnosis of Trypanosomiasis.
Researcher(s):	**N. Maina,** S. Karanja, D.W. Kariuki and J.M. Ngotho.
Status of Research:	On-going.
Topic:	Use of community health workers in the management of tuberculosis in Kenya: A cost benefits analysis.
Researcher(s):	Ong'ng'o J.R. and **Karanja S.**
Status of Research:	On-going.
Topic:	Safety and toxicity of selected herbal preparation in use in Kenya.
Researcher(s):	Maina, W.N., Maina-Ngotho, Kagira, J.M. **Karanja, S.M.** Wanyoike M.W and Bukachi S.
Status of Research:	On-going.
Topic:	Experimental and in silico drug design against *Leishmania major*.
Researcher(s):	Mutoro C, Kinyua J.K., **Kariuki D.W.** and Ng'ang'a J.K.
Status of Research:	On-going.
Topic:	Isolation and characterization of cysteine proteinase activity from fruits of papay varieties grown in Kenya.
Researcher(s):	Metzner D.**, Kariuki D.W** Wanzala F.K. and Gitong L.
Status of Research:	On-going.
Topic:	Experimental and in silico drug design against African trypanosomiasis.
Researcher(s):	**J. Kinyua,** J. Nganga and D.W. Kariuki.
Status of Research:	On-going.
Topic:	Soil fertility assessment in tea growing areas of Kenya: working towards improved application of Tea fertilizers.
Researcher(s):	Kinyua, J.K. **Kariuki D.W.**, Njue M., Karanja S. and Muhoho S.
Status of Research:	On-going.
Topic:	Experimental and in Silico Drug Design against *Plasmodium falciparum*.
Researcher(s):	Ng'ong'a F. Atieno, **Kinyua J.K., Kariuki D.W.,** and Ng'ang'a J.K.
Status of Research:	On-going.
Topic:	Determination of Proximate composition and antioxidant activity of crude extracts from African indigenous vegetables. In vitro activity against selected microorganisms.
Researcher(s):	M. E. Kibiwott, S. Karnaja, **J. Kinyua** and J. Ojijo.
Status of Research:	On-going.

Topic:	Morphological characterization and DNA Bar coding for taxonomy and conservation of wild silk moths in Kenya.
Researcher(s):	P. K. Kamau, **J. Nganga** and M. Imbuga.
Status of Research:	On-going.
Topic:	Experimental and in silico drug design against African trypanosomiasis.
Researcher(s):	J. Kinyua, **J. Nganga** and D.W. Kariuki.
Status of Research:	On-going.
Topic:	Epidemiology of Hepatitis B in Marsabit District
Researcher(s):	**J. Ngaira.**
Status of Research:	On-going.
Topic:	Studies on chloroquine and sulphadoxin resistance in malarial parasites.
Researcher(s):	**J. Ngaira.**
Status of Research:	On-going.
Topic:	Characterization of tsetse olfactory receptor proteins
Researcher(s):	**S. Ger**, P. Lomo and D. Masiga.
Status of Research:	On-going.
Topic:	Prevalence of artemisinin and sp resistance gene markers in *Plasmodium falciparum* and gene flow patterns in main malarial zones of Kenya.
Researcher(s):	**L. Wangai**, G. Magoma and Omar Sabah.
Status of Research:	On-going.
Topic:	Comparative and functional Analysis of an aquaporin of gene from tsetse flies.
Researcher(s):	F. Wamunyokoli, D. Masiga and **J. Bargul.**
Status of Research:	On-going.
Topic:	Study of cross resistance of piperaquine and Lumefantrine resistant *Plasmodium berghei and selection of Amodiaquine resistance in a mouse model.*
Researcher(s):	B.K. Langat, **V.C.S Nyambati**, Y.Kombe and C. Mbakaya.
Status of Research:	On-going.
Topic:	A Retrospective study to determine the Bacterial causes of bloody diarrhea and their antimicrobial susceptibility patterns at Tabitha Medical Clinic in Kibera, Nairobi.
Researcher(s):	S.O Gitari, **V.C.S Nyambati,** Y.Kombe and C. Mbakaya.
Status of Research:	On-going.
Topic:	Serum vitamin A and Zinc levels in school children with and without parasitemia in Kisii district, Kenya.
Researcher(s):	**I.M. Makori**, C.Mbakaya, Y.Kombe and V.C.S Nyambati.
Status of Research:	On-going.

1.4 DEPARTMENT OF BOTANY

Topic:	Effects of interactions between species traits and habitat characteristics in the control of *Prosopis juliflora* on the Lake Baringo ecosystem.
Researcher(s):	**Moses Kirega Gichua.**
Status of Research:	On-going.
Topic:	Characterization of the indigenous sheep of Kenya
Researcher(s):	**A.W.T Muigai**, O. Mwai, D. Muhongo, M. Tapio.
Status of Research:	On-going.
Topic:	Novel approaches to the diagnosis, characterization and surveillance of priority infectious diseases.
Researcher(s):	M. Mwau, K. Morita, **A.W.T Muigai.**
Status of Research:	On-going.

1.5 DEPARTMENT OF PHYSICS

Topic:	Electrical and optical analysis of microcrystalline silicon on glass grown by hot wire chemical vapour depositionand DC magnetron sputtering.
Researcher(s):	Thomas Nyang'onda and **David M. Mulati**.
Status of Research:	On-going.
Topic:	Atmospheric tidal waves impact on wether focus models.
Researcher(s):	**David M. Mulati,** Joseph N. Mutuku and Francis Gatheri.
Status of Research:	On-going.
Topic:	Electrical and optical analysis of microstalline silicon on glass grown by hotwire chemical vapours deposition and DC magnetron sputtering.
Researcher(s):	Thomas Nyang'onda, **David M. Mulati**, and Bernard O. Aduda.
Status of Research:	On-going.
Topic:	Assessment of electromagnetic radiations from mobile cell phone brands commonly used in Kenya.
Researcher(s):	**R. Kinyua**, Ombati, J. Mutuku.
Status of Research:	On-going.
Topic:	Determination of naturally occurring radioactive materials and radiation exposure levels in the soapstone quarries of Tabaka region of Kisii district, Kenya.
Researcher(s):	**R. Kinyua**, V. Atambo, R. Ongeri.
Status of Research:	On-going.
Topic:	Assessment of Quality control in Medical diagnostic X-ray facilities in the Western region of Kenya.
Researcher(s):	**R. Kinyua**, M.P. Kadima, P. Mwose.
Status of Research:	On-going.

1.6 DEPARTMENT OF ZOOLOGY

Topic:	Evaluation of fusing a cell penetrating peptide to *Theileria parva parva* antigens on the induction of $CD8^+$ cytotoxic T-lymphocyte responses (ILRI, Kenya).
Researcher(s):	Tinega Alex Nyaribo and **Kutima Helen Lydia.**
Status of Research:	On-going.
Topic:	The Seasonal Abundance of *Anopheles gambiae* group and malaria transmission in a fringe area of Western Kenya.
Researcher(s):	Obala Andrew Ambogo, **Kutima Helen Lydia** and Ouma John Henry.
Status of Research:	On-going.
Topic:	Integrating attraction aggregation pheromone (AAAP) and kairomones from *Calpurina aurea* with entomopathogenic fungi for the control of *Rhipicephalus appendiculatus* and *Amblyomma variegatum*.
Researcher(s):	Nana Paulin, Maranga R., **Kutima Helen Lydia,** Boga, H. and Maniania J, N.
Status of Research:	On-going.
Topic:	Characterization of the nymphal aggregation pheromone of Malagasy Migratory Locust, *Locusta migratoria capito* (Saussure, 1884) and its effects on adult maturation and oviposition.
Researcher(s):	Razafindranaivo V., **Kutima Helen Lydia,** Tsanuo, M. and Njagi, P.
Status of Research:	On-going.
Topic:	Attractiveness of sand fly baits and the effects of long-lasting insecticidal nets on the feeding behaviour and survival of *Phlebotomus (Phlebotomus) duboscqi* Neveu-Lemaire (Diptera: Psychodidae).
Researcher(s):	Sichangi Kasili, **Kutima Helen Lydia,** Mwanawiro and Anjili C.
Status of Research:	On-going.
Topic:	Dry Onion production practices and evaluation of local germplasm susceptibility to onion thrips.
Researcher(s):	Kimani Kibanyu, Gitonga, L.M,. **Kutima Helen Lydia** and Waiganjo, M.
Status of Research:	On-going.
Topic:	*Schistosoma haematobium* infection in pregnant women: the effect on anaemia, patho-physiological changes, nutritional status and birth weight outcomes.
Researcher(s):	Kihara, J. H and **Kutima Helen Lydia.**
Status of Research:	On-going.
Topic:	Prevalence of HIV/AIDS among people living in the slums of Nairobi.
Researcher(s):	Nyamongo, D. S. and **Kutima Helen Lydia.**
Status of Research:	On-going.
Topic:	Diagnostic Procedures, Epidemiology And Genetic Diversity Of Cryptosporidiosis In Bungoma District, Kenya.
Researcher(s):	Wasike W. Eric, **Kutima Helen Lydia,** Muya Shadrack and Wamachi A.
Status of Research:	On-going.

Topic:	Dry Onion production practices and evaluation of local germplasm susceptibility to onion thrips.
Researcher(s):	Kimani Kibanyu, Gitonga, L.M., **Kutima Helen Lydia and** Waiganjo M.
Status of Research:	On-going.
Topic:	Recombinant expression of immunosuppressive proteins of the tick vector *Amblyomma variegatum* (ILRI).
Researcher(s):	Naftaly Githaka, **Kutima Helen Lydia,** Mutugi Marion, Skilton Robert and Bishop Richard.
Status of Research:	On-going.
Topic:	Management of Mango seed weevil *Sternochetus mangiferae* (F.) in Kenya by chemical and physical barriers.
Researcher(s):	Muriuki Samuel, Gitonga L.M, **Kutima Helen Lydia** and Waturu.
Status of Research:	On-going.
Topic:	Antobody response in baboons experimentally inoculated with HIV-I.
Researcher(s):	**Njenge H.K.**
Status of Research:	On-going.
Topic:	Molecular characterization of the RANTES gene polymorphisms in Nairobi Province, Kenya.
Researcher(s):	**Mutuiri, S.P.M.**
Status of Research:	On-going.
Topic:	Frequency of variant human cytokine genes in malarial infections with drug resistant parasites in different endemic zones in Kenya.
Researcher(s):	**Undisa, S.M.**
Status of Research:	On-going.
Topic:	Immunization of BalB/c mice with soluble proteins obtained from snail vector and challenging with *Schistosoma mansoni* parasite.
Researcher(s):	**Muna K, K.**
Status of Research:	On-going.
Topic:	Assessment of gastro-intestinal parasites of Captive Olive Baboons, *Papio cynocephalus anubis*, at the Institute of Primate Research.
Researcher(s):	**Oduor, M.A.**
Status of Research:	On-going.
Topic:	Investigation on the prevalence of Helminthes and effectiveness of crude extract of *Aloe scundiflora* as an antihelminthic in indigenous chicken in Kenya.
Researcher(s):	**Kaingu, F.B.**
Status of Research:	On-going.
Topic:	Population dynamics and IPM of Thrips using Entomopathogenic Nematodes on French Beans.
Researcher(s):	**Nganga Joseph Waweru.**
Status of Research:	On-going.
Topic:	Determination of effective dose of Praziquantel in different mouse strains: BalB/c and Swiss mice infected with *Schistosoma mansoni.*
Researcher(s):	**Muchira, N.P.**

Status of Research:	On-going.
Topic:	Immunological responses in BalB/c mice infected with *Schistosoma mansoni* and treated with medicinal plant extracts.
Researcher(s):	**Mokua, J.M.**
Status of Research:	On-going.
Topic:	Determining the potential of kairomonal attractants with colored sticky traps in pest management of Thrips in French Beans and tomatoes
Researcher(s):	**Muvea Alexander.**
Status of Research:	On-going.
Topic:	Epitope specificity and polyfunctional CD4 responses in HIV-1 resistant versus infected commercial sex workers
Researcher(s):	**Kiguoya Marion Wangui.**
Status of Research:	On-going.
Topic:	The efficacy of oduor baited bottom board trap for trapping small hive beetle in honey bee colonies.
Researcher(s):	**Mutyambai Daniel Munyao.**
Status of Research:	On-going.
Topic:	Haemoglobin as a measure of HIV disease progression in ARV naïve patients in Nairobi
Researcher(s):	**Mutisya Mary.**
Status of Research:	On-going.

2. FACULTY OF AGRICULTURE

2.0 DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

Food products at FOTEC in JKUAT Juja Campus.

Topic:	Physicochemical characterization of sweet sorghum [Sorghum bicolor (L.) Moench juice and products.
Researcher(s):	M.A. Mwasaru, W.O. Owino, D.N. Sila, and **E.M. Makori**.
Status of research:	On-going.
Topic:	KAPP FP2006046: Identification and prioritization of maize technologies in terms of yield and nutritional content through research and development.
Researcher(s):	Dr. George A. Ombakho, Mr. Japhether Masinde Wanyama, **Dr. Christine A. Onyango**, Nick Hutchinson, Dr. Evans O. Sikinyi, James Gichanga Karanja, J Nzomo, Elizabeth Kamau.
Status of Research:	On-going.
Topic:	EDULINK (ACP/EU): Strengthening Universities' capacity for promoting, facilitating and teaching rural innovation process (SUCAPRI)
Researcher(s):	Prof. Moses Tenywa, **Dr. Christine A. Onyango**, Dr. George N. Chemining'wa, Dr. Samuel Mwonga, Dr. Speranza Ndege and others.
Status of Research:	On-going.
Topic:	JKUAT: Screening and use of SSR markers to evaluate sorghum soma-clonal variants and mutants for salinity and drought resistance
Researcher(s):	Dr. Martha M. Makobe, Prof. Mabel Imbuga, Prof. Catherine Muthuri, Prof. Anne Muigai, **Dr. Christine A. Onyango**, and Ms. Judy M. Wambua.

Status of Research:	On-going.
Topic:	Nutritional quality, Toxicological Safety and Utilization of insects in Kenya.
Researcher(s):	John Kinyuru and **Glaston Kenji.**
Status of Research:	On-going.
Topic:	Determination of anabolic steroids and antibiotics in poultry products.
Researcher(s):	M. G. Kamau, H.K. Rotich, **G. M. Kenji** and D. Kariuki.
Status of Research:	On-going.
Topic:	Chemical Hazards associated with Agriculture produce irrigated with raw sewage in lower Eastern Nairobi.
Researcher(s):	S. Mathenge and **G.M.Kenji.**
Status of Research:	On-going.
Topic:	Characterization of the Diversity of Coffee Varieties in Kenya by Genetic, Biochemical and Beverage Quality Profile.
Researcher(s):	Kathurima C.W., **Kenji G.M.,** Njoroge S. M., Boulanger R.
Status of Research:	On-going.
Topic:	Evaluation of contamination levels of honey produced in different regions of Kenya.
Researcher(s):	Orina, I.N. and **Kenji G.M.**
Status of Research:	On-going.
Topic:	Regeneration of Bamboo to diversify the Food-base and Help stem the tide of Deforestation in Kenya
Researcher(s):	Karebu M., Kanyi B.and **Kenji G.M.**
Status of Research:	On-going.
Topic:	Increasing profitability of horticultural production through value addition and water saving irrigation technologies.
Researcher(s):	**Charles K. Njoroge.**
Status of Research:	On-going.
Topic:	Formulation of innovative processing technology for herbal medicine and fabrication of allied equipment.
Researcher(s):	**Charles K. Njoroge.**
Status of Research:	On-going.
Topic:	Characterization of Lactic acid bacteria Isolated from Coconut wine for probiotic Potential.
Researcher(s):	J.N. Wambugu, **M.J. Maina** and P. M. Kutima.
Status of Research:	On-going.
Topic:	Microbial diversity of fermented uji produced by the Meru, Embu and Kikuyu communities and evaluation of their enzymes production potential.
Researcher(s):	P. K. Kahenya **M. J. Maina** R. Mwirichia A. O. Makokha
Status of Research:	On-going.

Topic:	Evaluation of contamination levels of honey produced in different regions of Kenya.
Researcher(s):	Orina I. Nyagoge, G. M. Kenji, **M. J. Maina.**
Status of Research:	On-going.
Topic:	Evolution and stability of color in cowpea leaves (*Vigna unguiculata*) during pretreatment and pasteurization.
Researcher(s):	**M.M. Wawire,** F.M. Mathooko, C.K. Njoroge and D. Shitanda.
Status of Research:	On-going.
Topic:	Evolution and stability of polyphenol oxidase in cowpea leaves (*Vigna unguiculata*) during pretreatment and pasteurization.
Researcher(s):	**M.M. Wawire,** F.M. Mathooko, C.K. Njoroge and D. Shitanda.
Status of Research:	On-going.
Topic:	Evolution and stability of folates in cowpea leaves (*Vigna unguiculata*) during pretreatment and pasteurization.
Researcher(s):	**M.M. Wawire,** F.M. Mathooko, C.K. Njoroge and D. Shitanda.
Status of Research:	On-going.
Topic:	Evolution of minerals in cowpea leaves (*Vigna unguiculata*) during pretreatment and pasteurization.
Researcher(s):	**M.M. Wawire,** F.M. Mathooko, C.K. Njoroge and D. Shitanda.
Status of Research:	On-going.
Topic:	The hard to cook defect in common beans: towards food security and sustainability in sub-Saharan Africa.
Researcher(s):	**Dr. Daniel N. Sila**, Prof. Marc Hendrickx.
Status of Research:	On-going.
Topic:	Value Addition of Slaughter House Wastes: Case of Blood Processing.
Researcher(s):	**Dr. Daniel N Sila**, Mr Peter Kahenya.
Status of Research:	On-going.

2.1 DEPARTMENT OF HORTICULTURE

Topic:	Spatial assessment of landscape structure of Nairobi city, Kenya.
Researcher(s):	**John Bosco Njoroge**, Maina M. Geoffrey and Paul K. Nda'Nganga.
Status of Research:	On-going.
Topic:	Effects of landscape characteristics and cropping systems on bird diversity and ecological function within an agricultural landscape of Kenya.
Researcher(s):	Paul K. Nda'Nganga and **John Bosco Njoroge.**
Status of Research:	On-going.
Topic:	Studies on growth and flower quality of mobydick (*Gomphocarpus physocarpus*).
Researcher(s):	**A. O. Watako** and C. N. Mundia.
Status of Research:	On-going.

Topic:	Calibration of lime requirement tests for acid soils of Kenya through maize yield and development of a quick liming test kit –intermediate and appropriate technological innovations for enhanced food security.
Researcher(s):	**Elisha Njue Mugai**, P.G. Kareru, A. B. Nyende and W. Karugu.
Status of Research:	On-going.

Mushroom growing at the Faculty of Agriculture.

Topic:	The impact of liming on biodiversity in Embu Tea Zone Landscapes: Case study of Kavutiri area.
Researcher(s):	James Njeru, **Njue Mugai** and A. Kihurani.
Status of Research:	On-going.
Topic:	Evaluation of capillary wicks for use in irrigation for intensive horticultural crop production in Kenya.
Researcher(s):	**John M. Wesonga**, Peter W. Masinde, Francis K. Ombwara, Patrick Home.
Status of Research:	On-going.
Topic:	Evaluation of Suitability of Roselle cultivars under Juja conditions.
Researcher(s):	**John M. Wesonga**, Christopher O. Ojiewo.
Status of Research:	On-going.
Topic:	Maize and cover crop technologies on weed diversity and maize productivity in Machakos District, Kenya.
Researcher(s):	Hottensiah Mwangi, **Agnes Kihurani**, Safari Ariga, Kanampiu.
Status of Research:	On-going.

Topic:	Resistance of Sweet Potato genotypes to sweet potato virus disease, transmission, and molecular characterization of sweet potato mottle virus.
Researcher(s):	Joyce Ngubia, **Elijah Ateka**, Amata, John M. Wesonga.
Status of Research:	On-going.
Topic:	Potential for utilization of HearNPV and PlxyGV in the control of African bollworm (*Helicoverpa armigera*) and Diamond back moth (*Plutella xylostella*) in Kenya
Researcher(s):	Edna Muthamia, Nikolai van Beek, **John M. Wesonga**, Elijah M. Ateka.
Status of Research:	On-going.
Topic:	Africa Knowledge Transfer Partnerships (AKTP) Carbon finger print.
Researcher(s):	Juliah Mnyambo, Wariara Kariuki, Anne Wangechi, John M. Wesonga.
Status of Research:	On-going.
Topic:	The effect of flower and boll thinning on quality parametars of cut mobydick (*Gomphocarpus physocarpus*) flowers.
Researcher(s):	**A. O. Watako** and C. N. Mundia.
Status of Research:	On-going.
Topic:	Commercial and Industrial Development of Papaya (*Carica papaya* L.): Varietal Improvement, Production and Processing Technologies.
Researcher(s):	**F. K. Wanzala**, L. S. Wamocho, A. B. Nyende, E. M. Ateka, D. Shitanda and A. Onyango.
Status of Research:	On-going.
Topic:	Selection and Improvement of Agronomic Traits and PRSV Tolerance of Papaya in Kenya.
Researcher(s):	**F. K. Ombwara**, F. K. Wanzala, L. S. Wamocho and E. M. Ateka.
Status of Research:	On-going.

3. FACULTY OF ENGINEERING

3.0 DEPARTMENT OF BIOMECHANICAL AND ENVIRONMENTAL ENGINEERING (BEED)

Topic: Development of Integrated Solar Driers for Fish Drying along Lake Victoria.
Researcher(s): **Prof. D. Shitanda**, Prof. V.C.K. Silayo, Mr. P.M.O. Odote, Ms. J.S. Bongyereire.
Status of Research: On-going.

Topic: Optimal Use of Locally Available Trees or Tree Products for Smoking of African and marine Catfish to Prevent Postharvest Losses and Improve Quality as a Measure for Conservation of Aquatic Resources in Kipini and Tana delta areas of Kenya.
Researcher(s): Mr. P.M.O. Odote, **Prof. D. Shitanda.**
Status of Research: On-going.

Topic: Explore the Utility of Low Cost Seed Oil as Potential Feedstock for Biodiesel Production.
Researcher(s): **Prof. D. Shitanda**, Prof. M. Mbarawa.
Status of Research: On-going.

Topic: Application of Genetic Algorithms for Optimization of On-farm Machine Design Parameters for Eco-Efficient Timber Processing.
Researcher(s): Mr. George M. Muthike, **Prof. D. Shitanda**, Dr. C. L. Kanali, F. N. Muisu.
Status of Research: On-going.

Topic: Application of Genetic Algorithms for Optimization of On-farm Machine Design Parameters for Eco-Efficient Timber Processing.
Researcher(s): **Mr. George M. Muthike**, Prof. D. Shitanda, Dr. C. L. Kanali, F. N. Muisu.
Status of Research: On-going.

Topic: **Muthike G.M**., Shitanda D., Kanali C.L. and Muisu F.N.
Researcher(s): The potential of Chainsaw Frame Mills in On-farm Timber Processing in Kenya.
Status of Research: On-going.

Topic: Development of a solar-charcoal cooler for storage of farm produce in marginal areas of Kenya.
Researcher(s): **J.T. Makanga,** D. Shitanda and C. Njoroge.
Status of Research: On-going.

Topic: Design and development of a rice harvester for Kenya: Phase I – Design of crop cutting and Elevating mechanism.
Researcher(s): **J.T. Makanga,** J.T. Mailutha, C.L. Kanali, P.G. Home and L.O. Mulamu.
Status of Research: On-going.

Topic:	Investigating removal of pesticides and natural organic matter from water by ultrafiltration (UF) and nanofiltration (NF) membranes.
Researcher(s):	**J.Riungu**, P. Home, G. Ndegwa, M. Hesampour, P. Arto, M. Mantari
Status of Research:	On-going.
Topic:	Assessment of Runoff Harvesting Potential for Irrigation at Kabiruini Nyeri, Kenya
Researcher(s):	G.K. Karara, J. M. Gathenya and **P.G. Home**.
Status of Research:	On-going.
Topic:	Assessment of the System of Rice Intensification (SRI) for improving crop and water productivity in Mwea Irrigation Scheme, Kenya.
Researcher(s):	**M. Nyamai**, B. Mati, P.G. Home, R. Wanjogu.
Status of Research:	On-going.
Topic:	Assessments of long-term impacts of land use/cover change on bio-physical environment of Buathonaro catchment, Kenya.
Researcher(s):	**C. Ngeera.**
Status of Research:	On-going.
Topic:	Application of Genetic Algorithms for Optimization of On-farm Machine Design Parameters for Eco-Efficient Timber Processing.
Researcher(s):	Mr. G.M. Muthike, Prof. D. Shitanda**, Dr. C.L. Kanali**, F.N. Muisu.
Status of Research:	On-going.
Topic:	Design and development of a rice harvester for Kenya: Phase I-design of crop cutting and windrowing mechanism.
Researcher(s):	Dr. J.T. Makanga, Dr. J.T. Mailutha, **Dr. C.L. Kanali**, Dr. P.G. Home, Mr. L.O. Mulamu.
Status of Research:	On-going.
Topic:	Application of genetic algorithm in the optimisation of a solar tent fish dryer.
Researcher(s):	Mr. G.M. Kituu, Prof. D. Shitanda**, Dr. C.L. Kanali**, Dr. J.T. Mailutha.
Status of Research:	On-going.
Topic:	Thin layer drying characteristics of amaranth grains in a natural convection solar tent dryer.
Researcher(s):	Mr. E.K. Ronoh, **Dr. C.L. Kanali**, Dr. J.T. Mailutha, Prof. D. Shitanda.
Status of Research:	On-going.

3.1 DEPARTMENT OF MECHATRONICS ENGINEERING

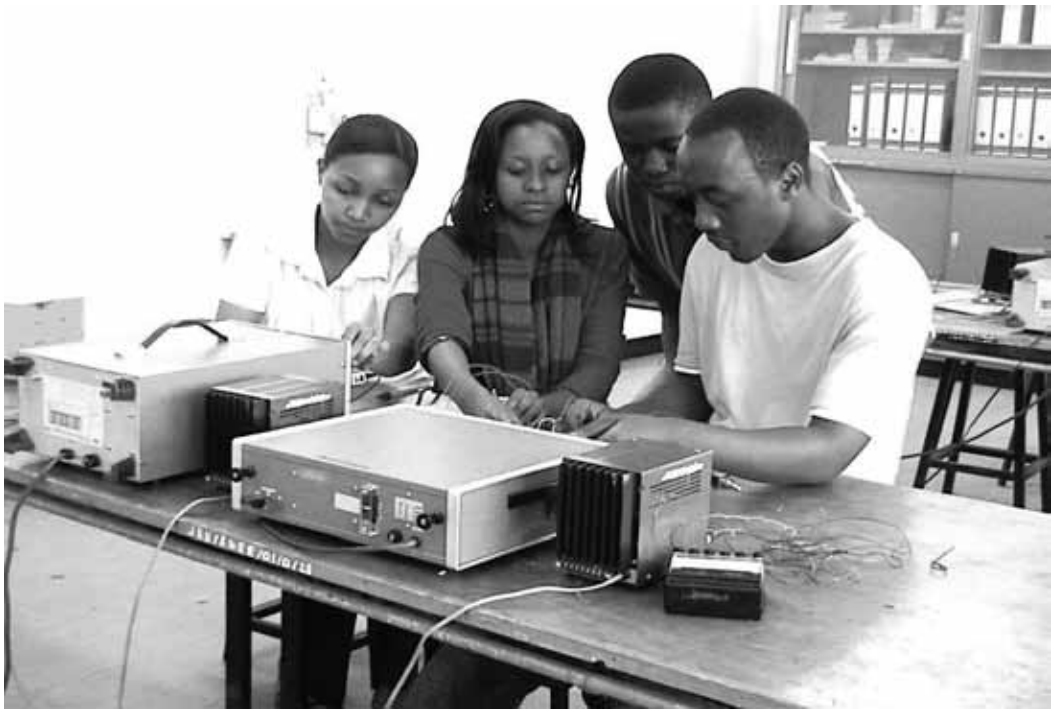
Topic:	Design and Development of an Electro Discharge Machine
Researcher(s):	**B. W. Ikua**, G. N. Nyakoe, J. N. Keraita.
Status of Research:	On-going.
Topic:	Optimization of Machining Process for Free-form Surfaces Using Intelligent Adaptive Controller.
Researcher(s):	**J. G. Njiri**, B. W. Ikua, G. N. Nyakoe.
Status of Research:	On-going.

Topic:	Development and Analysis of a CO_2 Laser Engraving System.
Researcher(s):	B. W. Ikua, P. N. Kioni, **G. Wairimu.**
Status of Research:	On-going.
Topic:	Modelling of Buldge Formation in Polymers during Laser Micromachining.
Researcher(s):	**R. Ndeda**, J. N. Keraita, P. N. Kioni.
Status of Research:	On-going.
Topic:	Development of a Brown Paper Converting Machine.
Researcher(s):	**A. Muchiri**, Nduati.
Status of Research:	On-going.
Topic:	Development of an Autonomous Mobile Robot.
Researcher(s):	**G. N. Nyakoe**, B. W. Ikua, Ernest Mutisya, Dennis Mbuthia, Salim Faraj, Cyrus Mugo, Chomba Mjomba, Juzer Kapacee
Status of Research:	On-going.
Topic:	Impact of Fuzzy and Neural Network Techniques in Dynamic Load Modelling for Voltage Stability Analysis.
Researcher(s):	**C. M. Mureithi**, L. M. Ngoo, G. N. Nyakoe.
Status of Research:	On-going.
Topic:	Optimization of Fuel Consumption in Hybrid Wind-Diesel-Storage System using a Neuro-Fuzzy Controller.
Researcher(s):	**L. A. Owino**, G. N. Nyakoe, K. Kibicho.
Status of Research:	On-going.
Topic:	Design of an Adaptive Controller for the Cylindrical Grinding Process.
Researcher(s):	**S. K. Kabini**, B. W. Ikua, G. N. Nyakoe.
Status of Research:	On-going.
Topic:	Experimental Setup for Producing Embossed Holograms.
Researcher(s):	**C. Ominde**, G. K. Rurimo, G. N. Nyakoe.
Status of Research:	On-going.

3.2 DEPARTMENT OF ELERTICAL AND ELECTRONIC ENGINEERING

Topic:	Analysis and Visualization of Metabolic Syndrome Using Self Organizing Maps (SOM).
Researcher(s):	**P. K. Kihato**, J. N. Nderu, H. Tokutaka.
Status of Research:	On-going.
Topic:	A Hybrid Formulation for EMI / EMT Problems for Mechanic Enclosures with Apertures.
Researcher(s):	**J. Makiche**, D. O. Konditi, H. Ouma.
Status of Research:	On-going.

Topic:	Non-utility generation: An Analysis of its Impact on the Kenyan Power System.
Researcher(s):	Alloyce G. Oduor, A. O. Akumu, **L. M. Ngoo.**
Status of Research:	On-going.
Topic:	Modelling and Simulation of a Neural Fuzzy Based Maximum Power Point Tracking of a Photo Voltaic System.
Researcher(s):	C. Otieno, **G. Nyakoe**, C. Wekesa.
Status of Research:	On-going.



Students during electrical engineering practical session.

Topic:	Impact of Fuzzy and Neural Network Techniques in Dynamic Load Modelling for Voltage Stability Analysis.
Researcher(s):	**C. M. Muriithi**, L. M. Ngoo, G. N. Nyakoe
Status of Research:	On-going.
Topic:	Kenyan Power System Reactive Power Compensation and Transmission Line Power Transfer Capacity Improvement.
Researcher(s):	R. Njoroge, **K. Kaberere**, A. Akumu.
Status of Research:	On-going.
Topic:	Electronic Load Controller for Mini/Micro Hydro Power Generation
Researcher(s):	C. K. Kitur, J. N. Nderu, **K. Kaberere.**
Status of Research:	On-going.
Topic:	Design and Simulation of a Fuzzy Logic Based Traffic Signal Controller for a Signalized Roundabout.
Researcher(s):	C. Mwangi, **G. Nyakoe**, S. Kang'ethe.
Status of Research:	On-going.

Topic:	Application of Artificial Neural Networks.
Researcher(s):	S. N. Kamau, **D. O. Konditi**, L. M. Ngoo.
Status of Research:	On-going.
Topic:	An Optimized Parking Algorithm Control for Passenger Elevator Group by Using Artificial Neural Network System.
Researcher(s):	H. T. Ngetha, **J. N. Nderu**, L. M. Ngoo.
Status of Research:	On-going.
Topic:	Power Generation Enhancement in Kenya Using Integrated Grid-Solar Photovoltaic and Associated Challenges.
Researcher(s):	Gideon G. Kidegho, **A. O. Akumu**, S. M. Mbogho.
Status of Research:	On-going.
Topic:	Application of Neuro-Fuzzy Control Technique in a Three-phase Hybrid Power Filter for Harmonic Mitigation.
Researcher(s):	Nelson K Bett, **P. K. Hinga**, J. N. Nderu
Status of Research:	On-going.

3. 3 DEPARTMENT OF GEOSPATIAL INFORMATION SYSTEMS

Topic:	Development of a web mapping solution for water supply and management.
Researcher(s):	**D. Kuria**, D. Musiega and M. Ngigi.
Status of Research:	On-going.
Topic:	Assessing Application of Markov Chain Analysis in Predicting Land Cover Change: A Case Study of Nakuru Municipality
Researcher(s):	**Kenneth Mubea**, Thomas Ngigi and Charles Ndegwa.
Status of Research:	On-going.
Topic:	Spatial temporal changes in a wildlife conservancy in Kenya.
Researcher(s):	**C. N. Mundia**.
Status of Research:	On-going.
Topic:	Maize Suitability analysis in Kilifi District Using GIS and remote sensing.
Researcher(s):	**C. N. Mundia**, Dzoro.
Status of Research:	On-going.
Topic:	Real Time Orthometric Height Determination Using GPS Technology: A Case Study of Nairobi Province.
Researcher(s):	N.O. Agutu, **E. H. Waithaka** and B.K. Kenduiywo.
Status of Research:	On-going.
Topic:	Land Use Land Cover Changes and implications for proposed expansion of Nairobi Metropolitan.
Researcher(s):	**E. H. Waithaka**, F.K. Kirimi, D. N. Kuria, C.M. Ndegwa and M. K. Gachari.
Status of Research:	On-going.

Topic:	Geographical Scale Replicability of the Mix-unmix Classifier.
Researcher(s):	Thomas G. Ngigi, Ryutaro Tateishi, Moses Gachari and **Edward Waithaka.**
Status of Research:	On-going.
Topic:	Mapping Locations of Nesting Sites of the Indian House Crow in Mombasa
Researcher(s):	**Muye Chongomwa,** Thomas Ngigi and David Kuria.
Status of Research:	On-going.
Topic:	Developing a Tool for Optimization in Visualization and Interpretation aspects in Location Based Services Systems.
Researcher(s):	**Charles B. Wasomi.**
Status of Research:	On-going.
Topic:	An Interactive Webmap application on Tourism Promotion.
Researcher(s):	**Charles B. Wasomi** and Munyithya Vincent Ngondi.
Status of Research:	On-going.
Topic:	Identification and assessment of potential Fishing zones using Modis Imagery.
Researcher(s):	**Charles B. Wasomi** and Erastus Chege Mwangi.
Status of Research:	On-going.
Topic:	Implementing a Tool for designing water pipeline layout with the use of GIS for efficient water management and Distribution.
Researcher(s):	**Charles B. Wasomi** and Akbar Ahmed Abdulrahman.
Status of Research:	On-going.
Topic:	Implementing a Tool to assist in Rate and Resource Management in Regional development strategy.
Researcher(s):	**Charles B. Wasomi** and Kogi Micheal Kiragu.
Status of Research:	On-going.

4. SCHOOL OF ARCHTECTURE AND BULDING SCIENCES (SABS)

4. 0 DEPARTMENT OF CONSTRUCTION MANAGEMENT

Student's studio work in the School of Archtecture and Building Sciences.

Topic:	Value management and "satisfying current and future end-users of a building"
Researcher(s):	**A. Alkizim.**
Status of Research:	On-going.
Topic:	Value management and satisfying end users needs
Researcher(s):	**A. Alkizim.**
Status of Research:	On-going.

5. INSTITUTE OF BIOTECHNOLOGY RESEARCH (IBR)

Topic:	Micropropagation (Tissue culture) of *Allanblackia stulhmannii (*Clusiaceae), an economically endangered Tanzanian tree species.
Researcher(s):	**Neondo. J.,** Prof. Muigai. A, Dr. Nyende. A. B.
Status of Research:	On-going.
Topic:	Selection for yield and high oil content in macadamia hybrids using conventional and molecular breeding tools
Researcher(s):	**A. B. Nyende**, K. Ngamau and A. Nyagah
Status of Research:	On-going.
Topic:	Evaluation of seed potato tuber production under aeroponics in Malawi.
Researcher(s):	**A.B. Nyende,** K. Ngamau and O. Tsoka.
Status of Research:	On-going.
Topic:	Screening and genetic analysis of somaclonal variants and mutants of sorghum for drought and salinity tolerance.
Researcher(s):	Makobe, **A.B. Nyende** and E. Njue, J. Mwende
Status of Research:	On-going.
Topic:	Characterization of Fusarium species on maize and determination of their mycotoxins in Eastern province of Kenya.
Researcher(s):	M. Wanyoike, **A.B. Nyende** and F. Bii.
Status of Research:	On-going.
Topic:	Development of an in vitro protocol for the elimination of viruses from banana.
Researcher(s):	**A.B. Nyende**, E. Ateka and G. Mungai.
Status of Research:	On-going.
Topic:	Collection and characterization of papaya germplasm in Kenya
Researcher(s):	F. Wanzala, L. Wamocho, **A.B. Nyende**, E. Ateka and G. Asudi.
Status of Research:	On-going.
Topic:	Diversity of white rot fungi from selected horticultural farms and their potential in biodegradation of pesticides.
Researcher(s):	Magoma, Ochora, A.B**. Nyende** and O. Nyakundi.
Status of Research:	On-going.
Topic:	Biological performance, response and population dynamics of *Tetranychus evansi* Baker and Pritchard, as influenced by different African nightshade (*Solanum* spp.) species.
Researcher(s):	**A.B. Nyende**, J. Wesonga, P. Masinde and L. Kananu.
Status of Research:	On-going.
Topic:	Screening, yield evaluation and genetic finger printing of Drought Tolerant Orange-Fleshed Sweet potato (*Ipomoea batatas Lam*) hybrid clones for East Africa.
Researcher(s):	**A.B. Nyende**, P. Masinde. K. Ngamau and S. Agili
Status of Research:	On-going.

Topic:	Distribution, diversity and conservation of yam species in Kenya
Researcher(s):	**A.B. Nyende**, E. Mamati and Z. Muthamia.
Status of Research:	On-going.
Topic:	Molecular characterisation, regeneration and agrobacterium mediated transformation of Jatropha Curcas.
Researcher(s):	**A.B. Nyende**, J. Onguso, J. Machuka and C. Mweu
Status of Research:	On-going.
Topic:	Inheritance of low soil phosphorus, and nitrogen tolerance in development of upland rice varieties for medium potential areas of Kenya.
Researcher(s):	P. Tongoona, J. Deere, **A.B. Nyende** and J. Kimani
Status of Research:	On-going.
Topic:	Selection of quality and resistance to coffee Berry Disease in the coffee Arabica L. Composite cultivar, Ruiru 11.
Researcher(s):	**A.B. Nyende**, E. Mamati, and M. Gichimu.
Status of Research:	On-going.

6. INSTITUTE OF COMPUTER SCIENCE AND INFORMATION TECHNOLOGY (ICSIT)

Topic:	Information Technology security in Small and Medium Enterprises (SMEs).
Researcher(s):	**Michael Kimwele**, Dr. Waweru Mwangi, Dr. Stephen Kimani.
Status of Research:	On-going.
Topic:	Mobile money transfer security issues
Researcher(s):	**Geoffrey Wekesa Chemwa.**
Status of Research:	On-going.
Topic:	Intergrating ICT in the value chains of farmers cooperatives in Kenya
Researcher(s):	**Geoffrey Wekesa Chemwa.**
Status of Research:	On-going.
Topic:	A real time full-time Biometric mouse.
Researcher(s):	**Pius Thuku.**
Status of Research:	On-going.
Topic:	Using computer games to enhance learning.
Researcher(s):	**Rose Mwangi.**
Status of Research:	On-going.
Topic:	ICT and Economic Development.
Researcher(s):	**Agnes Mindila.**
Status of Research:	On-going.
Topic:	Intelligent Automated Teller Machine.
Researcher(s):	**Dr. Waweru Mwangi.**
Status of Research:	On-going.
Topic:	Human Computer Interaction: User based applications.
Researcher(s):	**Dr. Stephen Kimani.**
Status of Research:	On-going.

7. INSTITUTE OF ENERGY AND ENIVIRONMENTAL TECHNOLOGY (IEET)

Topic:	The role of community wildlife conservancies in the management of resource conflicts in Kenya using GIS and strategic environmental assessment (SEM).
Researcher(s):	Gichuhi, M. W.; Mwaura, C.; **Keriko, J. M.** and Kitetu, J. J.
Status of Research:	On-going.
Topic:	An Assessment of pollution status of Lake Naivasha and Potential for Utilization of Geothermal fluids for Irrigation and solution mining.
Researcher(s):	Njogu, P. M.; **Keriko, J. M**. and Kitetu, J. J.
Status of Research:	On-going.
Topic:	Eco-paints for Adobe constructions.
Researcher(s):	Karanja, H. K.; Inoti, I. K.; Thiong'o, G. T. and **Keriko, J. M.**
Status of Research:	On-going.
Topic:	Development of anti-malarial briquettes from pyrethrum and Jatropha carcus seed cake.
Researcher(s):	Nyakairo, K.; **Keriko, J. M**. and Karanja, H. K.
Status of Research:	On-going.
Topic:	Evaluation of selected biomass energy resources as converted by a gasifier stove.
Researcher(s):	Masai, J. K.; Makanga, J. T.; **Keriko, J. M.** and Mailutha, J. T.
Status of Research:	On-going.
Topic:	The impact of prosecution on the status of health and safety in work places in Kenya.
Researcher(s):	Nyakego, J. B.; **Keriko, J. M.**; Pete, Peter
Status of Research:	On-going.
Topic:	Effects of work injury compensation on an organization's profitability and its implication on the Kenyan economic growth.
Researcher(s):	Ndegwa, O. T.; **Keriko, J. M.;** Mburu, C.
Status of Research:	On-going.
Topic:	Workplace fires: An assessment of fire safety measures in supermarkets within Nairobi.
Researcher(s):	Karanja, I. W.; **Keriko, J. M.;** Mburu, C.
Status of Research:	On-going.
Topic:	Nairobi Household solid waste management practices: Need for re-designing.
Researcher(s):	Mutuku, D. M.; **Keriko, J. M**. and Njogu, P. M.
Status of Research:	On-going.
Topic:	Impact of safety committee on organizational safety and health: A case of limited companies at the Nairobi Stock Exchange.
Researcher(s):	Tuitoek, N. K.; Kitetu, J. J.; **Keriko, J. M.**
Status of Research:	On-going.

Topic:	Determination of some heavy metals and fish lipids classes in common freshwater fish species in selected Kenyan waters.
Researcher(s):	Mbugua, M. M.; **Keriko, J. M.** and Kareru, P. G.
Status of Research:	On-going.
Topic:	Accidents involving motocycle taxis: An emmerging road safety problem in Kenya.
Researcher(s):	Bartich, P. C., **Keriko, J. M**. and Kiiyukia, C.
Status of Research:	On-going.
Topic:	Impact of integrating road safety in trucking industry: A case study of some multiple hauling companies.
Researcher(s):	Makau, I. K.; **Keriko, J. M.** and Kitetu, J. J.
Status of Research:	On-going.
Topic:	Investigation of the 'Savannah Hypothesis' and comfort in workplaces.
Researcher(s):	Muruka, A. O.; **Keriko, J. M**. and Shinji, M.
Status of Research:	On-going.
Topic:	Phytoremediation of heavy metals using Arrowroots (*Colocasia esculanta*) found in Meru region.
Researcher(s):	Kimathi, E. T.; **Keriko, J. M**.; Nyagah, C. G. and Njenga, J. W.
Status of Research:	On-going.
Topic:	Up-scaling of Soil-Water Management (SWM) Technologies and drought tolerant of maize varieties for increased productivity in Eastern and Central African countries (ASARECA-CGS Stream B Projects)
Researcher(s):	Mwangi, H. W. (Ken); **Keriko, J. M.** (Ken); Mgonja, F. M. (Tz); Matowo, P. (Tz); Admassu H. (Et); Wagari, D. (Et), Debele, T. (Et).
Status of Research:	On-going.

