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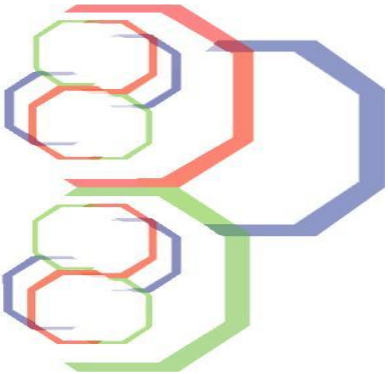

3rd International e-Conference on

Agricultural BioSciences 2010

(IeCAB 2010)

Book of Abstracts

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Foreword

The International e-Conference on Agricultural BioSciences 2010 (IeCAB 2010) held from June 1 - 15, 2010 is unique in that participants exhibit their presentations and interact entirely electronically, i.e. on the Internet. The major reason behind the conception of the e-conference is a desire to reduce the costs of participation, and thereby provide more opportunity for participation for scientists in developing countries. Participants incur no expenses for transportation, hotel accommodation, per diem, visa, etc since the conference can be attended from the office, home or any other place with Internet access.

The 3rd e-Conference has again received positive interest from scientists around the world. In addition to publishing the abstracts online, participants have an opportunity to electronically exhibit a poster and to publish full papers in the Journal of Applied Biosciences (ISSN 1997-5902) and in the Journal of Animal and Plant Sciences (ISSN 2071 – 7024). In addition this year is unique in that selected papers will be published as chapters in a book titled "The role of Agricultural Sciences Towards Achieving the Millenium Development Goals; Publisher: Elewa Biosciences; Assigned ISBN: 978-9966-7415-1-8 (Expected publication date: September 2010).

Proceedings of the 3rd International e-Conference on Agricultural BioSciences 2010

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This publication comprises the Book of Abstracts submitted for the 3rd e-Conference (IeCAB 2010). All full papers will be published in the ***Journal of Applied Biosciences*** and in the ***Journal of Animal and Plant Sciences*** in the issues of July-August 2010. Links to all outputs of this e-conference can be accessed at http://www.m.elewa.org/econferenceIeCAB.php.

F.A.C.T BioSciences Unit based at Nairobi, Kenya, co-coordinates this annual event. We hope it will stimulate your interest and provide a suitable outlet for scientists in developing countries to publish their outputs and hence contribute more to the global pool of knowledge. We gratefully acknowledge the support of all participants and members of the scientific committee who have reviewed the abstracts and the full papers.

M. Mwangi, PhD

Elewa BioSciences

Proceedings of the 3rd International e-Conference on Agricultural BioSciences 2010

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CROP (Agronomy)

Proximate traits of the seed and seed cake of shea butter tree (*Vitellaria pradoxa* C. F. Gaertn.) from Nigeria's savanna agroecological zone

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ABSTRACT

Introduction and objectives of the study: The shea tree has wide distribution in Nigeria. The seed fat has dietary, medicinal and commercial uses. However, proximate properties of the seed, much less the seed cake, of the Nigerian shea species have not been explored, which may partly explain the non-existent or low use of these products in the livestock feed industry. The objective of this study was to explore the proximate qualities of the seed and seed cake of the species across its distribution range in Nigeria.

Methodology and results: Proximate traits of the seed and seed cake of 8 accessions of ***V. paradoxa*** growing across the guinea and sudan savanna zones of Nigeria were investigated using standard laboratory procedures.

Results indicated significant variation in all seed proximate traits except ash, across agroecological zones. In terms of the kernel cake, only moisture and fibre contents varied significantly with agroecological zone. All proximate traits of the seed/cake varied remarkably across accessions. Variations in the energy and energy related proximate traits of the seed were 480.2 – 519.7 Cal/100g, 43.4 – 48.9% carbohydrate, 6.3 – 8.9% protein and 28.6 – 34.9% fat. Corresponding ranges for the seed cake were 305.2 – 348.6 Cal/100g, 58.4 – 71.9%, 7.6 – 10.1% and 2.8 – 4.0% for energy, CHO, protein and fat, repsectively. Principal component analysis identified energy related traits and fibre of the seed and all but fat of the seed cake as more discriminate traits for shea seed and seed cake classification on the basis of proximate quality. Substantial significant correlations occurred between the proximate traits of the seed and seed cake. Generally, the study established that shea seeds from Jalingo and Kachia locations had higher fat content. However, seed cake from Jalingo, Makurdi, Lokoja, Yola and Minna gave higher values of one or more of the energy related proximate traits of carbohydrate, protein, fat and energy.

Actual or potential application of findings: Results of this work are of interest to stakeholders seeking shea resources with high fat content in Nigeria and provide a basis for recommending shea seed and cake for the animal feed industry. It will also contribute to the effort to genetically upgrade the species in Nigeria.

Proceedings of the 3rd International e-Conference on Agricultural BioSciences 2010

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Key words: Agroecology, nutritional content, principal component analysis, shea kernel, trait correlations.

Determination of growth stages and seedling structures associated with slow growth of the shea butter tree (***Vitellaria paradoxa*** C. F. Gaertn.)

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ABSTRACT

Introduction and objectives of the study: The shea tree, ***Vitellaria paradoxa***, is of much dietary and socio-economic importance, which has made it the priority species for domestication in the semi-arid tropics. However, among some of the disturbing characteristics of the species under cultivation is its slow emergence and low growth rate. Admittedly, under favorable conditions, the seed of ***Vitellaria*** sprouts easily. However, its cryptogeal germination pattern makes the false radicle to grow downwards, form the shoot somewhere along its length which subsequently appears above ground. The time lag between the sprouting of the false radicle and emergence of the plumule above ground is long. Unfortunately, information on the relative period of growth of seedling structures which

could indicate the relative contributions of each structure to the long time it takes the plumule to emerge above ground is not available. It was therefore considered imperative in this study to monitor the germination and emergence processes of shea seedlings and identify which stages or seedling structures are responsible for emergence delays in this very important species. The knowledge obtained would contribute to efforts towards overcoming the characteristic slow emergence of ***Vitellaria*** seedlings.

Methodology and results: Duration and growth of seedling structures of ***V. paradoxa*** of three accessions– Makurdi, Jalingo and Kano – were investigated at Makurdi, Nigeria, in 2007. Ten (10) seeds per accession were planted in 7-litre plastic containers filled with weathered saw dust at the rate of one seed/container, with each seed representing a replicate. The experiment was a completely randomized design (CRD). Weekly observations for germination and growth of seedling structures were done on the seeds or seedlings. Results of analysis of variance indicated that accessions differed with respect to days to appearance of swelling, length of radicle at which swelling appeared and shoot length above ground at the time of emergence. Similarly, the percentage of seedlings that sprouted during the first week of observation differed in favour of seeds from Makurdi (80%) and Kano (60%), while seeds from

Jalingo began sprouting after two weeks of planting. Seedling emergence spanned from 51-79 days. It was evident that the accessions followed the pattern of germination and growth associated with ***Vitellaria***. However, time to sprouting, formation of swelling, splitting of swelling for shoot formation and formation of shoot to its growth and emergence could account for the long time it takes for the seedling to emerge above ground.

Actual or potential application of findings: Results of this study will help in focusing future efforts at overcoming seedling emergence delays in this species to the identified specific seedling structures and stages.

Key words: Accessions, duration, growth, seedling structures, ***Vitellaria paradoxa***

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Determination of Mineral Composition of Some Varieties of Iranian Dry Bean (*Phaseolus vulgaris* L.)

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ABSTRACT:
Grain legumes can contain all fifteen of the essential minerals required by man, although concentrations will vary in response to both genetic and environmental factors. The common bean is one of the most important food legume, providing essential nutrients for millions of people in developing countries. Given the widespread use of beans throughout the world, efforts to improve their micronutrient content may benefit people.
The data collected suggest that there is sufficient genetic variability to increase significantly mineral concentrations in common beans.
The objective of this study was to determine iron, zinc, copper, manganese, boron, phosphorus, potassium, calcium and sodium content in fifteen genotypes related to three varieties (red, Chiti and white) of Iranian common bean. In the evaluation of bean genotypes observed , there was a significant difference ($P<0.01$) in Fe, Zn, Cu, Mn, B, P, K, Ca and Na content between the 15 genotypes and in a range of 50.37 to 118.35 ppm for iron, 28.01 to 47.55 ppm for zinc, 11.94 to 16.85 ppm for

copper, 12.68 to 23.73 ppm for manganese, 0.44 to 0.55% for phosphorus, 1.5 to 1.78% for potassium, 0.15 to 0.29% for calcium and 0.014 to 0.041% for sodium . A Comparison between three varieties of red, Chiti and white, revealed that there was no significant difference in Zn, Cu, B and Ca content but there was a significant difference ($P<0.01$) in iron, manganese and sodium content. The red bean variety had the highest iron content and white bean variety had highest Mn and Na content. There were significant difference ($P<0.05$) in phosphorus and potassium content. Chiti bean variety had highest phosphorus and potassium content in present study. In this study there was a significant ($P<0.01$) correlation between Ca and Fe content of genotypes but there wasn't any statistically significant correlation between other mineral elements.

Key words: Common Bean, Varieties, Mineral Content, Genetic Diversity.