8. INSTITUTE OF TROPICAL MEDICINE AND INFECTIUOS DISEASES (INTROMID)

8.0 DEPARTMENT OF MEDICAL LABARATORY SCIENCES

Topic:	Recurrence of tuberculosis and association with emergence of multidrug resistant strains in Nairobi, Kenya.
Researcher(s):	**Perpetual Ndung'u.**
Status of Research:	On-going.
Topic:	The Baculovirus Expression Vector System and a Model for Demonstrating the Susceptibility of Rift Valley Fever Virus to RNA-induced Gene Silencing.
Researcher(s):	E. Rono, D. Masiga and **J. R. Ongus.**
Status of Research:	On-going.
Topic:	Development of Replenishable, Cost Effective and Stable ELISA Reagents for the detection of Chikungunya Virus Infection.
Researcher(s):	C. Wasonga, J. Kimotho, **J. R. Ongus**, L. Musila and R. Sang.
Status of Research:	On-going.
Topic:	Molecular Sub-typing of Wild-Type Rubella Viruses Circulating in Kenya.
Researcher(s):	F. Mbugua, G. G. Mbugua, **J. R. Ongus** and W. Bulimo.
Status of Research:	On-going.
Topic:	Paediatric Blood Transfusion Practices at Nyanza Provincial General Hospital, Kisumu, Kenya, 2007/2008.
Researcher(s):	J. O. Ndinya, **J. R. Ongus** and R. Juma.
Status of Research:	On-going.
Topic:	Risk Factors Associated With Loss-to-Follow-Up Adults Patients at the Mbagathi District Hospital Comprehensive Care Clinic, Nairobi, Kenya.
Researcher(s):	S. N. Gathu, **J. R. Ongus** and P. Wanzala.
Status of Research:	On-going.
Topic:	Seroprevalence of Dengue Viruses in Patients With Fever Visiting Alupe District Hospital and KEMRI/CIPDCR Alupe Health Facility.
Researcher(s):	A. Awando, **J. R. Ongus** and M. Mwau.
Status of Research:	On-going.
Topic:	Dried Blood Spots and Saliva as Alternative Specimens to Serum in the Detection of Rubella Virus-Specific IgM by Enzyme Immunoassay.
Researcher(s):	R. Chelangat, **J. R. Ongus** and J. Kombich.
Status of Research:	On-going.
Topic:	Prevalence of HIV-1, Hepatitis B Virus and Hepatitis C Virus among Selected Arbovirus Seropositive Patents in Selected Health Facilities in Trans Nzoia District, Kenya.

Researcher(s):	N. R. Demba, J. Ouma, **J.R. Ongus** and M. Mwau.
Status of Research:	On-going.

Topic:	Determinants of Uptake of the Human Papilloma Virus Vaccines by Health Care Workers in Nairobi, 2009
Researcher(s):	L. A. Osamong, J. Mutai and **J. R. Ongus.**
Status of Research:	On-going.

9. NAIROBI CENTRE CAMPUS

Topic:	Production and products evaluation of the seed oil and other plant parts of Yellow oleander *(Thevetia peruviana)* plant.
Researcher(s):	**Keriko, J. M.;** Waihenya, R.; Shitanda, D.; Odhiambo, P.; Karanja, P. N.; Muthuri, C.; Muturi, W.; Shiunda, R. O.; Ojijo, N.; Gachanja, A. N.; Njonge, F. K.
Status of Research:	On-going.
Topic:	Fish lipids in Marine and freshwater fishes and their effects on reducing chronic diseases resulting from high cholesterol level intake.
Researcher(s):	**Keriko, J. M.; Chege**, C. W.; Mwachiro, E.; Githua, M. N. and Mbugua, M. M.
Status of Research:	On-going.
Topic:	Anti-malarial and Chemical Studies in *Microglossa pyrifolia* and *Trimeria glandifolia.*
Researcher(s):	Omollo, J.; Rukunga, G. M. and **Keriko, J. M.**
Status of Research:	On-going.
Topic:	Phytochemical and anti-helminthic activity of *Entada leptostachya* and *Rapanea rhododendroides.*
Researcher(s):	Omigo M. O.; Kareru, P. G.; Rukunga, G. M.; Mbaria, J.; **Keriko, J. M.**
Status of Research:	On-going.
Topic:	Anti-malarial and Anti-leishmanial Studies of Some Selected Medicinal Plants of Kenya.
Researcher(s):	Elizabeth V. M. Kigondu; **Keriko, J. M.;** Rukunga, G. M. and Yenesew, Abiy.
Status of Research:	On-going.
Topic:	Efficacy and Chemistry of Potential Anti-malarial Compounds from Some Selected Kenyan Medicinal Plants.
Researcher(s):	Muthaura, C.; Keriko, J. M.; Rukunga, G. M. and Derese, S.
Status of Research:	On-going.
Topic:	Pharmaceutical Formulation Development Involving Excipients of Problem Drugs Manufactured in Kenya.
Researcher(s):	Ouko, S. P. A.; **Keriko, J. M.;** Rukunga, G. M. and Orwa, A.
Status of Research:	On-going.
Topic:	Anti-schistosomal properties of *Chenopodium ambrosoides* (Wormseed) against the parasite S. mansoni in mice.
Researcher(s):	Moilo, J. M.; Yole, D.; **Keriko, J. M.** and Mkoji, O.
Status of Research:	On-going.
Topic:	The characteristic absorption of pavaquone, bupavaquone and related drugs.
Researcher(s):	Ronoh, W.; **Keriko, J. M.** and Rukunga, G. M.
Status of Research:	On-going.

Topic:	In search of Leads for *Mycobacterium tuberculosis*.
Researcher(s):	Muriuki, B.; **Keriko, J. M.** and Midiwo, J. O.
Status of Research:	On-going.
Topic:	Respiratory health of Jua Kali garage workers in Nairobi, Kenya.
Researcher(s):	Mungoma, M**.; Keriko, J. M.** and Mbakaya, C. L.
Status of Research:	On-going.
Topic:	Health Effects Associated with Occupational Exposure to Organic Solvents Among Construction Company Painters in Nairobi.
Researcher(s):	Machache, M. E.; Mbakaya, C. L. and **Keriko, J. M.**
Status of Research:	On-going.
Topic:	Formulation of innovative processing technology for herbal medicine and fabrication of allied equipments.
Researcher(s):	Njoroge, C. K.; Shitanda, D. and **Keriko, J. M.**
Status of Research:	On-going.

10. SCHOOL OF HUMAN RESOURCE DEVELOPMENT (SHRD)

Topic:	Effects of Infrastructure Sharing on Competition and Growth in Telecommunications Industry in Kenya.
Researcher(s):	**Dr. Oloko** and Amos Kipyegon Chebon.
Status of Research:	On-going.
Topic:	Factors Influencing Competitive Customer Service in the Banking Sector in Kenya: A Case of Coop Bank Thika
Researcher(s):	**Dr. Sakwa** and Ann Wangechi Gaichiri.
Status of Research:	On-going.
Topic:	Mobile Banking Opportunities in the Banking Sector in Kenya: A Case of Cooperative Bank of Kenya- Thika Branch
Researcher(s):	**Dr. Sakwa** and Anthony Irungu Muchiri.
Status of Research:	On-going.
Topic:	Evaluation of the Performance of Nairobi Water and Sewerage Company Ltd.
Researcher(s):	**Dr. Sakwa** and Arthur Omondi Omollo.
Status of Research:	On-going.
Topic:	Factors that Influence the Growth of Financial Markets in Kenya
Researcher(s):	**Dr. Karanja** and Benson Mbugua Gakumo.
Status of Research:	On-going.
Topic:	The Role of Group Cohesiveness in Organizational Performance: A Case of Nairobi City Water and Sewerage Company's Pangani Branch
Researcher(s):	**Prof. Namusonge** and Beryl Kathomi Mate.
Status of Research:	On-going.
Topic:	Causes and Effects of Financial Distress in Manufacturing Companies: A Case of Cadbury Kenya
Researcher(s):	**Prof. Namusonge** and Carolyne Nyokabi Muiruri.
Status of Research:	On-going.
Topic:	Overcoming the Challenges of Marketing Small Law Firms in Kenya
Researcher(s):	Catherine Nkirote Mputhia and **Dr. Sakwa.**
Status of Research:	On-going.
Topic:	Management Strategies in the Financial Co-operative Services: A Case of Fundilima SaCCO
Researcher(s):	Charity W. Kamau and **Prof. Namusonge.**
Status of Research:	On-going.
Topic:	Determinants of the Effectiveness of Inventory Management in the Government Ministries of the Republic of Kenya
Researcher(s):	**Dr. Oyugi** and Charles Kyalo Ndeto.
Status of Research:	On-going.

Topic:	Challenges Facing Fishermen in the Fishing Industry: A Survey of Fishermen in Lake Victoria
Researcher(s):	**Dr. Sakwa** and Christine Akoth Oswago.
Status of Research:	On-going.
Topic:	Why Are Bank Customers Using ATMs and Human Tellers in Trade? A Case of Cooperative Bank of Kenya Industrial Area Branch.
Researcher(s):	Constance Ouna and **Dr. Sakwa.**
Status of Research:	On-going.
Topic:	Evaluation of Factors Influencing Corporate Social Responsibility Activities of an Organization: A Case of JKUAT.
Researcher(s):	**Dr. Karanja.**
Status of Research:	On-going.
Topic:	A study of Factors that Influence an Organization's Listing at the NSE: A Case of Public Quoted Campanies at the NSE.
Researcher(s):	**Dr. Karanja** and David Kamau Nduruhu.
Status of Research:	On-going.
Topic:	The Role of E-Banking in Service Delivery: A Case of National Bank of Kenya, Ruiru Branch.
Researcher(s):	**Prof. Namusonge** and Diana Cherono Koech.
Status of Research:	On-going.
Topic:	Effects of Globalization on Human Resources Management Function in International NGOs in Kenya: A case of World Vision International.
Researcher(s):	Dorcas F. Chelagat and **Dr. Sakwa.**
Status of Research:	On-going.
Topic:	Financing as a Determinant of Growth among Micro and Small Manufacturing Enterprises in Thika District.
Researcher(s):	Dorice Atieno Ogilo and **Prof. Namusonge.**
Status of Research:	On-going.
Topic:	Factors that Promote Successful Implementation of Performance Contracting in Public Universities in Kenya: A Case of JKUAT.
Researcher(s):	**Dr. Sakwa** and Duke Omwenga Kiage.
Status of Research:	On-going.
Topic:	Factors that Influence Adoption of Business Process Outsourcing: A Case of East African Breweries.
Researcher(s):	**Dr. Karanja** and Edwin Mureithi Gicheni.
Status of Research:	On-going.
Topic:	Effect of Technological Advances on Customer Service in the Banking Industry Industry.
Researcher(s):	Elizabeth Awinja Omukala and **Dr. Sakwa.**
Status of Research:	On-going.
Topic:	Factors Influencing Performance Management in Kenyan Public Universities: A Case of JKUAT.
Researcher(s):	Esther Thairu and **Dr. Karanja.**
Status of Research:	On-going.

Topic:	Customers' Attitudes towards Online and Mobile Banking in Kenya: A Case of Cooperative Bank of Kenya- Kimathi Street.
Researcher(s):	Evans Buhula Kavulavu and **Dr. Sakwa.**
Status of Research:	On-going.
Topic:	Change Management and its Effects on Enterprise Performance: A Case of Postal Corporation of Kenya.
Researcher(s):	Irene Nyachoka Gisemba and **Prof. Namusonge.**
Status of Research:	On-going.
Topic:	Improving Efficiency of a Voluntary Managed Organization Through Management Practice: A Case of the Insurance Institute of Kenya.
Researcher(s):	**Prof. Bwisa** and Jacinta Wanjeri Karita.
Status of Research:	On-going.
Topic:	Factors Influencing Adoption of Retail E- Banking.
Researcher(s):	Jackson Musyimi Mutua and **Prof. Namusonge.**
Status of Research:	On-going.
Topic:	The Role of Credit Management in Small and Medium Enterprises' Growth in Kenya.
Researcher(s):	Jacqueline Anunda Osango and **Prof. Namusonge.**
Status of Research:	On-going.
Topic:	An Assessment of the Internal Management Control of Procurement System at JKUAT.
Researcher(s):	**James M. Magoka** and Dr. Oloko.
Status of Research:	On-going.
Topic:	Factors Affecting Development of Businesses Among Kenyan Youths Through the Youth Enterprise Fund: A Case of Juja Location.
Researcher(s):	James Munga Njaria and **Dr. Oloko.**
Status of Research:	On-going.
Topic:	Determinants of Growth and Development of Fundilima SaCCO.
Researcher(s):	**Johnmark Obura Ouma** and Dr. Oyugi.
Status of Research:	On-going.
Topic:	Factors Affecting Performance of Community Based Organizations Dealing with HIV/AIDS Projects in Kenya: A Case of Nyeri South District.
Researcher(s):	**Dr. Karanja** and Joseph Mwangi Machira.
Status of Research:	On-going.
Topic:	The Contribution of Business Enterprises on Service Delivery in Kenya's Public Universities: A Case of JKUAT.
Researcher(s):	Jotham O. Odera and **Dr. Sakwa.**
Status of Research:	On-going.
Topic:	Challenges Face by Micro Enterprises in the Access of Microcredit from MFIs.
Researcher(s):	**Dr. Sakwa** and Joyce Wambui Kinyanjui.
Status of Research:	On-going.

Topic:	Factors Contributing to the Counterfeiting Phenomenon in SMEs in Kenya.
Researcher(s):	Julius Kithinji Kirima and **Dr. Gakure.**
Status of Research:	On-going.
Topic:	Relationship Between Resource Planning and Business Performance: A Case of Nakumaatt Holdings.
Researcher(s):	Karimi James Ngari and **Dr. Mukulu.**
Status of Research:	On-going.
Topic:	Factors Affecting Transition of Kenyan Private Colleges Based in Nairobi into Universities
Researcher(s):	Kezia Njeri Wanjiku and **Dr. Karanja.**
Status of Research:	On-going.
Topic:	The Effectiveness of Performance Appraisal Systems in Agriculture Based Research Institutions in Kenya: A Case of Coffee Research Foundation
Researcher(s):	Kimeu Emmanuel Mutinda and **Dr. Oloko.**
Status of Research:	On-going.
Topic:	Factors Which Influence the Choice of Distribution Channels in the Dairy Industry: A Case ob Brookside Dairy Limited
Researcher(s):	Loise W. Mwangi and Dr. Oloko.
Status of Research:	On-going.
Topic:	A Case Study on Levels of Job Satisfaction among National Trainers at CEMASTEA
Researcher(s):	Macharia Beatrice Wairimu and **Dr. Sakwa.**
Status of Research:	On-going.
Topic:	Customer Care and Public Sector Performance: A Case of Kenya Airports Authority.
Researcher(s):	**Prof. Namusonge** and Makory Margaret Wambui.
Status of Research:	On-going.
Topic:	The Impact of Financial Liberalization on Banking Products in Kenya.
Researcher(s):	Maku Peter Ngatia and **Dr. Oloko.**
Status of Research:	On-going.
Topic:	Information and Communication Technology (ICTs) Investment and Performance of Small and Medium Scale Enterprises (SMEs) in Nairobi.
Researcher(s):	Mburu Harrison Gathuru and **Dr. Oloko.**
Status of Research:	On-going.
Topic:	Management of Funds in Kenya State Corporarions: A case of NHIF
Researcher(s):	Mburugu Rosemary Maiti and **Dr. Oyugi.**
Status of Research:	On-going.
Topic:	Factors that Influence Performance of Relief Workers in Conflict Regions: A Case of AMREF in Southern Sudan
Researcher(s):	Mungai Charles Maina and **Dr. Karanja.**
Status of Research:	On-going.
Topic:	Factors Influencing Participation of Small Scale Individual Investors

	in the Stock Exchange: A Survey of Thika Town
Researcher(s):	Munyaka Joseph Mungai and **Dr. Sakwa.**
Status of Research:	On-going.
Topic:	Factors Promoting and Hindering the Use of Electronic Payment Among Kenyans: A Survey of Thika Town Supermarkets.
Researcher(s):	Murabu Tabitha Wanjiku and **Dr. Sakwa.**
Status of Research:	On-going.
Topic:	The Effects of Cooperative Bank's Banking Services on the Growth of Savings and Credit Cooperative Societies: A Case of Thika Sacco Society.
Researcher(s):	Mutua John Mutisya and **Dr. Sakwa.**
Status of Research:	On-going.
Topic:	Investigating the Challenges in Implementing E-Learning in Public Universities: A Case of JKUAT.
Researcher(s):	Mwangi John Ngure and **Dr. Oloko.**
Status of Research:	On-going.
Topic:	Factors Affecting Public Relations Effectiveness in Tertiary Training Institutions in Kenya: A Case of Kenya Institute of Management.
Researcher(s):	**Dr.Oloko** and Nairo Anne Waithira.
Status of Research:	On-going.
Topic:	Challenges in Accessing Business Financing from Various Sources by SMEs in Kenya: A Case of SMEs in Thika Municipality.
Researcher(s):	Ngichiri Kenneth Wamai and **Dr. Sakwa.**
Status of Research:	On-going.
Topic:	Contribution of Corporate Social Responsibility to Competitve Advantage: A Survey of Corporate Firms in Kenya.
Researcher(s):	Ngugi Stanley Wainaina and **Dr. Sakwa.**
Status of Research:	On-going.
Topic:	Factors Hampering the Continuity of Education of Standard Eight Leavers in Kenya: A Survey of Juja Division.
Researcher(s):	Njogu Lawrence Kimando and **Dr. Sakwa.**
Status of Research:	On-going.
Topic:	The Factors Influencing the Performance of Genaral Insurance Companies in Kenya: A Case of AMACO Insurance Company.
Researcher(s):	Njuguna Mercy Wangari and **Dr.Karanja.**
Status of Research:	On-going.
Topic:	Managerial Factors Behind the Successful Running of Mission Hospitals in Kenya: A Case of St. Mary's Mission Hospital, Nairobi.
Researcher(s):	Nyangeri Bryann and **Prof. Bwisa.**
Status of Research:	On-going.
Topic:	Factors affecting Strategy Implementation in Tertiary Institutions in Kenya: A Case of JKUAT.
Researcher(s):	Nyangoto Andrew Otoigo and **Prof. Namusonge.**
Status of Research:	On-going.

Topic:	Factors Influencing Growth of Small and Medium Sized Financial Institutions in Kenya: A Case of Embu Farmers SaCCO.
Researcher(s):	Okello Joseph and **Dr. Sakwa.**
Status of Research:	On-going.
Topic:	The Contribution of Corporate Values to Employee Motivation in Kenya: A Survey of Barclays Bank of Kenya.
Researcher(s):	Ouma Ruth Okana and **Dr. Sakwa.**
Status of Research:	On-going.
Topic:	The Contribution of Corporate Values to Employee Motivation in Kenya: A Survey of Barclays Bank of Kenya.
Researcher(s):	**Dr. Sakwa** and Ouma Ruth Okana.
Status of Research:	On-going.
Topic:	Factors Influencing Subscription Television Market: A Case of Ongata Rongai in Kenya.
Researcher(s):	**Dr. Oyugi** and Owino Martin Miewe.
Status of Research:	On-going.
Topic:	The Effects of the Traffic Amendment Rules, on Passenger Transport Sub-sector in Thika Kenya.
Researcher(s):	**Dr. Oyugi** and Patrick Kibati.
Status of Research:	On-going.
Topic:	An Analysis of Outsourcing in Government Ministries in Kenya: A Case of Ministry of Education.
Researcher(s):	**Dr. Oyugi** and Patrick Kiprotich Malakwen.
Status of Research:	On-going.
Topic:	The Effects of Value Added Tax on the Operations of Medium Business Enterprises: A Case of Falling Medium Business Enterprises within Thika Town.
Researcher(s):	**Prof. Namusonge** and Paul Mutuku Muema.
Status of Research:	On-going.
Topic:	Factors Contributing to Failure to Establish Enterprises by Youth in Kenya.
Researcher(s):	Peter Kamau Ndichu and **Dr. Gakure**.
Status of Research:	On-going.
Topic:	Challenges Facing Private Housing Developers in Supply of Housing to Residents of Nairobi.
Researcher(s):	Racheal W. Ndei and **Dr. Sakwa.**
Status of Research:	On-going.
Topic:	Determinants of Employees Retention in Non- Governmental Humanitarian Organizations: A Case of Favour International Kenya Office.
Researcher(s):	Rugui Mary Njoki and **Dr. Oloko.**
Status of Research:	On-going.
Topic:	Public Road Transport Sector Reforms in Kenya: Attempts to Reduce Road Accident Casualties.

Researcher(s):	Salat Hussein Wathi and **Dr. Sakwa.**
Status of Research:	On-going.
Topic:	The Effect of Corporate Identity and Corporate Image Congruence on Customer Satisfaction and Loyalty: A Case of Agricultural Information Resource Center.
Researcher(s):	Stephen Kibet Rono and **Dr. Sakwa.**
Status of Research:	On-going.
Topic:	Assessing the Role of Water Service Providers in Helping Achieve the Millennium Development Goal on Water and Sanitation: A Case of Nyeri Water and Sewerage Company.
Researcher(s):	Tom Mutua and **Prof. Njoroge.**
Status of Research:	On-going.
Topic:	The Effects of Human Resource Policies and Practices on Service Delivery in Cooperative Societies: A Case of Ukulima SACCO.
Researcher(s):	**Dr. Oyugi** and Toroitich K. Hillary.
Status of Research:	On-going.
Topic:	Factors That Influence Resistance to Change in Public Universities in Kenya: A Case JKUAT.
Researcher(s):	Wilson Ngaruiya Njoroge and **Dr. Gakure.**
Status of Research:	On-going.
Topic:	The Role of Financial Cooperatives in the Provision of Financial Services in Kenya: A Case of Kenya Canners SaCCO Ltd, Thika District.
Researcher(s):	**Prof. Namusonge** and Wycliffe Wanjala Kisiang'ani.
Status of Research:	On-going.

11. TAITA TAVETA CAMPUS

Prof. Gichaga second left with Vice chancellor Prof Imbuga and DVC's Odhiambo and Prof. Njeruh (right) at Taita Taveta water pump station.

Topic:	Isolation and characterization of Microbial Communities in Termite guts.
Researcher(s):	**Boga H.I.,** Tsanuo M.K., Wamunyokoli F., and A.W.T Muigai
Status of Research:	On-going.
Topic:	Characterization of enzymes and bioactive metabolites from Actinomycete Species
Researcher(s):	**Boga H.I.,** Tsanuo M.K., Kinyua, Wamunyokoli F., Masiga D., and Lwande W.
Status of Research:	On-going.
Topic:	The Impact of heavy metal pollution and other human activities on Lake Victoria Wetlands.
Researcher(s):	**Boga H.I.**, Ikingura J., Mutakyawa M. and E. Barifaijo.
Status of Research:	On-going.
Topic:	Isolation and characterization of pesticide degrading microorganisms from soil/termites.
Researcher(s):	**Boga H.I.,** Tsanuo M.K. and Magoma G.
Status of Research:	On-going.
Topic:	Isolation and characterization of actinomycetes from protected habitats.
Researcher(s):	Boga H.I., Dan Masiga, Okech M. Lwande W.
Status of Research:	On-going.
Topic:	Characterization of microbial communities in Soda Lakes.
Researcher(s):	**Boga H.I.,** Mwirichia R.K.
Status of Research:	On-going.
Topic:	Assessing the impact of Bt-Maize delta-endotoxin on soil microbial communities.
Researcher(s):	**Boga H.I.,** Kahangi E, Lenga F.K., Jefwa J., Mugo S, Masiga D.
Status of Research:	On-going.
Topic:	Assessing the microbial diversity in the hypersaline Lake Magadi.
Researcher(s):	**Boga H.I**, Mwirichia R.K, D. Cowan.
Status of Research:	On-going.

SECTION B: COMPENDIUM OF COMPLETED RESEARCH ACTIVITIES

1. FACULTY OF SCIENCE

1.0 DEPARTMENT OF STATISTICS AND ACTUARIAL SCIENCES

Title:	Modelling the Volatility of Exchange Rates in the Kenyan Market.
Researcher(s):	Isaya Maana, Peter Mwita and **Romanus Odhiambo.**
Background:	The research considered the application of the Generalized Autoregressive Conditional Heteroscedasticity process in the estimation of volatility in the Kenyan exchange rates.
Methods:	A quasi-maximum likelihood estimation procedure was used and asymptotic properties of the estimators derived.
Results:	Exploratory data analysis performed showed that the Kenyan returns are heavy tailed.
Conclusions:	It was found that the estimated model fits the exchange rates return data well.

Title:	Conflict Resolution using Statistical Approach.
Researcher(s):	Vincent O. Omwenga and **Peter N. Mwita.**
Background:	Conflict can be described as a condition in which actions of one person prevent or compel some outcome at the resistance of the other. Quite often this can be seen as "two or more competing, often incompatible, responses to same event".
Methods:	In the work, a statistical approach to conflict resolution using the concept of bargaining game theory was presented. The approach gave chances of failure that are minimal since any offer made in a conflict situation is tied to the likelihood of it being accepted as it takes into considerations demands from the other party.
Results:	The approach was found to be presenting a fair way of solving a conflict without affecting a system.
Conclusions:	An employer-employee relationship was used to illustrate the application of the approach.

Title:	Logistic Regression for Credit Scoring Using Neural Networks.
Researcher(s):	**Gichuhi A. Waititu**, Mboya Edward.
Background:	Credit scores are increasingly and widely being adopted by insurance and financial institutions as a measure to mitigate losses due to bad debt and potential risk posed by lending money to consumers.
Methods:	Maximum Likelihood Estimation (MLE) methods seek to maximize the log likelihood, which reflects how likely it is (the odds) that the observed values of the dependent variables may be predicted from the observed values of the independent variables.
Results:	Backward stepwise regression appears to be the preferred method of exploratory analyses, where the analysis begins with a full or

	saturated model and variables are eliminated from the model in an iterative process.
Conclusions:	However, Artificial Neural Network as an alternative technique to elimination of variables can be employed to estimate the coefficients of the predictor variables through Feed forward technique.
Title:	Logistic Estimation of Multinomial Ordered Choices Using Neural Networks.
Researcher(s):	**Gichuhi A. Waititu,** Mboya Edward.
Background:	To mitigate against potential losses poised by advancing credits to potential customers, Financial and Insurance institutions have increasingly adopted systems to classify the customers into categories tat represent the creditworthiness of the customers.
Methods:	The most preferred technique is the logistic regression assuming binary variables.
Results:	However Multinomial logistic regression can be used to analyze relationships between a non-metric dependent variable and metric or dichotomous independent variables, it compares multiple groups through a combination of binary logistic regressions.
Conclusions:	As opposed to the norm of comparing Multinomial logistic regression and Artificial Neural network separately by using logistic regression in its training algorithm better results can be obtained in determining the relationship between variables and detecting relevant patterns in the data and estimating the coefficients of the predictor variables through Feed forward technique.

1.1 DEPARTMENT OF BIOCHEMISTRY

Some innovative products of hair conditioner and shampoo at Chemistry Product Centre.

Title: Characterization of Seed Oil and Preliminary Evaluation of Oxalate Oxidase Activity among Kenyan Sunflower Varieties.

Researcher(s): J. Kimani, **D.W. Kariuki,** G. M. Kenji and A.M. Kihurani.

Background: Pathogenesis-related (PR) protein accumulation observed in many plant species upon infection by pathogens is associated with acquired resistance. This study investigated the presence of oxalate oxidae in six sunflower (helianthus annuus) varieties available in Kenya, namely: Kenya Fedha, Rekord, Issanka, H8998, H4038 and H4088.

Methods: A calorimetric enzyme assay was used to screen for the enzyme activity in sunflower leaf tissue. A detached leaflet assay was conducted and lesion size measured following degradation by exogenously applied oxalic acid on leaf tissue. Sunflower oil was also characterized from the six varieties through determination of Acid Value, Saponification Value, Iodine Value, Peroxide Value, Relative Density and Refractive index. The oil content and Fatty Acid composition of the oil were also determined. The relationship between the oil quality/quantity and level of oxalate oxidase activity was also investigated.

Results: This study revealed that the selected sunflower varieties had an oil content of up to 50.55%. H8998 and H4088 and 50.55% and 49.41%oil content respectively. The two varieties may thus be recommended for commercial oil extraction. The oils were found to be highly unsaturated at levels of 81.93% to 89.09% making sunflower oil superior to many edible fats and oils used commercially. Peroxide values ranged from 1.04 to 2.98 meq/kg oil while acid values ranged from 0.14 to 0.28 meq/kg oil while acid values ranged from 0.14 to 0.28 mg KOH/g oil. Saponification that the oils were composed of high molecular weight fatty acids. The oil was also found to be pure and light as indicated by Refractive Index and Relative Density values of 1.4709 to 1.4724 and 0.9106 to 0.9193 respectively, making it suitable for various cooking options.

Conclusions: All the varieties responded differently to oxalic acid degradation as characterized by differences in lesion areas per variety ($p>0.05$) at different acid concentrations. H4088 showed higher oxalate oxidase activity and hence higher resistance to degradation by the acid compared to other varieties and was second highest in oil content (49.40%). This study, therefore, recommends that H4088 be promoted to farmers for farming. H8998 which had relatively less oxalate oxidase activity but highest oil content (50.55) may also be recommended for transformation with the resistance gene in order to enhance its oxalate oxidase activity.

1.2 DEPARTMENT OF PHYSICS

Title: The absorption spectra of natural dyes and their suitability as a sensitizer in organic solar cell application

Researcher(s): **David M. Mulati** and Bjorn Witt.

Background: Dye Sensitized Solar Cells (DSSC) provide a low-budget solution for photovoltaic.Unlike the classical silicon cells they are easy and cheap to produce and are therefore a good candidate for small scale application in East Africa's rural areas. A led-lamp powered by DSSCs which replaces the noxious petroleum lamp could be one out of many application scenarios.Most of the recent research studies focus on DSSCs based on the pretty expensive ruthenium complex as a sensitizer. In contrast, this study analyzes the suitability of organic

dyes that are locally available in East Africa. In particular hibiscus, Solanum Nigrum, beetroot and eggplant are subjects of this study. Eggplant fails due to a difficult extraction process. Also beetroot turns out to be a poor candidate since it contains betanin which does not chelate to the TiO_2-surface of the cell. Hibiscus shows good performance, while Solanum Nigrum is strong in terms of voltage but poor in terms of current. The first experiments are followed by more intensive studies of the last two candidates. It is shown, that the process of chelating to the TiO_2 shifts the absorption spectra of the dyes slightly towards lower wavelengths. After analyzing the effects of mixing Solanum Nigrum and hibiscus it can be concluded, that mixtures do usually not lead to a better performance. In current, voltage and efficiency a mixture shows average values between those of the single components. So the mixture will always perform less effective than the most effective component. Interesting results are found after extracting hibiscus in water at 100°C and at 50°C. The dye extracted at 50°C shows a significantly better performance in current and efficiency. This behaviour shows how sensitive the complex organic dye molecules are and how easily they can be destroyed. Last but not least the importance of =O and -OH groups for chelating to TiO_2 is demonstrated with the help of beetroot. After analyzing the molecule structures of betanin and certain anthocyanins it can be seen that the number of =O and -OH groups relative to the total number of atoms per molecule is higher for most anthocyanins, so that they can connect better to TiO_2 than betanin. The perspectives for DSSCs are good, even though it still needs a lot of improvement in efficiency and life time. Especially for small scale application they could be used within the next two or three years in pilot projects.

Methods:

Analysing the absorption spectra using 1. Hibiscus, 2. Beetroot, 3. Solanum Nigrum 4. Blackcurrant (concentrate); 5. Eggplant. With the exception of blackcurrant concentrate all these dyes are easily available in East Africa. After analyzing the single components, hibiscus and Solanum Nigrum were mixed and analyzed as well to test if the different dyes can complement one another. Also the difference in absorption between the pure dye and the dye absorbed by TiO_2 was analyzed. To get the juice of nightshade the berries were simply crushed. The blackcurrant concentrate was just taken out of the bottle as it was. For hibiscus and beetroot the dried (hibiscus) or fresh (beetroot) fruit was boiled in water and ethanol. Also a water temperature of 50°C instead of 100°C was tried for extracting hibiscus.

Results:

	Uoc / mV	Isc (μA)	Umpp (mV)	Impp (μ A)	η (%)
S. N.	331.0	2 47.80	216.61	34.70	0.04
H.	339.0	2 294.0	1 208.0	5 210.41	0.26
M.	368.0	190.10	214.05	118.31	0.15

Table: Properties of hibiscus, Solanum Nigrum and its mixture.

Conclusions:

Even though DSSCs might still show a low efficiency and problems in life time their concept is extremely suitable, especially for rural areas in developing countries. Due to the mentioned challenges, organic DSSCs will not replace oil as a power source for energy-hungry applications in near future. Once a device needs a higher amount of power (computer, heater), the DSSCs fail due to the low efficiency. But it is a good candidate for small scale applications like battery chargers for cell phones or LED-lamps in areas where there is no electricity yet. Especially LED-lamps need only very little power and

	can bring a big improvement by replacing the noxious petroleum lamp.
Title:	Design and Fabrication of Magnetic Nanowire array thin films for potential use in high-energy photon portal imaging.
Researcher(s):	**David M.Mulati;** Richard M. Makori; and Paul K. Mwose.
Background:	Portal imaging is the process of recording the radiation pattern emerging from the patient during cancer treatment, and verifying that it matches the radiation pattern calculated during cancer treatment planning. It involves transfer of energy from a source of high-photon energy such as X-rays and γ-rays to the human body. The selective interaction of the photons with the structure of the human body produces images which are received by the receptor. A portal imaging device with magnetic nanowire arrays as the sensing elements has the potential to offer better contrast, a good spatial resolution and wide exposure latitude by adjusting the irradiation bias. It retains the radiation pattern until it is erased, if and when required.The design of a novel magnetic nanowire array image detector requires the fabrication of nanowires that are uniform and parallel over the surface areas wider than those currently used.
Methods:	The devices designed and fabricated; included the Faraday cage, potentiostat circuit, the electrochemical cells, working electrode, working electrode fixtures and the temperature control system. The fabrication of nanowire arrays by the self organized nanoporous AAO template method involved; anodizing the plate and electrodeposition of the desired nanowire material in the pores of the template. A set-up for electropolishing of all the samples was done using copper as the cathode and aluminium as the substrate. Finally scanning electron microscopy was done to confirm the structure.
Results:	From this study, it is noted that self organized anodic aluminium oxide can be grown in sulphuric acid at 0°C, using voltage as low as 15.0 V dc, producing less gray coloured membranes, in more than one anodizing steps. The diameter of the pores increases with increasing temperature. Agitation of the electrolyte has a direct impact on the surface morphology of the anodic aluminium oxide membranes.
Conclusions:	The study realized nanowires although not uniform. The conditions for uniform formation of nanowires require further research. A programmable potentiostat may be used to fabricate multi-segement nanowire array thin films. The state of magnetization of each wire may be used to record and store a portal image.
Title:	Gravity and magnetic Investigations of the greater Magadi Area.
Researcher(s):	**Githiri, J.G**, Patel, J.P., Barongo, J.O. and Karanja, P.K.
Background:	Magadi area is located in the southern part of the Kenyan rift, an active continental rift that is part of the East African Rift system. Thermal manifestations in the form of hot springs in the northern and southern shores of Lake Magadi and high heat flows suggest geothermal potential in the area. Local seismic activity monitored around Lake Magadi revealed an earthquake cluster caused by swarm activity in the rift centre at shallow depths, which was probably triggered by magma movements.
Methods:	Ground magnetic and gravity investigations were carried out as a follow-up to locate any body at depth with sufficient magnetic susceptibility and density contrast respectively that may represent a magmatic intrusion. Euler deconvolution technique was used to image depth to the causative bodies. Spectral analysis was applied

to magnetic data along selected profiles cutting through discerned anomalies. 2-D gravity and magnetic models were of the subsurface structure were generated. From the magnetic model, an attempt was made to determine depth to the curie isotherm. The final magnetic and gravity models were controlled using the existing seismic model and geology of the area.

Results: Rapid interpretation for source positions and depths by Euler deconvolution technique using a structural index 1.0 yields depth to magnetic bodies ranging from 0-11 Km. Spectral analysis results suggest that the Curie-point isotherm depth under Magadi ranges from 5.20 km to 8.30 km. Estimated vertical temperature gradients along the profiles ranges from 111.53˚C/km to 69.92˚C/km.

Conclusions: The Euler depths suggest deep sedimentary basins overlying volcanics of high magnetization. The high temperature gradients and relatively shallow Curie point depths indicates high heat flow which suggests presence of a hot magmatic intrusion in to the lower crust.

Title: An Experimental Design for Producing Holograms.

Researcher(s): **Ominde, C.F.**, Kihara, G.R. and Nyakoe, G.

Background: The rapid growth and development of modern technology in our markets has made fake currency notes, bank credit cards, University certificates, and other government documents to find their way into our markets. The challenge of how to differentiate authentic documents from counterfeit supplies has since increased. Holography is proposed as a way of countering these forgeries. Using an experimental setup, holograms of tailor made objects are made and attached onto documents to help any user verify the authenticity of the documents. An intense study of holographic recording is thus presented and tested within this region.

Methods: Local custom made setup were designed and fabricated. A successful advance was the designing and setting up of a tailor made optical table that perfectly suits holographic applications as well as other future experiments in the laboratories. The optical table was made purely from steel and weighs about 325 Kg. It was specially designed with good static rigidity and excellent stiffness with well damped structure. Preliminary running of holographic set-up was then done and from these, the best exposure times for efficient bright hologram determined. An intense study of holographic recording was thus presented.

Results: A stable Optical table was designed and fabricated. This table purely made from steel has a well damped structure which means no low frequency (<100 Hz) resonances are present. The interior design of this table was made of honeycomb structures to resist the long, short, and torsional bending modes in essence having a sensitive system for demonstrating holography, interferometry amongst other sensitive experiments. Stability of fabricated optical table was analyzed using a Michelson interferometer experiment. Laser beam analysis using spectrum analyzer was carried out and another mode very close to the dominant wavelength was observed on the He-Ne laser beam used. However, this mode was studied and observed to almost disappear after the He-Ne laser source had been heated for about 3 hours thus giving out a single mode curve and it is during this moment that excellent holograms were obtained. A high degree of consistency and quality control on exposure time, chemical concentration and time was observed during processing of holograms.

Conclusions: A successful experimental set-up to implement holography was therefore designed and fabricated. This is such a step forward for local companies and institutions for a custom made local setup is now available that can be applied in research and training as well as for commercial use within the region of Africa. Successful samples of holograms were generated and observed using this setup. This implies that we have demonstrated the feasibility of holography in this region of Africa.

1.3 DEPARTMENT OF ZOOLOGY

Title: Responses of adult *Rhipicephalus appendiculatus* and *Rhipicephalus pulchellus* (Acari: Ixodidae) to *Calpurnia aurea* (Fabaceae) plant extracts

Researcher(s): P. Nana, N.K. Maniania, R.O. Maranga, H.L. Kutima, H.I. Boga, F. Nchu[3] and E. Kobus.

Background: Experiments were carried out in the laboratory to investigate the response of ticks *Rhipicephalus pulchellus* (Gerstaker 1873) and *Rhipicephalus appendiculatus* (Neumann 1901) to different concentrations of *Calpurnia aurea* (Aiton) Benth 1971 extracts (aqueous, oil and acetone) in both inverted tube glasses and dual choice T-olfactometer.

Methods: Oil extract at the concentration of 50 and 100 mg/ml was the most effective, attracting 46.7 and 65.9% of *R. appendiculatus* ticks in the inverted glass tubes bioassay, respectively, and 52.4% of *R. pulchellus* in the T-olfactometer bioassay.

Results: The level of attraction was similar to the one of attraction-aggregation-attachment pheromone (AAAP) used as a check. The attraction of both tick species to a trap baited with different concentrations of emulsifiable extract was also tested in semi-plot field experiments. More ticks were attracted from 1 m distance than from 5 m at all the doses tested. However, the attraction was greater at the high concentrations of 50 and 100 mg/ml.

Conclusions: The presence of CO_2 significantly increased the number of tick attracted to plant extract. The results of this study suggest that extracts from *C. aurea* have potential for use as a trap for the control ticks in the field.

Title: The prevalence of malaria, associated anemia and the use of Insecticide Treated Bed nets among expectant women during high transmission season in Bungoma, Kenya.

Researcher(s): Wasike, E.W., **Kutima, H.L.,** Vulule J., Magambo, J.K., Kiambo J.

Background: To demonstrate the effectiveness of insecticide Treated Nets (ITNS) in community set ups and under program situations, 387 expectant women in an endemic area were recruited. The objective was to assess the use of ITNS and determine prevalence of malaria and anaemia in expectant women attending Ante natal clinic (ANC) during high transmission season.

Methods: Of the 387 women recruited, 190 (49.1%) owned nets, either conventional or long lasting ones. Prevalence of malaria parasitemia was 28.9% of which 19.8% (77/387) had malaria (parasitemia ≥800mps/ml blood).

Results: Thirty two point eight percent (32.80%), 21.64% and 9.09% of primigravidae, secundigravidae and multigravidae, respectively had

moderately severe anaemia (5.0g/dl<7g/dl). Parity and net use were significantly associated with malaria status

Conclusions: Marital status and level of education were important predictors of net ownership and use.

Title: Immunization studies in rabbits using gut membrane-bound proteins Derived from *Rhipicephalus appendiculatus, R. evertsi evertsi* and *Amblyomma variegatum* female ticks.

Researcher(s): **Helen Lydia Kutima**, Adepapo Amoo, Mabel Imbuga, Philip Museve Kutima

Background: Ticks and tick-borne diseases are of world-wide importance. Ticks are responsible for severe losses caused by either the effect of the tick through mortality or debility due to the diseases transmitted, blood loss, damage to the hides and udders, tick worry, the injection of toxins and low weight gain. The current and most common method used to control ticks is the acaricide application. Acaricides are usually applied topically, by dipping the animals, running them through spray races, hand spraying or hand dressing. These practices are carried out as often as two times a week. There are many drawbacks associated with the use of acaricides in an attempt to control ticks. The rigorous application of acaricides has led to the development of acaricide resistant ticks. Development of new acaricides with different formulation is expensive. This poses a threat to livestock health and production in many areas of the world hence the need for an alternative method of control. The objectives of this study were to immunize rabbits with Gut Membrane-Bound Proteins (GMBP) derived from partially engorged *Rhipicephalus appendiculatus*, *R. evertsi evertsi* and *Amblyomma variegatum* female ticks and to assess whether the elicited immunity was protective against both homologous and heterologous tick instars and to isolate and identify the protective antigens.

Methods: Mid guts were dissected from fully engorged female ticks and Sodium Dodecyl Sulphate-Polyacrylamide Gel Electrophoresis (SDS-PAGE), carried out to determine the protein profile of the homogenized and sonicated midguts. Groups of rabbits were immunized with the midguts and later challenged with homologous and heterologous tick species. Ouchterlony, Western Blot and ELISA were carried out to assess the specificity and cross reacting antigens.

Results: SDS-PAGE of the GMBP antigens demonstrated protein bands with molecular weights ranging from 16 to 140 KDa. Thirty-seven, 45 and 39 protein bands were fractionated from *R. appendiculatus*, *R. evertsi evertsi* and *A. variegatum* GMBP antigens, respectively, all possessing molecular weights ranging from 14 to 140 KDa. Twenty-two of the isolated proteins were shared among the three tick species. Immunized rabbits acquired resistance to challenge infestation by all instars of the three tick species. Resistance was manifested by prolonged feeding, reduction in engorgement weights, egg mass weights, moulting and percentage hatchability and increased mortality. Immunization of rabbits with GMBP antigens generated protection and cross-protection against challenge infestation with homologous and heterologous instars, respectively. Cross-protection was more pronounced in the homologous than heterologous systems. Enzyme-Linked Immunosorbent Assay (ELISA) technique detected circulating antibodies in the anti-sera to GMBP from homologous and heterologous systems one week after the primary dose. Ouchterlony double immunodiffusion reactions with anti-tick GMBP sera formed 2 to 3 precipitin lines with homologous GMBP antigens and one to

two precipitin line(s) with each heterologous GMBP antigens. A line of complete identity was observed when anti-sera to GMBP antigens reacted with GMBP from homologous and heterologous tick species, suggesting common antigenic epitopes. Western blot analysis on GMBP of *R. appendiculatus*, *R. evertsi evertsi* and *A. variegatum* with sera from immunized rabbits detected protein bands specific to the homologous GMBP antigens, and revealed considerable cross-reactions in the heterologous systems.

Conclusions: These results suggested further the presence of common antigens. The presence of cross-reacting antigens conferred cross-protection. Further work is required to purify and characterize the cross-reacting antigens that were responsible for the cross-protection.

Title: Assessment Of Gastro-Intestinal Parasites of Captive Olive Baboons, *Papio cynocephalus anubis,* At The Institute Of Primate Research, Nairobi Kenya.

Researcher(s): Michael Oduor, **Helen Lydia Kutima**, Dorcas S. Yole, Rosebella O. Maranga.

Background: A wide array of parasites may infect non-human primates (NHPs) that are often valuable in studies of either human disease processes or vaccine and drug development. At the Institute of Primate Research, baboons are used for biomedical research. They are models for diseases like Schistosomiasis, Malaria and even Reproductive biology.

Methods: Assessment of gastrointestinal parasites of colony experimental baboon of different age and sex was done using non-invasive technique to determine the identity; prevalence and intensity of these parasites since parasitic infections may affect animal health and ultimately the studies for which the animals are used. A total of 80 faecal samples were collected from 20 baboons: Four faecal samples were collected per week from each animal. Examination of these faecal samples through Direct smears method to detect trophozoites of amoebae and flagellates, Formal ether sedimentation technique for the identification of parasite eggs, cysts, and larval stages. Harada-Mori culture technique for identification of larvae from L1-L3 stage and MacMaster egg counting technique for intensity of parasite eggs per gram of feacal material.

Results: Four protozoan parasites (*Balantidium coli, Entamoeba coli, Entamoeba histolytica* and Giardia *spp*) and 3 nematodes (*Trichuris spp, Oesophagostomum* spp and *Strongyloides spp*) were identified from the faecal samples collected. *Entamoeba coli* were the most prevalent protozoan among the sex and age groups of baboons with all the sexes and age groups having a prevalence rate of 100%. In nematodes, *Trichuris spp* and *Oesophagostomum spp* had a prevalence of 100% in all the age group and sexes. Only one male adult and one female adult had one cyst count of *Giardia*.

Conclusions: There was significant variation on the parasite intensity among age and sex group with $p < 0.05$ for protozoan parasite. *Trichuris spp* had the highest intensity; no significant difference was observed between sex and age groups ($p > 0.05$). *Oesophagostomum spp*, the male adults had the highest intensity with low intensity recorded in male juveniles while the female adult and juvenile had equal intensity; there were significance difference of parasite between age and sex ($p < 0.05$). *Strongyloides spp* was not recorded in female adult though the female juvenile had a high intensity.

Title:	Antischistosomal Properties of Extracts from Medical Plants from Kakamega, on the parasite, *Schistosoma mansoni* in BALB/c Mice.
Researcher(s):	Muchika Susy, **Kutima Helen Lydia** and Yole Dorcas.
Background:	Schistosomiasis is a major public health problem in tropical and subtropical regions of the world where an estimated 200 million people are infected and close to a billion people are at risk of contracting the disease. Because it is a chronic insidious disease, it becomes a threat to development as the disease disables men and women during their most productive years. Although Praziquantel is a drug of choice for treatment of schistosomiasis, there have been reports of resistance hence a need for an alternative drug. Oxamniquine is the only alternative to praziquantel for *S. mansoni* infection but has limited supply because it is expensive. Cheaper treatment of schistosomiasis should be made available to poor communities in endemic areas and plants seem to be a cheaper source for drug development. The aim of this study was to investigate antischistosomal properties of extracts from Medicinal plants used in Kakamega in treatment of BALB/c mice infected with *Schistosoma mansoni*.
Methods:	Parasitological, cercaricidal and pathological assays were carried out to measure the antischistosomal activity of aqueous and methanol extracts. The mice were infected with *S. mansoni* and then treated with two doses of either 150mg/kg body weight *Solanum* or *papaya* (n=60) or 450mg/kg body weight praziquantel (n=15). Concentrations of plant extracts (5ug/ml, 15ug/ml and 30ug/ml) were used with cercariae *in vitro* cercaricidal assay.
Results:	*Solanum* and *papaya* extracts illustrated a desirable killing effect on the larvae worm of up to 100%. In worm recovery of different treatments, infected control had the highest number of worms (57 ± 1.3) as PZQ had the lowest (25 ± 1.8). The four treatments: *papaya* methanol, *papaya* aqueous, *Solanum* methanol, *Solanum* aqueous had worm number counts between the two extremes; (35 ± 2.2), (38 ± 1.9), (33 ± 3.4), (32 ± 1.8) respectively. However, the *papaya* groups had a higher worm counts compared to the *Solanum* groups. Granulomas observed followed a similar trend as worm recovery in praziquantel and infected non-treated mice. However in a comparison between *papaya* and *Solanum, Solanum* treatments showed to have minimal pathological effect of the two.
Conclusions:	There was a significant statistical difference between the number of worms recovered from praziquantel-treated mice and those from plant extracts ($p<0.05$). However there was no significant difference ($p>0.05$) between the number of worms recovered from infected non-treated mice and those from plant extracts. This suggests that praziquantel is more effective than plant extracts in the management of *S. mansoni infections*. Further work needs to be carried out to purify, characterize the active components form the medicinal plants and also carry out the synergistic effects of the two plants.
Title:	Risk Factors for Pneumonia in Children Under Five Years of Age, Hospitalized in A Rural District Hospital of Western Kenya.
Researcher(s):	Manya Ayub Shisia, **Helen Lydia Kutima,** Daniel Feikin and Christopher.
Background:	It is estimated that approximately 2 million children under five years of age die each year due to pneumonia in developing countries. In Kenya, pneumonia, along with malaria and diarrhoea, is a leading

cause of death among children. A case-control study was carried out in Siaya district, with the aim of identifying risk factors associated with childhood pneumonia.

Methods: Children hospitalised with pneumonia were compared to those without pneumonia, with particular reference to demographic, socio-economic, environmental, immunization, and nutritional factors. The study was conducted in the paediatric ward of Siaya district hospital during the months of September, October and November 2005. Children hospitalised with pneumonia were age-matched and compared to those without pneumonia in the same ward. The diagnosis of pneumonia was made on clinical features according to the World Health Organization's Integrated Management of Childhood Illness (I.M.C.I). A standardized questionnaire was administered to selected study participants. Data were entered and analysed using *Epi Info* version 3.2.2. A matched analysis and multivariate analysis using conditional logistic regression were done. A total of 188 children participated, 47 of them being cases.

Results: In a matched univariate analysis, malnutrition was the most important risk factor for pneumonia. There was a dose-response effect, with the risk of developing pneumonia increasing as the degree of malnutrition increased. Severe stunting, as represented by a low height-for-age (z-score <-3), was strongly associated with pneumonia with a matched odds ratio of 6.00 (95% Confidence Intervals 2.07-17.31, p-value 0.0004). Use of firewood for cooking was found to be a significant environmental risk factor for pneumonia (mO. R, 2.90, 95% C.I= 1.055-8.015, P-value 0.041). Several markers for lower socio-economic status also proved significant risk factors for pneumonia.

Conclusions: Children from homes without a television set were more than three times likely to develop pneumonia (mO. R= 3.30, 95%C.I =1.12-9.71, and P-value 0.03) than those with television sets. The risk for those living in houses without cemented floors was three times compared to those whose floors were cemented (mO. R 3.33, 95%C.I= 1.48-7.33, p-value 0.0048). Those who received medication prior to admission were at an increased risk of developing pneumonia (mO. R 2.08, 95%C.I 1.02-4.24, p-value= 0.04). In multivariate analysis using conditional logistic regression, severe stunting (height-for-age z-score <-3) remained a risk factor for pneumonia (Adjusted odds ratio 7.35, 95% CI=2.44-22.15, p-value=0.0004). Those children who resided in houses with earthen floors were at risk of developing pneumonia (adjusted odds ratio of 3.96(95% C.I 1.65-9.49, p-value= 0.002), while those who received treatment from other centres prior to admission to Siaya were still at risk (A.O.R 2.83, 95% C.I 1.12-6.59, p-value= 0.015). This study highlights the importance of malnutrition and low socio-economic status in the occurrence of childhood pneumonia. While poverty eradication programmes can take long to implement, there is an urgent need for local action to address the reduction of malnutrition.

Title: *Trypsin* activity in glossina morsitans morsitans, phlebotomus duboscqui, Aedes aegypti *and stomoxys calcitrans* infected with trypanosoma brucei brucei

Researcher(s): **Helen Lydia Kutima**, Mabel O. Imbuga, Ellie O. Osir and Japhet K. Magambo.

Background: Trypsin activity was consistently low in teneral unfed *G. m. morsitans* (0.0022 $\pm$ 0.0003), *P. duboscqi* (0.0024 $\pm$ 0.00064), *A. aegypti* (0.0003 $\pm$ 0.00024) and *S. calcitrans* (0.0025 $\pm$ 0.0002). Trypsin

activity increased following a bloodmeal and reached a peak between 48-72 h in *G. m. morsitans*, and 24-36 h post-feeding in *P. duboscqi*, *A. aegypti* and *S. calcitrans*, respectively.

Methods: After the peak, the trypsin levels dropped progressively and by 120 h post-feeding the trypsin levels had returned to the same level as in the unfed flies. These results indicate that a bloodmeal is essential in the stimulation of trypsin synthesis. Midgut homogenates from unfed *G. m. morsitans*, *P. duboscqi*, *A. aegypti* and *S. calcitrans* and at 0 h post-feeding had little or no effect on the parasites, but following a bloodmeal midgut homogenates lysed bloodstream and procyclic *T. b. brucei*.

Results: The activity of midgut trypsin of *Glossina m. morsitans* was significantly (ANOVA: P<0.0001) inhibited by bloodstream forms of *T. b. brucei* ingested in a bloodmeal between 0 and 24-h postfeeding. The activities of midgut trypsin of *P. duboscqi*, *A. aegypti* and *S. calcitrans* fed on an infected bloodmeal were lower than the controls but not significantly. In all the insect species, the peak of trypsin was delayed for 6-12 hours. The activity of trypsin in midgut homogenates isolated from *G. m. morsitans*, *P. duboscqi*, *A. aegypti* and *S. calcitrans* midgut trypsin activity was significantly (ANOVA: P < 0.0001) inhibited strongly by D-mannose. The other sugars tested either weakly inhibited the activity of midgut trypsin or had no inhibitory effect.

Conclusions: The activity of trypsin in midgut homogenates isolated from *G. m. morsitans*, *P. duboscqi*, *A. aegypti* and *S. calcitrans* midgut trypsin activity was significantly (ANOVA: P < 0.0001) inhibited strongly by D-mannose. The other sugars tested either weakly inhibited the activity of midgut trypsin or had no inhibitory effect.

Title: Mapping *Trichomonas vaginalis* among women living in Kisumu, Kenya.

Researcher(s): Harriette Sande, Elizabeth Bukusi, **Helen Lydia Kutima** and Craig Cohen.

Background: *Trichomonas vaginalis* is one of the most common occurring sexually transmitted infections in the world. It accounts for 170 million new cases of treatable STIs occurring every year world wide. This infection has been associated with increased rates of HIV transmission and can be used as a surrogate marker for recent risky sexual behaviour. The aims of this study were to evaluate the distribution of *Trichomonas vaginalis* among women living in Kisumu in relation to sexual hotspots.

Methods: The prevalence rate of *Trichomonas vaginalis* among women in Kisumu aged between 15-45 years was 15.5%. Women between the ages of 15-45 years were found to have the highest infection rate.

Results: Mapping of the infection showed that Township and West Kolwa locations had the highest numbers of infected participants and sexual hotspots. Multivariate logistic regression analysis showed there was no association between distance to hotspots and *Trichomonas* infection.

Conclusions: Marital status and age group was associated with infection. Intervention that is formulated should cater for the need of specific population especially those that indicate to have higher rates of infection.

2. FACULTY OF AGRICULTURE

2.0 DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

Title: Properties of a complementary food based on grain amaranth (*Amaranthus cruentus)* grown in Kenya.

Researcher(s): **M.W. Mburu**, G.M. Kenji, M.A. Mwasaru and N.K. Gikonyo.

Background: Amaranth grain (*Amaranthus cruentus)* is a pseudo cereal consumed in many parts of the world with potential as a source of dietary nutrients. Currently its commercial processing is not well established. Development of new products from amaranth is expected to expand its utilization as a food crop. Amaranth grain is a good source of proteins and vitamins and is thus suitable for infant and geriatric feeding and intervention programs.

Methods: A product was developed from amaranth grain by steeping, steaming, drying the steamed grain followed by comminution. The product was analyzed for nutritional, functional and sensory properties.

Results: The proximate analysis mean values for the raw and processed grain were moisture 10.2% and 2.4%; protein 17.2% and 16.7%; fat 7.0% and 7.0%; ash 2.7% and 2.6%; crude fiber 3.8% and 3.1%, carbohyrste59.2% and 68.3%. The predominant fatty acids in the amaranth grain oil were oleic (36.3%) and linoleic (35.9%). The processed product contained eight essential amino acids, whose contents were not significantly affected by processing conditions.

Conclusions: Steeping followed by steaming does not significantly affect the nutritional composition of amaranth grain except for vitamins.

Title: Technological approaches for enhancing utilization of sorghums and millets in Kenya.

Researcher(s): S.O. Ochanda, C.A. Onyango and **M.A. Mwasaru**.

Background: Sorghums and millets are arid and semi arid lands (ASAL) crops. They not only grow well in regions with rich soil and plentiful rain but they also grow well in regions with minimal rain and with little or no farm inputs. In spite of this, most ASAL regions in the country experience food shortages, hunger, malnutrition and related deaths because such crops are ignored. Local millers and the cereal industry have likewise not exploited their potential. On the other hand a ready market outlet for such cereals is lacking and manufacture of convenience products, from them may lead to renewed vigor in their production.

Methods: The research focused on detoxification and nutrient enhancement treatments namely; alkali treatment, malting, and fermentation. Optimized flours from these treatments together with pigeon pea were used to develop breakfast cereals with a view to encourage commercialization.

Results: Malting and fermentation significantly reduced tannins and phytates, enhanced protein digestibility and availability of B-vitamins ($p \leq 0.05$). Malting was done for 3 days and fermentation for 2 days both at room temperature of 25°C. Tannin was reduced by up to 50% by both malting and fermentation, while phytate reduction was about 20.4% by fermentation and 21.7% by malting. These differences were however not significant from each other ($p \leq 0.05$). Protein

digestibility was significantly different with malting and fermentation in comparison to that of unmalted and unfermented cereals ($p \leq 0.05$). Malted cereals had a protein content of 34.5-68.1% while fermented flours had 97.4-98.3%. Quantities of the selected B-vitamins were significantly enhanced by fermentation with a range of 71.2-94.2% while only riboflavin was enhanced by malting with 44.2% increase, the rest were less than 10.5%.

Conclusions: A product was successfully developed. The optimally treated flours together with pigeon pea yielded products with similar nutritive values as the ones in the market. The most preferred product was from white sorghum. The developed products' shelf-life was similar to those of commercial products in the market.

Title: Preservation Potential of Herbal Plants Commonly Used By the Maasai Community in Kajiado District.

Researcher(s): Ms. Lucy W. Gakuya, **Dr. Christine A. Onyango**, Prof. Francis M. Mathooko, Dr. Julius M. Mathara.

Background: Indigenous plants have been used in milk preservation among the Maasai community in Kajiado district from time immemorial. Although many of the herbs have been studied, their potential as food preservatives is not documented anywhere and neither has their efficacy been studied. The knowledge of such use is handed down the generations but due to changes in society and lifestyle is dying off and thus there is insignificant exploitation of these plants scientifically and commercially. Therefore, the study of these plants may form a basis of their commercial exploitation. There is evidence of their effectiveness and acceptability by the society. However, there is need to establish the scientific basis for their activity and their documentation before they can be exploited commercially.

Methods: *Research design: Field survey and laboratory analyses. Field survey - study site* Central Division, Kajiado district; Sajiloni and Bissil areas using a semi structured questionnaire administered to focus groups and key informants

Materials-

- plants collection and botanical identification,
- Extraction of plants materials - extraction with pet ether, methanol and distilled water using Trease and Evans method (Trease and Evans, 1987)
- Chemical analyses of her extracts and food products treated with the extracts
- Microbial assay of extracts using selected microbial cultures
- Toxicity tests for extracts using brine shrimp (*Artemia salina*) larvae
- Quantification of pro-oxidation elements (Gamez *et al*., 1999) and antioxidant activity- DPPH radical scavenging - and reducing power - spectrophotometric method (Yen and Duh, 1993)
- Fermentation of milk treated with and without herb extracts and stored at different conditions

Results: Several herbs identified as used in milk and meat by the Maasai of Kajiado district and taxonomically classified at the National Museums of Kenya. The herbs were found to be rich in a vast array of beneficial phytochemicals including, terpenes alkaloids, sterols, tannins, saponins and flavonoids among others. The presence and

concentration of phytochemicals present depended on the solvent extract used. The phytochemicals had varying antimicrobial inhibition capacity depending on the solvent used to extract them. They were also observed to have significant antioxidant capacity.

Conclusions: The study showed the presence of various phytochemicals in the plants tested and they possessed both antimicrobial and antioxidant activity. The addition of the phtyochemicals to milk before fermentation reduced the survival of pathogenic microorganisms and rendered the milk safer for human consumption. The milk also maintained its palability for longer than milk that was not treated. Some of the herbs had higher antibacterial activity while others had higher antioxidant activity. These phtyochemicals had little or no toxicity. The plants and herbs used by the Maasai people can be exploited for their potential to provide natural food preservatives.

Title: Studies on the Use of Herbs to Preserve Meat and Milk among the Pastoral Communities of West Pokot.

Researcher(s): Mr. Mikah O. Nyaberi, **Dr. Christine A. Onyango**, Prof. Francis M. Mathooko, Dr. Julius M. Mathara.

Background: A study was conducted to determine the efficacy of traditional herbs and methods of use in preservation of meat and milk. Herbs have been and are an integral part in the life of indigenous communities. They are used as building materials, fodder, weapons, medicine, flavour enhancers, appetizers, nutritional additives and preservatives of meat and milk. Different parts of these herbs are used for these purposes, including leaves, roots, and seeds, stem barks, and even the whole plant. In some cases a mixture of various herbs are used to meet a specific objective. These herbs are prepared and utilized in different forms such as liquid extracts, charcoal, ash, powders and even whole fresh plant parts. Many foods are also treated with various herbs in different forms either alone or in addition to dehydration and other preparations. Excessive use of these chemical preservatives, some of which are suspect because of their supposed or potential toxicity, is no longer desirable or acceptable as more consumers desire more natural foods that are perceived as safe and healthy hence the need to or adopt more natural alternatives for the extension of product life. Herbs may provide a viable alternative.

Methods: Herbs were collected and locally identified using a structured questionnaire various organized groups. Information on uses, parts and methods used was recorded. The herbs were taken to the East African Herbarium at the National Museums of Kenya for taxonomic identification. Chemical and bacteriological analysis of the herbs was carried out by prior drying of the herbs and the parts used at ambient temperatures. Extraction was undertaken using solvents at decreasing polarity, starting with Chloroform (50 - 60°C), Methanol (40-60°C) and water. The extracts were tested for antimicrobial and antifungal properties, against *B. subtilis*, *P. aeruginosa*, *E. coli, C. albicans*, and *S. aureus*. Chemically the extracts were analyzed for the presence of phytochemicals using the Trease and Evans (1989) methods. Tests for antioxidant activity and toxicity were also done. Aqueous extracts were tested in meat and milk to determine any preservative effect. Sensory analysis of the foods tested was carried to establish the presence of any after tastes or development of unlikely flavours in the food. The pH, titratable acidity, colour change, plate count and lactic acid bacteria count.

Results: Four herbs were identified; two for the preservation of milk *Kromwa* (KOIC), *Senetwo* (SSDC) and two for the preservation of meat *Oron* (OTI), *Angaun* (AZA). In the case of the two herbs used to preserve milk, (*Kromwa* (KOIC) and *Senetwo* (SSDC)). About 90% of the people in the pastoral communities of West Pokot use the herbs to preserve milk, while only 20% preserve meat. The stem is peeled and dried under a shed, then burnt after which the charcoal formed is pasted on the sides of the milk gourds with the excess dust being removed. Milk is then introduced. In the case of those used to preserve meat *Oron* (OTI) and *Angaun* (AZA)) fruits are used. The fleshy part of the fruit is dried, crushed to powder and then mixed with water to make a paste. Dried meat that has been cut into stripes is immersed and left to dry in storage. Fresh meat can also be immersed and then stored fresh for a few days, though this was not a common practice. The findings in the laboratory indicated that the milk treated with the herbs (MS_1) showed a slower accumulation of % titratable acidity to 2.8%. The microbial assay showed varied microbial activity with no activity against some organism and significant inhibitory activity against others. Water extracts had no anti microbial activity.

Conclusions: The chloroform extracts showed activity towards LAB and *B. subtilis* with inhibitory diameter of 20.00±1.0 and 10.5±1.49 respectively. The water extracts showed no activity towards all the test microorganisms. The methanol extract of SSDC showed the highest antioxidant capacity by reducing DPPH by 61.68% followed by the chloroform extract of SSDC which had 17.20% the water extract of SSDC and the methanol extract of KOIC showed no significant ($P<0.05$) antioxidant activity on DPPH.

Title: Technological Approaches for Enhancing Utilization of Sorghum and Millets in Kenya.

Researcher(s): Mr. Simon O. Ochanda, **Dr. Christine A. Onyango**, Prof. M. A. Mwasaru

Background: Sorghums and millets are arid and semi arid lands (ASAL) crops. They not only grow well in regions with rich soil and plentiful rain but they also grow well in regions with minimal rain and with little or no farm inputs. In spite of this, most ASAL regions in the country experience food shortages, hunger, malnutrition and related deaths because such crops are ignored. Local millers and the cereal industry have likewise not exploited their potential. On the other hand a ready market outlet for such cereals is lacking and manufacture of convenience products, from them may lead to renewed vigor in their production.

Methods: The research focused on detoxification and nutrient enhancement treatments namely; alkali treatment, malting, and fermentation. Optimized flours from these treatments together with pigeon pea were used to develop breakfast cereals with a view to encourage commercialization.

Results: Malting and fermentation significantly reduced tannins and phytates, enhanced protein digestibility and availability of B-vitamins ($p\leq0.05$). Malting was done for 3 days and fermentation for 2 days both at room temperature of 25°C. Tannin was reduced by up to 50% by both malting and fermentation, while phytate reduction was about 20.4% by fermentation and 21.7% by malting. These differences were however not significant from each other ($p\leq0.05$). Protein digestibility was significantly different with malting and fermentation in comparison

to that of unmalted and unfermented cereals ($p \leq 0.05$). Malted cereals had a protein content of 34.5-68.1% while fermented flours had 97.4-98.3%. Quantities of the selected B-vitamins were significantly enhanced by fermentation with a range of 71.2-94.2% while only riboflavin was enhanced by malting with 44.2% increase, the rest were less than 10.5%.

Conclusions: A product was successfully developed. The optimally treated flours together with pigeon pea yielded products with similar nutritive values as the ones in the market. The most preferred product was from white sorghum. The developed products' shelf-life was similar to those of commercial products in the market.

Title: Growth, physiology and quality on harvest of on-tree bagged mango (*Mangifera indica* L. cv Apple) Fruit**.**

Researcher(s): Prof. Francis M. Mathooko, **Dr. Christine A. Onyango**, Prof. Esther M. Kahangi, Dr. Willis O. Owino and Mr. Josephat M. Runkua.

Background: Apple mango is highly susceptible to russet-like physiological disorder that affects the fruit during maturation, and is severe in humid weather, rendering the fruit unfit for fresh market due to development of brown blemishes on the fruit peel. The resulting unattractive appearance disqualifies the fruit from the export market due to stringent quality requirements. Producers get low returns from such blemished fruits as the fruits are sold in the local low-end fresh market and to local juice processors. Due to a lack of locally validated information on best control options for Apple mango russet (commonly known as 'rust' by Kenyan mango growers), agribusiness oriented mango growers have tried use of broad spectrum synthetic pesticides for its control, without success. However, pre-harvest fruit bagging may control 'rust'. Mango fruit is also perishable and postharvest losses in Kenya are very high. The main objective of this study was to investigate the influence of pre-harvest bagging on fruit quality at harvest and response to 1-MCP.

Methods: Mango fruit tress (Mangifera indica cv. Apple) fruit trees were randomly selected and tagged for subsequent sampling at a commercial farm in Yatta District, a Semi-arid region of eastern Province, Kenya. Sampling and analysis commenced 14 days after bloom (DAB), and fortnightly thereafter up to harvest time at 168 DAB. On-tree fruit bagging was done at 70 DAB, Just before manifestation of Apple mango 'rust'. Bagged and unbagged fruits were subjected to sampling and analysis for physical, physiological and chemical parameters. After harvest, both bagged and unbaggedd fruits were each divided into two equal sets of fruits, with and without 1-MCP treatment at 20ppm, and subjected to analysis for changes in physical, physiological and chemical parameters during storage. Sensory evaluation for fruit appearance, colour, taste, texture aroma and overall acceptance was done at harvest and on ripening on a 9-point hedonic scale using 15 untrained panelists.

Results: Unbagged fruits had significantly ($p<0.05$) fructose, glucose and sucrose, anthocyanins,β carotene and ascorbic acid contents at harvest. Bagged fruits were more green at harvest, with significantly ($p<0.05$) higher chlorophyll (band total) contents, peel L* value (measure of brightness). Peel hue angle (measure of colour) and starch content. However the difference in pulp L values , total titratable acidity, total soluble solids , respiration rate, firmness, fruit weight, fruit equatorial diameter and minerals (Ca, Mg K and P) content between bagged and unbagged fruits were not significantly ($p>0.05$) different at harvest. No

ethylene was detected up to harvest. Bagged fruits had a significantly higher sensorial score in peel colour and appearance, with no visible blemishes at harvest. The unbagged fruit had visible blackish brown blemishes due to 'rust'.

Conclusions: Bagging and 1-MCP treatments had a slight effect on respiration and ethylene production rates, though control unbagged fruits had higher respiration AND ethylene peaks neither .neither bagging nor 1-MCP retarded fruit ripening. Fruits in all treatments reached full ripeness and eating quality at 7 days after harvest (DAB) Bagged fruits had higher sensorial score on peel colour, appearance and overall acceptance. The differences in taste colour and texture between the bagged and unbagged fruits were not significant at ($p<0.05$). Unbagged fruits had higher postharvest weight loss, shriveled earlier and consequently, a shorter postharvest life of nine days compared to 15 days for bagged fruits. Loss of total titratable acidity, ascorbic acid and initial firmness was retarded by 1-MCP (20ppm). Pre-harvest bagging was effective in controlling Apple mango 'rust'. However , post harvest 1-MCP treatment was not effective in improving the post harvest shelf-life of Apple mango harvested in improving the postharvest shelf life of Apple mango harvested 168 DAB.

2.1 DEPARTMENT OF HORTICULTURE

Title: Biological performance, response and population dynamics of *Tetranychus evansi* (Baker and Prichard) as influenced by different African nightshade (Solanum spp) species

Researcher(s): Lucy Kananu Murungi, Bernard A. Nyende, Peter W. Masinde, **John M. Wesonga** and Markus Knapp.

Background: The tomato spider mite, *Tetranychus evansi*, Baker and Pritchard is highly polyphagous and is considered one of the most destructive pests of vegetables and other crops worldwide posing a threat to food security in many economies. Although African indigenous vegetables are alleged to be tolerant to pests and diseases, African nightshades (*Solanum* spp) have been found severely infested by *T. evansi* and other tetranychid species in some countries in East and West Africa where they are grown by many rural communities for consumption. Despite the vast research on trichome-based resistance as well as plant chemical factors in plant-herbivore interactions in Solanaceous plants, little or no information is available on the association between *T. evansi* and these mechanisms in African nightshades. The current study focused on five African nightshade species viz. *Solanum sarrachoides* Sendter, *S. villosum Mill, S. tarderemotum* Bitter, *S. americanum* Mill and *S. scabrum* Mill that were evaluated for their resistance to *T. evansi*. The objective of the study was to investigate several host plant characteristics of the five *Solanum* species and their influence on developmental duration, oviposition, survival, intrinsic population growth rate and other life history characteristics of *T. evansi*.

Methods: To achieve this objective, the study concentrated on four major areas (i) Effect of five *Solanum* spp on biology and life table parameters of *T. evansi* (ii) Evaluating the effects of morphological and chemical factors in five *Solanum* spp to mite fecundity, repellency and olfactory responses (iii) population dynamics of *T. evansi* on five *Solanum* spp under field and greenhouse conditions and (iv) Effect of *T. evansi*

on growth and yield of five *Solanum* spp grown under field and greenhouse conditions.

Results: The results indicated that *S. villosum, S. scabrum, S. tarderemotum* and *S. americanum* are the most susceptible to *T. evansi* due to the shorter adult developmental period, longer adult longevity, higher reproduction and intrinsic rate (r_m)of natural increase ranging between 0.180 - 0.196 females/female/day compared with *S. sarrachoides* which cannot support *T. evansi* populations as the r_m was negative on this host (-0.063 females/female/day). Differences in developmental time and life table parameters among the other host plants were also not significant. Five different trichome types were identified among the *Solanum* spp with the glandular types predominant in *S. sarrachoides*. There was also a significant negative correlation between fecundity and distance traveled by mites with the density of glandular trichomes. Significantly fewer eggs were laid on *S. sarrachoides* in comparison to other *Solanum* spp. Distance traveled by mites was also significantly low in this species indicating that higher densities of glandular trichomes decreased distances walked by mites. In olfactometer bioassays, significantly more females responded to volatiles from intact plants of *S. villosum* than those from other *Solanum* spp. Based on mite response studies, intact plants of two species, *S. sarrachoides* and *S. villosum* were selected for volatile chemical analysis. GC-MS analysis showed that green leaf volatiles and aldehydes were released more significantly from intact plants of *S. sarrachoides* than from those of *S. villosum* and the variations were both quantitative and qualitative. Population densities of *T. evansi* in screenhouse studies revealed that *S. scabrum* was highly infested by *T. evansi* but the percentage leaf area damaged was very low in comparison to other *Solanum* spp. The highest level of resistance was observed in *S. sarrachoides* where *T. evansi* populations significantly remained low. Field studies revealed significant differences in number of motile individuals of *T. evansi* among the acaricide free and acaricide protected plots. Significant differences were also found on growth and yield among nightshade species in acaricide free and acaricide protected plots over time and space. Yields in both seasons were negatively correlated with leaf area damaged by *T. evansi* in acaricide free plots, except for one case in acaricide protected plots. Based on population dynamics findings, *S. sarrachoides* did not support any mite populations over time. However, *S. scabrum* supported high mite populations but no significant reduction in growth and yield was detected. In conclusion, *Solanum americanum, S. villosum, S. tarderemotum* are suitable host plants for *T. evansi* and severe mite outbreaks are likely to occur under favorable conditions in the field.

Conclusions: Since *S. sarrachoides* and *S. scabrum* seem to possess resistance and tolerance attributes respectively to *T. evansi,* these attributes can be investigated further and utilized in programs such as breeding and IPM in order to develop resistant genotypes and reduce *T. evansi* populations in African nightshades.

Title: Potential for utilization of entomopathogenic fungus *Beauveria bassiana* for control of banana weevil Cosmopolites sordidus

Researcher(s): Carolyne O. Anaye, **John M. Wesonga,** Esther M. Kahangi, Leonard S. Wamocho

Background: Banana production in Kenya has been on the decline due to among

other factors, pests and disease of which banana weevil is major. Although, entomopathogenic fungi such as *Beauveria bassiana* and *Metarhizium anisopliae* have been used successfully to control various agricultural and pasture pests, lack of effective application system limits their wider application. This study therefore sought to evaluate the potential of utilizing infected weevils to disseminate the entomopathogen, *Beauveria bassiana* for control of the banana weevil.

Methods: Tests were carried out in the laboratory with ten isolates of *Beauveria bassiana*; ICIPE 273, M 313, M 207, KE 300, M 221, ICIPE 50, M 573, M 618, M 470 and ICIPE 279. Pathogenicity studies were carried out. A virulence test of the best three isolates of *Beauveria bassiana* (ICIPE 273, M 313 and M207) at three concentrations (10^8, 3 x10^8 and 10^9) was carried out in the laboratory.

Results: All the ten isolates of *B. bassiana* tested were found to be pathogenic to adult *C. sordidus* causing mortalities of between 20 - 50% when a standard concentration of 10^8 was used 40 days post exposure. Isolate ICIPE 273 was the most pathogenic killing 50% of adults, followed by M 313 (36%), M 207 (30%). The rest KE 300, M 221, ICIPE 50, M 573, M 618, M 470 and ICIPE 279 had a kill of less than 20% with ICIPE 279 being the least pathogenic to the adult *C. sordidus*. At higher fungal concentrations of 3 x10^8 and 10^9 adult mortality for all the three isolates was between 35% - 70% . The LC_{50} values were 5.34 x 10^6, 4.22 x 10^8 and 8.89 x 10^8 conidia/ml for ICIPE 273, M 313 and M 207 strains respectively. Lethal time (LT_{50}) was 31, 34 and 51 days for ICIPE 273, M 313 and M 207. Incubation of dead weevils in a moist environment led to development of mycelia on the surface starting from intersegmental junctions, confirming that the mortality was caused by fungus. In the laboratory, the rate of transmission from two infected banana weevils to non infected was between 24% - 26 % for the three isolates ICIPE 273, M 313 and M 207. Finally, in the screenhouse, there was no transmission from infected to non infected weevils since the infected weevils were dying at the top of the buckets while the non infected had burrowed deep into the soil. For growth parameters there was no significant difference in the height, girth and number of leaves between the treatments with the controls which had no weevils.

Conclusions: The current studies show that *B. bassiana* has potential to be used as a biological control agent for the management of C. *sordidus*. However further research should be undertaken under semi field and field conditions to test the performance of *B. bassiana* against *C. sordidus*

Title: Plant Nutrition and Chemical Application in Management of Rice Blast Disease (*Pyricularia oryzae)* in Mwea Irrigation Scheme of Kenya.

Researcher(s): Catherine Muriithi, **Njue Mugai** and Agnes Kihurani.

Background: To develop technologies for use of plant nutrition and chemical application in management of rice blast. A trial was carried out Mwea irrigation scheme for two seasons.

Methods: Four levels of silicon (0, 500, 1000 and 1500kgSi/ha), four of nitrogen (0, 40, 80 and 120kgN/ha and ash husk (2ton/ha). Two commercial silicates were also compared with organic materials (rice straw and husks) as a source of silicon. Chemical control was done through *in-vitro* bioassays for Azoxystrobin 250 cs Thiophanatemethyl,

Hexaconazole and Carbendazim at three concentrations.

Results: The results indicated significance (P<0.05) differences among the infected and non-infected fields in total Nitrogen and Silicon as well as in the infected and non-infected plant tissues. Infected field had higher level of nitrogen and low silicon level. Similarly the infected plant tissues showed higher nitrogen level compared to the non-infected. The tested fungicides showed that the measurement on mycelia inhibition growth was significantly different (P<0.05) among the four fungicides, Carbendazim and Thiophanate methyl were effective at the middle concentration although Hexaconazole was also effective at higher concentration. Azoxystrobin did not show effectiveness in the in-vitro bioassays Disease blast infection was significantly different among the treatments in both seasons. Calcium silicate, Ash husk, potassium showed the least infection. The two silicates had the least infection in both season. However, Ash husk and potassium silicate was not significantly different.

Conclusions: Silicon showed a positive effect on almost all the yield attributes while the interaction of Nitrogen and silicon was found to be optimal at 80Kg N/ha and 1000Kg Si Kg/ha in both yield and in management of rice blast disease. Organic materials such as husk can be used as alternative source of silicon.

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Methods: To achieve this objective, the study concentrated on four major areas (i) Effect of five Solanum spp on biology and life table parameters of T. evansi (ii) Evaluating the effects of morphological and chemical factors in five Solanum spp to mite fecundity, repellency and olfactory responses (iii) population dynamics of T. evansi on five Solanum spp under field and greenhouse conditions and (iv) Effect of T. evansi on growth and yield of five Solanum spp grown under field and greenhouse conditions.

Results: The results indicated that S. villosum, S. scabrum, S. tarderemotum and S. americanum are the most susceptible to T. evansi due to the shorter adult developmental period, longer adult longevity, higher reproduction and intrinsic rate (rm)of natural increase ranging between 0.180 - 0.196 females/female/day compared with S. sarrachoides which cannot support T. evansi populations as the rm was negative on this host (-0.063 females/female/day). Differences in developmental time and life table parameters among the other host plants were also not significant. Five different trichome types were identified among the Solanum spp with the glandular types predominant in S. sarrachoides. There was also a significant negative correlation between fecundity and distance traveled by mites with the density of glandular trichomes. Significantly fewer eggs were laid on S. sarrachoides in comparison to other Solanum spp. Distance traveled by mites was also significantly low in this species indicating that higher densities of glandular trichomes decreased distances walked by mites. In olfactometer bioassays, significantly more females responded to volatiles from intact plants of S. villosum than those from other Solanum spp. Based on mite response studies, intact plants of two species, S. sarrachoides and S. villosum were selected for volatile chemical analysis. GC-MS analysis showed that green leaf volatiles and aldehydes were released more significantly from intact plants of S. sarrachoides than from those of S. villosum and the variations were both quantitative and qualitative. Population densities of T. evansi in screenhouse studies revealed that S. scabrum was highly infested by T. evansi but the percentage leaf area damaged was very low in comparison to other Solanum spp. The highest level of resistance was observed in S. sarrachoides where T. evansi populations significantly remained low. Field studies revealed significant differences in number of motile individuals of T. evansi among the acaricide free and acaricide protected plots. Significant differences were also found on growth and yield among nightshade species in acaricide free and acaricide protected plots over time and space. Yields in both seasons were negatively correlated with leaf area damaged by T. evansi in acaricide free plots, except for one case in acaricide protected plots. Based on population dynamics findings, S. sarrachoides did not support any mite populations over time. However, S. scabrum supported high mite populations but no significant reduction in growth and yield was detected. In conclusion, Solanum americanum, S. villosum, S. tarderemotum are suitable host plants for T. evansi and severe mite outbreaks are likely to occur under favorable conditions in the field.

Conclusions: Since S. sarrachoides and S. scabrum seem to possess resistance and tolerance attributes respectively to T. evansi, these attributes can be investigated further and utilized in programs such as breeding and IPM in order to develop resistant genotypes and reduce T. evansi populations in African nightshades.

Title: Potential for utilization of entomopathogenic fungus Beauveria bassiana for control of banana weevil Cosmopolites sordidus.

Researcher(s): Carolyne O. Anaye, John M. Wesonga, Esther M. Kahangi, **Leonard S. Wamocho.**

Background: Banana production in Kenya has been on the decline due to among other factors, pests and disease of which banana weevil is major. Although, entomopathogenic fungi such as Beauveria bassiana

and Metarhizium anisopliae have been used successfully to control various agricultural and pasture pests, lack of effective application system limits their wider application. This study therefore sought to evaluate the potential of utilizing infected weevils to disseminate the entomopathogen, Beauveria bassiana for control of the banana weevil.

Methods: Tests were carried out in the laboratory with ten isolates of Beauveria bassiana; ICIPE 273, M 313, M 207, KE 300, M 221, ICIPE 50, M 573, M 618, M 470 and ICIPE 279. Pathogenicity studies were carried out. A virulence test of the best three isolates of Beauveria bassiana (ICIPE 273, M 313 and M207) at three concentrations (108, 3 x108 and 109) was carried out in the laboratory.

Results: All the ten isolates of B. bassiana tested were found to be pathogenic to adult C. sordidus causing mortalities of between 20 - 50% when a standard concentration of 108 was used 40 days post exposure. Isolate ICIPE 273 was the most pathogenic killing 50% of adults, followed by M 313 (36%), M 207 (30%). The rest KE 300, M 221, ICIPE 50, M 573, M 618, M 470 and ICIPE 279 had a kill of less than 20% with ICIPE 279 being the least pathogenic to the adult C. sordidus. At higher fungal concentrations of 3 x108 and 109 adult mortality for all the three isolates was between 35% - 70% . The LC50 values were 5.34 x 106, 4.22 x 108 and 8.89 x 108 conidia/ml for ICIPE 273, M 313 and M 207 strains respectively. Lethal time (LT50) was 31, 34 and 51 days for ICIPE 273, M 313 and M 207. Incubation of dead weevils in a moist environment led to development of mycelia on the surface starting from intersegmental junctions, confirming that the mortality was caused by fungus. In the laboratory, the rate of transmission from two infected banana weevils to non infected was between 24% - 26 % for the three isolates ICIPE 273, M 313 and M 207. Finally, in the screenhouse, there was no transmission from infected to non infected weevils since the infected weevils were dying at the top of the buckets while the non infected had burrowed deep into the soil. For growth parameters there was no significant difference in the height, girth and number of leaves between the treatments with the controls which had no weevils.

Conclusions: The current studies show that *B. bassiana* has potential to be used as a biological control agent for the management of *C. sordidus.* However further research should be undertaken under semi field and field conditions to test the performance of *B. bassiana* against *C. sordidus*.

3. FACULTY OF ENGINEERING

DEPARTMENT OF BIOMECHANICAL AND ENVIROMENTAL ENGINEERING

Title: Status and Constraints of Wind Energy Resource Utilization in Kenya.

Researcher(s): **J.T. Makanga** and E. Ngondi.

Background: Energy has been identified as the prime mover that propels the wheel of economic development. Access to modern energy affects quality of life and supports the main aspects of sustainable development namely social equality, economic growth and environmental protection. This research was mainly concerned with the status and constraints of wind energy resource utilization in Kenya.

Methods: Studies were conducted in various parts of Kenya. These included use of questionnaires, interviews, visiting relevant stakeholders and in some cases carrying out some tests including checking wind velocities.

Results: Scattered areas of Kenya have the potential of utilizing wind energy if exposed to ideal conditions. The constraints in regards to the development and utilization of wind energy resources in the country can be highlighted as follows: (1) Site selection (Wind potential assessments are site specific and time consuming). (2) Need for frequent updating of wind resource map for the country. (3) Low awareness of wind energy systems (4) Lack of public campaign and of a professional organization marketing wind generators. (5) Distance from transmission lines.

Conclusions: Scattered areas of the country have the potential of utilizing wind energy. There are however, several constraints including low awareness of wind energy systems. The Government has shown some intervention towards the promotion and utilization of renewable energies in the country including wind energy. A lot is yet to be done.

Title: Thin layer drying characteristics of amaranth grains in a natural convection solar tent dryer.

Researcher(s): **E.K. Ronoh**, C.L. Kanali, J.T. Mailutha and D. Shitanda.

Background: The grains are traditionally dried in thin layers under the open sun. The open sun drying has disadvantages such as lack of temperature control, intensive labour and contamination from dust, foreign materials, rodents and bird droppings. A natural convection solar tent dryer would be a useful drying technique for safe preservation of these grains.

Methods: The distribution of temperature was analyzed using nine discrete points spread in two planes (Planes 1 and 2) spaced at 0.75 and 1.5 m above the ground concrete surface of the solar tent dryer. The effect of colour of cover material was determined by drying the grains in dryers with different PVC materials. Drying of grains in the actual dryer (1.85 m wide, 2.73 m long and 2.55 m high) was carried out at two levels (Layers 1 and 2). Thereafter, non-linear regression analysis was conducted to evaluate the performance of six thin layer drying models (viz., Newton, Page, Modified Page, Henderson & Pabis, Logarithmic and Wang & Singh) for amaranth grains. The models were compared using the coefficient of determination (R^2), root mean square error (RMSE), reduced chi-square (χ^2) and prediction performance (η_p). Finally,

amaranth grains that were dried under different cover materials were evaluated for hardness, colour and crude protein content.

Results: An analysis of variance at 5% level of significance shows that there was no significant difference in temperature distribution within and between the planes. However, high mean temperatures in the range of 38.8–39.2°C were developed at Plane 2 as compared to 38.2–38.4°C achieved in Plane 1. This implies that the dryer capacity can be increased by drying the grains in layers. In addition, the results show that the dryer with the clear cover material achieved highest temperatures (44.5±5.8°C) and drying rates, and lowest relative humidity values (23.5±6.5%) as compared to those with yellow and nectarine diffused materials. However, the temperatures and relative humidity values were found not to be significantly different. Further, the results indicate that the grains dried in the solar tent dryer attained an equilibrium moisture content of 7% d.b from an initial one of 61.3–66.7% d.b after 4.5 hours of drying as opposed to 7 hours for the open sun. There was no significant difference in drying rates when the grains were dried in Layers 1 and 2 of the dryer. The Page model best described thin layer drying of the grains, attaining the highest R^2 (0.994–0.999) and η_p (80.0–88.2%), and the lowest RMSE (0.0003–0.0240) and χ^2 (0.0000–0.0154) values. Finally, the results show that there was no significant difference on hardness, colour and crude protein content of the grains dried under different cover materials.

Conclusions: The results demonstrate that natural convection solar tent dryers can be utilized to enhance drying of amaranth grains in layers without significantly affecting their physical, optical and nutritive properties. The high level of accuracy of the Page model illustrates its capability in predicting thin layer drying of amaranth grains in a solar tent dryer under natural convection.

Title: Technical, Economic and Environmental assessment of Smallholder pumped irrigation systems.

Researcher(s): **S. Njenga** and P. Home and J. Gathenya.

Background: In the recent years, there has been an increase in smallholder pumped irrigation technologies and very little research has been done to investigate their performance. This study entails evaluation of their performance with respect to technical, economic and environmental effects due to their operation.

Methods: An assessment of smallholder farmers practicing pumped irrigated agriculture in two districts was done i.e. Thika and Yatta. First, an observational study was done and, secondly, socio-economic assessment of the smallholder farmers was studied into detail using semi-structured questionnaires. Finally, detailed assessment was done in 10 farms where issues such as technical performance of the pumped irrigation systems as well as economic assessment and water use efficiency were done.

Results: Overall, 80 smallholder farmers were interviewed and it was found out that farmers did not embrace the engineering concept in design of the irrigation systems and no assistance by engineers in system selection and design resulting to their poor performance. Few farmers use modern irrigation technologies in the study areas. Generally, irrigated agriculture is profitable but if well managed, it can yield more benefits. Water application efficiency was found to be too low and this resulted to increase in cost of production. On average, the water application efficiency was found to range between 19.5% to 30 % which was quite

low. Water conveyance efficiency in field sub canals on the other had was higher and was found to be 81.4%.

Conclusions: If well selected and designed, smallholder pumped irrigated agriculture would result to more benefits and hence become more profitable and adaptable by majority of the farmers. Farmers should be capacity built inorder to be aware of the need to consult engineers during selection and design of the systems. Due to low water use efficiency, it is imperative that measures should be put in place to ensure that farmers are aware of the environmental harm that would result and the lack of sustainability of the systems. Ideal designs should always be adopted by the farmers.

DEPARTMENT OF GEOMATIC AND GEOSPATIAL ENGINEERING

Title: Analysis of Land Use/Cover Changes and Animal Population Dynamics in a Wildlife Sanctuary in East Africa using GIS and remote sensing.

Researcher(s): **C. N. Mundia**, Y. Murayama.

Background: Land use/cover change in wildlife conservation areas has serious implications for the ecological systems and distribution of wildlife species. It is important to analyzed long term land use/cover changes and wildlife population dynamics and identifies the major driving factors to these changes.

Methods: Multi-temporal satellite images (1975, 1986, and 2007) together with physical and socio-economic data were employed in a post classification analysis with GIS to analyze outcomes of different land use practices and policies.

Results: The results show rapid land use/cover conversions and a drastic decline for a wide range of wildlife species. Over 132,000 ha of grasslands were converted to cultivated farms between 1975 and 2007. Substantial loss in forest cover and habitat fragmentation were also observed. The changing habitat has led to loss of grazing and dispersal areas and could be responsible for the observed 60% wildlife decline in 32 years. Qualitative analyses of driving forces indicate that agricultural expansion, land use policy and expansion of tourist facilities are some of the major factors. Measures proposed in this study need to be implemented urgently to halt habitat destruction and ensure sustainable tourism in Masai Mara ecosystem.