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The effects of application of a microorganism mixture (EM) as a bio-fertilizer on yield and protein content of corn forage (KSC 704)

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ABSTRACT

In this study, effects of a microorganisms mixture (EM) and two kinds of fertilizer was determined on yield, and protein content of corn forage. In order to study the effects, EM as the first factor was sprayed in three levels: 1= no spray or control, 2= $^{1}/_{200}$ concentration and 3= $^{1}/_{500}$ concentration. Fertilizer was the second factor with 1=without fertilizer, 2= chemical fertilizer, and 3= farm yard manure (FYM). The study was designed in a complete block design in four replicates and factorial experiment. The results highlighted that EM, promotes plant growth, seed size, plant height, leaf area index, 1000 seeds weight, fresh and dry ear weight, and seed percentage significantly. The EM had no significant effect on forage CP content. The organic fertilizer (FYM) increased CP significantly, but the chemical fertilizer no had significant difference with control (without fertilizer). The greatest yield was related to interactions

of: No fertilizer 1/500 EM. Thus application of EM would helps to improve agriculture production.

Key words: Effective Microorganism, Chemical fertilizer, Organic fertilizer, Yield, Crude protein, Corn forage.

The application of organic farming for sustainable fruit production in Kenya

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ABSTRACT

Organic agriculture is a holistic production and management system which promotes and enhances agro ecosystem health, including biodiversity, biological cycles and soil biodiversity activity. It emphasizes the use of management practices in preference to the use of off-farm inputs, taking into account regional conditions. Organic agriculture uses, where possible, agronomic, biological and mechanical methods, as opposed to using synthetic materials, to fulfill any specific function within the system. Since excessive use of potentially harmful agrochemicals may affect biodiversity, environmental quality, food safety and farmer's health, there is increased interest in more sustainable production

systems such as organic farming, with minimum synthetic pesticide and fertilizer use. Benefits of organic farming include preservation of both ground water resources and fragile ecosystems; allowing growers to benefit from special marketing riches and grower-friendly price mechanisms. Consumers are also increasingly avoiding fruits from synthetic chemical fertilizers and pesticides because of the risks involved in health and environment. The horticultural industry in Kenya is the fastest growing agricultural sub-sector in the country. This progress has come due to considerable investment in production infrastructure at all levels, largely funded by the private sector. This paper reviews the potential of applying organic farming in Kenya especially on farming systems that can be transformed into organic systems easily with tree crop products as an additional source of income and poverty alleviation.

Key words: Organic farming, fruit production

Proceedings of the 3rd International e-Conference on Agricultural BioSciences 2010

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Evaluating health of macropropagated banana seedlings

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ABSTRACT

Objective of study: Banana (Musa spp.) is one of the most important food and cash crops in parts of Kenya. The crop provides food security, nutrition and income for many smallholder farmers. Bananas can be eaten fresh, cooked or processed into numerous value added products, depending on the variety. Despite the importance of the crop, it faces major production challenges including scarcity of high quality seedlings, insect pests and diseases. Naturally produced suckers are more likely to carry pests and diseases leading to reduced productivity and shortened lifetime of new plantations. Demand for disease free high quality planting materials has been on the increase. To address this demand macropropagation has been introduced as an alternative seedling production technology. The technology requires little capital and skill to

implement, and can therefore be promoted to small scale seedling entrepreneurs and farmers. However, some aspects of the technology require further research to ensure quality of seedlings. This study is being carried out to establish the effectiveness of macropropagation technology to produce disease free banana seedlings.

Methodology: The study will commence with a survey to identify the key diseases and insect pests of bananas in Eastern and Central Kenya. Macropropagation nurseries for research will be established at Kenyatta University. Pests and pathogens will be isolated from banana corms and their importance in health of seedlings determined through pathogenicity tests.

Expected outputs: The information obtained through the study will contribute to improvement of the macropropagation protocol to ensure the propagated seedlings are free from pests and pathogens.

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Timing of bunch pruning management enhances bunch and fruit qualities of 'PITA 24' plantain (*Musa* AAB) hybrid

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ABSTRACT

Objective: Reports on the effects of sink-source modifications on banana fruit growth differ between studies; and may be related to differences in fruit age at the time of bunch pruning . Timing is a highly crucial factor in routine horticultural practices as inappropriate timing may not be effective. This study investigated the post-anthesis period at which bunch pruning would be most effective in enhancing post harvest qualities of plantains.

Methodology and results: Bunch pruning (i.e., removal of two distal hands and the male bud) was applied at full anthesis (at opening of last female hand) and at weekly intervals of 1, 2, 3 or 4 weeks thereafter. These were compared to a non-prune control in a randomized complete block design trial. Data were collected at harvest on bunch weight, hand and fruit count, bulking duration, bunch-fill index (BFI) and number of properly-filled fruits (PFF) per bunch. Other data were

harvest index (HI), fruit weight, length and girth, pulp dry matter content and fruit edible proportion. Bunch and fruit quality traits generally improved with bunch pruning up till 3 weeks after the full anthesis, but best fruit traits were obtained when pruning was applied immediately after the opening of the last female hand. There was a drop in BFI, PFF, HI, fruit yield and individual fruit size when bunch pruning was delayed for 4 weeks after full bunch anthesis.

Conclusion and application of findings: Our results confirmed that bunch and fruit qualities of plantains could be improved through a judicious and timely application of bunch pruning. Bunch pruning management should not be delayed beyond 3 weeks after the opening of the last female hand for optimum result.

Key words: Bunch pruning, timing, bunch and fruit traits, plantain.

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Region of bunch pruning influenced the bunch and fruit physical traits of 'PITA 24' plantain (***Musa*** AAB) hybrid.

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ABSTRACT

Objective: Achieving maximum uniformity of fruit size within a banana or plantain bunch is highly important and has commercial implications. In bananas, distal fruits which often do not reach commercial size constitute a loss through respiration and redistribution of dry matter with no commercial value. This study aimed at promoting uniformity in fruit size and quality within a bunch through pruning at opposite ends of a developing infrutescence.

Methodology and results: Treatments comprised of proximal pruning (PP), distal pruning (DP), pruning at both ends of the bunch (BE) and a no-prune control. These were evaluated in randomized complete blocks of four replicates. Two nodal clusters (hands) were severed from the developing bunch as soon as the last female

hand opened. Male bud was removed in all the pruned bunches. Data were collected at harvest on bunch weight, hand and fruit count, bunch-fill index and number of properly-filled fruits per bunch. Others were harvest index, fruit weight, length and girth, pulp dry matter content and fruit edible proportion. Results showed a non-significant difference in bunch weight between the treatments, although fruit and bunch yield drastically reduced in the proximally pruned bunches. Bunch and fruit metric traits were similar and superior in bunches pruned at the distal (DP) and both ends (BE) of the bunch. Bunches pruned at both ends also produced fairly uniform fruits.

Conclusion and application of findings: Our results revealed that an improvement in fruit yield and quality could be achieved through selective removal of some distal fruits with the terminal bud, but a complementary excision of some proximal fruits is necessary when uniformity of fruits is desired.

Key words: Bunch yield, fruit quality, bunch pruning, plantain.

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Effect of organomineral and inorganic fertilizers on the growth, fruit yield and quality of pepper (*capsicum frutescence*)

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ABSTRACT

Objective: To determine the effect of organomineral and inorganic fertilizers application on the yield and nutrient compositions of pepper (***Capsicum frutescence***) so as to form an objective basis for selection of fertilizer and growth improvement strategies.

Methodology and results: Pepper seedlings were treated with two levels of NPK (0 and 250 kg. ha^{-1}) and five levels of organomineral fertilizers (0, 2, 3, 4 and 5 t. ha^{-1}) and their various combinations. The treatments were assigned randomly and arranged in a randomized complete block design fitted into a factorial experiment, each with three replicates. Pepper growth, seed yield and quality attributes were assessed and subjected to analysis of variance. The growth parameters such as plant height and number of leaves showed increasing response to all the treatments as the rate increased. The yield components increased as the rate increased from 0 to 4 t. OMF ha^{-1} and thereafter reduced at 5 t. OMF ha^{-1}.

The optimum yield of pepper was obtained from sole application of NPK at 250 kg.NPK ha^{-1}. The combined application of 4 t. OMF and 125 kg. NPK ha^{-1} gave the highest fruit yield performance of pepper. The concentration of essential elements increased with treatment rates. These were significantly affected by the various treatments except for the effect of NPK on Ca and Mg.

Conclusion and application of findings: The study revealed that yield and nutritional quality of pepper fruit in the Guinea savannah of south western Nigeria could be significantly improved by the sole application of 4 t. OMF ha^{-1} and 250 kg NPK ha^{-1}, and by their combination at 4 t. OMF and 125 kg NPK ha^{-1}.

Key words: ***Capsicum frutescence,*** NPK, organomineral, yield, quality.

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Evaluation of a rapid multiplication method for pineapple (*ananas comosus*)

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ABSTRACT

Objectives: To improve pineapple production by increasing availability of planting materials through the use of rapid multiplication method.

Methodology and results: The study evaluated the best corm size and cutting method. The treatments included three lengths of corm cutting; 5cm, 7.5cm and 10cm, having both sliced and unsliced corm cutting methods. The sliced and unsliced corm cuttings of different sizes were planted on sawdust: poultry manure (1:1) mixture and watered fortnightly. Plant height and number of leaves of sprouted plants at transplanting were significantly affected by all the treatments and their various combinations. Number of sprouted plants was significantly ($P \leq 0.05$) influenced by cutting lengths, corm cutting methods and the interactive effects of length and cutting method at each sampling occasions. The sett size of 7.5cm with sliced method of cutting gave the best growth parameters and higher number of sprouted plants than the other cutting sizes.

Conclusion and application of findings: Based on the results 7.5cm long cuttings made by slicing method, which produced more planting materials and better percent plant survival in the field, can be recommended as a rapid multiplication method for pineapple.

Key words: ***Ananas comosus***, corm size, cutting method, sprouting, plant, growth.

Effect of nursery media on emergence and growth of tamarind (***Tamarindus indica*** L.) seedlings

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ABSTRACT
Introduction and Objectives of the Study: Although tamarind can be considered an ornamental plant, it is much more valued as a fruit tree. The pods from this tree are regarded as its most important product. Modern trends in tamarind plantation establishment are moving away from planting at stake to raising seedlings in the nursery which are later transplanted to the field. However, tamarind seedling emergence could be slow and erratic, spreading over a period of two months even with pretreatment. Its growth rate could equally be

slow. However, the use of a suitable nursery medium could address both problems. Generally, growth medium has been adjudged the most critical factor determining seedling quality in the nursery. The objective of this study was to assess tamarind seedling emergence and growth response to rice hull and saw dust based media with a view to identifying the best media for the raising of tamarind seedlings in the nursery.

Methodology and Results: Four growth media were evaluated for their effect on seedling emergence and growth of tamarind seedlings in the nursery. The nursery media comprised two rice hull based media (RHB) and two saw dust based media (SDB) formulated on volume basis in the following ratios: 1:2:3 (rice hull: poultry manure: river sand), 2:3:1 (rice hull: poultry manure: river sand), 1:4:3 (Saw dust: poultry manure: river sand) and 1:2:3 (Saw dust: poultry manure: river sand). The soilless nursery media, filled into 7-litre plastic containers, were laid out in completely randomized design (CRD) replicated five times. Analysis of variance revealed significant effect of growth media on emergence and seedling growth of tamarind. Thus, the saw dust based media exhibited superior performance in most of the emergence and seedling growth characters considered, including dry matter attributes. This has been ascribed to the use of well weathered saw dust and inclusion of higher proportions of poultry manure in the saw dust based media which may have supplied adequate levels of nitrogen to compensate for nitrogen depletion

occasioned by microbial decomposition characteristic of saw dust.

Actual or potential application of findings: The results of this can be utilized by farmers and other stake holders interested in raising quality tamarind seedlings. The technology is simple and within reach given the ready availability of nursery media constituents.

Key words: Emergence, dry matter, growth media; seedling growth, tamarind seedlings.

Production de matière sèche, rendement et composantes du rendement en grains du riz cultive en condition de toxicité ferreuse

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RESUME

En zone tropicale, la culture du riz (***O ;ryza sativa*** L), de bas-fond (avec ou sans contrôle de l'eau), est souvent confrontée au problème de toxicité ferreuse. Cette contrainte édaphique est couramment observée dans les bas-fonds ouest africains. C'est un trouble nutritionnel associé à de fortes concentrations de fer dans la solution du sol. Les conditions réductrices que l'on rencontre couramment dans les sols engorgés de bas-fond sont précurseurs de la toxicité ferreuse par la solubilisation dans la solution du sol de la quasi-totalité du fer sous forme ferreux (Fe^{2+}). Ce fer ferreux (Fe^{2+}) est absorbé en abondance, se concentre dans les feuilles, entraînant une décoloration des limbes, une réduction du tallage, de la taille des plants, et provoque une baisse importante des rendements.

Une étude a été réalisée afin de déterminer l'effet de la toxicité ferreuse sur le rendement et les composantes du rendement du riz. Quatre variétés de riz (BKE189, CG14, CK4 et TOX3069), à sensibilité différente à la toxicité ferreuse, ont été cultivées en champ à Bouaké (site non toxique) et à Korhogo (site affecté par la toxicité ferreuse). A la récolte, la quantité de matière sèche, le rendement en grain du riz et les composantes du rendement (masse de 1000 grains, densité de panicules, nombres de grains par panicule et le taux de fertilité) ont été évaluées. La toxicité ferreuse a entraînée chez les variétés cultivées, une diminution significative de la quantité de matière sèche et du rendement en grain sauf chez CG14. Par ailleurs, la masse de 1000 grains a diminuée de manière significative à Korhogo pour l'ensemble des variétés testées alors que les autres

composantes du rendement n'ont pas montré de différence significative entre leurs moyennes obtenues à Bouaké et à Korhogo.
En outre, les variétés résistantes CG14 et CK4, n'ont pas montré de différence significative entre leur indice de récolte à Bouaké (0,25 et 0,30 pour CG14 et CK4, respectivement) et à Korhogo (0,27 et 0,23 pour CG14 et CK4, respectivement) au contraire des variétés sensibles BKE189 et TOX3069. Tous ces résultats montrent que la toxicité ferreuse entraîne chez les variétés sensibles une perturbation de la distribution des synthétisats produits dans les feuilles, ce qui a pour conséquence un mauvais remplissage des grains lors de la formation de ceux-ci d'où des grains plus légers à la récolte.

Mots clés: ***Oryza sativa***, Riz; Bas-fond; Toxicité ferreuse;composante du rendement, Côte d'Ivoire;

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Evaluating seedling production efficiency of different banana propagation methods (*proposed graduate research project*).

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ABSTRACT

Bananas are one of the important crops for food security and income in parts of Kenya. Promoting banana production in the country is therefore one strategy to enhance food security since bananas diversify the food crops base, and they can also remain productive even under poor rainfall distribution that is frequently associated with changing climatic condition. Availability of high quality seedlings has been a serious constraint to most farmers who wish to establish new or expand their existing banana plantations. Natural regeneration of banana seedlings that most farmers depend on is slow and may be a source of pests and disease spread between farms in different locations.

Considering the inefficiency of natural regeneration methods, better methods of propagating banana seedlings are required. To improve adoption among small scale banana farmers, a suitable method should preferably be less expensive and less sophisticated to implement. In this proposed research study, banana cultivars with high market demand in different agro ecological zones will be identified through a survey. . The propagation efficiency of the identified varieties will be studied and compared using three methods, i.e. macro-propagation, micro-propagation and natural regeneration. The methods will be compared based on number of seedlings produced within a pre-determined period (six months), cost, resources and skills required. Seedlings produced using each of the three methods will be planted in the field to compare growth in terms of establishment and vigour of individual plants. Data generated will form a basis for recommending the best cultivars for different agro-ecological zones and the most viable and economical seedling propagation method.

Key words: macropropagation, bananas

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Research gaps on passion fruit diseases in Kenya

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ABSTRACT

The passion fruit industry contributes substantially to the Kenyan economy. However, farmers have experienced significant yield losses during the past two years, leading to the need for research to identify the causal pathogens and develop effective management methods. Towards this end, consultations were planned with key players in order to identify a potential research topic that could be addressed as part of a study leading to the award of an M.Sc. degree at Kenyatta University in 2010 - 2011.The first meeting was held on 9th April 2010 at the Kenya Agricultural Research Institute (K.A.R.I) Thika During the discussion, it was pointed out that the major cause of the drop in passion fruit production has been disease infestations, primarily fungal and viral pathogens. The main fungal diseases have been identified to be Fusarium wilt and the

dieback attributed to ***Phytophthora*** spp., while the main viral disease is caused by the woodiness virus. It was further observed that substantial research has been undertaken on these diseases leading to reduced incidence in some cases. However, in the recent past, the dieback disease has increased in importance. The disease is characterized by severe rapid infection leading to yield reduction of over 60%. The knowledge available suggests that the disease involves a complex of several organisms. Its epidemiology has also not been systematically and comprehensively investigated. Considering the current and increasing importance of the dieback disease to the passion fruit industry, it was identified as one of the potential areas for research which could have immediate impact on the livelihoods of the passion fruit industry dependents. It was therefore agreed that a research project will be implemented to more deeply investigate the etiology and epidemiology of the dieback disease. It is expected that the outcomes of this project will contribute towards sustainable management of the disease and at the same time generate data for a Master of Science degree thesis.

Key words: research, passion fruits

Proceedings of the 3rd International e-Conference on Agricultural BioSciences 2010

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Effects of organo-mineral and inorganic fertilizers on the growth, fruit yield, quality and chemical compositions of okra

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ABSTRACT

Objective: To determine the effect of different levels of organo mineral and inorganic fertilizers on the growth, yield quality and chemical compositions of okra.

Methodology and results: The treatments consisted of three levels of NPK fertilizer (0, 150 and 200kg NPK ha^{-1}), and four levels of organo mineral fertilizer (0, 2, 3 and 4 t. ha^{-1}) used solely or in combination in a factorial laid out as a complete randomized block design with three replications. The data collected were number of leaves, plant height, number of fruits and fruit yield. The leaves, fruits nutritional contents and quality were also assessed. The results showed that application of organo mineral and inorganic fertilizers singularly or in combination influenced the parameters assessed. Sole application of 150kg NPK ha^{-1} or 3 t. ha^{-1} organo mineral fertilizer gave the highest growth, yield and quality of

okra. However, there was no significant difference in the crop performance under these two fertilizer regimes. The combined application rates of 75kg NPK and 3 t. ha^{-1} organo mineral fertilizer gave the best okra performance compared to other treatments.

Conclusion and application of findings: From the results, combined application of the two fertilizers type will reduce the farmer's budget for crop fertilization. Inclusion of organic fertilizer in the combination would be suitable to reduce pollution of the environment.

Key words: ***Abelmoschus esculentus***, organo mineral fertilizer, inorganic fertilizer, okra quality, fruit yield.

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FOOD TECHNOLOGY

Consumption pattern and characteristics of potato crisps in Nairobi city, Kenya

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ABSTRACT

Objective: To determine the consumption pattern and characteristics of potato crisps in Nairobi City, Kenya.