Conclusions: Measures proposed in this study need to be implemented urgently to halt habitat destruction and ensure sustainable tourism in Masai Mara ecosystem.

Title: Remote Sensing and GIS Modeling of Spatial Processes of Urban Growth.

Researcher(s): **C. N. Mundia**, Y. Murayama.

Background: It is important to use examples of rapidly urbanizing cities to study the dynamics of land use/cover changes and simulate future urban expansion in order to address the need for urban management tools that can guide sustainable urban planning policies.

Methods: Cellular Automata, that integrates biophysical factors with dynamic spatial modeling, was used for this study. The model was calibrated and tested using time series of urbanized areas derived from land use/

cover maps, produced from multi-spectral satellite imageries, and future urban growth projected out to 2030.

Results: Results show that the model is useful for urban modeling and an effective tool to foresee the spatial consequences of poor planning policies in the context of many cities in Africa. The forecast for Nairobi shows an unsustainable sprawled urban growth.

Conclusions: The results show that urban simulations can represent a useful approach to an understanding of the consequences of current planning policies or their incompleteness.

Title: Towards a national cadastral information system.

Researcher(s): **N. Karanja** and D. Kuria.

Background: Survey of Kenya (SoK) is the mapping agency for the country. The director of surveys under provisions of Survey Act (Chapter 299) and Registered Lands Act (Chapter 300) has the responsibility of providing safe custody of, maintaining, updating, retrieving, dissemination and managing cadastral information in the country. The Cadastral Branch is responsible for processing survey records for purposes of land registration and ensuring quality control. These survey records form fundamental component of cadastre. Cadastral survey started way back in 1903. Over the years, volumes of records have increased. Demand for land due to population growth has greatly increased and need for land information for other purposes has grown.

Methods: Questionnaires and interview, system development (programming).

Results: The developed system is capable of storing parcel information e.g. owner, area, locality, data of authentication etc, allows for fast retrieval of these information, retrieval of survey plans (scanned images), retrieval of boundary definition, tracking of survey jobs.

Conclusions: The proposed system addresses the problems of storage and retrieval of parcel information and tracking the progress of survey jobs within the Cadastral Branch.

Title: Assessing the Influences of Catchment Characteristics on the Cost of Water treatment Using GIS and Remote Sensing Tools.

Researcher(s): V. Kirui, **E. H. Waithaka** and J. M. Gathenya

Background: Most water treatment companies getting water from rivers are facing a lot of challenges in their attempt to break even. The costs of producing and delivering water to consumers are higher than the revenues generated from the sales. Reasons behind this include high expenditures on chemicals for removing suspended sediment from water, high pumping costs, high percentages of unaccounted-for-water and general low levels operational efficiency.

Methods: Visual and digital image interpretation techniques were used to prepare thematic maps for each parameter important for this study. All resulting Arc-Info raster grid layers were rescaled to a cell size of 28.5 meter resolution to match up with the Landsat ETM imagery resolution used for LULC classification. ArcGIS 9.3 Desktop GIS software was used as the main platform for analysis in this study. Other support software used includes Idrisi Andes that was used to implement Land use land cover classification and SPSS 15 was used for statistical analysis.

Results: The results achieved clearly define the characteristics of each watershed. Ndakaini watershed has the steepest mean slope of 11% which is quite high as opposed to Sasumua watershed exhibiting the lowest mean slope of about 4%. Sasumua watershed exhibits the highest erodibility

factor of 0.33tons/acre annually. Ndarugu watershed on the other hand exhibits the lowest erodibility factor among the 5 watersheds with a k value of 0.25tons/acre. This variation is wholly attributed to the fact that Ndarugu watershed has close to ¾ of its area is covered by clay type of soil, where as is Sasumua watershed a larger percentage of the watershed is covered by silt loam soils. Ndakaini watershed exhibits the highest forest cover, with over 65% of the total area covered by forested areas. Sasumua watershed on the other hand exhibits the lowest forest cover of 21%. Population density in the five watersheds greatly vary with Ruiru watershed exhibiting the highest with a mean of 430 people/ km^2, Ndakaini watershed on the other hand exhibits the least with a mean of 120 people/ km^2.

Conclusions: There is correlation between watershed parameters and the costs incurred during water treatment. More catchment areas need to be included in future studies.

DEPARTMENT OF MECHATRONICS ENGINEERING

Title: Design and Simulation of a Fuzzy Logic Based Servo Controller for a Micro-Electro-Discharge Machining System.

Researcher(s): **Jean Bosco Byiringiro**, Bernard W. Ikua and George N. Nyakoe.

Background: Micro-Electro-Discharge machining (micro-EDM) is one of the most valuable techniques for micro machining because of its high precision in the fabrication of micro-holes, micro-mechanical parts, and complex microstructures on difficult-to-machine materials. Material removal mechanism is by discharging of an electric current across a narrow dielectric-filled gap between the tool and workpiece. This leads to sparking which generates heat that produces a tiny crater by melting and vaporization. As the discharge takes place in a very narrow gap between the electrode and workpiece, the machining process can be thought to be closely related to the gap discharge conditions. Therefore, identification and control of the gap discharge conditions is essential to enhance the performance of micro-EDM operations. In this study, a tunable fuzzy logic controller (FLC) using the behavior of discharge pulses for monitoring and control of the micro-EDM process was developed.

Methods: Experiments aimed at distinguishing and classifying discharge pulses in the spark erosion process were carried out through measurements and analysis of the gap voltage and current pulse characteristics. The pulses were then classified according to the identified discharge behavior into open, sparking, arcing, off and short circuit. The classified pulses were utilized as the fuzzy inputs to the FLC that drives the servo system to maintain the desired gap width. The effectiveness and performance of the FLC for the micro-EDM process was tested and evaluated through simulation in Matlab/Simulink.

Results: Results demonstrated that the fuzzy logic controller is able to provide stable machining and improve the performance of the micro-EDM process. This is possible because the servo system inputs from the FLC efficiently regulate the gap width and hence the gap discharge conditions for spark erosion. Machining time and cost are effectively reduced since prolonged open circuit (arcing) and short circuit discharge pulses that occur in the conventional micro-EDM process are prevented.

Conclusions:	Micro-EDM system with FLC has a better performance compared to that using conventional controller such as PID as demonstrated by the above results.
Title:	Modeling and Simulation of a Neural Fuzzy based Maximum Power Point Tracking of a Photo Voltaic System.
Researcher(s):	**Christopher A. Otieno**, George N. Nyakoe and Cyrus W. Wekesa.
Background:	Solar energy is directly converted into electrical energy by solar Photovoltaic module. PV systems still have relatively low conversion efficiency; therefore, controlling maximum power point tracking for the solar array is essential. Many tracking control strategies have been proposed. However, these strategies have disadvantages such as high cost, difficulty, complexity and instability. A more efficient method to solve this problem becomes crucial. This work employs a neural fuzzy based optimal power tracking system. The role of the neural fuzzy MPPT technique is to acquire as much power as possible from the photovoltaic system while overcoming the challenges experienced by the already existing methods.
Methods:	This work involved modeling the ANFIS system, data collection, data modeling, building the ANFIS structure, training and testing of the proposed ANFIS model.
Results:	Simulation results obtained from the complete ANFIS MPPT model suggest that an adaptive neural fuzzy approach can effectively handle complex and non linear systems better than the already popular artificial intelligence methods (fuzzy logic and neural networks). The ANFIS model achieved a prediction accuracy of about 98%. This means that about 98% of the available power was captured by the tracking algorithm. These results suggest that the ANFIS model is able to capture the inherent nonlinearity in photovoltaic systems and hence its suitability in modeling a maximum power point tracking system for PV systems.
Conclusions:	The simulation results indicate that a significant amount of additional energy can be extracted from a photovoltaic array by using neural-fuzzy maximum power point trackers. This results in improved efficiency of the PV systems. ANFIS is therefore more suitable control method for handling complex and nonlinear systems similar to the maximum power tracking problem compared with other control schemes.

4. SCHOOL OF ARCHTECTURE AND BUILDING SCIENCES (SABS)

4.1 DEPARTMENT OF CONSTRUCTION MANAGEMENT

Title:	Alternative Conceptualization of Value Management
Researcher(s):	**A. Alkizim**.
Background:	Since the 1990s, value management has been conceptualised as being either 'hard' or 'soft'. This dichotomy has persisted to date, yet there is yet to be a consensus within the value management domain on the principles that separated hard VM and soft VM.
Methods:	A discourse analysis strategy was adopted to analyse the various interpretations and conceptualizations of VM as put forward by the various commentators of VM.
Results:	This research found that the idea of any particular VM approach being labelled as either "Hard" or "Soft" is not feasible. This is based on the fact that no one approach contains all the cameos of either hard or soft VM. It is argued that it is more reasonable to describe an approach as "leaning towards either hard of soft VM". This is upon considering a continuum where hard VM is on one extreme end and soft VM on the other. Therefore a particular VM approach may be located along the said continuum based on it being advanced in a way that resonates more with one end than the other. Based on the idea of a Hard/Soft VM continuum, a number of VM appracohes as advanced by various commentators were analysed in an attempt to locate them. Kelly et al and Dallas were found to be leaning toards Hard VM, while SMART VM, Barton's approach, Thiry and Leu and Leung were found to be leaning towards Soft VM.
Conclusions:	By considering VM in terms of a Hard/Soft continuum, the stalemate of what is Hard VM and what is Soft VM is solved.
Title:	Robust Value Management: Providing a script for satisfying current and future end user needs.
Researcher(s):	**A.Alkizim** and S. Green.
Background:	Within some recent and influential policy documents related to the UK built environment, satisfying current and future end-users' needs appears to be emphasised as the essence of achieving value for money. The quest to satisfy current and future end-users comes with implications, including; addressing needs in the face of uncertainty of the future; dealing with conflicting user needs; and addressing evolving, poorly articulated, and latent needs that are implicit until they emerge, often following experience. Robust Value Management was therefore proposed.
Methods:	VM practitioners were presented with Robust Value Management (RVM) to obtain their views on RVM. Initially, an interpretative phenomenological analysis was adopted to establish their conceptualisations of value management, specifically in terms of whether they lean towards hard or soft VM.
Results:	Next, a survey that sought to establish the current value management practices in the face of uncertainty was conducted. This was

followed by the presentation of feedback on the broader concepts of robustness analysis and last responsible moment, and feedback on the new VM methodology as developed by the author. An expository seminar, aimed at obtaining further feedback on the broader notions of robustness analysis and RVM from VM practitioners, was also conducted. Finally, a participant observation of the VM training as offered by a certified IVM training institute was done.

Conclusions:

In conclusion, RVM represents a development of VM towards an alternative approach to problem solving, which rejects the linear, 'predict and prepare' mode, in favour of a non-linear, iterative pattern of activities, with an emphasis on learning, reflection, and leaving options open. It also represents a shift, from focusing on performance maximisation to survival in the face of uncertainty.

5. INSTITUTE OF TROPICAL MEDICINE AND INFECTIOUS DISEASES

5.0 DEPARTMENT OF MEDICAL LABORATORY SCIENCES

Title:	Incidence and Molecular Subtyping of Human Metapneumovirus Isolates from Selected Populations of Kenya, 2006 – 2009
Researcher(s):	V. O. Omballa, J. Oundo, **J. R. Ongus** and K. M. Njenga.
Background:	Human Metapneumovirus (hMPV) is a newly discovered member of the family *Paramyxoviridae* responsible for Acute Lower Respiratory Tract Infections (ALRTI) in young children, elderly patients, and immuno-compromised hosts. It has an estimated prevalence of 5-15% in studied populations. Epidemiological data and genetic diversity on the virus is well documented worldwide, but not in developing countries especially Africa. Determining the circulating subtypes of hMPV in the selected study populations of Kenya and analyzing their epidemiological data relating to hMPV cases will provide knowledge on common symptoms, the most affected age groups and circulating subtypes for use in vaccine development.
Methods:	From 1st October 2006 to 30th September 2009, Nasopharyngeal and oropharyngeal swabs were collected in the study populations and analyzed for respiratory viruses to screen for hMPV. Selected hMPV positive samples were cultured in Rhesus monkey epithelial kidney cells (LLC-MK2) cells prior to DNA sequencing, multiple sequence alignment and phylogenetic analysis to determine genetic diversity.
Results:	The most affected segment of the population under study were children below 5 years old with incidence rates up to 7.59 per 1000 person years in males below 12 months in Kibera. Incidence rates per 1000 person-years in Kibera urban informal settlement were higher than those in Lwak rural community with the risk of acquiring the virus (RR = 1.79) in children below 5 years was statistically significant (p-value, 0.007). The common subtype of hMPV circulating determined from the isolates was B2. Common symptoms present in the study patients included Fever, Cough and runny nose and the average percent genetic identity was 88.4% among all isolates.
Conclusions:	hMPV seems to contribute a lot in child morbidity and data on seasonal strains in Kenya have still not been well elucidated. Further studies on prevalence, impact on human health, age association should be implemented.
Title:	Factors Associated with Multi-Drug Resistant Tuberculosis in Kenya, 2009.
Researcher(s):	H. O. Weyenga, J. Sitienei, J. Omolo, J. Oundo and **J. R. Ongus.**
Background:	Multi-drug resistant tuberculosis (MDR-TB) and weak health systems threaten global tuberculosis control. Kenya is ranked 13th among the 22 high TB burden countries worldwide, and currently has an estimated 2,300 MDR-TB patients.
Methods:	This was an unmatched case control study conducted in 41 health facilities in 20 districts across the eight provinces in Kenya from September 2009 to January 2010. Cases were confirmed MDR-TB

(resistance to at least rifampicin and isoniazid) patients while controls were sputum- smear positive TB patients with clinical response and negative sputum smear at the fifth month of treatment with first-line anti-tuberculosis drugs. Study approval was sought and obtained from relevant institutions. An informed consent was a prerequisite for enrollment of all participants. Using the health facility TB register as the sampling frame, consenting confirmed MDR-TB patients and two randomly selected unmatched controls per case were enrolled. A pretested structured interviewer administered questionnaire was used for patient interviews and to abstract information from records. Data on socio-demographic, behavioural, and clinical exposure history were obtained. We entered and analyzed data using *Epi-info* and Stata versions 3.5 and 9.0 software respectively

Results: A total of 81cases {mean age: 32 years (SD: 10), 62% males} and 162 controls {mean age: 35 years (SD: 13), 59% males} there was no statistically significant difference with respect to baseline socio-demographic characteristics. Six (7.4%) of the MDR-TB cases having no previous history of TB, were exposed to household case a known MDR-TB. Cases were more likely to have history of previous exposure to first line anti-Tuberculosis drugs (OR= 85, 95% CI=29.7- 243.3; P<0.0001) and being of foreign origin (OR=5.5, 95% CI=1.4-21.8; P=0.007). Case-patients with positive HIV status (OR=0.34, 95% CI= 0.1-0.9; P=0.025) and those who had received TB treatment under the Directly Observed Therapy program (DOT) (OR=0.23, 95% CI= 0.1-0.6; P=0.002) were less likely to have MDR-TB.

Conclusions: We recommend strengthening of MDR-TB surveillance among previously treated TB cases and refugees and active MDR-TB case finding among HIV infected TB patients. More rapid MDRTB diagnostic tests should be used among the HIV infected patients. Access to TB care services by all population groups including immigrants, implementation of DOT, MDRT-TB contact tracing and screening and infection prevention should be strengthened.

Title: Epidemiology of Salmonella Bacteraemia in a Rural Community in Western Kenya, 2009.

Researcher(s): C. W. Tabu, **J. R. Ongus**, D. Feikin and J. Oundo.

Background: Non-Typhoidal *Salmonella* (NTS) are the most common cause of bacteraemia and important causes of mortality in some countries in sub-Saharan Africa. Despite this, the factors associated with infection in developing countries are not well understood.

Methods: A descriptive study was conducted to determine the distribution, determinants and factors associated with NTS bacteraemia infection in a rural community in western Kenya. Clinical and demographic data of all patients seen at Lwak Hospital between October 2006 and September 2009 from the population based morbidity surveillance project of the KEMRI/CDC's International Emerging Infections Program and linked to HIV testing results from the home-based counselling and testing and malaria test results from the laboratory. All the cases were then mapped geographically by GIS to determine the patterns and distributions of the cases.

Results: From October 2006 to September 2009, 3,578 blood cultures were done. Among 156(4.4%) positive blood cultures, 63(40%) were positive for NTS -28/43(65%) among children under 5 years and 35/133(31%) among persons over 5 years. NTS accounted for a greater proportion of bacteraemia among febrile patients (72%) than among severe acute

respiratory illness patients (30%, p=0.0024). Of NTS patients, 36% had diarrhoea compared to 17% of blood cultured patients without NTS (p=0.0001). Salmonella sero-group B accounted for 86% and sero-group D for 10% of NTS isolates. Among NTS patients with HIV test results available, 13/31(42%) were HIV-positive. Overall crude incidence was 82/100,000 person-years of observation (Pyo) with an adjusted incidence-rate of 606/100,000 Pyo. Adjusted incidence-rate was highest in <5 age-group (2,080/100,000 Pyo) and lowest in the 10-17 age-group (22/100,000 Pyo). More NTS bacteraemia and malaria co-infected patients had illness severe enough to require hospital admission (50%) compared to NTS bacteraemia infected patients (36%) and the mortality within 90 days from date of presentation was higher (17%) in the co-infected patients than the single pathogen group. The 90-day mortality rate among NTS cases was 483/1,000 Pyo compared to 16/1,000 Pyo overall community mortality.

Conclusions: Targeted public health interventions like improvement of sanitation and vaccination are needed to mitigate the disease and improve treatment outcomes.

Title: The Determinants of Usage of Intermittent Preventive Therapy and Insecticide-Treated Bed Nets in Pregnancy in Juba, Southern Sudan, 2009.

Researcher(s): R. P. N. Abias, J. Omolo, D. Jones and **J. R. Ongus.**

Background: In areas of high malaria transmission such as Southern Sudan, pregnant women are at a greater risk of malaria infection, especially from the most severe form caused by *Plasmodium falciparum,* which can cause maternal anaemia or death, miscarriage, stillbirth, low birth weight or neonatal death. The disease is a leading cause of maternal mortality. In line with the WHO recommendations for the prevention of malaria in pregnancy, the Ministry of Health (MOH) of the Government of Southern Sudan (GoSS) has adopted the treatment of clinical malaria, use of insecticide treated nets (ITN's) and intermittent presumptive therapy (IPT).

Methods: A facility-based cross-sectional study on the determinants of the use of bed nets and intermittent preventive therapy and factors that affect their use was conducted in Juba Teaching Hospital, in the antenatal care (ANC) clinic and the maternity ward. The study participants were recruited from women in their second or third trimesters who came for ANC services and those women in the post delivery period. Using a semi-structured questionnaire, 334 study participants were enrolled, selected by systematic random sampling technique. The data was then entered, cleaned and univariate, bivariate and advanced analysis using *Epi info* computer software was done.

Results: The overall IPT usage among the participants was 61% (n = 204, 95%CI=56%-63%), and ITN usage was 87% (n = 296; 95%CI=85%-92%). Participants who made 3 or more ANC visits were 4 times more likely to use IPT than those who made less than 3 visits (OR= 4.00 , CI=2.30-6.50 , p=<0.05), while those who used indoor residual spraying were 2 times more likely to use IPT (OR= 2.20, CI=1.20 -3.90, p=0.01). Those study participants who bought ITN were 504 times more likely to use ITN (OR= 504.10, CI=291.50 -2777.9, p=<0.05), while those who use indoor residual spraying were 16 times more likely to use ITN (OR= 16.60, CI=1.3-206.20, p=<0.03). A household income of 250 Sudanese Pounds (about 90 USD) and above promoted the non use of ITN (OR= 0.17, CI=0.04-0.71, p=<0.015).

Conclusions: Improvement of the poverty situation, subsidizing ITNs, encouraging many ANC visits and use of indoor residual spraying can improve the coverage of IPT and ITN use in pregnancy.

Title: Factors Associated with Syphilis in Pregnant Women in Juba, Southern Sudan, 2009

Researcher(s): S. K. Emmanuel, **J. R. Ongus** and J. Oundo.

Background: Syphilis is a chronic infectious disease caused by the spirochaete *Treponema pallidum s*ubspecies *pallidum*. It has significant long-term morbidity for mothers and can seriously make several complications in pregnancy, which may result in; spontaneous abortion, stillbirth and other negative outcomes including congenital syphilis. There is currently, no data on the burden of syphilis in pregnant women in Juba. But surveillance conducted in 2007 revealed that the prevalence range from 12% to 21% in some areas in southern Sudan.

Methods: A cross-sectional study was carried out in three antenatal clinics in Juba to determine the prevalence and associated factors for syphilis in pregnant women. 231 Pregnant women who consented were recruited using a standard questionnaire and 5mililitres of blood was collected and plasma was obtained. Samples were tested for syphilis using both RPR and TPHA tests.

Results: Out of the 231 samples 51 (22.1%) tested positive for active syphilis. significant risk factors identified in this study were; being a housewife (OR 2.808; 95% CI 1.259-6.262; P= 0.0116), History of abortion (OR 2.654; 95%CI 1.244-5.664; P= 0.0116) and history of partner travel (OR 2.149; 95%CI 1.088-4.263; P= 0.028), while attending antenatal clinic for previous pregnancy was a protective factor (OR 0.281;95%CI 0.143-0.564; P= 0.0004). Other factors which were not significantly associated with syphilis were polygamous married (p= 0.355); given birth before (p= 0.386) and duration of stay with partner (p= 0.161). The prevalence of syphilis is 22.1% in pregnant women in Juba which is still high as compared to other studies; being a housewife, history of abortion and history of partner travelling were identified risk factors while attending antenatal clinic for previous pregnancy was a protective factor.

Conclusions: Screening and treating mothers for syphilis in their first visit to antenatal clinic can reduce the prevalence and outcomes of syphilis in pregnancy. Regular health education is also necessary for expectant mothers to create more awareness about the disease.

Title: Factors Associated with Severe Road Traffic Injuries in Juba, Southern Sudan, 2006/2007.

Researcher(s): N. R. Atem, J. Omolo, **J. R. Ongus** and J. M. Kihoro.

Background: Road traffic injuries are a major global public health challenge. An estimated 1.2 million people are killed annually from road traffic crashes, while the number injured is about 50 million. Road traffic injuries represent 12% of global disease burden, and accounts for 25% of all global mortality. The goal of this study was to determine the factors associated with severe road traffic injuries in Juba City, Southern Sudan.

Methods: This study is a cross-sectional descriptive study, of road traffic injuries in Juba City, Southern Sudan covering the period 2006 and 2007. The data was sourced from police and hospital records. The study analyzed the determinants of the severity of road traffic injury captured in the secondary data. Severe injury was defined as any road

traffic injury necessitating hospital in-patient admission

Results: The data was sourced from police and hospital records using a structured data collection tool. The study outcomes indicated that being in a motor vehicles was associated with severe injury (OR = 1.4018; P-value =0.0089) compared to motorcycle. Juba is divided into three main payams (administrative zones); Juba, Kator and Munuki payam. Residence in Munuki Payam was a risk factor for severe road RTI (OR = 1.2842; P-value = 0.0302) compare to residence in the other Payams. The year of injury 2007 was associated with severe injury (OR = 1.7747; P-value = 0.0001) when compared to year of injury 2006. Driver unemployment was protective of severe injury (OR = 0.7081; P-value = 0.0288) compared to employed driver. Motorcycles are less likely to cause severe injury than motor vehicles.

Conclusions: The study established that there had been a significant increase in the number of severe injuries in Juba in 2007 compared to 2006 due to increased motorization. The Custom market in Munuki Payam was the possible reason for the association detected between residence in Munuki and risk of severe RTI. Further investigation into other risk factors of severe injury such as alcohol, mobile phone use and seat belt use is recommended.

6. INSTITUTE OF ENERGY AND ENVIROMENTAL TECHNOLOGY (IEET)

Title:	Anti-plasmodial and Anti-trypanosomal natual poducts of Limonoids-Type of structure from some selected species of Meliaceae plants.
Researcher(s):	Githua, M. N.; **Keriko, J. M**.; Hassanali, A.; Murill, G.; Ndungu, M. W. and Nyagah, C.
Background:	Leaves and stem of Turaea abyssinica Hochst., Trichilia dregeana Harv. and Sond. and Trichilia emetica Vahl.; Leaves and roots of Toona ciliata M. Roem. and Azadirachta indica A. Juss.; Stem and roots of Turraea mombassana Hiern ex C.DC.; Leaves, root bark and stem bark of Melia azedarach L. are known to have medicinal effects and were therefore sceened against Plasmodium falciparum and Trypanosoma bucei rhdesiene in vitro.
Methods:	These plant parts were extracted with methanol for about 48 hr. twice and screened against the micoorganisms mentioned through the respective bioassay protocols. The active extracts were partitioned between water and chloroform and each fraction screened in vitro for antiprotozoal activities. Bioassay guideed chromatogaphic sepaations were done and structure elucidation performed.
Results:	*Methanol extacts of Turraea abyssinica leaves showed the* highest antiplasmodial activity at IC50 = 21.9 µg/ml)followed by Azadirachta indica roots and leaves with IC50 = 25.6 and 31.2 µg/ml, respectively. The chloroform extracts of A. indica leaves and roots showed the highest antiplasmodial activity with IC50 = 11.1 and 17.8 µg/ml respectively. Methanol extracts of Toona ciliata roots exhibited the highest antitrypanasomal activity with MIC = 6.95 µg/ml follwed by A. indica leaves and roots with MIC = 51.2 and 145.8 µg/ml respectively. Antitrypanosomal activities of their chloroform extract were highe with T. ciliata having an MIC = 3.2 µg/ml while A. indica leaves and roots had MIC = 4.4 and 8.5 µg/ml respectively. Nomal and reverse phase column chromatography follwed by prep. HPLC yielded 9 compounds which were screened fo antitrypanosomal activity individually and in blends.
Conclusions:	Results indicates that the 9 isolated compounds exhibited antitrypanosomal activities with MIC values ranging fom 1.7 - 31.25 µg/ml. Futher investigation is recommended and these and their constituent compounds be subjected to *in vivo* tests for their efficacy and safety by carrying out cytotoxicity tests for use by humans as potential antipotozoal drugs or as template for synthetic drug manufacture.
Title:	Biological and phytochemical studies of medicinal plants, Antidesma venosum (Euphorbiaceae) and Kotschya africana (Fabaceae) used in traditional medicine in Kenya.
Researcher(s):	Gitu, L. M.; **Keriko, J. M**. and Chhabra, S. C.
Background:	Kotschya africana and Antidesma venosum plants are used in traditional medicine ti treat bacterial, fungal and viral infections. The two plants have however not been systematically investiagated before. These work aimed at investigating the active pinciples in them. The leaves, stems and the roots were collected and subjected to extraction procedures.

Methods: Leaves, stems and root bark of the two plants were solvent extracted using solvents of increasing polarity namely; hexane, dichloromethane, ethyl acetate and methanol inthat order to afford various extracts.The crude extracts were subjected to several anti-fungal and anti-bacterial tests. Though seveal fractionation by column chomatographic steps and pep. TLC pocedures, pure compounds were isolated which wee also subjected to bioassay tests.

Results: Using the disc diffusion method, it was demonstrated that extracts of the leaves, stem and roots of these plants have moderate anti-bacterial activities against Escherichia coli and Staphylococeus aureus and low antifungal activity against the fungus, Candida albicans. The root extracts were the most active followed by the stem and the leaf extract. Extracts from these 2 plants exhibited mild cytotoxicity to brine shrimp (Artemia salina) larvae with LD50 values ranging from 89.21 to 3876.7 for K. Africana and 32.61 to 2515.4 for A. venosum. Five compounds were isolated and structurally elucidated.

Conclusions: Crude extacts and pure compound *K. africana* and *A. venosum* showed some radical scavenging characteristics at a loading of 50 µg. β-Sistosterol and lupeol had moderate activities while one impure compound showed the highest. More studies are recommended.

Title: Phytochemical and Biological studies of the compounds of the aerial parts of Senecio lyratus (Asteraceae)

Researcher(s): **Keriko, J. M**.; Nderitu, P. N.; Nyagah, C. G.

Background: Man has from time immemorial relied on plants as a source of food and shelter for his survival. He has also discovered that plants could be used for treating his various ailments including those of their animals. Moreover, plants extracts could also be used as medicinal, pesticides, fungicides and insecticides which cannot be underestimated. It is estimated that 20,000 plants are used for medicinal purpose.

Methods: Solvent extract from the aerial part of Senecio lyratus (Asteraceae) were phytochemically and biologically studied. The extracts were obtained by fisrt drying and grinding the earial parts of the plant and sorking them in n-hexane folloewd by DCM and finaly with methanol at room temperature. After filteration, the filtrate was vacuum dried in a rota vap. equipment. From the crude extract, sample for biasssay were prepared. The active crude extracts were them subjected to further fractionation on silica gel columns. Three pure cmpound were isolated, purified and identified. Further biactivity tests were carried out on the pure compounds.

Results: The LD50 of the crude extracts were determined and found to be; 506.11, 553.21 and 689.44 ppm respectively for n-hexane, dichloromethane and methanol respectively. Fractionations of the n-hexane led to various fraction which were found to be active against Staphylococcus aureus and Bacillus subtilis at 100 ppm. Pure compound were found to be active against Candida albacans fungi. The three pure compounds were; β- amyrin, β-sitosterol and stigmasterol.

Conclusions: Further research work was recommended in order to try to unravel the nature of the active compound(s) from this medicinal plant and their mode of action.

Title: Ethnomedicine practices, analyses, and standardization of herbal althelmintics used by the Embu and Mbeere peoples of Kenya.

Researcher(s): Kareru, P. G.; **Keriko, J. M**.; Gachanja, A. N. and Kenji, G. M.

Background: Ethnobotany is the study of the relationship between plants and people, the focus being on the plant use for medicines, food, building tools, social life etc. including cultivation and conservation. Ethnobotanical information is therefore, indegenous knowledge about plants uses and is obtained from experienced herbalists and knowledgeable old people down generations. Often, indigenous knowledge is jealously guarded and kept secret among family members within communities. Ethnobotany requires a variety of issues: the identification and preservation of plant specimens, cultural role of plants (anthropology) in society, leading to ethnomedical uses. Scientists are then able to screen plants for pharmacological activity, discover lead compounds, from which new drugs can be developed.

Methods: Ethnobotanical information and traditional medicines were investigated and documented in Embu and Mbeere districts, Eastern Province of Kenya. Oral interviews were obtained from over 100 herbalists, both men and women agedbetween 40 and 80 years. All the herbalists interviewed were christians and had little formal education. Non-Christian herbalists were purpoted to combine herbal medicine with witchcraft and were therefore not interviewed.

Results: Of the 40commonly used herbal plants, 25 were used as multipurpose medicinal plants (mpmp), while 15 were used to treat one disease type. There was correlation between the outpatient morbidity data at the local district hospital, and the common incident diseases treated by the herbalist. Generaly, a decoction or infusion of the herb was recommended for the treatment of internal or external condition of the patients. Malaria and typhoid were treatable with a total of 15 and 12 plants respectively and were among the first two commonest diseases found in the study area. Terminalia brownii was found to be the most used medicinal plants either alone or in combination with other herbs. The second and third most utilized medicinal plants were Ovariodendron anisatum and Rapanea rhododendrides respectively. Aqueous extracts from these plants were found to show activity against Escherichia coli and other micro-organisms. A number of these medicinal plants were screened for in vitro anthelmintic activity. Aq extracts of some plants exhibited high activities.

Conclusions: Some plants were chosen and recommended as the helminthes herbal drugs alternatives. One specific plant, Entada leptostachya was identify as having the highest activity and exhibited the 'fingerprint' of the phytochemical marker compounds.

Title: Development and eveluation of an "Anti-aging" cosmetic product derived from plants and ruminants animals oil extracts: Phase 1. Evaluation of physical-chemical characteristics of the plants and ruminants animals oils/fats extracts and their effects on cosmetic products.

Researcher(s): **Keriko, J. M.;** Kareru, P. G. and Musatzi, A.

Background: The manifestations of ageing that are of primary concern to the cosmetic chemist are wrinkles. Shrinking of the superficial muscles, which have their points of insertion in the dermis, causes these lines, which become more pronounced with age especially on the face. The facial expression muscles are the first areas to change with age. As they loose superficial mass, thinning of epidermis and a loss of collagen and elastin are apparent. These all contribute to the visible process called ageing. Ageing is thus an effect caused by the high

death rate of the epidermal cells than they can be replaced by fresh cells coming up from below. This causes thinning and wrinkling formation. The new cells become increasingly disorganized. Vitamins are essential nutrients for human organism. They are not obtainable via metabolic functions but must be introduced in the body through a balanced diet. Vitamins are characterized by their ability to be soluble and are divided into two groups, fat-soluble and water-soluble. Fat-soluble include; A, D, E and K while water –soluble vitamins are; B1, B2, B6, B12 and C.3. These Vitamins are very essential in determining the nature and state of the skin during aging process.

Methods: Phase I was the evaluation and characterization phase. It involved the determination of the physical-chemical parameters of the plants oil extracts i.e. of the grain amaranth species (A. cruentus and A. hypochondriacus), cucumber fruits, and goat and camel milk fat extracts. The physical parameters determined included; pH value, density, butterfat content and percentage oil content. The chemical parameters determined were sub-divided into identification and quality tests. Identification tests included; Hexabromide tests, Hydroxyl tests, Iodine value, Saponification value determination, Refractive index and Fatty acid composition. Quality tests included; Acid value, foreign matter, Moisture and Peroxide value. Other major chemical parameters include isolation and quantification of retinol and tocopherol in both plants oil and animal fats extracts and β-carotene in the grain amaranth leaves extracts.

Results: The physical – parameters that were determined had a direct bearing to the quality of the oils and fats extracts, which in turn can affect the quality of the formulated cosmetic product. The vales of pH, specific gravity, butterfat and % oil content all were found to be within the recommended range. However, some variable factors can affect these ranges of values and hence have an either positive or negative impact to the formulations. The physical parameters can also be distorted contamination e.g. unhygienic conditions; adulteration can affect the pH value, specific density etc. The chemical parameters that were determined also played a major role in the quality of the oils and fats extracts hence, affecting the quality of the product too. However, these parameters mainly focused on the chemical composition of the extracts e.g. saturation and unsaturation levels of the fatty acids, which are a major determinant of the chemical character of an oil/fat extract. These characters are not necessarily affected by contaminations like adulteration. Their values also fell within the recommended region.

Conclusions: Chemical parameters like retinol and tocopherol, which play a major role in the “anti-aging” effect to the skin, are easily denatured and hence their quality and quantities were greatly altered before their effects were achieved on the skin. Factors such as temperatures/heat that occurred as a result of poor storage and analytical methods of formulations also played a major role in determining the quality of products. Better and convenient methods of preventing or reducing these impacts are recommended to enhance and maintain the quality needed to formulate these products. Phase 2 of thisproject will require the incorporation of the plant oil extracts and animal fat extracts into the formulated body cream/lotion base and subject the product to individuals to test its impacts on the users skin.

Title:	Biological studies of the crude and fractions of the root bark of *Senecio lyratus* (Asteraceae).
Researcher(s):	**Keriko, J. M.;** Marete, E. N. and Ndung'u, M. W.
Background:	A key challenge to anti-biotic industry is that constant innovation is necessary not only because of the resistance but also of the side effects associated with the use of the anti-biotics, including bacterial resistance to the existing drugs. Most bacteria also produce materials that destroy the drug. One area of research that remains far unexploited is the search for antibiotics from plant origin. This research work geared towards search for such materials from *Senecio lyratus*.
Methods:	The root bark of *Senecio lyratus* were collected from Sotick in Bonet district. The samples were dried at room temperature, and ground into fine powder. 1.3 Kg of the powdered roots were sequentially extracted using; *n*-hexane (1.5 L), dichloromethane (1.5 L) and methanol (1.5 L) which were added sequentially and allowed to sock for three days each. The respective extracts were filtered and the filtrate dried in vacuo usind a rotary evaporator. Further column fractionation led to the isolation of pure compounds. Bioassay tests included; brine shrimp lethality test, anti-bacterial bioassay test, and structural elucidation was done through NMR, IR and other physical tests like, Mpt.
Results:	The crude extracts exhibited significant anti-bacterial and anti-fungal activities. *n*-Hexane and DCM extracts exhibited relatively higher inhibition against *S. aureus* at 12.0 mm and 9,7 mm respectively at 1000 ppm. MeOH extracts exhibited relatively high inhibition diameter of 11.3 mm at 1000 ppm. 2 compounds were isolated where one was identified as β-sitosterol. No tests were carried out for the pure compound.
Conclusions:	The results obtained indicated that compounds from *S. lyratus* may have a potential for use as anti-microbial agents and therefore, more work is recommended.

7. SCHOOL OF HUMAN RESOURCE DEVELOPMENT (SHRD)

7.0 DEPARTMENT OF COMMERCE AND ECONOMIC STUDIES

Students revising at the library at JKUAT Juja Campus.

Title:	The effect of debt collection techniques on performance of microfinance institutions in Kenya: Case Study of Opportunity International Limited (OIL) – Kakamege Branch.
Researcher(s):	**Richard W. Wamalwa** and Maurice Sakwa.
Background:	The major objective of this study was to determine the effect of debt collection techniques on performance of OIL. The economic recession and post election violence has meant that many Kenyans firms are experiencing difficulties in collecting debts owed them by customers. In light of this, debt recovery has become a crucial factor of ensuring a firm's survival. These calls for MFI to implement debt collection techniques that improve performance and at the same time retain their customers.
Methods:	A systematic random sample consisting of thirty customers out of three hundred and a census of seven employees participated in the study. The research instruments for the study were questionnaires and interviews. The pre-test study was done using 13 respondents i.e. 3 employees and 10 customers. Data was collected by giving 7 employees and 30 customers' questionnaires respectively to fill. Interviews were followed to compare the responses given in the questionnaires.
Results:	Employees unanimously thought that debt collection agency as highly expensive and intimidating. Debt collection though internal debt collectors and guarantors which had 96% and 80% response

respectively were favored techniques by customers. Debt collection through debt collection agency (93%), pre-collection letter (53%) and court of law (70%) were thought to provide less flexibility during payment. The customers' responses for internal debt collectors (97%), pre-collection letter (83%), telephone (83%) and guarantors (60%) showed that these debt collection techniques would less increase chances of driving customers. Court of law (97%), collateral (87%) and debt collection agency (63%) topped customers' list as debt collection techniques that when used they would highly increase the chances of drive away customers.

Conclusions:

The research showed that debt collection agency and court of law could be used as a last resort as it increases chances of driving customers when used. Use of guarantors and collateral as debt collection techniques should be used to avoid bad debt. Debt collection techniques through telephone, internal debt collectors and pre-collection letters were perceived to be favored by both employees and customers.

8. NAIROBI CENTRE CAMPUS

Title:	Studies on novel pesticide fomulations based on botanical extracts.
Researcher(s):	Wanyika, H. J.; Gachanja, A. N.; Kenji, G. M. and **Keriko, J. M**.
Background:	Natural pyrethrins are highly active and safe insecticides but not photostable. In order to study their stability characteristics, various plant extracts were used including; galic extracts, neem oil, yellow oleander oil, cotton oil and tea extracts, were used.
Methods:	The photostabilization effect wasconfirmed by studying UV profiles and by HPLC determination of the pyethrin contents of the mixtures before and after exposure to UV light at 254 nm and 366 nm.
Results:	The vaious botanical oils under investigation were found to stabilize pyrethrins in a dose related relationship against UV radiations. At a concentration of 3%, cotton oil and yellow oleander oil in the pyrethrum extract based mixtures had the best photo stabilizing effects to the pyrethum compared to the 1% and 2% concentration. Tea extracts was also found to stabilize pyrethrum against UV light to varying degrees. Blending pyrethrum extract with garlic extract improved the biological efficacy of the pyrethrins.
Conclusions:	Thus, solutions of pyrethrum extract (1%) blended with the botanical oils under investigation were found to be more efficacious against maize weevil, Sitophilus zeamais compared to neempyretto.

Title:	Phytochemical and anti-parasitic activity studies of some selected Kenyan Medicinal plants.
Researcher(s):	Kigondu, Elizabeth V. M.; **Keriko, J. M.;** Rukunga, G. M. and Ndiege, I. O.
Background:	Malaria and leishmaniasis belong to the most widespread and poorly controlled parasitic diseases in the world. Since there is no vaccine in the immediate horizon coupled with an inrease in cases of drug resistance and failure, herbal medicine is highly used in the treatment of these diseases. Anti-protozoal drugs are inadequate due to their toxicity, lack of efficacy and inability to eliminate all life cycle stages of the parasite from the host. Therefore, new anti-protozoal agents with novel targets are urgently needed. 8 medicinal plants found locally were studied in this investigation.
Methods:	The plants extracts were screened for in nvitro anti-plasmodial activity against two laboratory adapted Plasmodium falciparum stains (D6, chloroquin sensitive, and W2, chloroquin resistant). Related assay methods were applied; in vitro anti-plasmodial assay, in vitro anti-leishmanial assay, anti-promastigote assay, anti-amastigote assay, nitric oxide production determination method,, cytotoxicity assay, molecular structural determination methods etc. were employed.
Results:	Methanol extract of the leaves of *Suregada zanzibariensis* had the highest anti-plasmodial activity against D6 and W2 (IC50 4.66 and 1.82 μg/ml respectively while dichloomethane extract had appreciable anti-plasmodial activity (IC50 9.40 and 9.90 μg/ml respectively. Three pure compounds were isolated and subjected to similar assay protocol.
Conclusions:	*Suregada zanzibariensis* and *Aloe nyeriensis var kedongensis* (Christian) exhibited good anti-malarial and anti-leishmanial

activities and hence should be considered as a template in the development of anti-protozoal drugs.

Title: Exposure to mercury and other mine related hazards amongst, Goldmine workers in Migori Gold belt, Kenya

Researcher(s): Waruguru, M.; Mbakaya, C. L.; **Keriko J. M.** and Kombe, Y.

Background: Use of mercury (Hg) in gold mining is a recognized occupational hazard worldwide, yet little has been done to document its magnitude in Kenya. In order to determine the magnitude of exposure to mercury and other mine related hazards, a cross sectional study was undertaken.

Methods: Structured questions were used to determine prvalennce of signs of symptoms of mercury poisoning as well as injuries related to Gold mining. Spot urine wasobtained in 30% of randomly selected subjects for the determination of urinary mercury and creatinine levels. Data was coded and entered into a database using SPSS version 111.5. Categorical data was analyzed using chi-squares and continous data using mann Whitney U-test.

Results: Gold mine workers (23%) axceeded the WHO recommended upper urinary limit of 50 ug/ml Hg/g of creatinine. Dealers had higher median Hg levels than the miners and manifested with significantly more mercury-related neurological, respiratory and dermal disorders than the miners. Subjects who worked for more than 8 hrs per day had median Hg level of 30.18 ug/g creatinine that was higher than the 13.8 ug/g creatinine for those who worked for less hrs ($p = 0.012$). cuts and blisters were reported in 58% of the workers as miners reported higher burdens of bronchial irritation, probably due to exposure to dust in the mines.

Conclusions: There is an urgent need to intervene on the dangers associated with gold mining in Kenya and beyond in order to protect the workers from further exposure and subsequent suffering that comes with it.

Title: Phytochemical and Biological studies of the compounds from the root bark of Vernonia auriculifera Hiern (Asteraceae).

Researcher(s): **Keriko, J. M**.; Githua, R. N.; Nyagah, C. G.

Background: Natural products once served man as a source of all drugs and higher plants provided most of the therapeutic agents. Today, natural products (and their derivatives and analogs) still represent over 50% of all drugs in clinical use, with higher plants - derived natural products representing 25 % of the total. Some of the drugs in clinical use are quinine from the cinchona bark, morphine and codeine from latex of opimium, poppy, digitalis leaves and atropine from the genus Solanaceae. The WHO estimates that 80% of the people in developing countries rely on traditional medicine for their primaryy health care and about 3.5 to 4 billion people in the World rely on plants as a source of their needed drugs.

Methods: The root bark of Vernonia auriculifera was sequentially extracted with n-hexane, dichloromethane and methanol respectively. The bioactivities of these extracts were determined against brine shrimps using the existing protocols. Fractionation of the crude extracts through column chromatographic techniques led to the isolation of 5 compounds which were also subjected to similar micro-organism tests.