Methodology and results: Potato crisps consumption pattern was studied using studied structured questionnaires to collect data from 215 crisps consumers. A total of 80 shops were surveyed to establish the brands and characteristics of potato crisps sold within Nairobi City. The available brands were then sampled and evaluated at the University of Nairobi. Of the sampled 215 consumers were males while 67.4 % were females. A majority, 73.9 % consumed potato crisps on average once a week. A part from

gender, the frequency of purchasing crisps was also influenced by factors such as occasions, seasons and availability of money. Most consumers (22.3 %) preferred Tropical heat brand, 10.82 % preferred Krackles while the least (0.57 %) preferred Pringles, Delice and Highlands crisps. The most preferred flavor was onion and slightly salted crisps. The most purchased packaging units (51.7 %) ranged from 30-50 g due to affordability, retailing at Kshs. 30-40 (about 0.5 USD) compared to units of 150 g and above that were least purchased (1.7 %) due to their high costs, retailing at Kshs. 100 (about 1.5 USD) and above. A total of 28 % of the consumers bought crisps for self-consumption while 72 % purchased both for self and family members. All the outlets surveyed (100 %) sold potato crisps. Only 15 % of the outlets stocked potato crisps and other potato products such as ***chevda*** and potato sticks. A total of 24 brands of crisps were sold in Nairobi city. The most stocked brands in the outlets were Tropical heat and Krackles that were available in 46 and 45 % of the outlets surveyed, respectively. All the shops surveyed stocked brands of crisps made in Kenya while only 15.3 % of the outlets also had imported brands. The units of packaging ranged from less than 10 g to 1 kg. The most popular unit packages (40 %) varied from 10 to 100 g as they were cheap and affordable to most customers selling between Kshs. 10 to Kshs. 60. The study indicates that potato crisps are highly consumed by young children and youths in their teen ages while parents were moderate buyers of the products. Laboratory

characteristics of the brands evaluated included colour, size, thickness, moisture, salt and oil contents that significantly (P≤0.05) differed among the brands. The oil content ranged from 24.37 to 40.22 % while the moisture and salt contents varied from 1.09 to 5.45 %, and 1.10 to 2.96 %, respectively.

Conclusions and application of results: Consumption of crisps in Nairobi city depends on gender, occasions, and seasons of the year and availability of disposable income. Except in the sizes, most brands had characteristics that conformed to the standards set for crisps. This study provides a view of the current scenario in the crisp market and is useful information to consumers, processors and policy makers in the potato sub sector.

Key words
Potato brands, consumers, oil content, salt content.

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Characteristics of potato crisps processing industries in Kenya

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ABSTRACT

Objective: To characterize the potato crisps processing industry in Kenya in terms of preferred potato varieties, constraints and pre-processing storage practices.

Methodology and results: A total of 24 brands of potato crisps had earlier been identified from supermarkets and kiosks in Nairobi city and with appropriate contact information provided on the labels, the processors were contacted, visited and interviewed. A total of 23 processors traced up to within and around Nairobi city and Nakuru Town were interviewed between October 2009 and February 2010. Data was collected using structured questionnaires administered to managers or owners of the processing firms. The number of

employees ranged from 2 to 250 and 60.9 % of the processing industries had 5 or less employees, 21.7 % employed 6-10 people while only 4.3 % had over 100 employees. In addition to potato crisps 60 % processed peanuts, 30.4 % processed ***chevda*** and potato sticks, 26.1 % processed pop-corns, 13 % processed banana crisps, and 8.7 % processed cassava crisps while 4.3 % also processed arrow roots crisps, spices, peas and herbs. A total of 4.3 % pointed at lack of proper equipments and market, 63.6 % complained of lack of and poor raw potato quality while 42.5 % cited lack of finances to increase volume of production. Majority (82.6 %) of the processors sell their products to supermarkets compared to a few (4.3 %) that sold their products to wholesalers while 13 % sold to individuals and kiosks. Potato variety Dutch Robjyn grown mostly in Bomet district of Rift Valley province is the cultivar of choice for many processors in Kenya. Other cultivars have been used in processing through trial and error when there are insufficient amounts of Dutch Robjyn.

Conclusions and application of results: The potato crisps processing industry in Kenya is largely dominated by small scale processors who are faced with a myriad of problems including price fluctuations of raw potato, unavailability and poor quality of raw potatoes, and lack of skills and information in raw potato storage. The industry relies heavily on only one variety that is not always available to meet the needs of all the processors. The information generated in this study is critical to potato breeders, and it provides strong

justification for breeding more crisping cultivars. Post harvest technologists can use the information to research on performance of other potato cultivars for processing potato crisps in Kenya.

Key words: Potato, processors, crisping, cultivars.

Characteristics of fresh (ware) potato traders in Nairobi and Nakuru towns, Kenya

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ABSTRACT
Objective: The potato being an important food crop in Kenya employs over 2.5 million people along its value chain thereby contributing to food security and poverty alleviation. The fresh (ware) potato market is an integral part of this chain. The potato market in Kenya

has been assumed to have defined structure with various limitations that require urgent redress. This study was therefore designed to characterize potato sellers in terms of location, volume of sale, customer base, sources of information, variety most traded, demand and supply variations and handling practices by the traders.

Methodology and results: A total of 169 potato sellers were interviewed in Nairobi and Nakuru town markets and selling points. About 25 % of the respondents were located in Nakuru town while the majorities (75 %) were located in Nairobi. A large number (70 %) of respondents traded in potatoes as the only source of income while 30 % traded in other fresh produce in addition to fresh potatoes. The average daily sales in terms of quantity were 200 kg while sales volume in monetary value ranged from Kenya shillings 5, 000 – 31, 500. Demand by customers varied highly (99 %) with seasons being low between January and March which coincide with harvesting seasons but improves between April and June to 24 % when the glut reduces and reaches a peak high in July-August (79 %) when most stocks of fresh potatoes have run out of season. The demand for fresh potatoes was significantly ($P \leq 0.05$) correlated ($r = -0.96$) to the supply. The main customers of the fresh potatoes were individuals who bought the produce for home consumption. Other customers included wholesalers and traders (23 %) and outside catering (21 %) while kiosks and supermarkets were the least buyers at 3 % and 0 % respectively. The potato variety sold by most sellers was Cangi (42 %) followed

by Tigoni (34 %) while Nyayo and Meru were the least traded (4 %). Most (48 %) traders depended on the farmers and fellow traders (41 %) as sources of information compared to Ministry of Agriculture (7 %) and other researchers (4 %).

Approximately 56 % of the respondents stored fresh potatoes for between 1-3 weeks in gunny bags at their premises with reported losses mainly due to rotting (69 %) and greening (31 %). Traders lacked proper skills of handling and storage of fresh potatoes required to prevent these losses.

Conclusions and application: Many kenyans depend on fresh (ware) potato trading as a source of income. The demand is, however, dependent on seasons. There is general lack of skills and capacity for handling and storing potatoes. This information is vital for the purposes improving quality of potato for processing since these markets are the major sources of raw potatoes for the many small-scale crisps processors in Kenya. The gap in potato handling and storage skills could be bridged through appropriate training of the traders.

Key words: potato handling, potato traders, Cangi, Tigoni

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CROP (Genetics and Biotechnology)

Identification of molecular markers linked to drought tolerance using bulked segregant analysis in Kenyan maize (***zea mays*** l) landraces

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EXTENDED ABSTRACT

Introduction: Drought is an important climatic phenomenon, which is the second most severe limitation to maize (***Zea mays*** L.) production in developing countries, after low soil fertility. Maize is particularly sensitive to water stress at reproductive stages, and breeding to improve drought tolerance has been a challenge. When drought occurs just before or during the flowering period, it results in delayed silking and a consequent increase in the length of anthesis-silking interval (ASI) (Li ***et al.***, 2003). Selection for reduced ASI has shown correlated response to improved grain yields under drought (Banziger ***et. al.***, 2000). However, conventional selection has been limited

by the difficulty in establishing uniform experimental conditions to eliminate environmental effects and their possible interactions with the genotype (Ribaut ***et al.,*** 2002; Campos ***et al.,*** 2004). The objectives of this study were: (i) to identify SSR polymorphisms for ASI between the parents and the F_2 population developed from selected Kenyan maize landraces; (ii) to determine correlations between morphological traits such as ASI, grain yield and SSR markers (iii) to estimate co-segregation of SSR candidate markers and ASI.

Methodology: An F_2 population of 203 individuals developed from a cross between drought susceptible (KCB) and drought tolerant (GBK032357) maize landraces was screened under drought to categorize into tolerant and susceptible groups. Based on the ASI values derived through the BSA procedure, the DNA from the 10 most drought tolerant and 10 most drought susceptible F_2 plants was used to make DNA pools. These DNA pools and DNA from parents were assayed at 109 loci using SSR primer pairs. Polymorphic candidate markers were then confirmed on the 20 individuals making up the bulks, alongside the parental DNA. Association between markers and quantitative traits in the F_2 individuals selected for the bulked segregant analysis was determined by regression analysis. A $p < 0.05$ value based on the F-test significance, was used as the threshold for considering the likely presence of a candidate QTL near a marker (Crouzillat ***et al.***, 2000).

Results: The investigation of polymorphic candidate markers on the 20 individuals used to make DNA bulks

revealed four genomic regions associated with ASI. These were regions near markers ***p-umc2189***, ***p-bnlg1179*** and ***p-bnlg1014*** on chromosome 1 and ***p-umc1542*** on chromosome 2. Together, the candidate QTLs accounted for about 65% of the observed variation for ASI. Significant phenotypic correlations among flowering parameters, grain yield and yield components were observed. Overlaps between the corresponding candidate QTLs were also observed. For instance, markers p-***umc2189*** and ***p-bnlg1014*** showed significant association with female flowering time (FFT) whereas markers ***p-bnlg1179*** and ***p-umc1542*** showed significant association with both kernel number (KN) and grain yield (GY). This finding could imply pleiotropism between loci for ASI and FFT, KN and GY. The candidate QTLs identified in the study may be useful in developing molecular marker assisted selection strategies to transfer drought tolerance traits from the local landraces into the elite varieties. However, the candidate markers as identified here need to be screened in the entire F_2 population and further analysis be carried out to confirm and Map these QTLs. The candidate QTLs should also be tested in varied environments to establish their stability.

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Genome variability and plant age influenced susceptibility to moisture stress in the cultivated bananas (***Musa*** species).

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ABSTRACT

Objective: Water stress is one of the major environmental constraints that limit crop productivity worldwide. As a consequence of climatic change, moisture availability (in terms of quantity, quality and duration) has become very unpredictable in most places. In this study, the effects of moisture stress on six ***Musa*** genotypes were investigated at varying plant ages to ascertain the influence of age and genome composition on the susceptibility of ***Musa*** plants to transient drought condition.

Methodology and result: A six-week moisture stress was imposed on six ***Musa*** genotypes comprising the dessert bananas (AAA), plantains (AAB) and the ABB cooking bananas at varying growth ages (8, 12 or 16 weeks after planting) in a glasshouse. Growth changes in plant height, girth, number of live leaves, leaf area, and dry matter yield were evaluated after six-week drought and

6-week rehydration cycles. All the growth parameters were affected by moisture stress. Genome variability and plant age significantly influenced the response and sensitivities of these plants to moisture stress. The cooking bananas (ABB) and plantains (AAB) were more drought-tolerant than the AAA - dessert bananas. Similarly, the landrace triploid genotypes were relatively more susceptible than the tetraploid hybrids. The effects of moisture stress were found to be most severe in the 16-week plants, while the 8- and 12-week-old plants had a fair tolerance.

Conclusion and application of findings: This study suggests that ***Musa*** crops at their early vegetative growth stage are more likely to withstand moisture stress than their reproductive transition phase, thus, field planting and other cultural practices (like irrigation and mulching) should be conscientiously planned to avoid prolonged exposure of plants to drought during their reproductive growth phase. The differential sensitivities of the genomic groups to the induced moisture stress makes breeding a viable option in combating soil moisture deficits in ***Musa*** species.

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Evaluation of cowpea cultivars for resistance to *Megalurothrips sjostedti* under insecticide applications

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ABSTRACT

Objectives of study: To investigate integration of host-plant resistance with insecticide applications for the management of the flower thrips ***Megalurothrips sjostedti*** on cowpea.

Methodology and results: The trials were carried out at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria. Three resistant cultivars (Sanzisabinli, Sewe and IT90K-277-2) and one susceptible check (Ife-Brown) were evaluated under unprotected and two protection levels (endosulphan (organochloride) 35 EC and lambda-cyhalothrin (synthetic pyrethroid) 35 EC give the application rates of the insecticide also show the name of the insecticide, indicate the active ingredient). Unprotected plots gave very low yields due to their exposure to entire cowpea insect pest complex. The pest complex of cowpea in Nigeria during the trial was ***Aphis craccivora, Ootheca mutabilis and Empoasca spp***. during the seedling stage; ***Megalurothrips sjostedti***, during the flowering stage and ***Maruca vitrata*** during the flowering and early podding stage. The pod sucking bugs: ***Clavigralla tomentosicollis, Riptortus dentipes, Nezara viridula*** and ***Anoplocnemis curvipes*** were encountered during the podding

stage of the cowpea. Results showed that ***M. sjostedti*** larval mean population density is not reliable as a basis of categorizing cowpea cultivars as resistant or susceptible. Also, when cowpea was exposed to ***M. sjostedti*** infestations alone, the resistant cultivars performed best with low damage indices ranging from 2.6 to 3.3 ($p < 0.001$). Although grain yield of Sewe under full protection was low (485.1 kg/ha), factors conferring its inherent resistance to ***M. sjostedti*** could be further exploited. Sewe had low damage indices (3.1 = Resistant) when it was exposed to thrips infestations.

Higher grain yields obtained from Sanzisabinli plots (1679.1 kg/ha) under ***M. sjostedti*** infestation and low, negative cost-benefit ratios (1.5 and –6.0, respectively) obtained for IT90K-277-2 and Sanzisabinli ,respectively suggests that these cultivars possess significant resistance to ***M. sjostedti*** and there is no need to chemically protect them against thrips infestations.

Conclusion and application of findings: Judicious application of pesticides based on resistance levels of cowpea to pests can therefore minimize insecticide applications and consequently reduce costs and environmental hazards.

Key words: ***Vigna unguiculata***, ***Megalurothrips sjostedti***, lambda-cyhalothrin, endosulphan, resistance host plant resistance.

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ENTOMOLOGY

Dimorphisme sexuel chez les adultes de *Rhynocoris albopilosus* Signoret (Hétéroptères : Reduviidae)

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RESUME

Rhynocoris albopilosus (Hétéroptères : Reduviidae) est une punaise prédatrice dont les activités ont été observées dans divers agroécosystèmes. La définition des caractères de distinction entre les adultes mâles et femelles est un préalable à son élevage en masse. Le dimorphisme sexuel chez les adultes de ***R. albopilosus*** a été examiné en considérant d'abord des caractères morphométriques, ensuite la coloration et l'ornementation et enfin les caractères sexuels externes. Les résultats obtenus révèlent que le mâle de ***R. albopilosus*** est plus petit que la femelle. Les mâles et les femelles présentent les mêmes ornementations et

pratiquement la même coloration. Pour confirmer le sexe chez cette punaise, une méthode adoptée consiste à mettre en évidence les organes génitaux du mâle en exerçant une légère pression au niveau des 6ième et 7ième segments abdominaux, à l'aide d'une pince souple.

ABSTRACT

Rhynocoris albopilosus (Heteroptera: Reduviidae) is a bug predator which activities have been observed in several agroecosystems. Define some characters of distinction between adult males and females of this predator is a preliminary to its mass rearing. Sexual dimorphism in ***R. albopilosus*** has been examined through morphometric characters, coloration, ornamentation and external sexual characters. The results obtained reveal that males are smaller than females. The both sexes show the same ornamentation and almost the same coloration. To confirm the sex in ***R. albopilosus***, a light pressure on the 6th and 7th abdominal segments with à soft forceps emphasize the male genitals.

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CROP PROTECTION

Distribution of *Mycosphaerella* spp. diseases on banana in Côte d'Ivoire

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ABSTRACT

Introduction and objective: Bananas and plantains are attacked by several fungi belonging to the genus ***Mycosphaerella***. The most virulent M. ***fijiensis***, was observed in east of Côte d'Ivoire in 1985. It moved westward into bananas cultivation areas, giving the impression of a replacement of yellow Sigatoka but their distribution is not stable. The objective of this study was to actualize ***Mycosphaerella*** diseases distribution in Côte d'Ivoire. Methodology and Results:Field visits and observations of Sigatoka damage ratings were conducted from August to October 2006. The Horn 1 cultivar was selected for evaluating the BLSD effect. Yellow and black Sigatoka diseases were identified throughout the forest zone of Côte d'Ivoire, from Aboisso (East) near the Ghana border to San Pedro (West) and running into Liberia. The 2 diseases coexist

on the banana with the prevalence of black Sigatoka. For a banana variety susceptible to the two diseases, symptoms of the BLSD were very visible because of a faster development. Therefore, the yellow leaf spot has been identified on leaves of the cultivar Figue Sucrée which is partially resistant to BLSD. The severity of the disease decreased from the East (Aboisso) to West (San Pedro). In Aboisso, the infection index was 38%, as compared to only 30% for the rest of the country. These observations were made in parallel with the duration of the disease in the area and the use of fungicides in industrial banana plantations.

Key words: Banana, Plantain, ***Mycosphaerella***, Côte d'Ivoire

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Smut: An increasing threat to maize production in Central Kenya

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ABSTRACT

Maize smut occurs globally wherever maize is grown. The disease reduces yields drastically through stunting and formation of galls on the above ground parts of the plant especially on the developing cob and the tassel. In the recent past increased incidence of maize smut has been observed in parts of central province of Kenya, where maize is the staple diet. Infection usually becomes apparent when grain filling starts when it is often late to commence intervention measures. The pathogen, ***Ustilago zeae*** (***maydis***), causes enlargement of host tissues with the grains being converted into inedible structures filled with masses of dark spores of the pathogen. Observations indicate that most of the maize varieties grown in these regions are susceptible to infection with incidence reaching upto 50% in many farms. Infection appears to be exacerbated by the close integration of maize farming and dairy animal production through the zero grazing system in the region. The use of infected maize residues as fodder increases disease spread since pathogen spores pass

through animal gut undamaged and are returned to the farm in manure, thus serving as sources of primary inoculum for maize crops in the following season. In addition, the pathogen also infects napier grass which is also widely grown for fodder in the region. Napier not only provides an alternate host for this pathogen but also plays a key role in the continuity of pathogen cycle. Normally, when there is no maize in the fields, farmers ensure there is napier so as to secure fodder supplies, thus ***U. zeae*** is assured of a host continuously. Further, the practice of continous maize cultivation on the same pieces of land (without rotation) also favours disease spread since the pathogen's teliospores can survive in crop debris and in soil, where they remain viable for several years. Considering the increasing incidence and severity of smut infection on maize, and the associated threat to food security, it is necessary that efforts be made to investigate the disease further and develop effective management measures. Intervention should consider raising farmer awareness on the management measures, especially the importance of regular scouting and timely removal of the smut galls before they break open and release the spores. Studies are needed to determine the extent of loss being incurred by farmers; to characterize the linkage between dairy farming and smut spread, and to identify resistant maize varieties.