Results: DCM crude extract was found to show high larvicidal activities. All the extracts showed high anti-bacterial activity against E. coli, and S. aureus. The pure compound also indicated substantial activity

	against the same micro-organisms. Anti-fungal asssay using Candida albacans showed significant activity (inhibition diameter > 10 mm) with n-hexane and DCM extracts. Compound 1 and 11 had good inhibition on the fungal test.
Conclusions:	The extract and the pure compounds isolated from this plant can be a suitbale constituent cheap natural alternative anti-biotics and more studies were recommended. The compounds could also be used as template in the manufacture of synthetic drugs.
Title:	Anti-plasmodial and larvicidal flavonoids from the seedpods of *Tephrosia elata* and *Tephrosia aequilata*.
Researcher(s):	Muiva, Loise M.; Yenesew, A.; **Keriko, J. M.;** Derese, S. and Mutai, C.
Background:	The genus *Tephrosia* is rich in flavonoids and isoflavonoid including rotenoids. In the search for compounds with anti-plasmodial and larvicidal activities from medicinal plants, the seedpods of *Tephrosia elata* and *Tephrosia aequilata* were investigated.
Methods:	The dried and ground seedpods of the two plants were extracted separately with dichloromethane/methanol (1:1) by cold percolation for 24 hr at room temp. Chromatographic separation led to the isolation and identification of seven compounds. The crude extracts and the pure compounds were subjected to the, in vitro antiplasmodial assay and larvicidal assay protocols.
Results:	The crude extract showed significant anti-plasmodial activities with IC50 value of 8.4 and 8.6 ug/ml for T. elata and 1.5 and 22.4 ug/ml for T aequilata against chloroquin sensitive (D6) and chloroquin-resistant (W2) stains of Plasmodium falciparum respectively. The crude extract of seedpods of T. elata also showed larvicidal activity against the mosquito larvae of Aedes aegypti with LC50 of 68.9 ug/ml at 24 hr and 40.2 ug/ml at 48 hr. One novel compound from T. elata, elatdihydrochalcone showed anti-plasmodial activities with IC50 = 2.8 ug/ml and 5.5 ug/ml against (D6) and W2) respectively.
Conclusions:	There is high possibility of the use of compounds from this study, β-hydroxydihydrochalcones and flavanones as lead structures in the future development of anti-malarial drugs.
Title:	Assessment of challenges encountered by small scale cut-flower sector in Central Kenya in complying with environmental standards.
Researcher(s):	Kinyanjui, Jennifer, W.; **Keriko, J. M**. and Kituyi, E.
Background:	Small scale cut-flower farmers in Kenya face various challenges including those involving compliance to environmental requirments. This study was carried out to assess these specific challenges by farmers in some regions of Centrel Kenya in particular those in Nyeri, Muranga and Kiambu districts.
Methods:	Using a total of 360 small scale cut-flower farmers four main methods were applied in data collection; Field visits and interviews using closed ended questionares, observation and a ckecklist as a means of data collection instrument, consultations with experts and desk studies was also applied.
Results:	The findings revealed that farming, post harvest handling, transportation, inspection and distribution of flowers to market are the activities along the supply chain involving small holder cut-flower farmers. The major actors/players along the value chain are inputs suppliers, exporters, Horticultural Crops Development Authority, Kenya Plant Health Inspectorate, Fresh Produce Exporters

Association of Kenya, Kenya Flower Council, Ministry of Agriculture and donors. Key constraint faced by out growers in producing and complying with environmental requirements administered by international markets include: Lack of pesticides storage facilities, lack of training in safe use of pesticides and fertilizers, first aid, water and waste management in flower production, lack of proper record keeping, lack of financial assistance, poor water management skills and lack of proper harvest handling infrastructures.

Conclusions: Proper organized interventions are needed to save the sector. These include; the formation of stable producer groups with organizational structures to be classified as single farms, facilitation of group certification under the 2 of the GlobalGAP, strengthening of capacities to meet environmental standards by government, private sector and donors. An enabling policy framework that assures environmental requirements and provision of incentives to comply with private voluntary standards were recommended.

Title: An integrated economic, social and environmental impacts assessment model for geothermal power development in Kenya.

Researcher(s): Nyakundi, P. A.; Inoti, I. K., Thiong'o, G. T. and **Keriko, J. M**.

Background: Geothermal power has been used for electric and non-electric purpose for many centuries. In Kenya, geothermal power is one of the two main sources of energy available for a large scale electric power generation the other source being hydropowewr. The geothermal power generation in Africa is a new technology. In Africa however, Kenya is the only country utilizing this technology in power generation. There are some negative impact of its generation including noise, water pollution and other environmental effects that are associated with its generation.

Methods: Economic, environmental and social impacts were identified and quantified by use of; remote sensing, setelite images, Arcview 3.2a, topographic maps, table stereoscope, rainfall and noise measurements, energy generation and sales, Focused Group Discussion (FGD), questionares, Statistical Package for Social Scientist (SPSS) and Ms Excel, quantification of the amount of water used for well drilling and population trends for 1979, 1989 and 1999 to analyze development trends in a temporal basis and develop a model to analyze economic, social and environmental impacts resulting from the geothermal power development.

Results: In this study, economic, environmental and social impacts have been identified and quantified by the use of; remote sensing, settlite images, Arcview 3.2a, topographic maps, table stereoscope, rainfall and noise measurements, energy generation sales, Focused Group Discussions (FGD), questionares, Statistical Package for Social Scientists (SPSS) and Ms Excel, amount of water used for well drilling and population trends for 1979, 1989, 1999 to analyze development trends in a temporal basis. These data helped to arrive at the conclusions and recommendations given in this study.

Conclusions: Current and future geothermal power exploitation in Olkaria field should take into consideration immediate and long term exploitation impacts for resource use sustainability. An integrated economic, social and environmental model has been proposed to guide sustainable development of this exploitation.

Title:	Investigating institutional, policy and project financing barriers impeding clean development mechanism (CDM) implementation in Kenya.
Researcher(s):	Mutevu, M. M.; **Keriko, J. M.;** Kituyi, E. and Kitetu, J. J.
Background:	The Clean Development mechanism (CDM) is a new tool for promoting sustainable development in developing countries. It was established by the Kyoto protocol under the United Nation Framework Convention on Climate Change (UNFCCC). It promises developed countries certified emission reductions (CERs) if they comply with their quantified emission targets and developing countries sustainable development benefits if they participate and invest in clean renewable technologies
Methods:	Primary data required here were collected by using semi-structured questionares and personal interviews with respondents. Questionares were send by post, e-mail and hand delivered. Secondary data were collected through comprehensive review and analysis of up to date theoretical and empirical literature on CDM. Literature review was obtained from scientific journals, hand books, reports and reliable scientific web sites. The sample population was 30 respondents
Results:	70% of respondents complied with our requirement and good feedback was received from them. 80% of respondents drawn from the private sector observed that institutional, policy and project financing barriers were impending CDM uptake. 60% of respondents in the public sector pointed out that, lack of willingness by private sector to embrace CDM is a key impendiment. Policy and legislative gaps in the energy policy, forestry policy and related Acts have played a key role in slowing the uptake of CDM. A poor profile of Kenya as a host country has made project financing a challene for CDM investor and project developer due to high CDM-specific risks and regulatory risks
Conclusions:	Kenya has a high potential to accelerate develoment of CDM projects. However, there in need to move away from the status quo if we are to benefit more from Clean Development Mechanism (CDM).
Title:	Factors that influence environmental regulation compliance by micro- and small enterprises in the manufacturing sector in Nairobi.
Researcher(s):	Mputhia, J.; Mukulu, E. and **Keriko, J. M.**
Background:	Micro and Small Enterprises (MSEs) are recognized as agents of industrial change, innovation, and important vehicle for emloyment creation and economic growth. Since the 1972, International Labour Organization (ILO) report, the informal sector's contribution to overall economic development has assumed dominance in many debates in Kenya. The gorvernment has recognized the sector as a primary means of strengthening Kenya's economy since it has a far higher capacity to create employment and to alleviate poverty through equitable distribution of income than a situation where multinational and established companies take the centre stage.
Methods:	The research work sought to establish the factors that influence environmental regulations compliance by Micro and Small Enterprises in the manufacturing sector in Nairobi, Kenya. The research adopted a mixed method approach which was both qualitative and quantitative. The qualitatvie aspect of the research was designed to find out the respondent's perception about benefits of environmental regulations compliance while the quantitative aspect was designed to find out the number and quantities or amounts of

some of the variables used in the study. The target population was any highly polluting MSE in the manufacturing sector registered by the Ministry of Industrialization.

Results: The study established that awareness of environmental regulations (ER), cost of compliance, experts capability, perception of benefits of compliance and business premises ownership influenced compliance with environmental regulations. The results revealed a high correlation between the level of education, technical and mangement skills and familiarity with environmental regulations peocedures. The majority of MSEs found cost of compliance to be prohibitive but nevertheless undertook EAs regulaly using external consultants. Procedures found most difficult to implement by the majority of MSEs included liquid effluent management and solid waste management.

Conclusions: The national Environmental Management Authority (NEMA) and other stakeholders should increase outreach to all the MSEs in the sector to make them aware of the benefits of the environmental regulation compliance, support MSEs to reduce cost of compliance by increasing their internal capacity to undertake EAs and by ensuring that MSEs become aware of the negotiated compliance on the basis of risks to the environment poised by their activities. Implementing measures to convince MSEs to participate in environmental conservation activities and issue of awards for the MSE which complied with ER in order to encourage them and showcase them to other who may not have been so keen are other measures that should be considered.

SECTION C: COMPENDIUM OF PUBLICATIONS

1. FACULTY OF SCIENCE

1.0 DEPARTMENT OF STATISTICS AND ACTUARIAL SCIENCES

Name of Lecturer/Authors:	**Peter.N. Mwita.**
Title of Publication:	Estimation of T-Period's Ahead Extreme Quantile Autoregression Function.
Abstract:	The paper considers the estimation of extreme quantile autoregression function by using a parametric model. We combine direct estimation of quantiles in the middle region with that of extreme parts using the model and results from extreme value theory (EVT). The volatility used to scale the residuals is estimated indirectly, without estimating conditional mean, using the conditional quantile (CQ) range. The estimators are found to be consistent. Simulation study carried out shows that the estimator of the volatility function converges to the true function over a range of distributional errors. Finally, the T-periods ahead extreme quantile autoregression function is given.
Name of Journal/Conference Proceedings/Workshop:	frica Journal of Mathematics and computer Science research.
Year of Publication:	2010.

1.1 DEPARTMENT OF BIOCHEMISTRY

Name of Lecturer/Authors:	Ngotho M., Kagira J.M., Jensen H.E., **Karanja S.M**, Farah I. O. and Hau J.
Title of Publication:	Immunospecific immunoglobulins and IL-10 as markers for *Trypanosoma brucei rodesiense* late stage disease in experimentally infected vervet monkeys.
Abstract:	Objective to determine the usefulness of IL-10 and immunoglobuline M (IgM) as biomarkers for staging HAT in vervet monkeys, a useful pathogenesis model for humans. Vervet monkey were infected with Trypanosoma brucei rhodesiense and subsequently given su-curative and curative treatment 28 and 140 days pot-infection (dpi) respectively. Mathed serum and CSF samples were obtained at regular intervals andinnunospecific Igm, immunoglobuline G(igG) and IL-10 were quantified by ELISA. There was no detectable innunospecific IgM and igG in the CSF before 49 dpi. CSF IgM and IgM and srum IgM wre significantly elevated with peak levels coinciding with meningoencephalitis 98 dpi. The serum IL-10 was upregulated in

both early and late disease stage, coinciding with primary and relapse parasitaemia respectively. CSF white cell counts (CSF WCC) were elevated progressively till curative treatment was given. After curative treatment, there was rapid and significant drop inserum IgM and IL-1- concentration as well as CSF WCC. However, the CSF IGM and IgG remained detectable to the end of the study.
Conclusion: Serum and CSF concentrations of immunospecific IgM and CSF IgG changes followed a pattern that mimics the progression of the disease and may present reliable and useful biomarkers of the disease stage. Due to rapid decline, serum IgM and IL-10 are, additionally, potential biomarkers of the successs of chemotherapy.

Name of Journal/Conference Proceedings/Workshop: Tropical Medicine and International health. Volume 14 No 7pp.
Year of Publication: 2009.

Name of Lecturer/Authors: J.W. Kimani, **D.W Kariuki**, G.M.Kenji A.W. Kihurani.
Title of Publication: Characterization of seed oil and preliminary evaluation of oxalate oxidase activity among Kenyan sunflower.

Abstract:
Pathogenesis-related (PR) protein accumulation observed in many plant species upon infection by pathogens is associated with acquired resistance. This study investigated the presence of oxalate oxidae in six sunflower (helianthus annuus) varieties available in Kenya, namely: Kenya Fedha, Rekord, Issanka, H8998, H4038 and H4088. A calorimetric enzyme assay was used to screen for the enzyme activity in sunflower leaf tissue. A detached leaflet assay was conducted and lesion size measured following degradation by exogenously applied oxalic acid on leaf tissue. Sunflower oil was also characterized from the six varieties through determination of Acid Value, Saponification Value, Iodine Value, Peroxide Value, Relative Density and Refractive index. The oil content and Fatty Acid composition of the oil were also determined. The relationship between the oil quality/quantity and level of oxalate oxidase activity was also investigated. This study revealed that the selected sunflower varieties had an oil content of up to 50.55%. H8998 and H4088 and 50.55% and 49.41%oil content respectively. The two varieties may thus be recommended for commercial oil extraction. The oils were found to be highly unsaturated at levels of 81.93% to 89.09% making sunflower oil superior to many edible fats and oils used commercially. Peroxide values ranged from 1.04 to 2.98 meq/kg oil while acid values ranged from 0.14 to 0.28 meq/kg oil while acid values ranged from 0.14 to 0.28 mg KOH/g oil. Saponification that the oils were composed of high molecular weight fatty acids. The oil was also found to be pure and light as indicated by Refractive Index and Relative Density values of 1.4709 to 1.4724 and 0.9106 to 0.9193 respectively, making it suitable for various cooking options. All the varieties responded differently to oxalic acid degradation as characterized by differences in lesion areas per variety ($p>0.05$) at different acid concentrations. H4088 showed higher oxalate oxidase activity and hence higher resistance to degradation by the acid compared to other vairetites and was second highest in oil content (49.40%). This study, therefore, recommends that H4088 be promoted to farmers for farming. H8998 which had relatively less oxalate oxidase activity but highest oil content (50.55) may also be recommended for transformation with the resistance gene in order to enhance its oxalate oxidase activity.

Name of Journal/Conference Proceedings/Workshop:	JKUAT Faculty of Science 2nd Scientific Conference.
Year of Publication:	2009.
Name of Lecturer/Authors:	Ogoti Peter, **Esther Magiri**, Joanna Auma, Gabriel Magoma, Mabel Imbuga and Grace Murilla.
Title of Publication:	Evaluation of in vivo antitrypanosomal activity of selected medicinal plant extracts.
Abstract:	This study was based on the observation that traditional practitioners in Kenya use plant based extracts for the treatment of parasitic disease. This necessitated the need to investigate the potential of such plants. Four plants (Kigelia Africana, Arte, esoa ammia, Bidens pilosa and Azadirachata indica) were selected for investigation against African human trypanosomiasis. The methanol, dicholoromethane and acqueous extracts of these plants were administered intraperitoneally to Swiss white mice that had previously been inoculated with Trypanosoma brucei rhodesiense KETRI 3798. The parasitaemia, packed cell volume and body weight in each mouse was monitered for 60 days. This was done in paralles with control mice, which had been given water and ethanol (Negative control) and standard drugs; Melarsoprol and Suramin (positive control) respectively, Among the extracts tested, the dichloromethane extract prepared from the fruits of *kigelia Africana*, tested at a dose of 2000 mg/kg was effective, curing 60% of the animals treated. The other extracts did not show significant anti trypanosomal activitiy. The treated positive controls (Melarsoprol and Suramin at dose of 3.6 and 5 mg/kg respectively), showed 100% survival and cleared parasites. These results show that k.africana has great potential as anti trypanosomiasis agent, which could be developed into an alternative drug to complement treatment of trypanosomiasis.
Name of Journal/Conference Proceedings/Workshop:	Journal of Medicinal Plants Research Vol. 3(11) pp.849-854*)*.
Year of Publication:	2009.
Name of Lecturer/Authors:	Gerald Juma, Mathayo Chimtawi, Peter O.Ahuya, Peter G.N Njagi Bruno Le RU, **Gabriel Magoma** Jean-Francois Silbain and Paul-Andre Calatayud.
Title of Publication:	Distribution of chemo-and mechanoreceptors on the antenaae and maxillae of *Busseola fusca larvae*.
Abstract:	The stem borer Busseola fusca (Fuller) Lepidoptera: Noctuidae) is a major post of maize, Zea mays I and sorghum, sorghum bicolor (L) Moench (both poaceae), in sub-saharan Africa. Like in May other lepidopteran insect, the success of B.fusca in recognizing and colonizing a limited variety of plants is based on the interaction between its sensory systems and the physicochemical characteristics of its immediate environment. The sensilla on the maxillary galeae of B.fusca larvae are typical of Lepidoptera and comprise two uniporous styloconic sensilla, which are contact chemoreceptors, three basiconic sensilla, and two aporous sensilla chaetica. The maxillary palp is tow-segmented and has eight small basiconic sensilla at the tip, which were also found to be gustatory. The antennae of B.fusca larvae are short and simple. The sensilla of the antenna are composed of two aporous sensilla chaetica, three multiporous cone-shaped basiconic sensilla, three small basiconic sensilla, and one aporous styloconic

	sensillum. The basiconic sensilla located on the third antennal segment displayed a contact chemoreception response. The other basiconic sensilla did not show any action potential activity in tip-recording tests. The significant and positive dose-response curve obtained for the antennal basiconic sensillum with sucrose indicated for the first time the presence of gustatory chemoreceptors on the antennae of a lepidopteran larva.
Name of Journal/Conference Proceedings/Workshop:	Entomologia Experimentalis *et* Applicata 128:93-98.
Year of Publication:	2008.
Name of Lecturer/Authors:	L.E. Agola, M.L.Steinauer, D.N Mburu, B.N. Mungai, I. N. Mwangi, **G.N. Magoma**, E.S. Loker and G.M. Mkoji.
Title of Publication:	Genetic diversity and population structure of *Schistosoma mansoni* withing human infrapopulations in Mwea, central Kenya assessed by microsatellite markers.
Abstract:	A recently developed high-through put technique that allows multi-locus microsatellite analysis of individual miracidia of schistosoma mansoni was used to assess the levels of genetic diversity and population structure in 12 infrapopulations of the parasite, each infrapopulation derived from an infected school child from the Mwea area, central Kenya. The mean number of alleles per locus was in the range 8.22-10.22, expected heterozygosity in Hardy-weinberg equilibrium was 0.68-0.70 and pairwise F_{st} vaules ranged fro 0.16% to 3.98% for the 12 infrapopulations. Although the genetic diversity within each infrapopulation of S.mansoni in this area was generally high, low levels of genetic structure were observed, suggestive of high levels of gene flow among infrapopulations. Private alleles were found in 8 of the 12 infrapopulation, the ghiest number of private alleles recorded per infrapopulation was 3. Our data suggest that the level of gene flow among infrapopulations of S.mansoni in Mwea is extremely high, thus providing opportunity for spread of rare alleles, including those that may confer character traits such as drug resistance and virulence.
Name of Journal/Conference Proceedings/Workshop:	Acta Tropica.
Year of Publication:	2009.
Name of Lecturer/Authors:	**Laura N. Wangai**, Sabah A. Omar, Gabriel N. Magoma, Francis T. Kimani.
Title of Publication:	Prevalence of Mutant DHPS/DHFR Genes of *P. Falciparum* infections 10 years after introduction of Sulfadoxine pyrimethamine in the main Malaria Zones in Kenya.
Abstract:	Plamodium falciparum strains with resistance to the commonly used drugs are becoming increasingly widespread in Kenya. The emergency and spread of resistant strains is an impediment to efforts to manage the disease. In the present study, samples from Mbita, Oyugis, rural villages on the shores of Lake Victoria in Suba District, Western Kenya and eight epidemic districts in Kenya were analysed. PCR followed by restriction fragments digestion were carried out to detect the presence of dhfr-codon Arg 59 an dhps-codon Glu 540 which are known to confer resistance to sulphdoxine-pyrimethamine (SP) drugs, which were previously firstline treatment optins in these regions. From the study we found out that prevalence of the mutants strains

was 16.7% f (n=12/72) in 1998 when SPs were initially introduced in Kenya. This was significantly low compared to 78.9% (n=101/128) in Mbita in 2007 two years after withdrawal of SPs in Kenya. In epidemic areas declined from 69.4% to 3.9% in the same period. The study demonstrate the resistance to SP is largely influenced by drug pressure which has been present and is still present after the withdraw of drugs due to the use as second line drug. Therefore, proper policy on the SPs use should be implemented to reduce build up of the resistant strains.

Name of Journal/Conference Proceedings/Workshop: East African Conference on Health Science.
Year of Publication: 2009.

1.2 DEPARTMENT OF BOTANY

Name of Lecturer/Authors: H. W Karuri, E. M Ateka, R Amata, A.B., Nyende, and **A.W.T. Muigai.**

Title of Publication: Morphological markers cannot reliably identify and classify sweet potato genotypes based on resistance tosweet potato virus disease and dry matter content.

Abstract: *Objective:* To characterize Kenyan sweet potato genotypes for resistance to sweet potato virus disease (SPVD) and dry matter content using morphological markers. *Methodology and results:* Three hundred and fourteen genotypes were evaluated in the screenhouse for their reaction to sweet potato virus disease (SPVD) followed by serological analysis. Severity of SPVD was determined following graft-inoculation using a severity scale of 1- 5. Results showed that the genotypes responded significantly differently ($P<0.01$) to SPVD infection. Twenty genotypes were resistant to SPVD in the screenhouse. The 314 genotypes were planted in the field and characterized using 42 morphological characters. Tuber dry matter (DM) content was determined 5 months after planting in the field. The tuber DM content varied significantly ($P<0.01$) among the sweet potato genotypes. Phylogenetic analysis using morphological descriptors grouped the genotypes into two major clusters. None of the clusters clearly distinguished the 20 resistant genotypes from the 294 susceptible ones. Genotypes with highest and lowest tuber DM content were not distinguished from each other using the UPGMA phenogram generated. *Conclusions and application of findings:* Our results indicate that morphological markers are not reliable in identifying and classifying sweet potato genotypes based on response to SPVD and dry matter content of the tubers. Morphological markers therefore need to be supplemented with molecular markers in identification of sweet potato germplasm with SPVD resistance and high dry matter content. This study has further shown that there is a significant amount of morphological variability among the SPVD resistant and high dry matter genotypes, which could be utilized in breeding to diversify resistance to the disease and generation of novel/new genotypes.

Name of Journal/Conference Proceedings/Workshop:	Journal of Applied Biosciences (2009), Vol. 15: 820 – 828. ISSN 1997 – 5902: www.biosciences.elewa.org.
Year of Publication:	2009
Name of Lecturer/Authors:	H. W Karuri, E. M Ateka, R Amata, A.B., Nyende, and **A.W.T. Muigai.**
Title of Publication:	*Characterization of Kenyan sweet* potato genotypes for SPVD resistance and high dry matter content using simple sequence repeat markers.
Abstract:	Simple sequence repeat (SSR) markers were used to characterize Kenyan sweet potato genotypes for resistance to the sweet potato virus disease (SPVD) and high dry matter content. Eighty nine (89) genotypes with a mean symptom severity score of between 1 and 1.5 were selected following graft inoculation with SPVD-infected scions and characterized using 6 SSR primers. The 6 SSR primer pairs had average polymorphic information content (PIC) of 0.47. The average number of alleles within the 89 genotypes across the 6 loci was 13.52. Cluster analyses revealed a 50% variation among the 89 genotypes. The dendrogram did not reveal any unique clustering of the genotypes according to dry matter content and reaction to SPVD. The genetic differences among the SPVD resistant genotypes and those with high dry matter revealed by the distinct groups suggest a significant genetic variability and the presence of different sources of resistance to SPVD and high dry matter. This characterization will give valuable information for breeders and serve as a baseline for efficient development of new cultivars resistant to SPVD and containing high dry matter.
Name of Journal/Conference Proceedings/Workshop:	African Journal of Biotechnology. Vol. 8 (10), pp. 2169-2175, 18 May, 2009.
Year of Publication:	2009.
Name of Lecturer/Authors:	**A.W.T. Muigai**, O. Mwai, A.K. Kwallah, D. Mburu, O. Hanotte.
Title of Publication:	Characterization of sheep populations of Kenya: Evidence of dilution in the indigenous Red Maasai breed.
Abstract:	Indigenous sheep of Kenya are very important to resource-poor farmers and pastoralists. They have over time adapted to the harsh environmental conditions of the arid and semi-arid lands where they are faced with challenges of persistent droughts, diseases, conflicts and poor nutrition, yet show resistance to gastrointestinal nematodes. In recent years, these indigenous sheep populations have been crossbred indiscriminately to exotic breeds particularly the Dorper. A study was undertaken to determine the level of genetic diversity and relatedness between the various sheep populations and breeds of Kenya. This paper reports results on the genetic diversity and admixture observed using microsatellite DNA markers.
Name of Journal/Conference Proceedings/Workshop:	South African Journal of Animal Science 2009, 39 (Supplement 1).
Year of Publication:	2009.
Name of Lecturer/Authors:	Romano Mwirichia • Sylvie Cousin, **Anne W. Muigai**, Hamadi I. Boga, Erko Stackebrandt.

Title of Publication:	Archaeal Diversity in the Haloalkaline Lake Elmenteita in Kenya.
Abstract:	A non-culture approach was used to study the archaeal diversity in Lake Elmenteita, Kenya. Five different sampling points were selected randomly within the lake. Wet sediments and water samples were collected from each sampling point. In addition, dry mud cake was collected from three points where the lake had dried. DNA was extracted from these samples and the 16S rRNA genes were amplified using primers described to be Domainspecific for Archaea. Eleven clone libraries were constructed using PCR-amplified 16S rRNA genes. A total of 1,399 clones were picked and analysed via ARDRA. 170 ARDRA patterns were unique and the respective clones were selected for sequencing. 149 clones gave analyzable sequences. BLAST analysis showed that 49 belong to the Domain Archaea while the others were either chimera or affiliated to eukaryotic taxa. Comparative sequence analysis of archaeal clones affiliated them to a wide range of genera. The order Halobacteriales was represented by members of the genera Natronococcus, Halovivax, Halobiforma, Halorubrum, and Halalkalicoccus. The highest percentage (46%) of the clones, however, belonged to uncultured members of the Domain Archaea in the order Halobacteriales. The results show that the archaeal diversity in the lake could be higher than previously reported.
Name of Journal/Conference Proceedings/Workshop:	Current Microbiology; 60:47–52.
Year of Publication:	2009.
Name of Lecturer/Authors:	H.W. Kariuki, E.M. Ateka, R. Amata, A.B. Nyende, **A.W.T. Muigai**, E. Mwasame AND S.T. Gichuki.
Title of Publication:	Evaluating Diversity among Kenyan Sweet Potato Genotypes Using Morphological and SSR Markers.
Abstract:	Genetic diversity of 89 sweet potato genotypes was evaluated using morphological and molecular markers. Eighteen aerial and sixteen storage root characters were used in the morphological characterization. Analysis of variance showed that all the characters evaluated were significantly different ($P<0.01$) between the genotypes. The dendrogram obtained using phenotypic characters separated the genotypes into two major clusters with a Euclidean distance ranging from 0.0 to 6.98. Twenty three unique alleles, ranging from 3 to 6 per locus were detected using six simple sequence repeats (SSR) markers. Cluster analysis showed a Jaccard co-efficient ranging from 0.5 to 1.0 indicating high genetic diversity. Comparison between morphological and molecular data using the mantel test revealed a low correlation ($r = -0.05$) between the two data sets. Despite the poor correlation both techniques showed a high degree of variation among the genotypes suggesting great genetic diversity in Kenyan sweet potato genotypes that can be utilized in breeding programs.
Name of Journal/Conference Proceedings/Workshop:	International Journal of Agriculture & Biology 12: 33–38.
Year of Publication:	2010.
Name of Lecturer/Authors:	Kinuthia Mwangi, Hamadi I. Boga, **Anne W. Muigai**, Ciira Kiiyukia and Muniru K. Tsanuo.
Title of Publication:	Degradation of dichlorodiphenyltrichloroethane (DDT) by bacterial isolates from cultivated and uncultivated soil.

Abstract:	The re-introduction of dichlorodiphenyltrichloroethane (DDT) to control mosquitos was recommended by the World Health Organization in 2007. In this study, the potential for biodegradation of DDT by soil microorganisms through enrichment and isolation of DDT biodegraders from soils without a history of prior exposure to DDT was done. Microorganisms from cultivated and uncultivated soils grew in minimal media with DDT (100 ppm) as the only carbon source. Six bacteria coded as isolates 101, 102, 103, 104, 105 and 110 degraded DDT to l, l-dichloro-2, 2-bis (p-chlorophenyl) ethane (DDD). None of the isolates degraded DDT into l, l-dichloro-2,2-bis (p-chlorophenyl) ethylene (DDE). Degradation by the mixed culture of the six isolates was higher (82.63%) than that of any individual isolates whose range was 28.48 - 58.08%. The identity of the isolates was determined through biochemical, morphological, physiological and molecular techniques. Isolate 101 was a member of the genus *Bacillus*; isolates 102 and 110 belonged to the genus *Staphylococcus* while isolates 103, 104 and 105 clustered with members of the genus *Stenotrophomonas*. This study showed that there are microorganisms in the soil that can degrade DDT and that the rate of degradation is dependent on the presence and numbers of microbes in the soil with the required degradative ability, environmental factors and access of the microbes to
Name of Journal/Conference Proceedings/Workshop:	African Journal of Microbiology Research Vol. 4 (3) pp. 185-196, 4 February, 2010.
Year of Publication:	2010.
Name of Lecturer/Authors:	Kinuthia Mwangi, Hamadi I. Boga, **Anne W. Muigai**, Ciira Kiiyukia and Muniru K. Tsanuo.
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Name of Journal/Conference Proceedings/Workshop:	African Journal of Microbiology Research Vol. 4 (3) pp. 185-196, 4 February, 2010
Year of Publication:	2010.
Name of Lecturer/Authors:	L. N. Gitonga, **A. W. T. Muigai**, E. M. Kahangi, K. Ngamau and S. T. Gichuki.
Title of Publication:	Status of macadamia production in Kenya and the potential of biotechnology in enhancing its genetic improvement.
Abstract:	Macadamia (*Macadamia* spp.) is considered the world's finest dessert nut because of its delicate taste and numerous health benefits. It is grown in Kenya both as a cash crop and foreign exchange earner with Kenya producing about 10% of the world's total production. Macadamia has great potential for poverty reduction due to the high value of its products and its low requirement for external inputs. Although the crop has been grown in the country for over 5 decades, the growth of the industry is not commensurate with the demand and market potential that exists. Some of the challenges facing the macadamia industry in Kenya include lack of cultivars adapted to various agro ecological zones, inadequate planting materials of high quality, high cost of the available good quality planting materials and pests and diseases that affect nuts thus lowering post harvest quality. This paper discusses the potential of agricultural biotechnology relevant to genetic improvement of macadamia to compliment other efforts for its improved productivity and value.
Name of Journal/Conference Proceedings/Workshop:	Journal of Plant Breeding and Crop Science Vol. 1(3). pp. 049-059, May, 2009.
Year of Publication:	2009.
Name of Lecturer/Authors:	Lucy Gitonga, Esther Kananga, Kamau Ngamau, **Anne W.T. Muigai**, S.T Gichuki and Nancy Njogu.
Title of Publication:	Studies on *In Vitro* And *In Vivo* Methods of Propagation in an Effort Towards *Ex Situ* Conservation of Macadamia (*Macadamia* spp) Germplasm in Kenya.
Abstract:	Macadamia is an important nut crop in Kenya grown mainly for export. It is an attractive cash crop especially among small scale farmers due to its low requirement for external inputs. With new superior varieties, farmers replace old plantations with the new varieties. However, the old plantations still contain untapped genetic potential and hence the need for *ex situ* conservation. Since it is highly out crossing, true-to-type clones are propagated through vegetative means. A study was carried out to evaluate the effectiveness of using cuttings, grafting and direct and indirect regeneration tissue culture techniques across 39 accessions covering two *Macadamia* spp (*M. integrifolia* and *M. tetraphylla*) and the natural (*M. integrifolia* * *M. tetraphylla*) hybrids. Results indicated that cuttings could be used but took 9-15 months before whole plants could be obtained and also the success varied with genotype. All genotypes were also amenable to grafting but with varying success with the highest (100%) bud break being obtained in accessions related to *M. integrifolia*. Direct regeneration from nodal segments was achieved with up to 85% bud break and shoot multiplication of up to 12 shoots per explant while callus induction was possible from medium to mature cotyledonary tissue in some accessions. Although these studies

	are still ongoing, it can be recommended that grafting of seedlings with the accessions to be conserved and planting them closely in a small field is an effective and cost effective method of conserving the material for several years.
Name of Journal/Conference Proceedings/Workshop:	African Journal of Horticultural Science Vol 1(2) pp 001-008.
Year of Publication:	2009.
Name of Lecturer/Authors:	L.N. Gitonga, K. Ngamau, A.W.T. Muigai, S.T. Gichuki, P. Okech, L. Wasilwa6, W. Cheluget and E.M. Kahangi.
Title of Publication:	Geographical and Ecological Distribution of Some Macadamia Genotypes in Kenya and Prospects for Increased Production.
Abstract:	Macadamia (Family Protaceae) is the most important nut crop in Kenya, grown as a source of household income and foreign exchange. Kenya is the fourth largest producer of Macadamia nuts contributing about 10% of world's total production. However, its production, expansion and commercialization are hampered by various constraints, especially suitable varieties for the various agro-ecological zones in Kenya. Selection and development of new varieties currently rely on existing germplasms and introductions from other growing countries. Considering that genetic diversity is crucial to breeding efforts, studies were done to locate valuable germplasms using geographical positioning system (GPS) and evaluate ecological adaptation. A total of 39 accessions, including breeding lines currently being tested under Kenya's Macadamia breeding programme, some cultivars introduced from Australia and Hawaii and some new selections were evaluated. A total of 39 GPS points were recorded and data analyzed using ArcView GIS version 3.3. Results indicated that all accessions were located between 0 and 3 degrees south of the equator and between 36 and 37 degrees East of the Greenwich Meridian. Only one accession was adapted to over 2000 meters above sea level while all the others were adapted to between 1300 to 1920 meters above sea level. Mapping of the accessions
Name of Journal/Conference Proceedings/Workshop:	Journal of Plant Breeding and Crop Science Vol. 1(3). pp. 049-059, May, 2009.
Year of Publication:	2009.

1.3 DEPARTMENT OF PHYSICS

Name of Lecturer/Authors:	Thomas Nyachoti Nyang'onda, **David Masabule Mulati**, Bernard Odhiambo Aduda.
Title of Publication:	Raman Crystallinity and Hall Effect Studies of Polycrystalline Silicon Seed Layer from Annealed Glass/Al/a-Si and Glass/Al/a-Si/Al layers
Abstract:	Progress in the attainment of high efficiencies of microcrystalline silicon (μ-Si) solar cells may require the use of μ-Si seed layers grown by metal induced crystallization (MIC). The growth of optimal large grains of these seed layers reduces the effect of recombination at the grain boundaries. Aluminium induced crystallization (AIC) has been used for the crystallization of amorphous silicon (a-Si). Aluminium

induced crystallization (AIC) has been used to crystallize sputtered amorphous silicon thin films on glass at temperatures between 250-520 °C in vacuum. Crystalline volume fractions were then measured by Raman spectrometry as a function of annealing temperature. These measurements showed that the crystallized films were entirely polycrystalline as the Raman peaks were centred about 520 cm^{-1} at and over 420 °C. Hall mobilities and hole densities of 17-22.8 cm^2/Vs and (5 to 9) $x10^{18}$ cm^{-3} respectively were measured. The aluminium content in the films was found to reduce with increase in annealing temperature for films of the same thickness.

Name of Journal/Conference Proceedings/Workshop: 1ST-conference on solar energy and material science; at Dare-saalam University; 13th to 15th October.

Year of Publication: 2009.

Name of Lecturer/Authors: Thomas Nyachoti Nyang'onda, **David Masabule Mulati**, Bernard Odhiambo Aduda.

Title of Publication: Raman Crystallinity and Hall Effect Studies of Polycrystalline Silicon Seed Layer from Annealed Glass/Al/a-Si and Glass/Al/a-Si/Al layers

Abstract: Progress in the attainment of high efficiencies of microcrystalline silicon (μ-Si) solar cells may require the use of μ-Si seed layers grown by metal induced crystallization (MIC). The growth of optimal large grains of these seed layers reduces the effect of recombination at the grain boundaries. Aluminium induced crystallization (AIC) has been used for the crystallization of amorphous silicon (a-Si). Aluminium induced crystallization (AIC) has been used to crystallize sputtered amorphous silicon thin films on glass at temperatures between 250-520 °C in vacuum. Crystalline volume fractions were then measured by Raman spectrometry as a function of annealing temperature. These measurements showed that the crystallized films were entirely polycrystalline as the Raman peaks were centred about 520 cm^{-1} at and over 420 °C. Hall mobilities and whole densities of 17-22.8cm^2/Vs and (5 to 9) $x10^{18}$ cm^{-3} respectively were measured. The aluminium content in the films was found to reduce with increase in annealing temperature for films of the same thickness.

Name of Journal/Conference Proceedings/Workshop: 1ST-conference on solar energy and material science; at Dare-saalam University; 13th to 15th October.

Year of Publication: 2009.

Name of Lecturer/Authors: **R. Kinyua**, J.N. Kamau, J.K. Gathua.

Title of Publication: Six years of wind data for Marsabit, Kenya average over 14m/s at 100m hub height; An analysis of the wind energy poiential.

Abstract: The wind energy potential for generation of electricity and for domestic water pumping has been investigated for Marsabit, Kenya. Marsabit (37° 58'E, 2° 19'N) lies in Eastern province approximately 560km from Nairobi. Wind data from the Kenya Meteorological department for the period 2001-2006 has been used to study the Diurnal, monthly and inter-annual variability using empirical methods including the power law and Weibull statistics. Average wind speeds greater than 11m/s at a height of 10m are prevalent in this area. The available power density at a height of 100m is between 1776W/m^2 and 2202W/m^2 which is in the wind class range of 7 and

	8. The maximum extractable power density at 100m varied between 1417W/m² and 1757W/m². Values of the Weibull parameters k (dimensionless) and C (m/s) ranged between 2.5 – 3.05 and 18.86 – 12.97 respectively. Wind rose analysis revealed no marked variation in wind direction and frequency throughout the year (mean direction between 150 and 160 degrees with highest standard deviation of 33.5 degrees). From the analysis the site was found to be suitable for grid power generation and also for other stand-alone generators that can be used for water pumping and battery charging.
Name of Journal/Conference Proceedings/Workshop:	Renewable Energy.
Year of Publication:	2010.

1.4 DEPARTMENT OF ZOOLOGY

Name of Lecturer/Authors:	F. B. Kaingu1, A. C. Kibor, R. Shivairo1, **H. Kutima**, T. O. Okeno, R. Waihenya and A. K. Kahi.
Title of Publication:	Prevalence of gastro-intestinal helminthes and *Coccidia* in indigenous chicken from different agroclimatic zones in Kenya.
Abstract:	Background and objectives: A study on the prevalence of gastro-intestinal endoparasites in indigenous chicken was carried out in three regions in Kenya. The objective of the study was to determine the species and their prevalence rates. Methods: A total of 710 adult free-ranging local chickens were sampled from six districts, Kakamega (162), Bondo (81), Narok (81), Bomet (150), Turkana (70) and West Pokot (166). Qualitative and quantitative microscopic parasitological examinations were used for faecal examination. Results: The survey showed that 192 (27.04%) was infected with Coccidial oocysts, 182 (25.63%) with *Ascaridia galli,* 10 (1.41%) with *Heterakis gallinarum*, 2 (0.3%) with *Syngamus trachea*, 37 (5.21%) with *Capillaria retunsa*, 8.45% with *Capillaria annulata,* 21 (2.96%) with *Raillietina tetragona,* 94 (13.24%), while 112 (15.8%) were negative, with no helminthes infestation. Conclusion: The findings suggested that endoparasites are a common health problem in free range indigenous chicken in Kenya and agro-climate significantly influenced the distribution of endoparasites**.**
Name of Journal/Conference Proceedings/Workshop:	African Journal of Agricultural Research Vol. 5(6), pp. 458-462, 18 March, 2010 Available online at http://www.academicjournals.org/ AJARISSN 1991-637X © 2010 Academic Journals
Year of Publication:	2010.
Name of Lecturer/Authors:	Laboratory and semi-field evaluation of long-lasting insecticidal nets against leishmaniasis vector, *Phlebotomus* (*Phlebotomus*) *duboscqi* in Kenya.
Title of Publication:	Sichangi Kasili, **Helen Kutima**, Charles Mwandawiro, Philip M. Ngumbi & Christopher O. Anjili.
Abstract:	*Background & objectives*: Phlebotomine sandflies are vectors of leishmaniases and other diseases. Long-lasting insecticidal nets (LLINs) as possible tools for control have not been widely tested against them. The objective of this study was to determine the efficacy of Olyset® Net and PermaNet® LLINs alongside a local brand, K-O

Tab® treated net (Supanet) against *Phlebotomus duboscqi* female sandflies.
Methods: Four replicates of unwashed and 20x washed Olyset Nets and PermaNets, K-O Tabtreated and untreated Supanet and 'no net' treatments were evaluated against sandflies within the laboratory by tunnel tests and in semi-field conditions in the greenhouse model for their efficacy.
Results: All bednets allowed entry of *P. duboscqi* sandflies and subsequent blood-feeding. Olyset net's blood feeding inhibition was significantly higher than that of Supanet in the laboratory but not in semi-field condition. Of the LLINs, only Olyset net had sandflies that could not feed significantly more than those of Supanet. Additionally, no significant efficacy difference was observed between LLINs washed 20x and unwashed ones. The only significant difference noted in number of sandflies that were found dead or paralyzed within bednets in the semi-field condition was between Olyset and K-O Tab treated Supanet. In the laboratory, unwashed Olyset had a significantly higher number of sandflies killed than all other bednet treatments.
Conclusion: Olyset net use in areas where sandflies are nuisance biters and/or disease vectors could be more beneficial in preventing sandfly bites than other tested bednets.
Recommendations: It is recommended that mesh sizes of LLINs should be smaller for control of sandflies than those used for control of mosquitoes.

Name of Journal/Conference Proceedings/Workshop: Journal of Vector Borne Diseases 47, March 2010, pp. 1–10.
Year of Publication: 2010.

Name of Lecturer/Authors: Sichangi Kasili, Nicholas Odemba, Francis G. Ngere, John B. Kamanza, Alexander M. Muema & **Helen L. Kutima.**

Title of Publication: Entomological assessment of the potential for malaria transmission in Kibera slum of Nairobi, Kenya.

Abstract: *Background & objectives:* Malaria in urban and highland areas is emerging as a significant public health threat in Kenya which has seen a dramatic increase in malaria transmission in low risk highland areas. The objectives of the study were to find and incriminate potential vectors of malaria in Kibera, Nairobi.
Methods: One hundred and twenty houses within Lindi area of the southern central section of Kibera slum in Nairobi were chosen randomly and global positioning system (GPS) mapped. Day resting indoor mosquitoes were collected from January 2001 to December 2003. Larvae were collected between 2002 and 2004 and reared in the insectary to adults. *Results:* A total of 176,993 mosquitoes were collected. Out of this, 176,910 were *Culex fatigans* and 83 were *Anopheles gambiae* s.l. Mosquito population peaked during the long rains in April to May and the short rains in November and December. Blood meal analysis of *An. gambiae* s.l. female mosquitoes revealed 0.97 human blood index. No mosquito was found positive for *Plasmodium falciparum* sporozoites. *Anopheles gambiae* s.l. mosquitoes were found breeding in polluted water and 95% of the larvae were identified as *An. arabiensis. Interpretation & conclusion: Anopheles gambiae* s.l., malaria vector is present in Nairobi and it breeds in polluted water. *Anopheles arabiensis* predominantly prefers humans as blood meal source, thus, showing ecological flexibility within the species.

Name of Journal/Conference Proceedings/Workshop:	*J Vector Borne Dis* 46, December 2009, pp. 273–279.
Year of Publication:	2009.
Name of Lecturer/Authors:	Sichangi Kasili, **Helen Kutima**, Charles Mwandawiro, Philip M. Ngumbi & Christopher O. Anjili
Title of Publication:	Comparative attractiveness of CO2-baited CDC light traps and animal baits to *Phlebotomus duboscqi* sandflies.
Abstract:	*Background & objectives:* In order to understand sandfly bionomics, vector species identification, and to develop methods for sandfly control, there is a need to sample sandflies in any particular habitat. This survey was aimed at determining the best method of sampling *Phlebotomus (Phlebotomus) duboscqi* (Diptera: Psychodidae) in the field. *Methods:* Different animal baits and CO2-baited CDC light traps were used to attract sandflies released in an insect-proof screen-house located in the sandfly's natural habitat in Marigat, Baringo district of Kenya. *Results*: Attraction of hungry *P. duboscqi* female sandflies by the goat (*Capra hircis*) was significantly higher than that of hamster (*Mesocricetus auretus*), Nile grass rat (*Arvicanthis niloticus*), gerbil (*Tatera robusta*) and chicken (*Gallus domestica)*. However, two rodent species, *A. niloticus* and *T. robusta* did not differ significantly. A linear regression analysis of weights of animal baits and number of sandflies attracted revealed an insignificant result. The fluorescent dyes used to distinguish sandflies of different day experiments seemed not to influence the sandfly numbers in relation to the studied sandfly behaviour. *Interpretation & conclusion:* The similar attraction pattern of *P. duboscqi* in semi-field environment by CO2-baited CDC light trap and the goat provides hope for solution to the problem of fast dissipating dry ice (CO2 source) in the field. Recommendations: Goats can, therefore, also be utilized as deflectors of vectors of cutaneous leishmaniasis from humans in zooprophylaxis in *Leishmania major* endemic areas where the sandfly is found.
Name of Journal/Conference Proceedings/Workshop:	*J Vector Borne Dis* 46, September 2009, pp. 191–196.
Year of Publication:	2009.
Name of Lecturer/Authors:	Benjamin K. Muli, Fritz Schulthess, Rosebella O. Maranga, **Helen L. Kutima** and Nanqing Jiang.
Title of Publication:	Interspecific competition between *Xanthopimpla stemmator* Thunberg and *Dentichasmias busseolae* Heinrich (Hymenoptera: Ichneumonidae), pupal parasitoids attacking *Chilo partellus* (Lepidoptera: Crambidae) in East Africa.
Abstract:	Interspecific competition between *Xanthopimpla stemmator* and *Dentichasmias busseolae* was studied using pupae of the invasive crambid stemborer *Chilo partellus* as the host. While *X. stemmator* is an old association, *D. busseolae* formed a relatively new association with *C. partellus* in East Africa. Two different time intervals between parasitism (0 and 48 h) and two parasitoid sequences [i.e., *X. stemmator* before *D. busseolae* (Xs–Db) and *D. busseolae* before *X. stemmator* (Db–Xs)] were chosen. In addition, the parasitoids' performance on pupae in maize stems and ears was assessed. For both *X. stemmator* and *D. busseolae*, there was no difference in foraging time between unparasitized pupae and pupae previously parasitized

by the other species, indicating that the two species were not capable of interspecific host discrimination. In the Xs–Db sequence, the time interval between parasitism did not have an influence on the percentage of pupae producing either parasitoid species. By contrast, in the Db–Xs sequence, the percentage of pupae producing *X. stemmator* was almost 8 times higher in the 0-h than the 48-h interval, while for *D. busseolae* it was the reverse. In the 0-h interval, *X. stemmator* outcompeted *D. busseolae* irrespective of whether it parasitized first or second, while in the 48-h interval, the parasitoid parasitizing first won. While *D. busseolae* successfully searched for and parasitized pupae in stems and ears, parasitism of pupae in ears by *X. stemmator* was negligible. It was concluded that the two species could co-exist because they partly exploit different ecological niches.