Key words: Maize, napier grass, smut, dairy farming.

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Sensibilité au laboratoire de *Mycosphaerella fijiensis* responsable de la cercosporiose noire des bananiers vis-a-vis de fongicides couramment utilises dans les bananeraies Ivoiriennes

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Résumé

Objective : Etudier la sensibilité de ***Mycosphaerella fijiensis*** aux fongicides.

Methodologie et resultats : L'étude a été menée sur douze plantations industrielles de bananier cv Grande Naine (***Musa*** AAA), réparties en 6 bassins de production : Aboisso, Bassam, Dabou, Agboville, Azaguié et Tiassalé ; pour une superficie totale de 2576 ha. La sensibilité des souches de ***Mycosphaerella*** aux principaux

fongicides utilisés a été évaluée. Les observations ont été effectuées sur les conidies après 48 heures d'incubation, sur milieu gélosé amendé de fongicides. Les doses étudiées sont : 5 µl/L de méthyl-thiophanate (benzimidazoles), 0,1 µl/L de propiconazole (triazoles) et d'azoxystrobine (strobilurines). L'évaluation de l'effet a été réalisée sous microscopique photonique. Pour les benzimidazoles, le taux des conidies à germination normale est déterminé. Pour les triazoles et les strobilurines, les taux d'inhibition de croissance du tube germinatif des conidies ont été calculés à partir de témoins sur milieu sans fongicide. Les résultats ont montré l'émergence de la résistance aux triazoles dans 3 bassins de production : les taux moyens d'inhibition ont cependant été moyens à assez élevés : 43 % (Aboisso), 54 % (Dabou) et 70 % (Azaguié). Les zones de production d'Agboville, de Bassam et de Tiassalé étaient épargnées par ce phénomène.

Conclusion et application : Le niveau de sensibilité du champignon aux benzimidazoles et aux strobilurines s'est montré en général suffisant. Toutefois, le niveau de résistance aux strobilurines s'est montré très élevé dans les bassins de production de Dabou (80 %) et d'Azaguié (99 %). L'étude n'a pas permis d'en trouver une explication.

Mots clés : ***Mycosphaerella fijiensis***, bananiers, résistance, fongicide, Côte d'Ivoire, ***Musa.***

Proceedings of the 3rd International e-Conference on Agricultural BioSciences 2010

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Interactions entre deux nématodes endoparasites migrateurs ***Radopholus similis*** et ***Pratylenchus coffeae*** sur le développement de vitroplants du bananier ***Musa*** (AAA) « cv Williams »

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Résumé

L'effet d'interaction entre ***Radopholus similis*** et ***Pratylenchus coffeae***, deux nématodes endoparasites migrateurs du bananier, ont été étudiés sur le développement du bananier (***Musa AAA***) cultivar Williams. Différentes combinaisons de dose d'inoculum de ***R.similis*** et ***P. coffeae*** ont été mise au point en effectuant des inoculations simples et mixtes. En inoculation simple ***P. coffeae*** s'est multiplié plus rapidement que ***R. similis***. En double inoculation la reproduction de ***R. similis*** a été inhibée par la présence de ***P. coffeae.*** Individuellement chacune des deux espèces de nématode a causé des dégâts importants sur

développement du bananier cultivar Williams. Mais ***P. coffeae*** a été plus virulent que ***R. similis.*** Par contre inoculées concomitamment les deux espèces ont eu une action pathogène moins importante que la somme des actions individuelles.

Mots clés : Bananier, nématodes, parasites, développement, Côte d'Ivoire.

Abstract
The effect of interactions between ***Radopholus similis*** and ***Pratylenchus coffeae***, two migratory endoparasitic nematodes were studied on banana (***Musa AAA)*** cultivar Williams's growth. Different combinations of inoculum levels of ***Radopholus similis*** and ***Pratylenchus coffeae*** were used to make single organism inoculation and concomitant inoculation. In single inoculation, ***P. coffeae*** showed a faster multiplication rate than ***R. similis***. When the two nematodes were applied together, reproduction of ***R. similis*** was suppressed by ***P. coffeae.*** Individually, each of the nematodes caused significant damage on the development of banana cultivar Williams. However, ***P. coffeae*** was more virulent than ***R. similis.*** When the two nematodes were inoculated concomitantly, each species appeared to reduce the virulence of the other.

Keywords: Banana, nematodes, parasites, development, Côte d'Ivoire.

Proceedings of the 3rd International e-Conference on Agricultural BioSciences 2010

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Studies on the die back disease of passion fruit in major production areas in Kenya *(PROPOSED GRADUATE RESEARCH PROJECT)*

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ABSTRACT

Passion fruit is an important horticultural crop in Kenya where it is grown widely by small scale farmers primarily as a source of income. The fruits are supplied to the local and export markets where they are consumed as fresh fruit for its nutritive value or utilized for commercial processing purposes. Passion fruit is a good source of flavanoids that have important medicinal value. Presently, demand for the fruit greatly exceeds supply; and this trend is project to persist in future, especially due to the emergence of new large scale producers of beverages using locally available fruits, among the passion fruit. The downward trend of passion fruit production which has brought the industry to a near collapse is mainly attributed to pests and diseases. A number of fungal diseases have been identified as the major constraints to production. These include Fusarium wilt and a recently emerged but highly severe disease attributed to a complex involving

Phytopthora species. Compared to Fusarium wilt, the die back disease is rather poorly understood. Since the disease is fairly new in the major passion fruit production areas in Kenya, no effective management strategies have been developed as yet. Preliminary research is yet to conclusively determine whether the disease is caused by a single or multiple organisms, though some reports suggest it is a complex caused by several pathological organisms, possibly involving viruses l and fungi. This proposed research will aim to generate data to fill the existing knowledge gaps and thus contribute to the development of effective control methods. Field studies will be carried out in the major passion fruit growing areas in Central and Eastern provinces of Kenya in Meru, Embu and Thika districts. Disease incidence and severity will be recorded and infected plant samples will be collected for isolation and identification of the causal organism(s) in the laboratory. Several trials will be carried out under controlled environment to establish pathogenicity of the isolated organisms on healthy passion fruit plants. A combination of disease control methods will be investigated. The data generated will contribute to improved understanding and more effective management of the dieback and other diseases threatening the Kenyan passion fruit industry.

Key words: Die back disease, production, passion fruits

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Transmission abiotique du rice yellow mottle virus (RYMV) par le sol après enfouissement de résidus de récolte

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Résumé

La panachure jaune est la maladie virale la plus importante du riz connue aujourd'hui en Afrique. Elle est présente en Cote d'Ivoire et cause d'importantes pertes de production. Cependant, peu de travaux ont été consacrés à l'épidémiologie et aux méthodes de lutte contre cette maladie. Il existe plusieurs voies de transmission de la maladie. Cependant, l'effet de l'enfouissement de résidus de récolte virosés sur l'apparition du RYMV n'a pas encore été démontré. C'est pour répondre à cette préoccupation qu'une étude a été réalisée sous serre en utilisant une variété de riz sensible au RYMV (Bouaké 189). Cette étude a révélé que l'emploi de résidus de récolte virosés comme amendement organique des sols de culture pourrait contribuer à l'apparition de l'infection dans les rizières qui y sont établies.

Mots clés : RYMV, Résidu de récolte, Enfouissement, Epidémies, Riz, Cote d'Ivoire.

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Effect of six fungicides on *Lecanicillium (Verticillium) lecanii* (Zimm.) Zare & Gams

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ABSTRACT

Objective: The objective of the present work was to evaluate the effect of six fungicides on the entomopathogenic fungus ***Lecanicillium (Verticillium) lecanii*** (Zimm.) Zare & Gams), isolate Y–57.

Methodology and results: The assays were carried out ***in vitro*** with the following concentrations of the fungicides: 10, 100, 200, 500, 1000 and 2000 mg kg^{-1}. The parameters assessed were (i) the inhibition of the growth of the fungus colony, (ii) the effect on spore production capacity and (iii) the conidia germination. Difenoconazol and tebuconazol belonging to the triazols group had more severe effect on ***L. lecanii,*** both on the fungus growth, spore production and their germination. Thus, these fungicides were classified as toxic by the

OILB scale and very toxic according to the compatibility scale using the T value. The fungicide cuprous oxide was slightly toxic by the OILB scale and toxic according to the compatibility scale, affecting the spore germination at lower concentrations than field dose. Metalaxyl of the yeacylalanine group was slightly toxic by the OILB scale and compatible with ***L. lecanii***, not affecting spore germination at the studied doses. Mancozeb was inoffensive to ***L. lecanii*** by the OILB scale and moderately toxic according to the compatibility scale. Nevertheless it affects the spore germination in all the studied concentrations. Zineb was lightly toxic by the OILB scale and moderately toxic according to the compatibility scale, but spore germination was only affected at concentrations equal to or higher than field doses.

Key words: Fungicide, entomopathogenic fungi, toxicity, ***Lecanicillium lecanii***.

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Effectiveness of extracts of *Furcraea hexapetala* (Jacq.) Urban on *Myzus persicae* Sulzer

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ABSTRACT

An investigation was carried out during the period 2005-2008 with the objective of determining the technical effectiveness of an extract of ***Furcraea hexapetala*** (Jacq.) Urban (Maquey) on the insect ***Myzus persicae*** Sulzer under laboratory and field conditions. Assays to determine the technical effectiveness of natural extracts of ***F. hexapetala*** on ***M. persicae*** were carried out in the laboratory by spraying insects raised on potato and pepper leaves in Petri dishes, and in the field by spraying the extract on natural insect populations on potato and pepper crops. In all the cases five variants were studied: the extract of the plant at 12.5%, 25%, 50% and 100% extracted from the juice of leaves, and a control. In addition, an assay was carried out in the

Chemical Pharmacy Department of the Central University of Las Villas to determine the technical effectiveness of the fractions of the extract of ***F. hexapetala*** that were obtained with different solvents. on the aphid species. The extract of the plant manifested technical effectiveness on the insect higher than 73% "in vitro" and 71% under field conditions in both pepper and potato. After 48 hours of exposure the fraction of the extract of ***F. hexapetala*** obtained using ***n***-butanol showed 100% effectiveness. This result confirmed that the insecticidal effect of the plant is due to the presence of saponins in the ethanol-water extract, which is further concentrated through successive processes in the ***n*** -butanol solvent.

CROP (Medicinal Plants)

An inventory of medicinal plants used to treat malaria by the Nandi people of Kenya

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ABSTRACT

Introduction and objective: In Kenya, many people use traditional medicine to treat many diseases including malaria. Malaria is one of the major disease burdens worldwide affecting more than 90 countries inhabited by 2.4 billion people (40% of the world's population). In Kenya, it is an endemic disease affecting more than 4 million people with the highest incidences being recorded in the Rift valley, Western, Central and Eastern provinces. The disease threatens the life of around 25 million out of the country's total population of 39 million people. It is of national concern in view of development of resistance to conventional drugs by new resistant strains of ***Plasmodium falciparum***. There is therefore need for alternative and affordable therapy. Many antimalarial drugs have been derived from medicinal plants traditionally used to treat malaria by the Nandi community.

Methodology and results: An ethno medicinal study was conducted on the use of medicinal plants for treatment or prevention of human ailments by Nandi people. Semi-structured questionnaires were used to collect data mainly through individual interviews conducted with selected knowledgeable professional healers. Plants

were collected, pressed, dried, preserved, mounted and identified through available literature and voucher specimens at the University of Nairobi and Kenya National Museum Laboratories. Forty four (44) species in 40 genera and 27 families were identified during the study. Labiatae, Euphorbiacea and Compositae families represented the species most commonly cited.

Key words: Indigenous knowledge, medicinal plants, malaria, ethnobotany, Nandi people.

Proceedings of the 3rd International e-Conference on Agricultural BioSciences 2010

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Phytochemical constituents of some medicinal plants used by the Nandi people of Kenya

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ABSTRACT

The distributions of alkaloids, saponins, anthraquinones, glycosides, phenolics, terpenoids and flavonoids in ten medicinal plants belonging to different families were assessed and compared between the plants. The medicinal plants investigated were ***Asparagus racemosus***, ***Clutia abbysinica, Clerodendrum myricoides, Ehretia cymosia, Leucas calostachys, Toddalia asiatica, Rubia cordifolia, Spermacoce princeae,Carrisa edulis*** and ***Ajuga remota***. All plants were found to contain alkaloids, terpernoids, saponins and flavonoids. However, saponins were absent in root extracts of ***R. cordifolia*** and ***C.myricoides*** while flavonoids were absent in leaf extracts of ***L. calostachys*** and ***A. remota***. The

significance of the plants in traditional medicine and the importance of the distribution of their medicinal constituents are discussed with respect to their role in ethnomedicine in South Nandi district, Kenya.

Key words: Phytochemical analysis, medicinal plants, ethnomedicine

Ethnobotanical survey and propagation of some endangered medicinal plants from south Nandi district of Kenya

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ABSTRACT

Studies were conducted at Maseno University, Kenya to investigate the ethnobotanical and chemical characterization of selected medicinal plants growing in South Nandi District in the year 2004 and 2005.

Subsequently, propagation studies were carried out on the identified endangered medicinal plants. Local communities who use medicinal plants were interviewed. Ethnobotanical data on families, plant species, botanical name, local name, part (s) used, popular ethnobotanical medicinal use, forms of preparation and applications of the herbal remedies were collected. Plants were collected, pressed, dried, preserved, mounted and identified through available literature and voucher specimens at the University of Nairobi and National Museum Laboratories. From the surveys carried the endangered plants were determined to be ***Asystasia schimperi, Carissa edulis*** and ***Toddalia asiatica*** .These were propagated using stem cuttings subjected to different concentrations of auxin in a polypropagator in a completely randomized design experiment. Results showed that as auxin concentration increased from 100 to 500 ppm; there was increase in rooting and growth in the decreasing order of ***Asystasia schimperi, Carissa edulis*** and ***T. asiastica***. The treated cuttings were planted in polythene pots which were placed in a non-mist propagator. The duration of the experiment on propagation was four months and the data taken were number of rooted plants, plant height, and number of leaves. The data on propagation was subjected to analysis of variance and means separated by the Least Significant Difference (LSD = $P \leq 0.05$) test. The results showed that hormone concentration, species and date of sampling of cutting significantly ($P \leq 0.05$) affected the number of leaves, plant height and number of rooted cuttings. ***A. schimperi*** had the best rooting and

subsequent growth followed by ***CCarissa edulis*** and ***Toddalia asiastica*** in that order. It is concluded that ***Asystasia schimperi*** and ***C. edulis*** can be easily propagated by stem cuttings and hence have good possibility of being introduced to the farmers of South Nandi District.

Key words: Ethnobotanical, endangered, medicinal plants, vegetative propagation, auxin.

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Biochemical and antimicrobial effects of aqueous and alcoholic extracts of *Codiaeum variegatum* (L.) Blume cv. *ovalifolium* (Euphorbiaceae)

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ABSTRACT

Objective: Garden croton, ***Codiaeum variegatum*** (L.) Blume, a beautifully variegated leafy perennial, tropical ornamental herb with glabrous branches and prominent leafy scar has generated a lot of scientific enquiry. However, there is paucity of information on its toxicity. This study investigated the effects of aqueous and alcoholic leaf extracts of ***C. variegatum*** on blood clotting and coagulation time, as well as the antimicrobial and phytochemical profile of its bioactive constituents.

Results: The leaf methanolic extract tested positive for alkaloid, anthraquinone, cardiac glycosides, saponins, phlobatanins, tannins, cardenolids, steroids, flavonoids, phenols and phyllates. The ethanolic extract of leaf inhibited growth of ***Streptococcus pneumoniae*** Te2 (30 mm)***, S. pyrogeneae*** Td2 (14 mm), ***Salmonella typhi*** Tc2 (7 mm), ***S. typhi*** Tc19 (13 mm), ***S. typhi*** Sat7 (10 mm) and ***Escherichia coli*** Ecl7 (17 mm). Furthermore, results indicated that the clotting / bleeding time of methanolic extract of ***C. variegatum*** (3.98 ± 1.62 min) was significantly higher ($P < 0.05$) than the aqueous extract (1.72 ± 0.38 min) and control (normal saline) (2.35 ± 0.70 min). Although the investigation revealed no blood coagulation by the leaf aqueous extract, the methanolic extract (3.08 ± 2.5 min) and control (4.95±3.40 min) exhibited a coagulation tendency at the time of study.

Conclusion: Both aqueous and alcoholic extracts of ***C. variegatum*** cv. ***ovalifolium*** possess bioactive metabolites with anti-clotting, anti-coagulating and antimicrobial properties.

Key words: Antimicrobial, ***C. variegatum***, clotting, coagulation, phytochemical.

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ANIMAL SCIENCE

The effects of zeolite and yeast in managing aflatoxicosis in broiler chicks

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Abstract

Objective of study: The ability of dietary zeolite and yeast application as a (single treatment or compound with others) in combination 1.5 % zeolite to reduce the detrimental effects of aflatoxin B_1 (AFB_1) in broiler diets was evaluated.

Methodology and results: A total of 630 seven-day Ross old broiler chicks were placed into four equal treatment groups. Group A: control, group B: 0.5 % yeast, group C: 1.5 % zeolite and group D: 0.5 % yeast + 1.5 % zeolite. The study assessed serum profile biochemical and weight changes in of internal organs in chicks fed 200ppb AFB_1 plus adsorbent. Addition of an adsorbent in the diets significantly diminished the deleterious effects of aflatoxins on body weight gain, feed intake and Feed Conversion Rate. The serum concentrations of glucose, cholesterol, triglyceride, albumin and uric acid in chicks fed on diets B to D were significantly higher than the control group. The relative weights of proventriculus, gizzard, liver, heart, spleen and

pancreas decreased, whereas relative weight of bursa was increased compared to the control diet.
Application of findings; the results indicate that application of yeast and zeolite can contribute to reduce the detrimental effects of aflatoxins.

Key words: Zeolite, yeast, aflatoxicosis, broiler chicken.

Bio-indicators and induced stress-response of giant land snail (*Archanchatina marginata* Swainson) in polluted ecosystem

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ABSTRACT
Background and objectives: The giant land snail is an important source of revenue to farmers and animal protein to human beings. Molluscs are good bio-indicators of polluted and stressed environments.