Name of Journal/Conference Proceedings/Workshop: Biological Control Volume 36, Issue 2, February 2009, Pages 163-170.
Year of Publication: 2009.

2. FACULTY OF AGRICULTURE

2.0 DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY

Name of Lecturer/Authors: Nyaberi, M. O.; **Onyango, C. A.**; Mathooko, F. M.; Maina, J. M., Makobe M. Mwaura F.

Title of Publication: Bioactive fractions in the stem charcoal of *Ozoroa insignis* used by the pastoral communities in West Pokot to preserve milk.

Abstract: *Objective:* To determine the potential of Ozoroa insignis Del to preserve milk as practiced by the pastoralists of West Pokot, Kenya.
Methodology and results: The aqueous and organic solvents extracts of the peeled stem charcoal of Ozoroa insignis were screened for qualitative phytochemical composition by the Trease and Evans (1989) method. Antimicrobial activity was determined using the cork and bore diffusion method against test organisms Staphylococcus aureus (ATCC 22923), Pseudomonas aeruginosa (ATCC 27853), Escherichia coli (ATCC 25922) and Candida albicans (ATCC 90028). Antioxidant activities measured as hydrogen donating radical scavenging ability was determined using the stable radical 2, 2 diphenyl picrylhydrazyl (DPPH) (Brand et al. 1995). Toxicity test was carried out using brine shrimp larvae (Artemia salina, Aqua farm, USA) as the test organism (Meyer et al., 1982). Flavonoids, saponins, sterols and steroids were detected in the three extracts. Alkaloids were detected in the chloroform and methanol extracts, while hydrolysable tannins were detected in the methanol extract. The chloroform and methanol extract fractions were significantly ($p<0.05$) active against P. aeruginosa, E. coli and S. aureus compared to the aqueous extract that had no activity against any of the test organisms. This implies that alkaloids were directly responsible for the inhibition and growth of micro-organisms and also that the effective phytochemicals were not able to dissolve in water. The antioxidant activity in all the extracts was very high and reduced 2, 2 diphenyl picrylhydrazyl (DPPH) in the first minute by about 84.5%.
Conclusions and application of findings: These results show that there is scientific justification for the use of Ozoroa insignis Del in the preservation of milk by the pastoralists of West Pokot. This herb can therefore be considered as viable substitute for the chemical preservatives in the markets where more consumers show greater preference for products preserved with non-artificial compounds.

Name of Journal/Conference Proceedings/Workshop: J. Appl. Biosci. 26: 1653 – 1658.

Year of Publication: 2010.

Name of Lecturer/Authors: Nyaberi, M. O.; **Onyango, C. A.**; Mathooko, F. M.; Maina, J. M., Makobe M. Mwaura F.

Title of Publication: Evaluation of phytochemical, antioxidant and antibacterial activity of edible fruit extracts of *Ziziphus abyssinica* A. Rich.

Abstract: The conventional chemicals used in preservation of meat are perceived as harmful by health conscious consumers due to their potential toxicity. This has resulted in a general shift of preference to the use of traditional herbal remedies that are proven not to have any known

negative effects. The pastoralists from West Pokot district use the fruit paste of *Ziziphus abyssinica* A. Rich for meat processing and preservation. However, the preservative mechanism of *Z. abyssinica* remains unknown. In the present study the aqueous and methanol extracts of the fruit paste of this herb, that is traditionally used by the Kenyan pastoralists of West Pokot for meat preservation, were subjected to qualitative phytochemical analysis using the Trease and Evans (1989) methods; antibacterial properties using agar-diffusion method with the test microorganisms *Staphylococcus aureus, Pseudomonas aeruginosa, Escherichia coli* and *Candida albicans;* antioxidant activity using stable radical 2, 2 diphenylpicrylhydrazyl (DPPH), and toxicity using brine shrimps lethality test. From each of the extracts, fractions containing 100 and 200mg/ml were used in all tests. Alkaloids, saponins, flavonoids and polyphenolics, condensed tannins, reducing compounds, sterols and steroids were detected. The diameter of bacterial colony growth inhibition at an extract concentration of between 100 and 200mg/ml ranged between 9 to 15mm. The minimum inhibitory concentration (MIC) of the aqueous extract ranged between 3.13 and 50mg/ml, while the LC50 was 270Dg/ml. The reducing activity presented as a percentage ranged between 90 - 96%. The fruit extracts of *Z. abyssinica* were found to have highly potent antioxidant activity compared to the control sodium metabisulphite and the results lend scientific credence to justify the use of this plant in the preservation of meat. Copyright ©

Name of Journal/Conference Proceedings/Workshop: Journal of Animal & Plant Sciences, 2010. Vol. 6, Issue 2: 623- 629.

Year of Publication: 2010.

Name of Lecturer/Authors: Muoki, P. N., Makokha, A. O., **Onyango, C. A.**, Ojijo, N. K. O. and Maziya-Dixon, B.

Title of Publication: Potential contribution of mangoes to reduction of vitamin A deficiency in Kenya.

Abstract: The b-carotene content of fresh and dried mangoes commonly consumed in Kenya was evaluated and converted to retinol equivalent (RE). Mango fruits of varieties Ngowe, Apple, and Tommy Atkins were harvested at mature green, partially ripe, and ripe stages and their b-carotene content analyzed. The stability of β-carotene in sun dried mangoes was also studied over 6 months under usual marketing conditions used in Kenya. The effect of using simple pretreatment methods prior to drying of mango slices on retention of b-carotene was as well evaluated. In amounts acceptable to children and women, fresh and dried mangoes can supply 50% or more of the daily required retinol equivalent for children and women. Stage of ripeness, variety, postharvest holding temperature, method of drying, and storage time of dried mango slices affected β-carotene content and consequently vitamin A value of the fruits. Apple variety grown in Machakos had the highest β-carotene. It exceeded the daily RE requirements by 11.8% and 21.5% for women and children respectively. Fresh or dried mangoes are a significant provitamin A source and should be included in food-based approaches aiming to reduce vitamin A deficiency. Copyright ©

Name of Journal/Conference Proceedings/Workshop: J. Ecol. of Foods and Nutr. 48 (6): 482 – 498.

Year of Publication: 2009.

Name of Lecturer/Authors: Owaga, E.E., **Onyango, C.A.,** and Njoroge, C.K.
Title of Publication: Effect of Selected Washing Treatments and Drying Temperatures on bacterial Quality and Safety of Dagaa (*Rastrineobola argentea*).

Abstract: Microbiological analyses for aerobic bacteria counts and pathogens (coliforms, *E. coli, S. aureus, Salmonella spp* and *V. cholerae*) were carried out on small pelagic fish specie commonly found in Lake Victoria, *Dagaa* (*Rastrineobola argentea*). The samples were obtained from various process steps within the field sun-drying and market conditions in Kisumu, Kenya. *Dagaa* was also oven-dried at 30°C, 40°C and 50°C after washing with selected solutions i.e. salted (3% sodium chloride), chlorinated solutions (100ppm) and potable tap water, which was used as control. Results obtained indicated that total aerobic bacterial counts in the freshly caught *Dagaa* increased significantly ($p<0.05$) from 7.41×10^6 cfu/g to 6.17×10^7 cfu/g by day 1 of sun-drying. The study also observed presence of total coliforms, *E.coli*, *S. aureus, Salmonella spp* and *V. cholera* at levels above recommended safe limits of 102 cfu/g (total coliforms), 10 cfu/g (*E. coli*), 102 cfu/g (*S. aureus*) and zero tolerance (*Salmonella spp* and *V. cholerae*). Oven-drying of *dagaa* at 50°C and 40°C resulted to significantly ($p<0.05$) lower counts of total aerobic bacteria when compared to 30°C. The salted and chlorinated-wash treatments showed significantly ($p<0.05$) lower aerobic bacterial counts when compared to the potable tap water-wash treatments (control) after drying at 30°C, 40°C and 50°C. There was no detection of pathogenic bacteria of public health concerns such as *E. coli, S. aureus, Salmonella spp* and *V. cholerae* in the oven-dried *dagaa*. In conclusion, *Dagaa* dried at 50°C after pre-washing with salt solution was considered the most appropriate with regards to the lowest bacterial counts. Copyright ©

Name of Journal/Conference Proceedings/Workshop: J. Tropic. Microbiol. Biotechnol. 4 (1): 16-23.
Year of Publication: 2009

Name of Lecturer/Authors: Owaga, E.E., **Onyango, C.A.** and Njoroge, C.K.
Title of Publication: Investigation of mycoflora on *dagaa* (*Rastrineobola argentea*) as affected by washing and drying methods

Abstract: *Objective:* To determine the fungal characteristics and asses possible aflatoxin contamination during field sundrying and marketing stages of sun-dried *dagaa* (*Rastrineobola argentea*) (a small pelagic fish found in Lake Victoria) and to investigate the effect of selected pre-washing treatments and drying temperatures on the mycoflora characteristics of *dagaa*.
Methodology and results: Mould, yeast and aflatoxins analyses were carried out on *dagaa* that had been sampled from the sun-drying and market stages. Analyses were also done on *dagaa* that had been oven-dried at 30, 40 and 50°C after pre-washing with salted (3% NaCl), chlorinated (100ppm) solutions and potable tap water (control). The mean mould counts in the sun-dried *dagaa* from market were 3.63 log cfu/g. No aflatoxins were detected. The mould counts were below 1 log cfu/g in all the pre-wash treatments dried at 30, 40 and 50°C. At 40°C, the *dagaa* washed with salted water and chlorinated water had significantly less ($p<0.05$) yeast counts than those washed using potable tap water at 1.35 log cfu/g , 1.38 log cfu/g and 1.48 cfu/g respectively.

Conclusion and application of findings: This study demonstrates the importance of proper processing and handling of fish in order to safeguard public health. The study established that field sun-drying predisposes *dagaa* to contamination by mycotoxic flora. The low counts of mould growth in the oven-dried *dagaa* when compared to the open field sun-dried *dagaa* is attributed to enhanced hygiene due to the incorporated washing steps and during drying and storage. The lowest yeast and mould counts were obtained in the *dagaa* subjected to salted (3% NaCl) pre-wash and subsequently dried at 50°C for 15hrs. This process can be achieved at the local community level through use of solar driers or improved kiln ovens whereas common salt is accessible to the households involved in fish processing. The findings of this study will increase the knowledge base towards adoption of improved handling and drying methods hence minimize mould growth and possible aflatoxins contamination in the dried *dagaa* sub-sector.

Name of Journal/Conference Proceedings/Workshop: Journal of Applied Biosciences 19: 1074 – 1081.
Year of Publication: 2009.

Name of Lecturer/Authors: Owaga, E.E., **Onyango, C.A.** and Njoroge, C.K.
Title of Publication: Effect of selected washing treatments and drying temperatures on biochemical and microbiological quality of *dagaa* (*rastrineobola argentea*).

Abstract: *Dagaa* (*Rastrineobola argentea)* is one of the most important fish foods for the low income households in the Nyanza Province, Kenya. However, the off-flavour and off odour that results from the traditional sun-drying process of sun-dried *dagaa* is a major disincentive to the use of the fish for human consumption, hence leading to utilization in animal feed. Chemical analyses for pH, Thiobarbituric reactive substances (TBARS), Total volatile bases-nitrogen (TVBN) and aerobic bacterial counts were carried out on *dagaa* sampled from various process steps within the open field sun-drying and market conditions. *Dagaa* was also oven-dried at 30°C, 40°C and 50°C after washing with selected solutions namely salted (3% sodium chloride), chlorinated solutions (100ppm) and potable tap water (control). Results indicated that TBARS values increased significantly ($p<0.05$) from 1.39 mgMA/kg in fresh fish to 10.55 mgMA/kg in the market samples. The TVBN values increased significantly ($p<0.05$) from 9.42 mgMA/kg in fresh fish to 29.51 mg/ 100g in the market samples. The pH values declined significantly ($p<0.05$) from pH 6.72 in the fresh fish to pH 5.88 in the market samples. Lipid oxidation (TBARS) was significantly ($p<0.05$) higher in *dagaa* subjected to salted-wash treatments when compared to the chlorinated and control-wash treatments. The rate of lipid oxidation was significantly ($p<0.05$) higher at elevated temperatures of 50°C relative to 30°C and 40°C conditions. The TVBN levels observed in the salted and chlorinated-wash treatments showed significantly ($p<0.05$) lower TVBN values when compared with the control-wash treatments. However, the values of TVBN obtained at 30°C were significantly ($p<0.05$) higher when compared with the 40°C and 50°C drying temperature conditions. The salted-wash treatments resulted in lower pH values relative to the chlorinated and control-wash treatments on drying at 30°C and 40°C. In this study, the most appropriate treatment that showed the least TVBN and moderate TBARS values was drying the *dagaa* at 50°C after washing with chlorinated solution. Copyright ©

Name of Journal/Conference Proceedings/Workshop: African Journal of Food Agriculture, Nutrition and Development.
Year of Publication: 2009.

Name of Lecturer/Authors: Owaga, E.E., **Onyango, C.A.** and Njoroge, C.K.
Title of Publication: Assessment of insect contamination, acid insoluble ash content and colour characteristics of traditionally sun-dried and oven-dried *dagaa (Rastrineobola argentea)*.

Abstract: *Objective:* To determine and investigate the influence of selected pre-washing treatments and drying temperatures on the colour characteristics, insect infestation and insoluble ash content of sun-dried *dagaa* (a small pelagic fish found in Lake Victoria). *Methodology and results*: Insect infestation, colour (lightness L*; redness a*; yellowness b*) and acid insoluble ash contents were analyzed on *dagaa* that were sun-dried or oven-dried at 30, 40 and 50oC after pre-washing with salted water (3% NaCl), chlorinated water (100ppm) solutions and potable tap water (control). Insect fragments including blowfly (Lucilia spp), Beetle (Dermested spp), larvae and mites were present on the sun-dried *dagaa*. The acid insoluble ash in the sun-dried market samples (0.46% dry weight basis, dwb) was significantly higher ($p<0.05$) than in the fresh *dagaa* (0.11% dwb). The L* values of fresh *dagaa* (47.98) were significantly ($p<0.05$) lower than in market samples (67.16). Chlorinated-wash treatments had significantly ($p<0.05$) higher L* values compared to those washed in salted water and tap water (control).
Conclusion and application of findings: The study established that sun-drying *dagaa* in the field predisposes them to contamination by insects and grit. In the oven-dried *dagaa*, the chlorinated-wash treatments exhibited higher L* values and lower a* and b* values than the control-wash treatments. The apparent increase in the L* and b* values and decline in a* values could be attributed to the reactions of lipid oxidation products. This study emphasize the importance of improved handling and drying of *dagaa* in order to prevent occurrence of insects, grit and sand contamination; and colour degradation of *dagaa*. The knowledge will improve the capacity of local fishing communities on appropriate washing and drying methods for fish. Copyright ©

Name of Journal/Conference Proceedings/Workshop: J. Appl. Biosci. 24: 1497 – 1507.
Year of Publication: 2009.

Name of Lecturer/Authors: Muchui M.N., Mathooko, F.M., Njoroge C.K., Kahangi E.M., **Onyango C.A.,** S.B., Van Lauwe B. and Jefwa J.
Title of Publication: Total Soluble Solids. Sugar and Sensory Quality of Tissue culture bananas as influenced by inorganic fertilizers and micronutrients.

Abstract: There is a belief among farmers and traders that tissue culture bananas grown using inorganic fertilizers do not become sweet and soft on ripening rendering them unpalatable. The purpose of this study was to establish whether fertilizer application affects sugar quality and sensory perception of tissue culture bananas. Soil analysis indicated that N and K contents were fairly adequate; Mg content was low while P content was below optimum for banana growing. An experiment was set up in a randomized block design (RCBD) and each treatment replicated four times. Nutrients under investigation were N at 400kg/ha, P at 50kg/ha and K at 600kg/ha. Micronutrients were supplied in combinations as

follows; magnesium at 60ka/ha, zinc at 6kg/ha, molybdenum at 0.5 kg/ha and boron at 1kg/ha. The above nutrients were applied in different combinations and a control where no nutrients were applied. Fruits from mother plants were harvested and ripened. Parameters measured were total soluble solids and individual sugars in banana fruits. Sensory evaluation was carried out using an untrained sensory panel. Total soluble solids were higher in the control and where no micronutrients were applied while they were lowest where phosphorous was absent. Although individual sugars (sucrose, fructose and glucose) were not influenced by the treatments, fruits from the treatments without K had the highest content of total sugars followed by fruits from control while fruits from the treatment without P had the least. Overall, the fruits from the control were rated best in likeness, sweetness and aroma while the texture was also acceptable. Findings from this work indicate that fruits from the control had better overall quality. Copyright ©

Name of Journal/Conference Proceedings/Workshop: E. Afr. Agric. For. J. 74(1): 33 – 37.

Year of Publication: 2009.

Name of Lecturer/Authors: H.N. Wanyika, P.G. Kareru, J.M., Keriko, A.N., Gachanja, **G.M.Kenji** and N.J. Mukiira.

Title of Publication: Contact toxicity of some fixed plant oils and stabilized natural pyrethrums against adult maizeweevils (*Stitophilus zeamais motschulsky).*

Abstract: The contact toxicity of some selected fixed plant oils and stabilized natural pyrethrum (*Chrysanthemum cinerariaefolium*) blends against adult maize weevils (*Sitophilus zeamais*) were investigated. Natural pyrethrum extract was stabilized against ultraviolet (UV) light by blending with fixed oils extracted from *Azadirachta indica* A. Juss (neem tree), *Thevetia peruviana* (yellow oleander) and *Gossypium hirsutum* L. (cotton) seeds. Cottonseed oil had the highest stabilization effect on the pyrethrum blend exposed to UV light of 366 nm. The results indicated that the natural pyrethrum extract blended with cottonseed oil was the most potent against maize weevils and that the potency was concentration-time dependent. Cottonseed and neem seed oils enhanced the stabilization of the natural pyrethrum insecticide

Name of Journal/Conference Proceedings/Workshop: *African journal of Pharmacy and pharmacology* Vol. 3(2) 66-69.

Year of Publication: 2009.

Name of Lecturer/Authors: Kinyuru J. N., **Kenji G.M.,** Njoroge S.M.

Title of Publication: Process development, Nutrition and sensory qualities of wheat baked buns enriched with edible termites (*macrotermes subhylanus*) from Lake Victoria region, Kenya.

Abstract: Edible insects are an important source of nutrients. Edible winged termites *(Macrotermes subhylanus),* locally known as *agoro* in Lake Victoria region of Kenya, is an integral part of the diet in that region depending on seasonal availability and are traditionally consumed as a snack: raw, fried or sun-dried. The nutritional and economic value of the insect is often neglected and this study was geared towards encouraging their collection, utilization and commercialization. The present study was, therefore, undertaken to develop a process of incorporating edible termites into baked food products and evaluate the product's nutritional and sensory qualities. The study involved

substitution of wheat flour with ground termite at proportions of 0%, 5%, 10% and 20% levels based on weight. Sensory attributes were evaluated using a mixed panel where half the panelists had a prior history of insect's consumption. The sensory attributes were evaluated on a 7-point Hedonic scale. The results showed that there was no significant difference ($p>0.05$) in bun thickness (height) between the buns with 0% and 5% termite concentration. The scores for bun texture, aroma, taste and overall consumer preference were not significantly different ($p\leq0.05$) at 0% and 5% substitution. Differences in size, aroma and taste scores for the 5% bun and the 10% substitution were non-significant. Scores obtained at 20% level of substitution depicted lesser acceptability in all the attributes tested except for aroma, which scored above 5.0. In terms of consumer general acceptability, there was no significant difference ($p>0.05$) between the control (0%) and 5% substitution with both scoring above 5.0 (like slightly). The 5% substitution showed a significant increase ($p\leq0.05$) in protein, retinol, riboflavin, iron and zinc contents to the extents of between 16% and 53% increase. The wheat-termite buns at 5% substitution were well accepted by the consumers signifying the great potential for large-scale production and commercialization of the insects in an effort to ensuring food security in Africa.

Name of Journal/Conference Proceedings/Workshop: AJFAND.
Year of Publication: 2009.

Name of Lecturer/Authors: C.W. Kathurima, B.M. Gichimu, **G.M. Kenji**, S.M. Muhoho and R. Boulanger

Title of Publication: Evaluation of beverage quality and green bean physical characteristics of selected Arabica coffee genotypes in Kenya

Abstract: Physical characteristics of green coffee bean have been reported to affect beverage quality to some extent. The objective of this study was to assess the beverage quality and green bean physical characteristics of forty two arabica coffee genotypes and to determine the relationship between the two attributes. Green bean physical characteristics were assessed through actual measurements, grading and weighing while beverage quality was determined by a panel of seven judges using the prescribed sensory evaluation procedures. Sensory data was used to calculate diversity in beverage quality among genotypes and to construct a dendrogram using the unweighted pair-group method with arithmetic average. Data were also subjected to analysis of variance and differences declared significant at 5% level based on Duncan's Multiple Range Test. Linear correlation was done to compare the relationship between variables. Cluster analysis results demonstrated 0 - 47% diversity in beverage quality among genotypes. There was close similarity among coffee tasters in ranking various beverage quality characteristics of the cultivars indicating that the panel was reliable in assessment of beverage quality. All sensory variables evaluated were positively and significantly correlated. However, correlations between the sensory variables and green bean physical characteristics were non-significant.

Name of Journal/Conference Proceedings/Workshop: African Journal of Food Science Vol 3. (11) pp. 365-371.
Year of Publication: 2009.

Name of Lecturer/Authors: John N. Kinyuru, **Glaston M.Kenji**, Simon M. Njoroge and Monicah Ayieko.

Title of Publication: Effect of Processing Methods on the In Vitro Protein digestibility and Vitamin content of Edible Winged Termite (*Macrotermes subhylanus*) and Grasshopper (R*uspolia deferens*).

Abstract: The effect of processing on the in-vitro protein digestibility and vitamins content of edible winged termites, green grasshoppers, and brown grasshoppers consumed in Siaya, district of Kenya, was determined using standard methods. Analysis was done on fresh, toasted, toasted dried and fresh dried insect samples. There was no significant change (p›).05) in protein digestibility with processing. There was a significant decrease in riboflavin, niacin and retinol content withy processing.

Name of Journal/Conference Proceedings/Workshop: Food Bioprocess Technology.

Year of Publication: 2009.

Name of Lecturer/Authors: P. G. Kareru, J. M. Keriko, **G. M. Kenji** and A. N. Gachanja.

Title of Publication: Anti-termite and antimicrobial properties of paint made from *Thevetia peruviana* (Pers.) Schum. oil extract.

Abstract: *Thevetia peruviana* (Pers) K. Schum. seed oil was used to make a surface coating with antifungal,antibacterial and anti-termite properties. The paint exhibited inhibitory activity against *Escherichia coli, Staphylococcus aureus, Bacillus subtilis* and *Candida albicans* in a concentration dependent manner. The antibacterial activities were statistically significant (p = 0.05). The repellent action of paint against subterranean termites (*Microtermes* spp.) was significant (p = 0.03). From these results, it was concluded that the *Thevetia peruviana*-based oil paint was self-preserving.

Name of Journal/Conference Proceedings/Workshop: African Journal of Pharmacy and Pharmacology Vol. 4(2). pp. 087-089.

Year of Publication: 2010.

Name of Lecturer/Authors: Kareru P. G., Gachanja A. N., Keriko J M., **Kenji G. M.**

Title of Publication: Antimicrobial activity of some medicinal plants used by herbalists in eastern province, Kenya.

Abstract: The aqueous extracts from medicinal plants commonly used by herbalists in Mbeere, and Embu districts of Eastern province, Kenya, were tested for their inhibitory activity against three selected strains of bacteria. All the selected plant extracts (infusions: 1.0g sample in 100 ml water) investigated showed activity against *Escherichia coli* with inhibition zone diameters ranging from 5.8 – 18.0 mm. *Terminalia brownii* gave the largest inhibition zones against *E. coli* and *Staphylococcus aureus*. *Vernonia lasiopus* and *Tithonia diversifolia* were inactive to *S. aureus* and *Bacillus subtilis*, respectively. Eighteen and sixteen plants showed sensitivity of greater than 10 mm against *S. aureus* and *B. subtilis*, respectively. All control discs gave zones of inhibition of 12 - 24 mm, which were larger than those of the extracts. The present study validated the use of the selected medicinal plants by the herbalists in the treatment of bacterial ailments caused by the strains of bacteria investigated. Medicinal plants used for non-bacterial diseases also exhibited sensitivity towards bacterial strains tested. This implied they could be used as multi-purpose medicinal plants.

Name of Journal/Conference Proceedings/Workshop: African Journal, Complementary and Alternative Medicines.
Year of Publication: 2008.

Name of Lecturer/Authors: Kareru, P. G., Keriko, J. M., Gachanja, A., **Kenji, G. M.**
Title of Publication: Direct Detection of Triterpenoid Saponins in Medicinal Plants.
Abstract:

Direct detection of saponins in medicinal plants using Fourier Transform Infrared (FTIR) spectroscopy is reported in this paper. Crude dry plant powders were mixed with potassium bromide (KBr) powder and compressed to a thin pellet for infrared examination. FTIR spectra of the test samples showed –OH, -C=O, C-H, and C=C absorptions characteristic of oleanane triterpenoid saponins. The C-O-C absorptions indicated glycoside linkages to the sapogenins. Phytochemical analysis confirmed the presence of saponins in the tested specimens. *Entada leptostachya* was used as a reference sample. Dry plant powder was extracted sequentially with hexane, dichloromethane, ethyl acetate and methanol. FTIR spectra of the reference sample powder and its organic solvent extracts showed characteristicsaponin absorption peaks. These results indicated that direct detection of saponins in medicinal plants was possible by infrared analysis. Lengthy exhaustive chemical analyses necessary for detection of saponins could be avoided.

Name of Journal/Conference Proceedings/Workshop: African Journal, Complementary and Alternative Medicines.
Year of Publication: 2008.

Name of Lecturer/Authors: **Julius Maina Mathara**, ;Ulrich Schillinger, Claudia Guigas, Charles Franz, Phillip Museve Kutima, Samuel K Mbugua, Heuyn K Shin, Wilhelm H Holzapfel
Title of Publication: Functional characteristics of *Lactobacillus* spp. from traditional Maasai fermented milk products in Kenya.
Abstract:

In this study functional characteristics of 23 representative *Lactobacillus* strains isolated from the Maasai traditional fermented milk 'Kule naoto' were determined. The *Lb. acidophilus* group strains showed resistance to gastric juice and bile. In addition, some Lb. acidophilus strains expressed bile salt hydrolase activity, and had ability to assimilate cholesterol in vitro. In-vitro adhesion to HT29 MTX cells of up to 70% was recorded. *Lb. fermentum* strains showed almost 100% survival under simulated stomach acidic conditions and physiological salt concentrations of bile salts, hydrophobicity values were over 80%. Most strains of the *Lb. casei* and *Lb. acidophilus* groups showed aggregation abilities of above 50%. Many strains expressed a protective effect against N-methyl-N′-nitro—N-nitrosoguanidine induced DNA damage according to the 'comet assay' and none was virulent. The antibiotic minimum inhibitory concentration of selected strains was established. According to these results, the Lactobacillus spp associated with 'Kule naoto', contain potentially probiotic (functional) strains.

Name of Journal/Conference Proceedings/Workshop: International Journal of Food Microbiology 126: 57 – 64.
Year of Publication: 2008.

Name of Lecturer/Authors: **Julius Maina Mathara**, Ulrich Schillinger, Phillip Museve Kutima , Samuel Kuria Mbugua , Claudia Guigas, Charles Franz, Wilhelm Heinrich Holzapfel.

Title of Publication: Functional properties of *Lactobacillus plantarum* strains isolated from Maasai traditional fermented milk products in Kenya.

Abstract: *Lactobacillus plantarum* was the major species among the lactic acid bacterial strains isolated from traditional fermented milk of the Maasai in Kenya. Selected strains were characterized for their functional properties using in vitro standard procedures. All strains expressed acid tolerance at pH 2.0 after 2-h exposure of values that ranged from 1% to 100%, while bile tolerance of acid stressed cells at 0.3% oxgal varied from 30% to 80%. In vitro adhesion to the mucus-secreting cell line HT 29 MTX and binding capacity to extracellular protein matrices was demonstrated for several strains. The four strains tested in a simulated stomach duodenum passage survived with recovery rates ranging from 17% to 100%. Strains were intrinsically resistant to several antibiotics tested. From these in vitro studies, a number of Lb. plantarum strains isolated from the Maasai traditional fermented milk showed probiotic potential. The strains are good candidates for multifunctional starter culture development

Name of Journal/Conference Proceedings/Workshop: Current Microbiology 56: 315-321.

Year of Publication: 2008.

Name of Lecturer/Authors: Patrignani, F,. Iucci, I. Lanciotti, R, Vallicelli, M, **Maina Mathara J**, Holzapfel, W. H. and Guerzoni, M. E.

Title of Publication: Effect of High-Pressure Homogenization, Nonfat Milk Solids, and Milkfat on the Technological Performance of a Functional Strain for the Production of Probiotic Fermented Milks.

Abstract: The aim of this research was the evaluation of the effects of milkfat content, nonfat milk solids content, and high-pressure homogenization on 1) fermentation rates of the probiotic strain *Lactobacillus paracasei* BFE 5264 inoculated in milk; 2) viability loss of this strain during refrigerated storage; and 3) texture parameters, volatile compounds, and sensorial properties of the coagula obtained. The data achieved suggested a very strong effect of the independent variables on the measured attributes of fermented milks. In fact, the coagulation times were significantly affected by pressure and added milkfat, and the rheological parameters of the fermented milk increased with the pressure applied to the milk for added nonfat milk solids concentrations lower than 3%. Moreover, the polynomial models and the relative response surfaces obtained permitted us to identify the levels of the 3 independent variables that minimized the viability loss of the probiotic strain used during refrigerated storage.

Name of Journal/Conference Proceedings/Workshop: Journal of Dairy Science. 90 (10): 4513–4523.

Year of Publication: 2008.

Name of Lecturer/Authors: De Roeck A., Mols J., **Sila D.N.**, Duvetter T., Van Loey A., Hendrickx Marc.

Title of Publication: Improving the hardness of thermally processed carrots by selective pretreatments.

Abstract: The aim of this study was to improve the texture of thermally processed carrots by selective pretreatments modifying plant –intrinsic properties. Pretreatments were a combination of thermal or high-pressure (HP) treatments followed by a one hour soak in a specific solution. After a subsequent thermal process, the residual texture

(hardness) of the carrots was determined using a texture analyzer. Lowering the degree of methyl-esterification (DM) of the carrot pectins was confirmed to be one strategy to reduce texture degradation. The thermal or HP pretreatments stimulated pectinmethylesterase (PME), activity, resulting to pectin with lower DM which is less susceptible to β–eliminative depolymerisation. At the same time, the plant tissue was permeabilized, facilitating uptake of Ca^{2+} ions during subsequent calcium soak, resulting in an even better texture by enhancing the amount of Ca^{2+} cross links within the cell wall. Lowering the pH of the carrots was proven to be another strategy. A pretreatment followed by soaking the carrots in a solution of low pH proved to be effective in lowering the internal carrots pH, hereby retarding β–elimination and subsequently texture degradation. The composition of the low pH solution was shown to be important; soak solutions containing cations and/or Ca^{2+} complexing agents should be avoided. Since there is a move from food additives, use of natural occurring ferulic acid proved to be a good acidifying candidate, due to its natural presence in fruits and vegetables. In conclusion, for texture improvement of thermally processed carrots, lowering the susceptibility to β–elimination and enhancing cell wall cross linking are the two main ways used for manipulating the plant intrinsic properties.

Name of Journal/Conference Proceedings/Workshop: J. Agric Food Chem.
Year of Publication: 2010.

Name of Lecturer/Authors: **Sila D.N.,** Van Loey A. Hendrickx M.
Title of Publication: Pectin structural manipulations during processing: towards a better understanding of carrot texture.

Abstract: Pectin, a heterogeneous and abundant matrix omponent in plant cell walls, functions as an intercellular adhesive. During processing and/or storage, pectin can be demethoxylated and/or depolymerized enzymatically and/or non-enzymatically. Transformations in pectin structural features can yield profound alterations in its functional properties. In view of texture engineering in solid plant foods, insight on directed pectin structural modifications, the extent of modification and the influence of the change on functionality is important. Herein, pretreatment conditions (blanching; high pressure pretreatment; calcium soaking (0.5% $CaCl_2$) ferulic acid soaking (0.1% diferulic acid)) were used for *in situ* modification of carrot pectin structural properties prior to thermal processing. Pectin isolates were fractionated: water soluble (WSP), chelator soluble (CSP) and sodium carbonate soluble pectin (NSP). Changes in pectin solubility, degree of methoxylation (DM), degree and pattern of depolymerization of the isolates were fingerprinted and related to thermal texture degradation (90-110°C). Pretreatment conditions resulting in pronounced DM reduction in 'mother' pectin showed reduced β-elimination and better texture. Decreasing *in situ* DM by pretreatment resulted in decreasing WSP solubility at the expense of increasing NSP, a condition which was reversed by subsequent thermal processing. Thermal digestion of the WSP revealed a random depolymerization pattern marked by a non-homogeneous molecular weight distribution contrary to the homogeneous fragments observed for CSP and NSP. At constant temperature, the concentration of unsaturated galacturonides increased with increasing process time in the WSP (pH=6.5). β-elimination kinetics (k-value) of the WSP followed zero-order model, the Q_{10} factor

being 2-3.5. Pretreatment conditions didn't affect the temperature dependence of the k-values. Texture changes in thermally processed carrots are partly explained by the structural transformations and depolymerisation kinetics of the WSP. Enzyme aided pectin-structure-engineering is the key to understanding and optimization of plant foods texture. Keywords: pectin, degree of methoxylation, depolymerization

Name of Journal/Conference Proceedings/Workshop: IUFOST, 15th World Congress of Food Science and Technology.
Year of Publication: 2010.

2.1 DEPARTMENT OF HORTICULTURE

Name of Lecturer/Authors: Peter W. Masinde, **John M. Wesonga**, Christopher O. Ojiewo, Stephen G. Agong, Masaharu Masuda

Title of Publication: Plant Growth and Leaf N Content of Solanum Villosum Genotypes in Response to Nitrogen Supply

Abstract: *Solanumu villosum* is an important leafy vegetable in Kenya whose production faces low yields. Two potentially high leaf-yielding genotypes of *S. villosum*, T-5 and an octoploid have been developed. Field experiments were conducted at Jomo Kenyatta University of Agriculture and Technology to evaluate the vegetative and reproductive growth characteristics and leaf nitrogen of the genotypes under varying N levels. The experiments were carried out as split plots in a randomized complete block design with three replications. Nitrogen supply levels of 0, 2.7 and 5.4 g N/plant formed the main plots while the T-5, octoploid and the wild-type genotypes were allocated to the sub-plots. Periodic harvests were done at 5-10 days interval to quantify growth and leaf N. The octoploid plants had up to 30-50% more leaf area and up to 35-50% more leaf dry weight compared to wild-type plants. However, all the genotypes had similar shoot dry weight. The wild-type genotype had about 2-4 times higher flower/fruit dry weight as compared to the octoploid and T-5 genotypes. All the genotypes responded to N supply similarly by increasing leaf area and shoot dry weight 1.7-2.5 times. Leaf N on a dry weight basis was significantly higher in plants supplied with N, but these differences were not observed when the leaf N was expressed on leaf area basis. In conclusion, the *S. villosum* genotypes responded similarly to N limitation by drastic reduction in leaf area and dry matter production and maintaining the leaf N content on leaf area basis. The octoploid is a suitable candidate for increasing leaf yield of *S. villosum*.

Name of Journal/Conference Proceedings/Workshop: Dynamic Soil, Dynamic Plant.
Year of Publication: 2009

Name of Lecturer/Authors: Lucy Kananu Murungi, Aggrey Nyende, **John Wesonga,** Peter Masinde, Markus Knapp.

Title of Publication: Effect of African nightshade species (Solanaceae) on developmental time and life table parameters of *Tetranychus evansi* (Acari: Tetranychidae)

Abstract: The effect of five African nightshade (*Solanum sp*.) species on the biological and demographic parameters of the tomato spider mite, *Tetranychus evansi* Baker and Pritchard, was examined in the laboratory at 25 ± 1_C, 70–80% RH and 12L:12D photoperiod. Duration of each development stage, reproduction rate, longevity, intrinsic rate of natural increase (rm), and doubling time (DT) of the tomato spider mite on the five nightshade species were calculated. The results indicated that *S. villosum*, *S. scabrum*, *S. tarderemotum* and *S. americanum* are more suitable for T. evansi due to a shorter developmental period, longer adult longevity, higher reproduction and intrinsic rate of natural increase ranging between 0.180 and 0.196 females/female/day compared with *S. sarrachoides* which cannot support *T. evansi* populations as the rm (-0.063 females/female/day) and DT were negative on this host. Differences in developmental time and life table parameters among the other host plants were not significant.

Name of Journal/Conference Proceedings/Workshop: Experimental and Applied Acarology Journal.
Year of Publication: 2010.

Name of Lecturer/Authors: **A. O. Watako** and P. O. Odhiambo.
Title of Publication: Farmer production practices among small-scale flower enterprises in Kenya.

Abstract: Small-scale farmers in high potential areas of Kenya are shifting to high-value crops as an alternative to subsistence farming. Farmiing practices are varied among these enterprises under small-scale operators; and most comprises of annual and perennial crops, occasionally involving dairy.or poultry keeping. A survey was conducted on why growers were opting to high- value crops, and especially flower farming in central Kenya. The survey also examined farming practices and constraints to production, with reference to flowers. The study showed that small growers were shifting to flowers due to better product price and because it povides them with a regular monthly income. There were several different management practices including rotation and closed season among others. Sustainable production practices such as crop residue management, cattle / goat or poultry manure use and pest control using herbal mixtures were also identified in the survey. To mitigate challenges to safe production these beneficial practices could be incorporated in mordernization of flower production chain. Constraints to flower growing were cited as lack of access to production technology, high costs of inputs, scarcity of clean planting materials and plant protection problems. The survey also showed that most growers undertake group farming, outgrowing or contract farming for larger operations. The product price received by the contract growers was determined by the marketing agent or Export Company. These results suggest that smallholder floriculture is an important source for food security and farmers' welfare because of the income it genrates and could be a good vehicle to rural development. The results could also form a primary tool for evolving management options by enabling identification of point of intervention in value chain for flowers so as to provide a sustainable poduction strategy for smallholders.

Name of Journal/Conference Proceedings/Workshop: All Africa Horticulture Congress, Nairobi.
Year of Publication: 2009.

Name of Lecturer/Authors: **Arnold O. Watako.**
Title of Publication: Small-scale growers' access to technological inputs in mobydick (*Gymphocarpus physocarpus*) production

Abstract: A survey was conducted on small – scale mobydick cut flower growers in Kenya to assess technological capacity in production. The aim of the survey was to examine access to technological inputs as a component of value chain operation. A sample of sixty four growers across the larger Thika district, Central Province was interviewed using a structured questionnaire. Against each of the inputs, a scale of three – point likely – type response; sufficiently accessible (SA: 2.50 – 3.49), rarely accessible (RA: 1.50 – 2.49), and not accessible (NA: ≤ 1.49) was indicated. The study showed that mean accessibility rating (MAR) for fertilizer use, irrigation facilities, and agro – chemicals was 2.08, 2.22 and 1.93 respectively. The accessibility to fertilizer use ranged from 0.07 (NA) to 3.23 (SA), irrigation application from 0.02 (NA) to 3.46 (SA) and agro –chemical usage from 0.06 (NA) to 2.22 (RA), respectively. The study also showed that mechanized farming was only practiced by 8% by small growers compared to 92% no mechanization. Due to resource constraints, production practices such as crop residues (14%) and animal manure (86%) use were also identified in the survey. These results showed that accessibility to technological inputs such as fertilizers, agro – chemicals, irrigation water and mechanized farming were not adequate in the small scale operations.

Name of Journal/Conference Proceedings/Workshop: Sustainable Horticultural Production in the Tropics, Arusha, Tanzania.
Year of Publication: 2009.

Name of Lecturer/Authors: **John Bosco Njoroge** and Moses Kasini Kivungi.
Title of Publication: Development and Usage of Sportsturf: A Survey of Major Utility Areas within Nairobi, Kenya.

Abstract: Several major sports fields within Nairobi city offering playing grounds for soccer, golf, cricket, rugby and hockey were surveyed through direct interviews and questionnaires. The aim was to assess the status of sportsturf usage and point out the important challenges that need attention by researchers and other stakeholders in turfgrass industry. Information sought included, the types of turfgrass species used, soil profile construction method, cultural practices observed, level of technical expertise, source of information for management and problems encountered. It was noted from literature and personal discussion with several turfgrass managers, that, documented information on turfgrass use in Kenya is largely lacking. The survey showed that only golf courses had a strict quality maintenance programme of fields as compared to other sports fields. This was largely attributed to the nature of the game that demands certain minimum standards and the more informed and serious clientele. There is a general lack of schedule of maintenance activities to match demand of expected sports events. Mere working experience and peer advice served as the main source of knowledge for maintenance of fields and not factual scientific evidence. Most managers observed that the population and variety of users of sports fields are gradually increasing which will demand more playing fields that guarantee quality sportsturf for intense usage. It was further shown that the range of turfgrass species used was very limited thus raising concern for need to identify new local species.

Name of Journal/Conference Proceedings/Workshop: Journal of Agricultural Science and Technology, (2009) 9(1): 15-27.
Year of Publication: 2009.

Name of Lecturer/Authors: **John Bosco Mukundi** and Wariara Kariuki.
Title of Publication: The Role and Challenges of Informal Plant Nurseries in Urban Centre of a Developing Country.

Abstract:
Recently there has been a proliferation of private plant nurseries within most urban centers in Kenya. Despite this trend, their operations and contribution to the well being of people is not well understood. This study sought to establish characteristics of private plant nurseries, economic benefits, identify challenges faced by operators and evaluate the role of existing regulations in plant nursery business. A research survey was conducted through interviews and administering of semi-structured questionnaires to operators. Information obtained was analyzed and interpreted from descriptive statistics and ANOVA results. Spatially, concentration of nurseries was higher in northern than southern side of the city, particularly along main arterial roads. Over 60% of the nurseries were located within 10 km radius of the city centre. Space occupancy for over 96% of the plant nurseries was larger than required by city council regulations and only 40% had or have applied for license. Plant types were very similar across nurseries ranging from woody outdoor and indoor foliage plants to groundcovers and bedding plants, both exotic and indigenous. About 45% of nursery owners relied on wastewater sources for irrigation. Difficult-to-propagate plants included Olea capensis (Elgon teak), Araucaria heterophylla, Cycad and the Palms. Aspects that scored low mean scores included lack of skilled training, quality soil, water, propagation success and low incomes. Significant differences existed between the five locations of the city with the northern side and CBD having preferable responses as compared to the southern side. Despite the challenges, 96% of respondents relied on the business entirely for their economic needs. In order to manage and guarantee increased benefit from private plant nurseries, operators technical capacity should be enhanced, operational rules and regulations as set by the city council must be enforced and adapted to realities of this expanding peri-urban horticultural business.

Name of Journal/Conference Proceedings/Workshop: Acta Horticulturae 762, ISHS (2007): 357 – 364.
Year of Publication: 2009.

Name of Lecturer/Authors: **John Bosco Njoroge**, Joseph K. Maithya, Rachel M. Mwangi and Mathew C. Omina.
Title of Publication: Plan for sustainable landscape rehabilitation of quarried site.

Abstract:
In Kenya, quarrying activities have recently accelerated in tandem with the rise in demand of stones to supply the construction industry. Despite the enormous contribution to the economy, little effort has been done to rehabilitate the quarry sites leaving behind a scared landscape that is aesthetically unattractive, functionally distracted and a dangerous site for people. This research aimed at developing a sustainable rehabilitation plan for a quarry site in Ndarugu, Thika district, Kenya. Data on flora occurrence, soil characteristics and weather records was collected for the site. A questionnaire was administered to various stakeholders to identify the benefits and limitations wrought about by

quarrying and the preferred use of the quarried sites. The soil chemical properties of pH, EC, %C, % N, and %P, were found to be far below recommended levels for supporting healthy plant growth. About 20 different plant species were recorded. Woody plants of Acacia spp were the most widespread and invasive plant species such Lantana camara were dominant in most locations. Employment creation and supply of building materials were cited as the main benefits of the quarry. Pollution by noise and of air, insecurity and land destruction were noted by respondents as the most negative effects of the quarries. Over 60% of respondents proposed the site for natural planting or development for recreation as opposed to agriculture. Using the above information a rehabilitation plan was developed for the site. The procedure adopted in this study can be a good guiding tool for landscape rehabilitation of abandoned quarry sites in line with objectives of Environmental Management and Co-ordination Act (EMCA) of 1999, Kenyan laws, to restore environmental quality.

Name of Journal/Conference Proceedings/Workshop: Proceedings of the 7th Workshop on Sustainable Horticultural Production in the Tropics, College of Agriculture and Veterinary Services, Kabete Campus, University of Nairobi, Kenya.

Year of Publication: 2009.

Name of Lecturer/Authors: Name of Lecturer/Authors: **Kihurani, A.W.,** Narla, R.D., Shibairo, S., Imungi, J. and Carey, E.

Title of Publication: Effect of Storage Temperature on Postharvest Pathological Deterioration of Sweet Potato Storage Roots.

Abstract: Sweet potato (*Ipomoea batatas* (L.) Lam.) is the world's seventh most important food crop but its potential to contribute to food security and income generation is limited in tropical developing countries by its short shelf-life. Environmental and cultural stresses during growth and storage are known to directly or indirectly predispose sweet potato storage roots to postharvest microbial infection. Research was conducted to determine the effect of storage temperature on postharvest deterioration of sweet potato roots using root slices of sweet potato cultivar Yanshu 1 (CIP 440024) and seven temperature levels, 12°C, 16°C, 20°C, 24°C, 28°C, 32°C and 36°C. The experiment was arranged in completely randomized design with seven replications. Nine-mm circular agar plugs, removed from the edge of actively growing two-day old culture of three postharvest pathogens of sweet potato, *Rhizopus oryzae*, *R. stolonifer* and *Botryodiplodia theobromae*, were used to inoculate the root slices. Pathological deterioration (PD) was estimated by measuring the developing lesion along two diameters across the centre of the root slice. The mean of the two measurements were used to calculate mean lesion diameter (infection) on the root slice 24 hours after inoculation at each of the seven temperature levels. Results showed that storage temperature significantly (P>0.05) influenced infection of sweetpotato roots by all the three postharvest pathogens. Fresh sweet potato roots should be held under low temperature conditions at 12 – 16 °C, whenever possible, in order to prolong the shelf life and reduce post harvest losses.

Name of Journal/Conference Proceedings/Workshop: Horticultural Association of Kenya, 2nd-6th Dec, 2009.

Year of Publication: 2009.

Name of Lecturer/Authors: Mathew M. Abang, **Agnes W. Kihurani** and R. Srinivasan.
Title of Publication: Management of Diseases and Pests of Underutilized Vegetables for GAP-Compliance in Sub-Saharan Africa

Abstract: Underutilized vegetables play a key role in human nutrition, food security and poverty reduction for the growing populations of rural and urban poor in Sub-Saharan Africa. Increasing demand for vegetables such as amaranth, African nightshade and Ethiopian mustard coupled with finite agricultural resources are threatening the sustainability and profitability of production. Within this framework, pests and diseases reduce yields, and harmful pesticide regimes pose major risks to human and environmental health. In spite of their importance, little is known about the diagnosis, epidemiology, and sustainable management of major pests of underutilized vegetables due to research neglect. Nevertheless, progress has been made recently in germplasm enhancement, improved soil health and water quality, reduced microbial contamination of vegetables and integrated pest management. AVRDC-The World Vegetable Center, in collaboration with private and public sector partners, is leading efforts to reduce malnutrition and poverty in the region through the development of good agricultural practice (GAP)-compliant technologies that contribute to the production of safe and nutritious vegetables. Strategies for addressing this problem include improved knowledge of the diseases and insect pests affecting underutilized vegetables, the utilization of varieties resistant to major pests and diseases, and their cultivation using practicing that reduce indiscriminate and excessive use of fertilizers and pesticides. This paper reviews our current understanding of the nature and management of diseases and pests of underutilized vegetables and highlights opportunities with biological alternatives that reduce harmful pesticide regimes, protect the production environment and the produce, remove barriers to trade, and improve human health in Sub-Saharan Africa.

Name of Journal/Conference Proceedings/Workshop: Good Agricultural Practices for Production of Underutilized Vegetables in Sub-Saharan Africa.

Year of Publication: 2009.

Name of Lecturer/Authors: Quirien Elfrida Antoinette van Oirschot, Deborah Rees, Julia Aked, **Agnes Kihurani**.

Title of Publication: Sweetpotato cultivars differ in efficiency of wound healing.

Abstract: This paper presents a study on the wound healing processes in sweetpotatoes (*Ipomoea batatas* Lam.) when exposed to tropical conditions typical for marketing (RH 50–73%, *T* 25–30 ◦C). The physiological processes during healing were revisited. At low humidities (65%±10) the depth of the lignified layer i.e. the thickness of the desiccated cell layers was affected by both cultivar and humidity. Some cultivars consistently failed to produce a lignified layer and for others the layer was often not continuous. The continuity of the lignified layer was more important for effectiveness of wound healing than the actual thickness. A method for assessing efficiency of wound healing based on assessing the continuity of lignified layers was developed, and called the lignification score. Wound healing efficiency as measured by the lignification score was found to be a major factor for the shelf-life of sweetpotato cultivars. Lignification of wounds correlated with reduced rate of weight loss and reduced susceptibility to microbial infection. A

high dry matter content in cultivars correlated with a low lignification score. This relationship was consistent for five trials, including 34 cultivars.

Name of Journal/Conference Proceedings/Workshop: Postharvest Biology and Technology.
Year of Publication: 2009.

Name of Lecturer/Authors: Kimani J. W., D. W. Kariuki, G. M. Kenji and **A. W. Kihurani**
Title of Publication: Characterization of Seed Oil and Preliminary Evaluation of Resistance to *Sclerotinia Sclerotiorum* among Kenyan Sunflower Varieties.

Abstract: The study endeavored to identify sunflower varieties that are relatively resistant to *Sclerotinia sclerotiorum* and have superior oil yield. Oxalate oxidase has been reported to confer some resistance to *S. sclerotiorum*. This study investigated the presence of oxalate oxidase in six sunflower varieties available in Kenya, namely: Kenya Fedha, Rekord, Issanka, H8998, H4038 and H4088. A calorimetric enzyme assay was used to screen for the enzyme activity in sunflower leaf tissue. A detached leaflet assay was conducted and lesion size measured following degradation by exogenously applied oxalic acid on leaf tissue. Sunflower oil was characterized from the six varieties. The relationship between the oil quality/quantity and level of oxalate oxidase activity was also investigated. Results showed that the test sunflower varieties had oil content ranging from 40.92% w/w to 50.55% w/w. H8998 and H4088 had 50.55% w/w and 49.41% w/w oil content, respectively. The two varieties may thus be recommended for commercial oil extraction. All the varieties responded differently to oxalic acid degradation as characterized by differences in lesion areas per variety ($p<0.05$) at different acid concentrations. H4088 showed higher oxalate oxidase activity and hence higher resistance to degradation by oxalic acid compared to other varieties and was second highest in oil content (49.40% w/w). This study, therefore, recommends that H4088 be promoted to be grown by farmers. H8998, which had relatively less oxalate oxidase activity but highest oil content (50.55% w/w), is also be recommended for transformation with the resistance gene to enhance its oxalate oxidase activity. This study formed a basis for further investigation on resistance of Kenyan sunflower to *S. sclerotiorum* infection and recommends field studies to confirm these results and molecular studies to determine the genetic potential for resistance in the six varieties.

Name of Journal/Conference Proceedings/Workshop: Jomo Kenyatta University of Agriculture and Technology, Faculty of Science Scientific Conference, 5-6 May 2009.
Year of Publication: 2009.

Name of Lecturer/Authors: Paul K. Ng`ang`a and H. Stützel

Title of Publication: Influence of Different Peat Substrates on Physical and Chemical Substrate Properties and on Growth and Susceptibility to Water Stress of Vegetable Seedlings: Lettuce (*Lactuca sativa* L.) and Kohlrabi (*Brassica oleracea* var. gongylodes)

Abstract: Production of high quality plants involves several cultural inputs. The type of substrate used to grow plants perhaps stand out as the most important aspect determining plant quality. A common way to compare substrates is to describe them on the basis of their chemical and physical properties. Within the physical properties the air - water

ratio is the most important. Peat has been in use for a long time as substrate for raising vegetable seedlings for later field transplanting due to its good quality properties. Properties of peat differ from one peat type to another depending on the origin, conditions under which it is formed, species composition, harvesting procedures and processing. Therefore, plant growth responds differently under different peat types. Our study involved the determination of the effects of two peat substrates; Potgrond P and Container substrate 2 coarse on seedling emergence, growth and susceptibility to water stress using Lettuce (*Lactuca sativa* L.) and Kohlrabi (*Brassica oleracea* var. gongylodes) as test crops, the aim of the experiment was to determine if substrate used in tree nursery container plants production can be equally used to raise vegetable seedlings. The experiment was conducted in the greenhouse in the Institute of Biological Production Systems, Leibniz Universität Hannover, from early April to the end of May 2009. Complete Randomized Design involving factorial combination of two substrate types and two plant species was used. Data on substrate physical properties and nutrient contents were provided by substrate provider (Klasmann-Deilmann GmbH, Germany). Other chemical substrate analyses as well as plant analysis were carried out in the department of Tree Nursery Sciences and in the Institute of Biological Production Systems. Seeds were sown in standard plug trays which were filled with equal amount of substrate with each plug tray having 96 pots. Parameters measured include; leaf number, fresh weight, leaf area, dry weight and plant tissue analyses. 35 days after seed sowing, six seedlings and their substrates per treatment were selected for the determination of the seedlings response to water stress. The results of the experiment showed that seedlings raised in Container substrate 2 coarse both in non water stress and water stress conditions were better compared to those in Potgrond P. Better seedlings growth in this substrate could be attributed to better nutrient acquisition due to adequate availability of air at maximum water holding capacity and reduced resistance to root growth.

Name of Journal/Conference Proceedings/Workshop: Sustainable Horticultural Production in the Tropics, Arusha, Tanzania. Year: December 2 – 5th 2009.

Year of Publication: 2009.

3. FACULTY OF ENGINEERING

3.0 DEPARTMENT OF BIOMECHANICAL AND ENVIRONMENTAL ENGINEERING

A biodegradable black shoe polish invented by JKUAT researchers.

Name of Lecturer/Authors: Muthike G.M., **Shitanda D.,** Kanali C.L. and Muisu F.N.
Title of Publication: The potential of Chainsaw Frame Mills in On-farm Timber Processing in Kenya

Abstract: Chain saws have been used to convert on-farm trees into timber over a long time in Kenya. Large saw path, especially due to the back and forth mode of operation remains a major contributor to low timber recovery and surface quality associated with this sawing method. A new method of sawing using chain saws with attachments has been introduced. The attachments fix the chain bar on a straight line, enabling the operator to saw a log to uniform pre-set timber sizes with precision, higher recovery and smoother surface than free hand sawing method. A study was conducted to determine the difference in timber recovery and other sawing parameters between free hand and chain saw with attachments. Results showed that chain sawing with frames gave mean timber recovery of about 56% against 41% with free hand. Its fuel consumption was slightly higher than for free hand method but the difference was not significant. Chain sawing with attachment produced significantly less volume of sawn timber per unit time than free hand. However, the size uniformity, surface quality and high recovery of the resultant timber would pay back more than free hand method. It was concluded that Chain sawing with attachments is more efficient and higher in timber recovery than free hand. Although an operator may saw less timber in a day, all the timber is more likely to find ready market than timber processed using free hand due to uniformity of size along the piece and inferior surface quality. It was recommended that, chain sawing with frames be adopted, modified and promoted to replace the free hand method to minimise wastes, improve timber

surface quality, thus conserving the environment in the short term as development of more cost effective sawing technologies continue.

Name of Journal/Conference Proceedings/Workshop: Recent Advances in Forestry Research for Environmental Conservation, Improved Livelihood and Economic Development. *Proceedings of the 4th KEFRI Scientific Conference, 6th -9th October 2008.*

Year of Publication: 2008.

Name of Lecturer/Authors: Muthike G.M., **Shitanda D.,** Kanali C.L. and Muisu F.N.

Title of Publication: The Status of Chain Saw Usage in Kenya.

Abstract: The paper looks at the evolution of chain saw timber processing in Kenya. It explores the forest resources in the country, its management, utilization and rate of depletion over the years since independence and some of the major causes. The History of sawmilling in the country, its development in terms of technology and sawing skills are also discussed mentioning the factors in place at the time. The emergence of the ban on logging from Government plantations and its effects on timber processing especially the introduction of small-scale processing methods are mentioned. Further still the paper mentions the available technological options to improve timber processing especially on the farms.

Name of Journal/Conference Proceedings/Workshop: Developing alternatives for illegal chainsaw lumbering through multi-stakeholder dialogue in Ghana and Guyana. *West Africa Regional Workshop on Chainsaw Lumbering in Africa, the Guiana Shield and the Caribbean*. Tropenbos International. Held on 25 – 26 May 2009 in Accra, Ghana

Year of Publication: 2009.

Name of Lecturer/Authors: Mr. G.M. Kituu, **Prof. D. Shitanda**, Dr. C.L. Kanali, Dr. J.T. Mailutha, Prof. C.K. Njoroge, Mr. J.K. Wainaina, Prof. V.K. Silayo.

Title of Publication: Thin layer drying model for simulating the drying of Tilapia fish (Oreochromis niloticus) in a solar tunnel dryer

Abstract: Mathematical models for predicting the plenum chamber temperatures developed by a solar tunnel dryer and the drying of Tilapia fish (Oreochromis niloticus) in the solar tunnel dryer was developed, and simulated in Visual Basic 6 (Microsoft Visual Basic 6.0™). Based on Student's t-test, the simulated and actual data for both plenums chamber temperature and moisture ratio did not differ significant at 5% level of significance. In addition, the simulated and actual moisture ratios showed similar trends, and reduced exponentially with drying time. Further, the performances of models at 10% residual error interval were 83% and 81% for plenum chamber temperature and moisture ratio, respectively. Finally, strong linear correlations existed between simulated and actual data for plenum chamber temperature ($R2 = 0.961$), and for moisture ratio ($R2 = 0.995$). Therefore, the model can be used to predict the drying of Tilapia fish in a solar tunnel dryer.

Name of Journal/Conference Proceedings/Workshop: Journal of Food Engineering.

Year of Publication: 2010.

Name of Lecturer/Authors: Mr. G.M. Kituu, **Prof. D. Shitanda**, Dr. C.L. Kanali, Dr. J.T. Mailutha, Prof. C.K. Njoroge, Mr. J.K.Wainaina, Ms. J.S Bongyereire.

Title of Publication: A Simulation Model for Solar Energy Harnessing By the Tunnel Section of a Solar Tunnel Dryer.

Abstract: Models were developed to predict global solar radiation and the energy harnessed by a solar tunnel dryer, and simulated in Visual Basic 6. In addition, the simulated data were compared with actual data. Using a 10% absolute residual error interval, the developed model achieved 78.4% and 83.3% performance for global solar radiation and energy harnessing, respectively. Further, the relationship between global solar radiation and the ten year mean satellite solar radiation, and that between the actual and simulated plenum chamber temperatures were linear, with coefficients of determination (R2) of 0.788 and 0.962. Thus, there is the existence of a strong correlation between satellite and predicted global solar radiation, and between predicted and actual plenum chamber temperatures. Furthermore, Student's t-test did not show any significant difference between simulated and actual data for solar radiation and energy harnessing. Finally, this study shows that the developed model can be used to predict solar radiation and the energy harnessed by the solar tunnel dryer.

Name of Journal/Conference Proceedings/Workshop: Agricultural Engineering International: the CIGR Ejournal.

Year of Publication: 2010.

Name of Lecturer/Authors: Muthike G.M., **Shitanda D.,** Kanali C.L. and Muisu F.N.

Title of Publication: The potential of Chainsaw Frame Mills in On-farm Timber Processing in Kenya.

Abstract: Chain saws have been used to convert on-farm trees into timber over a long time in Kenya. Large saw path, especially due to the back and forth mode of operation remains a major contributor to low timber recovery and surface quality associated with this sawing method. A new method of sawing using chain saws with attachments has been introduced. The attachments fix the chain bar on a straight line, enabling the operator to saw a log to uniform pre-set timber sizes with precision, higher recovery and smoother surface than free hand sawing method. A study was conducted to determine the difference in timber recovery and other sawing parameters between free hand and chain saw with attachments. Results showed that chain sawing with frames gave mean timber recovery of about 56% against 41% with free hand. Its fuel consumption was slightly higher than for free hand method but the difference was not significant. Chain sawing with attachment produced significantly less volume of sawn timber per unit time than free hand. However, the size uniformity, surface quality and high recovery of the resultant timber would pay back more than free hand method. It was concluded that Chain sawing with attachments is more efficient and higher in timber recovery than free hand. Although an operator may saw less timber in a day, all the timber is more likely to find ready market than timber processed using free hand due to uniformity of size along the piece and inferior surface quality. It was recommended that, chain sawing with frames be adopted, modified and promoted to replace the free hand method to minimise wastes, improve timber surface quality, thus conserving the environment in the short term as development of more cost effective sawing technologies continue.

Name of Journal/Conference Proceedings/Workshop: Recent Advances in Forestry Research for Environmental Conservation, Improved Livelihood and Economic Development. *Proceedings of the 4th KEFRI Scientific Conference, 6th -9th October 2008.*

Year of Publication: 2008.

Name of Lecturer/Authors: **J.T. Makanga** and E. Ngondi.

Title of Publication: Status and Constraints of Wind Energy Resource Utilization in Kenya.

Abstract:

Energy has been identified as the prime mover that propels the wheel of economic development. Access to modern energy affects quality of life and supports the main aspects of sustainable development namely social equality, economic growth and environmental protection. Sub-Saharan Africa and many other countries with low per capita commercial energy consumption continue to exhibit correspondingly low per capita gross domestic products. In a continent where both per capita income and energy consumption are low, the use of renewable energy resources including biomass, solar, wind, geothermal and hydro power will be among the main solutions to clean and sustainable energy that will fuel economic growth and spearhead the fight against poverty. This paper reveals the status and constraints of wind energy resource utilization in Kenya. Studies were conducted in various areas of the country. This was done by use of questionnaires, interviews and actual measurements including determination of wind velocities. The results indicated that scattered areas of the country have some potential of using wind energy. There are however several obstacles which have to be overcome including low awareness of wind energy systems and need for frequent updating of wind resource map for the country.

Name of Journal/Conference Proceedings/Workshop: International Workshop on Small Scale Wind Energy Machines for Developing Countries, September 14th – 16th 2009, JKUAT, Nairobi, Kenya.

Year of Publication: 2009.

Name of Lecturer/Authors: **E.K. Ronoh**, C.L. Kanali, J.T. Mailutha and D. Shitanda.

Title of Publication: Modeling thin layer drying of amaranth seeds under open sun and natural convection solar tent dryer.

Abstract:

Thin layer drying studies of amaranth (*Amaranthus cruentus*) seeds were carried out under open sun and natural convection solar tent dryer. The ambient temperature and relative humidity ranged from 22.6–30.4°C and 25–52%, respectively, while the inside temperature and relative humidity in the solar dryer ranged from 31.2–54.7°C and 22–34%, respectively. Fresh amaranth seeds with an average moisture content of 64% (dry basis) were dried under both conditions for seven hours to a final moisture content of about 10% (dry basis). A non-linear regression analysis was used to develop drying models for amaranth seeds. The models were compared using the coefficient of determination (R^2), root mean square error (RMSE) and the reduced chi-square (χ^2) in order to determine the one that best represented thin layer drying characteristics of amaranth seeds. The results show that the Page model satisfactorily described the drying of amaranth seeds with R^2 of 0.9965, χ^2 of 0.00027 and RMSE of 0.01540 for open sun; R^2 of 0.9980, χ^2 of 0.00016 and RMSE of 0.01175 for bottom layer of the drying rack inside the solar tent dryer; and R^2 of 0.9996, χ^2 of 0.00003 and RMSE of 0.00550 for top layer of the drying rack. This shows that

the Page model can be used to predict drying of amaranth seeds in the open sun and under a natural convection solar tent dryer. Copyright ©.

Name of Journal/Conference Proceedings/Workshop: Agricultural Engineering International: the CIGR EJournal. Manuscript 1420. Vol. XI. November, 2009.

Year of Publication: 2009.

Name of Lecturer/Authors: Mr. G.M. Kituu, Prof. D. Shitanda, **Dr. C.L. Kanali**, Dr. J.T. Mailutha, Prof. C.K. Njoroge, Mr. J.K. Wainaina, Prof. V.K. Silayo.

Title of Publication: Thin layer drying model for simulating the drying of Tilapia fish (*Oreochromis niloticus*) in a solar tunnel dryer.

Abstract: Mathematical models for predicting the plenum chamber temperatures developed by a solar tunnel dryer and the drying of Tilapia fish (*Oreochromis niloticus*) in the solar tunnel dryer was developed, and simulated in Visual Basic 6 (Microsoft Visual Basic 6.0™). Based on Student's t-test, the simulated and actual data for both plenum chamber temperature and moisture ratio did not differ significant at 5% level of significance. In addition, the simulated and actual moisture ratios showed similar trends, and reduced exponentially with drying time. Further, the performances of models at 10% residual error interval were 83% and 81% for plenum chamber temperature and moisture ratio, respectively. Finally, strong linear correlations existed between simulated and actual data for plenum chamber temperature (R^2 = 0.961), and for moisture ratio (R^2 = 0.995). Therefore, the model can be used to predict the drying of Tilapia fish in a solar tunnel dryer.

Name of Journal/Conference Proceedings/Workshop: Journal of Food Engineering.

Year of Publication: 2010.

Name of Lecturer/Authors: Mr. G.M. Kituu, Prof. D. Shitanda, **Dr. C.L. Kanali**, Dr. J.T. Mailutha, Prof. C.K. Njoroge, Mr. J.K.Wainaina, Ms. J.S Bongyereire.

Title of Publication: A Simulation Model for Solar Energy Harnessing By the Tunnel Section of a Solar Tunnel Dryer.

Abstract: Models were developed to predict global solar radiation and the energy harnessed by a solar tunnel dryer, and simulated in Visual Basic 6. In addition, the simulated data were compared with actual data. Using a 10% absolute residual error interval, the developed model achieved 78.4% and 83.3% performance for global solar radiation and energy harnessing, respectively. Further, the relationship between global solar radiation and the ten year mean satellite solar radiation, and that between the actual and simulated plenum chamber temperatures were linear, with coefficients of determination (R2) of 0.788 and 0.962. Thus, there is the existence of a strong correlation between satellite and predicted global solar radiation, and between predicted and actual plenum chamber temperatures. Furthermore, Student's t-test did not show any significant difference between simulated and actual data for solar radiation and energy harnessing. Finally, this study shows that the developed model can be used to predict solar radiation and the energy harnessed by the solar tunnel dryer.

Name of Journal/Conference Proceedings/Workshop: Agricultural Engineering International: the CIGR Ejournal.

Year of Publication: 2010.

Name of Lecturer/Authors: G.M. Kituu, **C.L. Kanali**, J.T. Mailutha and D. Shitanda.
Title of Publication: Influence of brining on the drying parameters of tilapia *(Oreochromis niloticus)* in a glass-covered solar tunnel dryer.

Abstract: The objective of this study was to determine the effect of brining on the drying rate of tilapia (*Oreochromis niloticus*) in a glass-covered solar tunnel dryer. Tilapia fish, eviscerated, and split into pieces of approximately 4cm by 3cm by 9mm was soaked in brine at varying concentrations of 0, 5, 10 and 15%. The samples were dried in a glass-covered solar tunnel dryer for 40 hours. The moisture content was evaluated by the oven dry method. The moisture content of fish was found to reduce linearly from 5.58 to 2.76 kg/kg (db) as brine concentration increased from 0 to 15%. The drying rate reduced with increase in brine concentration. The effective diffusion coefficient decreased from 8.56 - 5.72x10–11 m2/s, and the drying rate constant from 0.1217-0.0813 h–1, as the brine concentration increased from 0-15%. These results provide useful information in the modelling and design of solar drying systems for tilapia fish drying.

Name of Journal/Conference Proceedings/Workshop: Agricultural Engineering International: the CIGR EJournal. Manuscript 1349. Vol. XI. November, 2009.
Year of Publication: 2009.

Name of Lecturer/Authors: E.K. Ronoh, **C.L. Kanali**, J.T. Mailutha and D. Shitanda.
Title of Publication: Thin layer drying kinetics of amaranth (*Amaranthus cruentus*) grains in a natural convection solar tent dryer.

Abstract: An experimental solar tent dryer under natural convection was used to study thin layer drying kinetics of amaranth (*Amaranthus cruentus*) grains. Drying of grains in the dryer was carried out on a drying rack having two layers; top and bottom. The ambient temperature and relative humidity ranged from 22.6–30.4°C and 25–52%, respectively, while the inside temperature and relative humidity in the solar dryer ranged from 31.2–54.7°C and 22–34%, respectively. Freshly harvested amaranth grains with an average moisture content of 64% were dried under the solar tent dryer for seven hours to a final moisture content of 7% (dry basis). A non-linear regression analysis was used to evaluate six thin layer drying models (viz., Newton, Page, Modified Page, Henderson & Pabis, Logarithmic and Wang & Singh) for amaranth grains. The models were compared using coefficient of determination (R^2), root mean square error (RMSE), reduced chi-square (χ^2) and prediction performance (η_p) in order to determine the one that best described thin layer drying of amaranth grains. The results show that the Page model satisfactorily described the drying of amaranth grains with R^2 of 0.9980, χ^2 of 0.00016 and RMSE of 0.01175 for bottom layer and R^2 of 0.9996, χ^2 of 0.00003 and RMSE of 0.00550 for top layer of the drying rack. Based on a ±5% residual error interval, the Page model attained the highest prediction performance (η_p = 80%) when drying the grains in both layers of the dryer. This shows that there was a good agreement between the predicted and experimental moisture changes during solar drying of amaranth grains under natural convection. The transport of water during dehydration was described by applying the Fick's diffusion model and the effective moisture diffusivity for solar tent drying of amaranth grains was found to be 5.88×10^{-12} m^2s^{-1} at the bottom layer and 6.20×10^{-12} m^2s^{-1} at the top layer. High temperatures developed at the top layer of the dryer led to high effective moisture

diffusivity and this showed that temperature strongly influences the mechanism of moisture removal from the grains.

Name of Journal/Conference Proceedings/Workshop: African Journal of Food, Agriculture, Nutrition and Development (AJFAND), 10(3): 2218-2234, March 2010. ISSN: 1684 5374.

Year of Publication: 2010.

Name of Lecturer/Authors: E.K. Ronoh, **C.L. Kanali**, J.T. Mailutha and D. Shitanda.

Title of Publication: Modeling thin layer drying of amaranth seeds under open sun and natural convection solar tent dryer.

Abstract: Thin layer drying studies of amaranth (*Amaranthus cruentus*) seeds were carried out under open sun and natural convection solar tent dryer. The ambient temperature and relative humidity ranged from 22.6–30.4°C and 25–52%, respectively, while the inside temperature and relative humidity in the solar dryer ranged from 31.2–54.7°C and 22–34%, respectively. Fresh amaranth seeds with an average moisture content of 64% (dry basis) were dried under both conditions for seven hours to a final moisture content of about 10% (dry basis). A non-linear regression analysis was used to develop drying models for amaranth seeds. The models were compared using the coefficient of determination (R^2), root mean square error (RMSE) and the reduced chi-square (χ^2) in order to determine the one that best represented thin layer drying characteristics of amaranth seeds. The results show that the Page model satisfactorily described the drying of amaranth seeds with R^2 of 0.9965, χ^2 of 0.00027 and RMSE of 0.01540 for open sun; R^2 of 0.9980, χ^2 of 0.00016 and RMSE of 0.01175 for bottom layer of the drying rack inside the solar tent dryer; and R^2 of 0.9996, χ^2 of 0.00003 and RMSE of 0.00550 for top layer of the drying rack. This shows that the Page model can be used to predict drying of amaranth seeds in the open sun and under a natural convection solar tent dryer. Copyright ©

Name of Journal/Conference Proceedings/Workshop: Agricultural Engineering International: the CIGR EJournal. Manuscript 1420. Vol. XI. November, 2009.

Year of Publication: 2009.

Name of Lecturer/Authors: Muthike G.M., Shitanda D., **Kanali C.L.** and Muisu F.N.

Title of Publication: The potential of Chainsaw Frame Mills in On-farm Timber Processing in Kenya.

Abstract: Chain saws have been used to convert on-farm trees into timber over a long time in Kenya. Large saw path, especially due to the back and forth mode of operation remains a major contributor to low timber recovery and surface quality associated with this sawing method. A new method of sawing using chain saws with attachments has been introduced. The attachments fix the chain bar on a straight line, enabling the operator to saw a log to uniform pre-set timber sizes with precision, higher recovery and smoother surface than free hand sawing method. A study was conducted to determine the difference in timber recovery and other sawing parameters between free hand and chain saw with attachments. Results showed that chain sawing with frames gave mean timber recovery of about 56% against 41% with free hand. Its fuel consumption was slightly higher than for free hand method but the difference was not significant. Chain sawing with attachment produced significantly less volume of sawn timber per unit time than free hand. However, the size uniformity, surface

quality and high recovery of the resultant timber would pay back more than free hand method. It was concluded that Chain sawing with attachments is more efficient and higher in timber recovery than free hand. Although an operator may saw less timber in a day, all the timber is more likely to find ready market than timber processed using free hand due to uniformity of size along the piece and inferior surface quality. It was recommended that, chain sawing with frames be adopted, modified and promoted to replace the free hand method to minimise wastes, improve timber surface quality, thus conserving the environment in the short term as development of more cost effective sawing technologies continue.

Name of Journal/Conference Proceedings/Workshop: Recent Advances in Forestry Research for Environmental Conservation, Improved Livelihood and Economic Development. *Proceedings of the 4th KEFRI Scientific Conference, 6th -9th October 2008.*

Year of Publication: 2008.

Name of Lecturer/Authors: Muthike GM, Shitanda D, **Kanali CL** and Muisu FN

Title of Publication: The Status of Chain Saw Usage in Kenya

Abstract: The paper looks at the evolution of chain saw timber processing in Kenya. It explores the forest resources in the country, its management, utilization and rate of depletion over the years since independence and some of the major causes. The History of sawmilling in the country, its development in terms of technology and sawing skills are also discussed mentioning the factors in place at the time. The emergence of the ban on logging from Government plantations and its effects on timber processing especially the introduction of small-scale processing methods are mentioned. Further still the paper mentions the available technological options to improve timber processing especially on the farms.

Name of Journal/Conference Proceedings/Workshop: Developing alternatives for illegal chainsaw lumbering through multi-stakeholder dialogue in Ghana and Guyana. *West Africa Regional Workshop on Chainsaw Lumbering in Africa, the Guiana Shield and the Caribbean.* Tropenbos International. Held on 25–26 May 2009 in Accra, Ghana.

Year of Publication: 2009.

Name of Lecturer/Authors: E.K. Ronoh, **C.L. Kanali**, J.T. Mailutha and D. Shitanda.

Title of Publication: Analysis of thin layer solar drying characteristics and product quality of amaranth grains.

Abstract: Studies were carried out to investigate the thin layer solar drying characteristics of amaranth grains (*Amaranthus cruentus*) and compare the quality of the grains dried under the solar tent dryers and the open sun. The dryers were covered with clear, yellow and nectarine diffused polyvinyl chloride (PVC) materials of 200 micron thickness whose transmissivities were 90, 85 and 82%, respectively. The ambient temperature and relative humidity ranged from 23.3–33.5°C and from 24–46%, respectively, while the inside temperature and relative humidity in the solar dryers ranged from 30.4–50.7°C and from 15–44%, respectively. Fresh amaranth grains with an initial moisture content ranging from 66.7–68.8% dry basis (d.b) were dried under both conditions for 8 hours to an equilibrium moisture content of about 7% d.b. The equilibrium moisture content was obtained after 4.5, 6, 7, and

7.5 hours of drying for the clear cover, yellow cover, nectarine diffused cover and the open sun, respectively. The effective moisture diffusivity (D_e) values of amaranth grains dried under the dryers with nectarine diffused, yellow and clear cover materials were found to be 3.45×10^{-12}, 4.29×10^{-12} and 4.60×10^{-12} m^2s^{-1}, respectively. The corresponding D_e value for the open sun was 4.04×10^{-12} m^2s^{-1}. The quality attributes assessed were colour, hardness and crude protein content of the grains. Quality assessment showed that the colour of cover material had no significant effect on hardness, colour and crude protein content properties of amaranth grains during thin layer drying. The results demonstrate that natural convection solar tent dryers covered with PVC materials can be used to increase the thin layer drying rate of amaranth grains without significantly affecting their physical, optical and nutritive properties.

Name of Journal/Conference Proceedings/Workshop: Sustainable Research and Innovation Conference, Department of Mechanical Engineering, Jomo Kenyatta University of Agriculture and Technology, 8th–9th April 2010.

Year of Publication: 2010.

3.1 DEPARTMENT OF MECHATRONIC ENGINEERING

Name of Lecturer/Authors: **Muchiri, A.K.**, Smit, K.
Title of Publication: Application of Maintenance Interval De-Escalation in Base Maintenance Planning Optimization.

Abstract: This paper presents a unique approach to aircraft maintenance optimization during base maintenance planning. The necessity to optimize maintenance follows from a need to reduce heavy maintenance visits that require significant downtime and are capital intensive. Further, unnecessary maintenance and frequent opening and closing of panels results in significant wear and tear, and thus reducing the inherent reliability of the aircraft. A simulation model has been developed to predict the maintenance requirement of aircraft in an airline operating under known conditions. Construction and validation of the model are based on knowledge and statistical data of actual operations and maintenance practices. The main use of the model is to group maintenance tasks into manageable packages that can be executed at extended maintenance intervals and within specified periods, and thus increasing aircraft availability. The concept of initial interval de-escalation of maintenance is introduced and its positive effects are demonstrated.

Name of Journal/Conference Proceedings/Workshop: Macrothink Institute, Publication Name: Enterprise Risk Management ISSN 1937-7916 2009, Vol. 1, No. 2: E5.

Year of Publication: 2009.

Name of Lecturer/Authors: **Christopher A. Otieno**, George N. Nyakoe, Cyrus W. Wekesa.
Title of Publication: A Neural Fuzzy Based Maximum Power Point Tracker for a Photovoltaic System.

Abstract: The global electrical energy consumption is steadily rising and therefore there is need to increase the power generation capacity.

The required capacity increase can be based on renewable energy. Photovoltaic energy remains a largely unexploited renewable energy source due to low conversion efficiency of the photovoltaic modules. To maximize the power derived from the PV systems it is important to operate the panel at its optimal power point by use of a maximum power point tracker (MPPT). MPPTs find and maintain operation at the maximum power point, using an MPPT algorithm. This paper presents a high performance tracking of maximum power delivered from photovoltaic systems using adaptive neural fuzzy inference systems (ANFIS). This method combines the learning abilities of artificial neural networks and the ability of fuzzy logic to handle imprecise data. It is therefore able to handle non linear and time varying problems hence making it suitable for this work. It is expected that this method will be able to accurately track the maximum power point. This will ensure efficient use of PV systems and therefore leading to reduced cost of electricity. The performance of the proposed method was compared to that of a fuzzy logic based MPPT to demonstrate its effectiveness over other previously used MPPT techniques.

Name of Journal/Conference Proceedings/Workshop: IEEE Africon, 23-25 September 2009, Nairobi Kenya.
Year of Publication: 2009.

Name of Lecturer/Authors: **Jean Bosco Byiringiro**, Bernard W. Ikua, George N. Nyakoe.
Title of Publication: Fuzzy Logic Based Controller for Micro-Electro Discharge Machining Servo Systems.

Abstract: In this paper, a tunable fuzzy logic based servo controller for monitoring and control of the micro-electro discharge machining (micro-EDM) process has been developed, which uses the behavior of discharge pulses. The fuzzy logic applies a heuristic approach in dealing with the non-linear and time varying nature of the micro-EDM process. The control parameters affecting the performance of micro-EDM include gap voltage and gap current discharge pulses. It is important to discriminate between different levels of pulses for proper operation of micro-EDM. Discrimination of pulses from an RC-type power source is still an ill-defined problem relying on heuristics. The choice of appropriate values of discharge pulses is generally based on the knowledge and experiences of operators. In this study experiments were carried out to distinguish the discharge pulses, which were then classified into open, sparking, arcing, off and short circuit. The classified pulses were utilized as the input fuzzy sets of the fuzzy logic based controller that drives the servo system to maintain the desired gap width. The simulated results obtained demonstrate that the fuzzy logic controller is able to provide stable machining and improve the performance of the micro-EDM process.

Name of Journal/Conference Proceedings/Workshop: IEEE Africon, 23-25 September 2009, Nairobi Kenya.
Year of Publication: 2009.

Name of Lecturer/Authors: **Muriithi C.M,** Ngoo L. M, Nyakoe G. N.
Title of Publication: Load Flow Analysis with a Neurofuzzy Model of an Induction Motor Load.

Abstract: In the conventional load flow study, the active and reactive powers of all load buses are generally specified. Although the constant power model is applicable for approximate studies, it may not be suitable for

the motors because the reactive power is very sensitive to the voltage variations while the active power is dependent upon the torque being driven. This paper proposes to solve the load flow equations using a neuro-fuzzy model of an induction motor. Both the active and reactive powers of the motor are estimated at each iteration using neuro fuzzy techniques. The efficiency is estimated using the IEEE 30 bus system. The results indicate that the inclusion of induction motor loads has an effect on the convergence characteristic of the active and reactive power mismatches of the modified load flow.

Name of Journal/Conference Proceedings/Workshop: IEEE Africon, 23-25 September 2009, Nairobi Kenya.

Year of Publication: 2009.

3.2 DEPARTMENT OF ELECTRICAL AND ELECTRONIC ENGINEERING

Name of Lecturer/Authors: **C. M. Muriithi,** L. M. Ngoo, G. N. Nyakoe, and K. K. Kaberere.

Title of Publication: Investigation of Static Voltage Stability Using a Modified Load Flow Algorithm and Counter Propagative Artificial Neural Networks.

Abstract: In conventional load flow studies, the active and reactive powers of all load buses are generally specified. Thus, by assuming a constant power load characteristic, the impact of the load in the system is over-emphasized and the theoretical transfer capability is reduced despite increased security margins, which leads to system under utilization. This paper proposes load flow solution with neuro-fuzzy induction motor model which updates the active and reactive powers consumed by the induction motor load during each iteration. Counter-Propagative Artificial Neural Networks (CPANN) are used to classify the weak buses. The stability margin of the weakest buses is investigated using different induction motor load models. The results indicate that the actual situation with induction motor load corresponds to less heavily loaded conditions and a higher voltage was predicted by the power flow.

Name of Journal/Conference Proceedings/Workshop: 8th International Conference on Power System Operation and Planning.

Year of Publication: 2010.

Name of Lecturer/Authors: **K. Kaberere,** A. P. Petroianu, K. Folly.

Title of Publication: Effect of Variation in Modelling of Generator Saturation on Electromechanical Models.

Abstract: Several industrial-grade power system simulation tools are commercially available on the market. They are expensive to acquire and time-consuming to learn. As a result, very few institutions (utilities, academic/research organizations) can afford to use more than one power system simulation tool.

The simulation tools differ in their components modelling. Different tools can give different results for the same system model. Understanding the reasons for the discrepancies in the results is not a trivial task. In this paper, we investigate the effect of variations in modelling generator saturation. We carried out an eigenvalue analysis of the single machine infinite bus (SMIB) system using PSS/E, PowerFactory, EUROSTAG, SSAT, and MatNetEig.Our results show that the effect of saturation

on the local modes is erratic and there is need for further research on saturation representation in power system stability simulation tools.

Name of Journal/Conference Proceedings/Workshop: IEEE Africon.
Year of Publication: 2009.

Name of Lecturer/Authors: **C. M. Muriithi,** L. M. Ngoo, G. N. Nyakoe.
Title of Publication: Load Flow Analysis with a Neuro – Fuzzy Model of an Induction Motor Load.
Abstract: In the conventional load flow study, the active and reactive powers of all load buses are generally specified. Although the constant power model is applicable for approximate studies, it may not be suitable for the motors because the reactive power is very sensitive to the voltage variations while the active power is dependent upon the torque being driven. This paper proposes to solve the load flow equations using a neuro-fuzzy model of an Induction motor. Both the active and reactive powers of the motor are estimated at each iteration using neuro fuzzy techniques. The efficiency is estimated using the IEEE 30 bus system. The results indicate that the inclusion of Induction motor loads has an effect on the convergence characteristics of the active and reactive power mismatches of the modified load flow.

Name of Journal/Conference Proceedings/Workshop: IEEE Africon.
Year of Publication: 2009.

Name of Lecturer/Authors: **J. N. Nderu,** P. K. Kihato, G. M. Hinga.
Title of Publication: Effect of Motor Cage Temperature on Motor Speed Sensing Characteristics of Magnetostrictive Amorphous Wire.
Abstract: Magnetostrictive amorphous wires have been shown to posses various important sensing characteristics. Previously we presented results of speed sensing of induction motor using the amorphous wire, in which the speed sensing capability was seen to match that of conventional speed sensors such as tachometer. However, one concern was the fact that the properties of amorphous wire change when exposed to certain temperature ranges for a long time(as would be expected to occur inside the motor cage) in a process termed relaxation. In the present work we have shown that the amorphous wire sensing characteristics are completely lost when the wire is exposed to elevated motor-cage temperatures. Furthermore, we have suggested and tested a simple, but effective remedy to this problem.

Name of Journal/Conference Proceedings/Workshop: IEEE Africon.
Year of Publication: 2009.

Name of Lecturer/Authors: **P. K. Kihato,** J. N. Nderu.
Title of Publication: Age Clustering Approach to Metabolic Syndrome Using Spherical and Torus SOM.
Abstract: One of the threatening trends of human health in recent years has been metabolic syndrome. Metabolic syndrome is a cluster of conditions that occur together resulting in simultaneous disorders related to ones metabolism. This paper analyses the effect age clustering has on visualization of the contributing parameters to the syndrome in each cluster and then projects the overall effect the clustered SOM analysis has on the entire group of examinees. Inter-

relation of the input parameters and the severity of their contribution to the syndrome risks are investigated.

Name of Journal/Conference Proceedings/Workshop: IEEE Africon.
Year of Publication: 2009.

Name of Lecturer/Authors: **K. Kaberere,** A. P. Petroianu, K. Folly.
Title of Publication: Is there a need for Benchmarking Power System Stability Simulation Tools?
Abstract: In this paper, the authors investigate the turbo-generator modelling employed by five industrial-grade power system simulation tools (PSS/E, PowerFactory, EUROSTAG, SSAT, and MatNetEig) in their application for small-signal stability analysis. The paper shows that variations among the tools in modelling aspects such as speed voltage terms and turbine output have an important influence on eigenvalue analysis results (damping of inter-area modes). The results obtained with the five tools for the same benchmark network are compared. The tools give conflicting results for some excitation control configurations. That is, results obtained with some tools indicate that the inter-area mode of oscillation is stable whereas those obtained with other tools show that it is unstable. This paper proposes a broader discussion among the power engineering community on the need for benchmarking and standardization of requirements for power system stability simulation tools.

Name of Journal/Conference Proceedings/Workshop: Power System Computation Conference.
Year of Publication: 2009.

Name of Lecturer/Authors: **K. Kaberere,** A. P. Petroianu, K. Folly.
Title of Publication: Effect of Variation in the Modelling of Speed Voltage terms on the Damping of Inter-Area Models.
Abstract: Power system analytical tools differ in their components modelling. Different tools can give different results for the same system model. Understanding the reasons for the discrepancies in the results is not a trivial task. In this paper, we investigate the effect of neglecting rotor speed deviation in stator voltage calculation on the damping of inter-area modes using the two-area four-generator system. We represent the generators using the 6^{th} order model with different excitation control configurations. We analyse results obtained using EUROSTAG and compare these with results obtained with three other industrial-grade tools. Our results show that if rotor speed deviation is neglected in the stator voltage calculation, the damping of inter-area modes is higher than that obtained if rotor speed deviation is considered. The frequency of inter-area modes is marginally affected.

Name of Journal/Conference Proceedings/Workshop: International Conference on Power System Operation and Planning.
Year of Publication: 2008.

Name of Lecturer/Authors: **G. K. Irungu,** A. O. Akumu, D. Murage **.**
Title of Publication: Load Modelling in Power Systems: A Case Study of Magadi Soda Company.
Abstract: Industrial load modeling is very important because it enables a power system engineer to determine the status of power system when subjected to gradual or sudden disturbances. This paper presents

the measured electric load characteristics of Magadi Soda Company modeled using static model (ZIP model) and dynamic model (slip model). Simulations are done to compare if these models can capture the power quality effects. The result shows that for all the seven cases of sudden disturbances the load is wholly dynamic and the dynamic model gives very accurate results as compared to static model.
The load model structure can also be used to estimate the technical energy losses. Symbols; P = active power, Q= reactive power, V = voltage and ω = angular frequency.

Name of Journal/Conference Proceedings/Workshop: IEEE Africon.
Year of Publication: 2008.

Name of Lecturer/Authors: **P. K. Kihato,** J. N. Nderu, G. M. Hinga.
Title of Publication: Motor Speed Measurement Using Magnetostrictive Amorphous Wire.
Abstract: Magnetostrictive amorphous wires posses unique magnetic characteristics that render them useful in various sensor applications. One such application is in sensing the speed of either a rotary or linear electrical machine. In this project, we have investigated the possibility of using the amorphous wire to measure the speed of an induction motor. The amorphous wire placed just below the surface of the rotor. A small cylindrical hole is etched on the outer cover (which covers the rotor bars) from where the amorphous wire is inserted. A small pick-up (sensing) coil is placed in the vicinity of the wire, on the stator side, inside the slots but just above the stator coil windings. The pick-up coil senses (by Faraday's Law of electromagnetic Induction method) the disturbance in the magnetic flux due to the sudden reversal of the magnetic flux of the amorphous wire. The magnetic reversal of the amorphous wire, and consequently the disturbance of the flux around the sensing coil disturbance occurs at a rate proportional to the rotation speed of the motor, hence can be employed in motor speed measurement. The ends of the pick-up coil are brought out and connected to an Oscilloscope or a pulse counter. The results of speed measurement obtained using the amorphous wire method compare well with those of conventional methods such as a tachometer.

Name of Journal/Conference Proceedings/Workshop: JKUAT Scientific Technological and Industrialization Conference.
Year of Publication: 2009.

3. 3 DEPARTMENT OF GEOSPATIAL INFORMATION SYSTEMS

Name of Lecturer/Authors: **Mundia, C. N**. and Murayama Y.
Title of Publication: Analysis of Land Use/Cover Changes and Animal Population Dynamics in a Wildlife Sanctuary in East Africa using GIS and remote sensing.
Abstract: Changes in wildlife conservation areas have serious implications for the ecological systems and distribution of wildlife species. Using Masai Mara ecosystem, we analyzed long-term land use/cover changes and wildlife population dynamics. Multi-temporal satellite images, together with physical and social economic data were employed in a post classification analysis with GIS to analyze outcomes of different land use practices and policies. The results show rapid land use/cover

conversions and a drastic decline for a wide range of wildlife species. The results show rapid land use/cover conversions and a drastic decline for a wide range of wildlife species. Integration of land use/cover monitoring data and wildlife resources data can allow for the analysis of changes, and can be used to project trends to provide knowledge about potential land use/cover change scenarios and ecological impacts.

Name of Journal/Conference Proceedings/Workshop: Japan Geoscience Union Meeting, Tokyo, Japan.
Year of Publication: 2010.

Name of Lecturer/Authors: **Mundia, C. N**. and Murayama Y.
Title of Publication: Remote Sensing and GIS Modeling of Spatial Processes of Urban Growth in an African City.

Abstract: The objective of this study was to use Nairobi as an example of a rapidly urbanizing African city to study the dynamics of land use/cover changes and simulate future urban expansion, in order to address the need for urban management tools that can guide sustainable urban planning policies. Cellular Automata, that integrates biophysical factors with dynamic spatial modeling, was used for this study. The model was calibrated and tested using time series of urbanized areas derived from land use/cover maps, produced from multi-spectral satellite imageries, and future urban growth projected out to 2030. The model accuracy assessment results showed high accuracies, indicating that the simulated results were realistic and accurate, thereby confirming the effectiveness of the model.
Results show that the model is useful for urban modeling and an effective tool to foresee the spatial consequences of poor planning policies in the context of many cities in Africa. The forecast for Nairobi shows an unsustainable sprawled urban growth. The results show that urban simulations can represent a useful approach to an understanding of the consequences of current planning policies or their incompleteness.

Name of Journal/Conference Proceedings/Workshop: Japan Geoscience Union Meeting, Tokyo, Japan.
Year of Publication: 2009.

Name of Lecturer/Authors: **D. Kuria**, E. Mutange, D. Musiega and C. Muriuki.
Title of Publication: Multi-epoch Land cover Mapping of the Kakamega Forest utilizing Landsat imagery and GIS.

Abstract: Forest resources contribute significantly to the Kenyan economy. However, due to pressures exerted by the growing population, this scarce resource is seriously endangered. In particular, the Kakamega Forest has experienced serious degradation in the past, though some restoration efforts have also been put in place. In this research, we utilize time series Landsat imagery to characterize the changes and capture the trends in land cover changes. Three epochs are utilized, namely 1986, 1995 and 2005. Pre-processing involved georeferencing and radiometric corrections. As a first step the time series imageries were evaluated via a threshold analysis distinguishing between `forest' and `non-forest'. Subsequently, a supervised multispectral classification was performed distinguishing various land cover classes. Ground truthing for the historical imagery was done using aerial photographs, topographic maps and site visits. Actual land cover verification was based on amateur photographs taken in 1999

from aircraft and ground observations in 2008. For classification the maximum-likelihood decision rule was applied considering bands 3, 4, 5, 7 plus 7/2 for Thematic Mapper (TM)/Enhanced Thematic Mapper Plus (ETM+) imagery and 1, 2, 3 and 4 for Multi-Spectral Scanner (MSS) data, respectively. The classification results form a solid basis for a consistent and detailed evaluation of forest history between 1986 and 2005. Analysis results presented include graphs and pie charts of change in land cover class areas over time as well as such allowing for true change detection with transitions between the different classes. In this study, maximum likelihood supervised classification change detection techniques were applied to Landsat images acquired in 1986, 1995 and 2005, respectively. To map land cover changes in kakamega forest, a supervised classification was carried out on the six reflective bands for the three images individually with the aid of ground truthing data. Changes among different land cover classes were assessed. During the study period, a very severe land cover change had taken place as a result of agricultural and settlement. These changes in land cover led to vegetation degradation. The effects of restoration e
orts are also captured in the research findings.

Name of Journal/Conference Proceedings/Workshop: Journal of Agriculture Science and Technology.
Year of Publication: 2010.

Name of Lecturer/Authors: **D. Kuria** and T. Koike.
Title of Publication: Convective cloud discrimination using multi-frequency microwave signature of the AMSR-E sensor: Evaluation over the Tibetan Plateau.

Abstract: Multi-frequency passive microwave remote sensing affords a unique opportunity to understand various phenomena; low frequency microwaves penetrate clouds and are able to observe earth surface conditions (6 – 18 GHz), while the higher frequencies are strongly impacted by prevailing atmosphere conditions. By utilizing these relationships, an atmospheric opacity index (AOI) using Advanced Microwave Scanning Radiometer on Earth Observing Satellite (AMSR-E) multi-frequency data is proposed. This index utilizes four AMSR-E frequencies spanning both high and low microwave frequencies. This atmospheric opacity index can be used to discriminate cloudy atmosphere from clear sky conditions. This index shows good agreement with currently utilized cloud indices. In this research it is compared against Moderate Imaging Spectroradiometer (MODIS) and the Geostationary Operational Environmental Satellite 9th series (GOES-9) atmosphere products. Due to the advantage of microwave sensors' independence on the sun for illumination, it offers the possibility of detecting convective clouds at all times (day and night).

Name of Journal/Conference Proceedings/Workshop: International Journal of Remote Sensing.
Year of Publication: 2010.

Name of Lecturer/Authors: **T. G. Ngigi**, R. Tateishi and M. Gachari.
Title of Publication: Global mean values in linear spectral unmixing: double fallacy!
Abstract: Almost all conventional linear spectral unmixing techniques are based on the principle of least squares. The global mean digital number (DN) of an endmember is taken as the representative

(i.e. contributory) DN for the end-member. This paper sets out to prove that the notion is a fallacy, and will always lead to negative percentages, super-positive percentages and non-100% sum of percentages if the unmixed pixel is not composed of, to within some tolerance, the global mean DNs only. Three sets of spectral end-members (two, three and four spectral end-members) are generated from Landsat ETM+ data. Practical percentages (between 0% and 100% and totalling 100%) of the end-members are returned by pixels in which the local mean DNs of the spectral end-members do not differ from the global mean DNs by, on average, 4.

Name of Journal/Conference Proceedings/Workshop: International Journal of Remote Sensing, Vol. 30, No. 5, pp. 1109 – 1125.

Year of Publication: 2009.

Name of Lecturer/Authors: **Thomas G. Ngigi**, Ryutaro Tateishi, Adel Shalaby, Nehal Soliman and Mohamed Ghar.

Title of Publication: Comparison of a new classifier, the Mix–Unmix Classifier, with conventional hard and soft classifiers.

Abstract: 'The number of bands must be more than the number of end-members…' is perhaps the most ubiquitous statement in linear spectral unmixing. The Mix–Unmix Classifier overcomes this limitation. Further, the classifier creates a processing environment that allows any pixel to be unmixed without any sort of restrictions (e.g. minimum determinable fraction), impracticalities (e.g. negative fractions), or trade-offs (e.g. either positivity or unity sum). The classifier gives not only the most probable fractions of end-members, but also their most probable contributory DNs. The contributory DNs directly define the qualities, (e.g. the phenological stages) of the end-members. The classifier is applied as a dual classification method and compared with popular conventional hard and soft classifiers in production of two to eight spectral classes/end-members from Landsat 7 ETM+ data. The classifiers considered are Spectral Angle Mapper, Binary Encoding Classifier, and Maximum Likelihood Classifier for hard classification; and IDRISI Kilimanjaro Probability Guided Option linear unmixing technique for soft classification. The Mix–Unmix Classifier performs better than the others.

Name of Journal/Conference Proceedings/Workshop: International Journal of Remote Sensing, Vol. 29, No. 14, pp. 4111 – 4128.

Year of Publication: 2008.

4. INSTITUTE OF BIOTECHNOLOGICAL RESEARCH (IBR)

Name of Lecturer/Authors: Karuri, H. W., Ateka, E. M., Amata, R., **Nyende, A.B.,** Muigai, A.W. T.

Title of Publication: Morphological markers cannot reliably identify and classify sweet potato gentypes based on resistance to SPVD and dry matter content.

Abstract:

Objective: To characterize Kenyan sweet potato genotypes for resistance to sweet potato virus disease (SPVD) and dry matter content using morphological markers.

Methodology and results: Three hundred and fourteen genotypes were evaluated in the screenhouse for their reaction to sweet potato virus disease (SPVD) followed by serological analysis. Severity of SPVD was determined following graft-inoculation using a severity scale of 1- 5. Results showed that the genotypes responded significantly differently ($P<0.01$) to SPVD infection. Twenty genotypes were resistant to SPVD in the screenhouse. The 314 genotypes were planted in the field and characterized using 42 morphological characters. Tuber dry matter (DM) content was determined 5 months after planting in the field. The tuber DM content varied significantly ($P<0.01$) among the sweet potato genotypes. Phylogenetic analysis using morphological descriptors grouped the genotypes into two major clusters. None of the clusters clearly distinguished the 20 resistant genotypes from the 294 susceptible ones. Genotypes with highest and lowest tuber DM content were not distinguished from each other using the UPGMA phenogram generated.

Conclusions and application of findings: Our results indicate that morphological markers are not reliable in identifying and classifying sweet potato genotypes based on response to SPVD and dry matter content of the tubers. Morphological markers therefore need to be supplemented with molecular markers in identification of sweet potato germplasm with SPVD resistance and high dry matter content. This study has further shown that there is a significant amount of morphological variability among the SPVD resistant and high dry matter genotypes, which could be utilized in breeding to diversify resistance to the disease and generation of novel/new genotypes.

Name of Journal/Conference Proceedings/Workshop: Journal of applied Biosciences.Vol. 15: 820-828.

Year of Publication: 2009.

Name of Lecturer/Authors: **Nyende A.B**, Mwangi J.K, Demo P, Matiru V.

Title of Publication: Improving seed potato tuber multiplication in Kenya using the Rapid-seed scheme technique.

Abstract:

The high cost of production, slow rate of multiplication of seed potato tubers and unavailability of good quality seed potato to farmers at affordable prices have impacted negatively on potato production in Kenya. Farmers, therefore turn to self-supply practices that have ultimately led to seed degeneration hence further lowering production. Rapid seed scheme-a method for increasing seed multiplication rates through positive selection, indexing and tuber splitting techniques-was evaluated. Positive selection involved the visual selection of healthy plants in the field. Tubers harvested from the healthy selected plants

were indexed for *Ralstonia solanacearum* and viruses using the ELISA techniques. Tubers certified free of disease after indexing were split into smaller sizes having at least two sprouts before planting in the subsequent season.
Out of 602 ridges and plots, 64.61 % were visually selected and then indexed. All the plant samples were found free of *Ralstonia solanacearum* but had virus incidence levels in the range of 88 – 99 % in respect to PLRV, PVY, PVX, PVA, PVM and PVS. The viruses were found in mixed infections of 4, 5 and 6 viruses at 3.47 %, 22.56 %, and 77.07 % respectively. Upon splitting of tubers certified free of diseases, the number of split seed tubers increased by 83 % with an actual increase of 60.6 %. Split seed and whole tubers upon planting showed no significant differences in emergence and number of above ground stems during growth ($p > 0.05$). The yield of whole tuber when compared with split tubers showed no significant difference in number of tubers/plant and tonnes/ha ($p>0.05$). These results indicate that positive selection is a good method of obtaining source materials while indexing ensures cleanliness of the seed materials to be used. Splitting of tubers increases the quantity of clean source materials thereby decreasing the number of field multiplications. Therefore, rapid seed scheme can be an additional low cost and faster technique of seed potato multiplication.

Name of Journal/Conference Proceedings/Workshop: JAGST (in press, August 2009: Accepted for the JAGST volume 11(1).

Year of Publication: 2009.

Name of Lecturer/Authors: Karuri, H. W., Ateka, E. M., Amata, R., **Nyende, A.B.,** Muigai, A.W. T.

Title of Publication: Molecular characterization of Kenyan sweet potato genotypes for SPVD resistance and high dry matter content using SSR markers.

Abstract: Genetic diversity of 89 sweet potato genotypes was evaluated using morphological and molecular markers. Eighteen aerial and sixteen storage root characters were used in the morphological characterization. Analysis of variance showed that all the characters evaluated were significantly different ($P<0.01$) between the genotypes. The dendrogram obtained using phenotypic characters separated the genotypes into two major clusters with a Euclidean distance ranging from 0.0 to 6.98. Twenty three unique alleles, ranging from 3 to 6 per locus were detected using six simple sequence repeats (SSR) markers. Cluster analysis showed a Jaccard co-efficient ranging from 0.5 to 1.0 indicating high genetic diversity. Comparison between morphological and molecular data using the mantel test revealed a low correlation ($r = -0.05$) between the two data sets. Despite the poor correlation both techniques showed a high degree of variation among the genotypes suggesting great genetic diversity in Kenyan sweet potato genotypes that can be utilized in breeding programs.

Name of Journal/Conference Proceedings/Workshop: The African Journal of Biotechnology. Vol. 8 (10) pp 2169-2175.

Year of Publication: 2009.

Name of Lecturer/Authors: Mwirigi P.N., Kahangi E.M., **Nyende A.B**., Mamati E.G.

Title of Publication: Morphological variability within the Kenyan yam (Dioscorea spp.)

Abstract: *Objective*: To characterize 43 Kenyan yam cultivars using morphological characters.

Methodology and results: Yam cultivars were collected in the major yam growing districts in Kenya. Data of 17 morphological variables measured on these accessions were subjected to multivariate analysis using Principal Component Analysis (PCA) and clustering criterion. The results indicated that the characters contributing most to variability were twining direction, stem colour, spine shape, leaf type and presence or absence of flowering for above ground plant parts; and tuber flesh colour, skin colour, shape of the tuber, hardness of the tuber when cooked, and presence or absence of roots on the tuber surface for the parts below ground. The pruned dendogram generated through agglomerative hierarchical clustering based on the similarity matrix revealed four main groups of this species. One group had only one cultivar which was collected in only one locality in Meru. This is possibly a newly discovered cultivar that has not been previously documented.
Conclusion and potential application of findings: This study has showed that there is wide variability in the major yam cultivars grown in Kenya and this can be used to breed higher yielding varieties or screen for cultivars resistant to pests and diseases. The results would also be useful for conservation planning and genetic improvement of the crop. Nevertheless further confirmatory research is required using molecular tools to analyze the diversity detected.

Name of Journal/Conference Proceedings/Workshop: Journal of Applied Biosciences 16: 894-901.
Year of Publication: 2009.

Name of Lecturer/Authors: Karuri, H. W., Ateka, E. M., Amata, R., **Nyende, A.B.,** Muigai, A.W. T, E. Mwasame and S.T. Gichuki.
Title of Publication: Effect of African nightshade species (Solanales: Solanaceae) on developmental time and life table parameters of *Tetranychus evansi* (Acari: Tetranychidae).
Abstract: Genetic diversity of 89 sweet potato genotypes was evaluated using morphological and molecular markers. Eighteen aerial and sixteen storage root characters were used in the morphological characterization. Analysis of variance showed that all the characters evaluated were significantly different ($P<0.01$) between the genotypes. The dendrogram obtained using phenotypic characters separated the genotypes into two major clusters with a Euclidean distance ranging from 0.0 to 6.98. Twenty three unique alleles, ranging from 3 to 6 per locus were detected using six simple sequence repeats (SSR) markers. Cluster analysis showed a Jaccard co-efficient ranging from 0.5 to 1.0 indicating high genetic diversity. Comparison between morphological and molecular data using the mantel test revealed a low correlation ($r = -0.05$) between the two data sets. Despite the poor correlation both techniques showed a high degree of variation among the genotypes suggesting great genetic diversity in Kenyan sweet potato genotypes that can be utilized in breeding programs.

Name of Journal/Conference Proceedings/Workshop: International journal of Agricultural Biology.12: 33-38.
Year of Publication: 2010

5. INSTITUTE OF ENERGY AND ENIVIRONMENTAL TECHNOLOGY (IEET)

Name of Lecturer/Authors: Njogu, P. M.; **Keriko, J. M.** and Kitetu, J. J.
Title of Publication: Distribution of heavy metals in various Lake matrices; Water, Soil, Fish and Sediments: A case study of the Lake Naivasha basin, Kenya.

Abstract: Water, sediments, soil and fish; Common carp (Cuprinus carpio), Blackbass (Micropterus salmoide), Tilapia (Oreochromis leucostictus) and Mirror carp (Cyprinus spectacularlus) from the Lake Naivasha basin were analyzed for lead (Pb), cadmium (Cd), zinc (Zn), copper (Cu), nickel (Ni) and mercury (Hg). Samples were collected from the Main lake, Lake Oloidien, Cresent Lake, River Malewa, River Gilgil, Naivasha Municipal Council Sewer entry point, Flower farm discharge canals and the Kenya Wildlife Service (KWS) Sanctuaary (Joan Roots Farm). Fish samples were bought from fishermen and identified by the Kenya Marine and Fisheries (KMF) staff. The metal concentrations were determined using Atomic Absorption Spectrophotometer (AAS). Results indicated that, there was introduction of the metals from other sources other than the parent soil in the catchment. Most soil samples from the catchment had more heavy metals contents compared to the KWS Sanctuary samples which was used as control. *There was also an indication of bioaccumulation of metals in fish.*

Name of Journal/Conference Proceedings/Workshop: Submitted to JAGST and now under review.
Year of Publication: 2010.

Name of Lecturer/Authors: **Keriko, J. M.;** Chege, C. W.; Magu, M. M.; Mwachiro, E. C.; Murigi, A. N. and Githua, M. N.
Title of Publication: Fish Lipid contents, lipid classes of Fish species of Lake Naivasha, Kenya.

Abstract: The aims of this paper were to investigate the total lipid content, lipid class composition of some fresh water fish species from Lake Naivasha and to establish the fish eating habits of the Naivasha community. The fish species, Cyprinus carprio (Common carp), Cyprinus carprio specularis (Mirror carp), Micropterus salmoides (Largemouth bass) and Oreochromis leucosticus (Tilapia), were purchased directly from the fishermen at the Central landing in L. Naivasha. The consumption of marine natural products especially fish has many benefits especially on reducing the attack by diseases such as coronary heart diseases, cancer, diabetes, high blood pressure, gout and other diseases that arise as a result of excessive consumption of foods containing high cholesterol levels. The total lipid content, lipid class composition of the fish tissues which included the muscle, pancreas and liver were analysed and determined individually. The total lipid content was highest in the O. leucosticus muscle tissue, M. salmoides pancreas, and the liver of Cyprinus carprio. These results suggest that the fish specimens are lean type of fishes. Triacylglycerol (TAG) was the dominant lipid class in the muscle tissue of all the four fish species. The order of the lipid class in the muscle tissue was as follows; TAG > PC > PE > other lipids > DAGE > FFA > WE > ST. The pancreas

	and the liver tissues of the four freshwater fish species had the same order of the lipid class. The phospholipids (PC and PE) were the dominant lipid classes in the two tissues. The order of the lipid class in the pancreas and the liver tissues were as follows; PC > PE > TAG > FFA > other lipids > ST > DAGE > WE. Fish eating habits of the Naivasha community was established using questionnaire method. The results suggest that 36% of the respondents consume fish more than once per week while only 6% do so few times a year because of the unavailability of fish (24%) and the cost of fish (25%) when available. Respondents are willing to consume more fish if they become available at subsidized prices.
Name of Journal/Conference Proceedings/Workshop:	African Journal of Pharmacy and Pharmacology.
Year of Publication:	2010.

6. INSTITUTE OF TROPICAL MEDICINE AND INFECTIOUS DISEASES (INTROMID)

6. 0 DEPARTMENT OF MEDICAL LABORATORY SCIENCES

Laboratory session at medical microbiology laboratory.

Name of Lecturer/Authors:	**Jesca O. Wesongah**, G.A. Murilla, A.N.Guantai and R.E. Mdachi.
Title of Publication:	Pharmacokinetics of Chloramphenicol in Sheep after Intramuscular Administration.
Abstract:	This study was carried out to determine the pharmacokinetics of chloramphenicol in eight sheep injected intramuscularly with chloramphenicol sodium succinate (25 mg/kg body weight). The animals were bled at pre-determined time intervals and serum chloramphenicol concentrations monitored using chloramphenicol-ELISA for a period of 30 days post drug administration. Pharmacokinetics evaluation was carried out using a non-compartment analysis model. The mean Cmax values obtained in the eight sheep was 134±34µg/ml and the time required to reach Cmax (tmax) was 10±0.05 minutes. The mean elimination half-life obtained was 36.37±3.7 h and the mean residence time was 2.83±0.27 h. These results show that chloramphenicol was absorbed and distributed rapidly from the injection site. At two weeks post drug administration, the drug levels had declined to below the limit of detection of the assay (0.1 ng/ml).
Name of Journal/Conference Proceedings/Workshop:	The East and Central African Journal of Pharmaceutical Sciences: ISSN 1026-552X.
Year of Publication:	2009.

7. SCHOOL OF HUMAN RESOURCE DEVELOPMENT

7.1 DEPARTMENT OF SOCIAL SCIENCES AND HUMANITIES

Name of Lecturer/Authors: Ondieki-Mwaura F.N.

Title of Publication: Social-economic characteristics associated with the adoption of agro-factory. The case of *Calliandia calothyrus* in Embu District of Kenya.

Abstract: This paper looks at socio-economic characteristics that are associated with the adoption of agro forestry in Embu district of Kenya. Adoption of trees on-farm is often assumed to be determined only by the inherent characteristics of the tree species. But as this study demonstrates other factors within the household and social system are also just as important in determining whether or not adoption talks place. A survey research was carried out in Embu district with a sample of 42 farmers having questionnaires administered to. Key informant interviews were also carried out. Socio-economic factors were found to play a key role in determining the adoption of agro-forestry technology. By combining elements of individual farmer and household characteristics and the influence of the farming system and institutions, one can predict a household/farm decision-making process as to whether or not to adopt a technology. A higher level of formal education, younger age (below 40 years) and a small farm size were found to encourage the adoption of calliandra. The uncertain milk market, unavailability of planning materials in centralized nurseries and the inadequacy of the extension service in promoting calliandra are institutional factors that were found to hamper the adoption of calliandra.

Name of Journal/Conference Proceedings/Workshop: Journal of Human Resource Development. Published by school of Human Resource Development Jomo Kenyatta University of Agriculture and Technology.Nairobi, Kenya
ISSN 1819-4370 2010

Year of Publication: 2010.

8. NAIROBI CENTRE CAMPUS

Name of Lecturer/Authors: Njogu, P. M.; **Keriko, J. M**.; Madadi, O. V.; Wandiga, S. O.; Kitetu, J. J.; Muttia, T. M. and Wanjau, R. N.

Title of Publication: The leaves of heavy metals in the waters from the Lake Naivasha basin, Kenya.

Abstract: Water samples from the Lake Naivasha ecosystems were analyzed for the levels of lead (Pb), cadmium (Cd), zinc (Zn), copper (Cu), calcium (Ca), iron (Fe), manganese (Mn) and nickel (Ni) to assess heavy metals pollution status in the basin. Water samples were collected from eleven sampling sites in the Main Lake, Lake Oloidien, Crescent Lake, River Malewa and canals that connect the lake to the flower farms. The concentrations were determined using the Atomic Absorption Spectrophotometry (AAS) as total concentration (mg/L). The results show wide variations between samples and were found to be in the ranges; 0.01 – 0.36 mg/L for Pb, 0.004 – 0.038 mg/L for Cd, 0.81 – 1.9 mg/L for Zn, 0.08 – 0.45 mg/L for Ni, 0.001 – 0.014 mg/L for Cu, 0.57 – 10.63 for Fe, 0.035 – 1.95 for Mn and 3.07 – 30.62 mg/L for Ca. Samples from Lake Oloidien and discharge canals show high levels of heavy metals compared to samples from other sites. The metal concentrations in the inflowing rivers were also high but decreased downstream as the rivers enters the lake indicating removal through natural processes. The agricultural sector is a major source of copper, lead, zinc and cadmium. Vehicles traffic pollution along the inflowing rivers was another important source of the metals. This was indicated by high heavy metal concentrations at points where the rivers crosses the highways. The study also indicates rapid removal of lead and copper from the waters which is thought to be due to water hyacinth. Dilution was also an important factor as the rivers and the canals discharge into the lake. The most important sources of heavy metals in the lake in order of volume of discharges are; flower farms, inflowing rivers, and Naivasha Municipal Council respectively. The heavy metals concentrations in the lake were lower than the maximum allowable limits in freshwater ecosystems.

Name of Journal/Conference Proceedings/Workshop: Green Chemistry Letters.

Year of Publication: 2010.

Name of Lecturer/Authors: Kigondu, E. V. M.; Geoffrey, M. Rukunga; **Joseph M. Keriko;** Isaiah O. Ndiege; Willy K.Tonui; Jeremiah W. Gathirwa; Peter G. Kirira; Beatrice Irungu; Johnston M. Ingonga.

Title of Publication: Anti-parasitics activity studies of some selected medicinal plants from Kenya.

Abstract: Indigenous rural communities in the tropics manage parasitic diseases like malaria and leishmaniasis using herbal drugs. The efficacy, dosage, safety and active principles of most of the herbal preparation are known. Extract from 6 selected plants species, used as medicinal plants by indegenous local communities in Kenya, were screened for in vitro anti-plasmodial and anti--leishmanial activity against a laboratory-adapted Plasmodium falciparum isolates (D6, CQ-sensitive and W2, CQ-resistant) and Leishmania major (IDU/KE/83 = NLB-144 strain). The investigation demonstrated the efficacy and safety of some extracts of plants that are used by rural indigenous communities for the treatment of parasitic diseases.

Name of Journal/Conference Proceedings/Workshop:	Journal of Ethnopharmacology 123: 504 – 509.
Year of Publication:	2009.
Name of Lecturer/Authors:	Muiva, L. M.; Yenesew, A.; Derese, S.; Heydenreich, M.; Martin, G. P.; Akala, H. M.; Norman, C.W.; Mutai, C.; Keriko, J. M. And Walsh, D.
Title of Publication:	Anti-plasmodial β-Hydroxydihydrochalcone from seedpods of *Tephrosia elata*.
Abstract:	From the seedpods of Tephrosia elata, a new β-hydroxydihydrochalcone named (S)-elatadihdrochalcone was isolated. In addition, the known flavonoid, obovatachalcone, obovatin, obovatin methyl ether and deguelin were identified. The structures were determined on the basis of spectroscopic evidence. The crude extract and the flavonoids obtained from the seedpods of this plant showed anti-plasmodial activities. The literature NMR data on β-hydroxydihydrochalcone is reviewed and the identity of some of the compounds assigned β-hydroxydihydrochalcone skeleton is questioned.
Name of Journal/Conference Proceedings/Workshop:	Phytochemistry Letters, 73, 1 – 3.
Year of Publication:	2009.
Name of Lecturer/Authors:	Wanyika, H. N.; Kareru, P. G.; **Keriko, J. M**.; Gachanja, A. N. Kenji, G. M. and Mukiira, N.
Title of Publication:	Contact toxicity of some fixed plants oils and stabilized natural pyrethrum extracts against adult weevils, Sitophilis zeamais Motschulsky.
Abstract:	The contact toxicity of some selected fixed plant oils and stabilized natural purethrum (Chrysanthemum cinerariaefolium) blends against adult maize weevils (Sitophilus zeamais) were investigated. Natural pyrethrum extracts was stabilized against ultraviolet (UV) light by blending with fixed oils extracted from Azadiachta indica A. Juss (neem tree), Thevetia peruviana (Yellow oleander) and Gossypium hirsutum L. (cottonseeds). Cottonseed oil had the highest stabilization effect on the pyrethrum blend exposed to UV light of 366 nm. The results indicated that the natural pyrethrum extract blended with cottonseed oil was the most potent against maize weevils and that the potency was concentration-time dependent. Cottonseed and neem seed oils enhanced the stabilization of the natural pyrethrum insecticide.
Name of Journal/Conference Proceedings/Workshop:	African Journal of Pharmacy and Pharmacology. Vol. 3 (2), 66 – 69.
Year of Publication:	2009.
Name of Lecturer/Authors:	Kareru, P. G.; **Keriko, J. M**.; Gachanja, .A. N.; Kenji, G. M.
Title of Publication:	Anti-microbial activity of Skincare products made from medicinal plant extracts.
Abstract:	In this study, Tithonia diversifolia Helms. (A. Gray), Aloe secundiflora (Miller) and Azadirachta indica (A. Juss) plant extracts were used to make herbal soaps while Thevetia peruviana (Schum) seed oil was used to make a herbal lotion for skincare. The soaps were tested for the inhibition of Escherichia coli and Candida albicans. The lotion

was evaluated against Staphylococcus aureus and E. coli. Although 'Tithonia diversifolia' soap exhibited the highest inhibitory effect on the test bacterial strains, it had the least inhibition against C. albicans. Results from this study indicated that the 'Tithonia diversifolia' soap would have superior skin protection against the tested bacteria but would offer the least skin protection against C. albacans. The herbal lotion inhibited S. aureus and E. coli in a concentration dependent manner. However, the inhibitory effect was more pronounced on S. aureus.

Name of Journal/Conference Proceedings/Workshop: African Journal of Traditional, Complementary and Alternative Medicines. (Received for review).

Year of Publication: 2009.

Name of Lecturer/Authors: Kareru, P. G.; Gachanja, A. N.; **Keriko, J. M**.; Kenji, G. M.

Title of Publication: Anti-microbial activity of some medicinal plants used by Herbalists in Eastern Province, Kenya.

Abstract: The aqueous extract from medicinal plants commonly used by herbalists in Mbeere and Embu districts of Eastern Province, Kenya, were tested for their inhibitory activity against three selected strains of bacteria. All the selected plants extracts (infusions: 1.0 g sample in 100 mL water) investigated showed activity against Eschirichia coli with inhibition zone diameter ranging from 5.8 - 18.0 mm. *Terminalia brownii* gave the largest inhibition zones against E. coli and *Staphylococcus aureus* respectively. Vernonia lasiopus and Tithonia diversifolia were inactive to S. aureus and *Bacillus subtilis* respectively. Eighteen and sixteen plants showed sensitivity of greater than 10 mm against *S. aureus* and *B. subtilis* respectively. All control discs gave zones of inhibition of 12 - 24 mm which were larger than those of the extracts. The present study validated the use of the selected medicinal plants by herbalists in the treatment of bacterial ailment caused by the strains of bacteria investigated. Medicinal plants used for non-bacterial diseases also exhibited sensitivity towards bacterial strains tested. This implied they could be used as multi-purpose medicinal plants.

Name of Journal/Conference *Proceedings/Workshop*: African Journal of Traditional Complimentary and alternative Medicine. Vol. 4 (1) 51 – 55.

Year of Publication: 2008.

Name of Lecturer/Authors: Kareru, P. G.; **Keriko, J. M**.; Gachanja, A. N.; Kenji, G. M.

Title of Publication: Direct detection of triterpenoid saponins in medicinal plants.

Abstract: Direct dection of saponins in medicinal plants using Fourier Transform Infrared (FT-IR) spectroscopy is reported in this paper. Crude dry plant powder were mixed with potassium bromide (KBr) powder and compressed to thin pellets for Infrared examination. FT-IR spectra of the test samples showed -OH, -C=O, C-H and C=C absorption characteristics of oleanane triterpenoid saponins. The C-O-C absorption indicated glycoside linkages to the sapogenins. Phytochemical analysis confirmed the presence of saponins in the tested specimens. *Entada leptostachya* was used as a reference sample. Dry plant powder was extracted sequentially with n-hexane, dichloromethane, ethyl acetate and methanol. FT-IR spectra of the reference sample powder and its organic solvent extracts showed

characteristic saponin absorption peaks. These results indicated that direct detection of saponins in medicinal plants was possible by infrared analysis. Lengthy exhaustive chemical analyses necessary for detection of saponins could be avoided.

Name of Journal/Conference Proceedings/Workshop: African Journal of Traditional, Complimentary and Alternative Medicine. Vol. 5 (1). 56 – 60.

Year of Publication: 2008.

Name of Lecturer/Authors: **Keriko, J. M.** and Mutua, M. M.

Title of Publication: Insecticidal activities of the exctracts of Sisal plant, *Agave sisalana,* (Agavaceae), against white termites, *Recticulitermes flavipes* Kollar (Rhinotermitidae)

Abstract: From 986 g of fresh chopped leaves of sisal plant, Agave sisalana, in a conical flask, methanol was added and left standing for three days. The filtrate obtained was then subjected to partition chromatography using n-hexane followed by dichloromethane to afford three soluble fractions. The three fractions were then concentrated separately in a vacuum before various samples for anti-termite and anti-brine shrimp assays were prepared. The three fractions indicated high toxicity levels, 100% mortality at a concentration of 1000 ppm against both, the white termite, Reticulitermes flavipes (Rhinotermitidae) and brine shrimps, Atemia salina. The methanol fraction showed relatively higher toxicity levels at lower concentrations compared to n-hexane and dichloromethane fractions.

Name of Journal/Conference Proceedings/Workshop: Journal of Agriculture Science and Technology, Vol. 10 (1), Pg 70 – 75.

Year of Publication: 2008.

Name of Lecturer/Authors: Nyakundi, P. A.; Inoti, I. K.; Thiongo, G. T.; **Keriko, J.**

Title of Publication: Impact of land use changes around Olkaria Geothermal power station.

Abstract: In Kenya, the most common form of industrial and domestic energy is electricity. It is generated from three main sources, hydro, geothermal and thermal, but the later is expensive due to the cost of importation of crude oil for its generation. Kenya's geothermal potential is in excess of 3,000 megawatts (MW) against the current national total generation of 1,117 MW. This form of energy is widely distributed in Olkaria, Naivasha. Exploitation of this energy requires a lot of land for the location of the power stations; wells stream transition pipes, roads, power transmision lines and residential housing for workers. It also requires a lot of water for drilling and construction. The setting up of the power plants in the study area has attracted other land use activities which too impact on land use and the water from Lake Naivasha, the only source of potable fresh water for the area's residents. There is continous development and exploitation of the geothermal power resources in the study area. In order to understand the magnitude of the impact, aerial photographs, 1975 topographical maps, sattlite images for 1975, 1985, 1995 and 2003 as well as personal observation since 1986, have been interpreted by use of Geographical Informaation Systems (GIS) and remote sensing (RS). These reveal intense land use changes which, if not managed, will lead to a lot of social, economic, health and environmental impacts.

Name of Journal/Conference Proceedings/Workshop:	Journal of Agriculture Science and Technology, Vol. 10 (1), Pg 106 – 118.
Year of Publication:	2008.
Name of Lecturer/Authors:	Kareru, P. G.; Kenji, G. M.; Gachanja, A. N.; **Keriko, J. M**.; Mungai, G.
Title of Publication:	Traditional medicines among the Embu and Mbeere peoples of Kenya.
Abstract:	Ethnobotanical information and traditional medicines were investigated and documented in Embu and Mbeere districts, Eastern Province of Kenya. Oral interviews were obtained from over 100 herbalists, both men and women aged between 40 and 80 years. All the herbalists interviewed were Christians and had little formal education. Non-Christian herbalists were purpoted to combine herbal medicines with witchraft and were not interviewed. Of the 40 commonly used herbal plants, 25 were used as multi-purpose medicinal plants (mpmp), while 15 were used to treat one disease type. There was correlation between the outpatient morbidity data at the local distict hospital, and the common incident disease treated by the herbalists. Generally, a decoction or infusion of the herb was recommended for the treatment of internal or external conditions of the patients. Malaria and typhoid were treatable with a total of 15 and 12 plants respectively and were among the first two commonest diseases found in the study area. Terminalia brownii was found to be the most used medicial plant either alone or combination with other herbs. The second and third most utilized medicinal plants were *Ovariodendron anisatum* and *Wurbugia ugandensis* respectively.
Proceedings/Workshop:	Journal of Agriculture Science and Technology, Vol. 10 (1), Pg 70 – 75.
Year of Publication:	2008.

9. SPORTS AND GAMES

Name of Lecturer/Authors: Leisure Sports Participation Patterns Of Post-Graduate Students: The Case of Kenyatta University, Nairobi, Kenya.

Title of Publication: **Andanje Mwisukha.**

Abstract: *Background:* The purpose of this paper was to investigate the reasons why post-graduate students don't participate in structured sport and their leisure activities. A cursory analysis of sports programmes in our universities reveals that undergraduate students are minimally involved, in sporting activities, yet universities have invested heavily in both sports infrastructure and human resource. Consequently the impelling need to unearth the reasons militating against post-graduates non participation in sport and their possible leisure patterns. *Methods:* Data was collected through questionnaires from 53 randomly selected post-graduate students of Kenyatta University. Data was manually analysed for frequencies and percentages. *Results:* Findings indicated that the post graduate students don't participate in sport due to lack of time, sport programmes not catering for their needs and too much academic work and engage in passive leisure activities of watching TV, spending time with the family and reading..This is contraindicative as they lament that there is no time to participate in sport programmes offered.

Conclusions: It was recommended that sport programmes in the University need to be made post-graduate students friendly and they need to be educated on the benefits of active lifestyles and management.

Name of Journal/Conference Proceedings/Workshop: Journal of Educational research and Development Vol. 4 No.2-August, 2009.

Year of Publication: 2009.

Name of Lecturer/Authors: **Elijah Gitonga Rintaugu.**

Title of Publication: Significant Others Influence On Socialization into Sport of Kenya Secondary School Athletes.

Abstract: *Background:* The purpose of this study was to investigate the influence of significant others in socialization into sports of secondary school athletes in Kenya. The three elements of sport socialization in the realm of social learning theory (SLT) include personal qualities, significant others and socializing situation. Therefore, the need to unearth the role of significant other (parents, peers, coaches and P.E teachers) in socialization into sport of secondary school athletes.

Methods: Data were collected through questionnaire from 636(320 males and 316 females) purposely selected from forty (40) secondary schools in Kenya. Data were analysed through chi-square test of independent measures and student t-test

Results: findings revealed that 500(7.8 61%) of the athletes took part in sport while in primary school as opposed to 136(2.1 4%) who did not take part with no gender difference. It was apparent that there were significant differences ($p<.05$) between male and female athletes on their initial entry into sport. Findings also revealed that a majority of 546(85.80%) of the athletes had their family members participate in sport while 90(14.20%) of the athletes family members did not participate in sport with no gender difference ($p<.05$). The influence of significant others in socialization into sport is mostly by the coach, followed by friends, P.E. teachers, brothers, father, sisters and the

mother with significant difference (p<.05)between male and female athletes.
Conclusions: It was recommended that parents needed to encourage their siblings to participate in sport and P.E teachers and coaches need to refocus on their roles in sport socialization into sport of secondary school athletes in Kenya.

Name of Journal/Conference Proceedings/Workshop: Journal of Educational Research and development Vol.4No.1-April, 2009.

Year of Publication: 2009.

Name of Lecturer/Authors: Mwangi Francis M., **Wanderi Peter M.** and Wamukoya Edwin K.
Title of Publication: Effects of Different Arm Actions on Performance in Long Distance Running.

Abstract:
Background: While most authors recommend that the arms should be moved back and forth with elbows held at about 90 degrees, some distance running athletes have used different arms movements with varying degree of success and failure during several international athletics competitions.
Methods: Ten elite Kenyan endurance athletes of both sexes were selected through purposive sampling procedures and tested in ten submaximal treadmill trial runs, each trial performed with different arm action for 15 minutes at a speed corresponding to individual's 80% running effort. Their working and recovery heart rates were monitored (using Polar heart rate monitor) during each trial, as well as the rating of perceived exertion (using Borg Scale of perceived exertion), ventilation rate (VR) and stride rate (SR). The values were recorded after every five minutes. The Cooper test was used to estimate the subjects' VO_2 max. Regression equations were used to estimate percentage of maximum oxygen consumption (%VO_2 max) and kilocalories expended (Kcl) from working heart rate values. *Results:* Significant difference was observed in WHR, %VO_2 max, Kcl, RPE, and SR at $p < .05$. Intraclass Correlation Coefficient (R) analysis of individuals' trial-to-trial test values showed high reliability for all the variables measurements and procedures. Medium effect size was observed; Omega Squared (ω^2) = .20, indicating practical significance of the results. *Conclusions:* The study concluded that arm action consisting of about ±20 degrees oscillation of the hands around 90 degrees angle at the elbow is more economical than running with the arm action recommended by many authors (with arms held at 90 degrees angle at the elbows), and that different arm actions have different effects on the various components of running mechanics.

Name of Journal/Conference Proceedings/Workshop: Pre-Olympic Games Scientific Convention: *International Convention on Science, Education and Medicine in Sport* held in Guangzhou, China, on 1st to 4th Aug. 2008.

Year of Publication: 2008.

SECTION D: CONTINUING EDUCATION PROGRAMME CENTRES (CEP)

1.0 INTRODUCTION

Jomo Kenyatta University of Agriculture and Technology (JKUAT) has been collaborating with various educational institutions in Kenya for the last ten years through the auspices of the Continuing Education Programme (CEP). There are 28 programmes offered at 35 University-approved centres.

In some of the centres mentioned under 1.2, the programmes have run full cycle and problems with regard to their quality have arisen. Some centres have even sequestered programmes previously offered by the University. In order to guarantee the quality of the programmes in the remaining centres, the Vice Chancellor, in her wisdom, constituted a committee in September, 2007 to investigate the quality of the University programmes offered at these centres.

1.1 PROGRAMMES OFFERED AT CEP CENTRES

A total of twenty eight (28) programmes are offered at the CEP centres. These are: Executive MBA, Bachelors degrees in: Information Technology (IT), Computer Technology, Business and Information Technology, Commerce, Commerce and Business Administration, Business and Office Management, Cooperative Business, Analytical Chemistry, and Medical Laboratory Sciences, Diploma programmes in Information Technology, Computer Technology, Management and Information Technology, Business and Information Technology, Purchasing and Supplies Management, Business Administration, Public Relations, Advertising and Sales, Mass Communication, Mechanical Engineering, Electrical Engineering, Clinical Medicine, HIV/AIDS Management, Community Development, Human Resource Management and Microfinance, Certificate courses in IT, Management and Information Technology and HIV/AIDS Management, and Bridging courses in IT, Mathematics, English, Chemistry, Physics and Biology.

1.2 LIST OF CEP CENTRES

The names of the 35 CEP centres are: Augustana College, Loreto College Msongari, Nairobi Institute of Business Studies, Kenya College of Accountancy University (Kisumu), Kenya College of Accountancy University (Nairobi), Nairobi Institute of Technology, Regional Centre for Mapping of Resources for Development, Pioneer International College, Kenya School of Professional Studies, Starehe Boys Centre, Kenya Armed Forces Technical College, Shepherd Foundation Education and Research Centre, Holy Rosary College, Zetech College, Embu College, Kirinyaga Technical College, Kenya Institute of Management – South C, Kenya Institute of Management – Nakuru, Kenya Institute of Management – Eldoret, Kenya Institute of Management – Kisumu, Kenya Institute of Management – Mombasa, Graffins College, Kenya Institute of Social Work and Community Development, Valley Business School, Wisemen Trainers and Consultants Limited, Cornerstone Training Institute, Megan College Lake Institute of Tropical Medicine, Cooperative College, Kenya College of Communication Technology,

Kenya Institute of Management, Nairobi Institute of Business Studies, Thika Institute of Technology, Muranga College of Technology, Kimathi University College of Technology, Tracom College (Nakuru), Alphax College (Eldoret) and Jaffrey Institute of Professional Studies (Mombasa).

OBJECTIVES OF AUDITING CEP CENTRES

The objectives of carrying out audit in CEP Centres are:

- To ensure that qualified and experienced resource persons servicing units at the affiliated institutions and approved centres are as per University policy.
- To ensure that academic resources availed to the students are relevant, adequate and meet University requirements.
- To ensure that there is provision of sufficient facilities at the affiliated institutions and approved centres for students' welfare.
- To ensure teaching is conducted in line with the syllabus.

1.1 HOW TO CONDUCT AUDIT IN CEP CENTRES

The quality audits are usually conducted according to DAQA "Scheduled Quality Audits of Affiliated Institutions and Approved Centers" procedure. The CEP Centres are expected to be cooperative during the audit in order to make the process successful. Most of the audit aspects are drawn from CHE and IUCEA Guidelines and as a result, CEP Centres are expected to fully adhere to these Guidelines.

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Institute of Tropical Medicine, Cooperative College, Kenya College of Communication Technology, Kenya Institute of Management, Nairobi Institute of Business Studies, Thika Institute of Technology, Muranga College of Technology, Kimathi University College of Technology, Tracom College (Nakuru), Alphax College (Eldoret) and Jaffrey Institute of Professional Studies (Mombasa).

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