Metabolism and bioaccumulation of toxic chemicals by edible organisms require constant monitoring because of their potential risks to human nutrition and health.
The response of giant land snail to lethal and sub lethal levels of an organophosphate pesticide (dichlorvos) was assessed. This is with a view to determining the physical and physiological changes of snails in polluted ecosystem and safety limits of exposure to the pesticide.
Results: Assessment of the mortality of snails (110-140 g) to dimethl-O-(2-2 dichlorovinyl)-phosphate (Dichlorvos) showed that concentrations above 0.135 mM caused death within 24 h while 0.002 – 0.02 mM resulted in death after 48 h. The symptoms accompanying mortality included physical and physiological changes like swelling of the muscular foot, inflammation, and colour change from brown to grey, black or white, flaccidness, and outright withdrawal from food and the environment. Exposure of the snails for 168 h to 0.0023 mM Dichlorvos resulted in 50% mortality – LC 50. a concentration of 0.0011 mM was non-lethal beyond 168 h (7 d) assay, with evidence of recovery. Sub lethal assessments of 10, 50 and 100 times dilution of LC 50 showed that the snails gained little weight. Histopathological studies of hepatopancrease showed lesions and foci of the snails exposed to 1/10th of LC 50. However, the ovotestes and muscular foot were normal.
Conclusion: Colour changes, swelling, flaccidness and withdrawal by snails are indication of contaminated environments that may also pose health hazards to human beings.

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Comparative performance of indigenous chicken ecotypes and Bovans Brown crosses

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ABSTRACT

Objective of study: Work previously done at Serere Agricultural and Animal Production Research Institute showed that crossbreeding Bovans Brown cocks and indigenous hens significantly increased growth rate, number of eggs per clutch and mean live weight at 20 weeks of age. While those findings could have been attributed to heterosis, it was not possible to delineate genetic and environmental (feeding) contributions. This study investigated the genetic and feeding contributions.

Methodology and results: New eggs (1-4 days old) of local chickens were purchased from households in Soroti, Sironko, Jinja, Masaka, Sembabule and Mbarara districts. In addition, new eggs of the same age of crossbred chickens (Bovans Brown x Local) were purchased from Soroti and Mukono districts. All eggs were hatched at the same time using a

commercial hatchery at Mukono Agricultural Research and Development Centre. Hatchability was recorded. Local eggs from Sironko district had the highest hatchability (90.0%) followed by those from Sembabule district (87.0%) and the crossbred eggs (75% cross) from Soroti had the lowest hatchability (70.0%). Chicks from Sembabule local eggs were heaviest (30.53gm) on average at day 1 followed by the crossbred chicks (75% cross) from Soroti which had average weight of 28.88gm at day 1. The smallest chicks (26.46gm) at day 1 were from the local eggs collected in Soroti district. All day 1 chicks were later transferred to Serere where they were managed in the same way and were fed ***ad libitum***. Weights from day 1 to day 180 were recorded. Between day 1 and day 30, all chicks grew almost at the same pace but after day 60 chicks from Masaka grew fastest followed by those from Soroti district. Those from Sembabule were the slowest growing on average. The rest were between these two ecotypes. The biggest increases in body weights were recorded between day 60 and day 150. At day 180 (6 months) the weights of all ecotypes converged towards the same mean weight of 1636gm with no signs of further growth. ***Conclusion and application of findings***: Some indigenous chicken ecotypes had better growth than the crossbred chickens. In addition, among the indigenous chicken ecotypes there were significant

differences in growth reflecting a certain level of genetic variability. If the feeding were standardized and maintained ***ad libitum*** and management was uniform, the differences observed in growth could be attributed to differences in genes or differences in feed conversion.

Key words: Hatchability, growth, indigenous chickens, Bovans Brown, ***ad libitum***

Proceedings of the 3rd International e-Conference on Agricultural BioSciences 2010

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Evaluation of cow milk production efficiency in eastern central highlands of Kenya
(Proposed graduate research study)

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ABSTRACT

Dairy cattle production is a major economic activity in Kenya contributing 3.5% of the national gross domestic product (GDP), and income, employment and food to many small-scale farmers. The country's dairy herd size is the biggest in sub-Saharan Africa. Kenya enjoys preferential market access for its products in the eastern and southern Africa region. However, the country's milk consumption level is low, at 76Kg per capita against the World Health Organization's recommendation of 210Kg. Kenya's milk has also not managed to capture substantial markets beyond its borders; a situation that is partly related to the nation's comparatively low per cow average daily production of 6Kg and unsustainably high cost of production. These constraints can be addressed by analyzing the milk production efficiency, especially the technical and cost efficiency aspects, to identify areas to target for improvement.

The objective of this proposed study is to assess and document the technical and cost efficiencies of farmers in the leading dairy farming region of Eastern central highlands of Kenya. The efficiency levels determined will be related to the farm gate price of milk and ultimately to the demand of milk or milk products by consumers. The study has been motivated by concerns raised by stakeholders and particularly policy makers regarding the country's inability to produce milk that is more affordable locally and also to sustainably penetrate the external market based on cost leadership.

Primary data will be collected through questionnaires administered to sampled dairy cattle farmers during a cross-sectional survey. . Further primary data will be collected from identified respondents representing other stakeholders as guided by a pre-developed interview checklist for each of them. Secondary data will be collected from reports and journals relevant to the study. The sample size will be derived using the Fischer's formula while the respondents will be selected with the help of extensionists and a computer program.

The information generated through this study will contribute to improved efficiency and competitiveness of the dairy sector in Kenya.

Key words: Technical efficiency, cost efficiency, cost leadership, per capita consumption

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Current status of Brucellosis and helminthosis in cattle and goats in the southwestern rangeland zone of Uganda

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ABSTRACT

Objectives of study: Between July 2008 and September 2009, a cross-sectional study was undertaken with the main aim of establishing the current status of Brucellosis and Helminthosis in cattle and goats in the nine districts comprising the Southwestern Rangeland Zone (SWRZ) of Uganda.

Methodology and results: Blood and faecal samples were collected from a total of randomly selected 912 cattle and 530 goats in the nine districts of Sembabule, Kiruhura, Rakai, Lyantonde, Isingiro, Mbarara, Bushenyi, Ntungamo and Ibanda. Serum was subsequently prepared from the blood samples and antibody titres for Brucellosis were established using the

Indirect Enzyme Linked Immuno-sorbent Assay (ELISA) procedure. All the faecal samples were examined for Strongyle eggs using the standardized procedure of Mac-master technique. This study established that Kiruhura and Isingiro districts had the highest prevalence of cattle Brucellosis with sero-prevalences of 41 and 34%, respectively; while Ntungamo district had the lowest sero-prevalence of 5%. The sero-prevalence of Brucellosis in goats was highest in Rakai and Isingiro districts with sero-prevalences of 46 and 27%, respectively; while Ntungamo district had a sero-prevalence of 1.9%. Cattle and goats more than 24 months old had the highest sero-prevalence of at least 50%. Trichostrongylus, Strongyloides and Haemonchus eggs were the most commonly indentified, making these worm species the commonest cause of helminthosis which could be due to lack of host specificity.

Conclusion and application of findings: These findings will contribute to the improvement of strategies for the control of Brucellosis and Helminthosis in cattle and goats in SWRZ of Uganda.

Key words: Brucellosis, Helminthosis, Cattle, Goats, Rangeland

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http://www.m.elewa.org/econferenceIeCAB.php

Occurrence of suspected egg drop syndrome in a commercial layers farm in Kenya

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ABSTRACT

Commercial poultry farming is a major economic activity in many parts of Kenya. Farmers keep layers or broilers depending on expertise, season of the year and financial resources available. For both types of chicken, chicks are obtained from any one of several commercial hatchery operators that exist in the country. Farmers obtain the chicks at one day age and are responsible for the delicate management that is necessary to ensure survival and growth of the chicken to laying or slaughter age. The cost of raising chicken to laying or slaughter age is a major component of the total recurrent enterprise cost.

In late 2009, a commercial layers farm with over 500 chicken located in Limuru, Kenya reported an unusual development in the laying pattern of the chicken. The birds commenced laying as expected at 4 months, 2 weeks old. The growth from hatching to laying had been normal with minimal losses. Laying reached a maximum 65% at 28 weeks age, which was significantly less than the expected 90% lay. Thereafter laying percentage dropped gradually to 45% by 33 weeks. Attempts

to nutritionally boost the birds with dicalcium phosphate, vitamins, fishmeal supplementation and regular deworming did not reverse the downward trend in egg lay. As the number of eggs dropped the characteristics of eggs appeared to change with the shell weakening and turning from brown to whitish colouration. Egg size also reduced substantially. After further investigation, and as reported in various publications, it was noted that the 35% chicken that did not lay at all had dull (white- pinkish) combs in contrast to the bright red combs of the laying chicken. Upon examination of the pubic bone, only one finger could fit in, and the vents were small and dry. With the drastically reduced laying rate, it was not viable to maintain the birds until the expected laying lifespan. The entire flock was therefore disposed for slaughter at 33 weeks. Informal enquiries within the farming community indicated that a substantial number of other farms in the region had experienced similar drops in laying rate at about the same period. A common factor amongst these farms was that they had obtained their chicks from the same hatchery (name withheld). These reports reinforce the need for regulatory authorities to more closely monitor hatchery operators to ensure compliance with set standards and thereby protect farmers from losses whose origin lies with unscrupulous hatchery operators.

Key words: Egg drop, layers, hatchery operators, standards.

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AGRICULTURE EXTENSION

Enhancing crop and livestock productivity: Learning and planning with local agro-pastoral communities in Nakapiripirit Karamoja Region of Uganda

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ABSTRACT

Objectives of study: This study was motivated by the fact that despite existence of large herds of cattle and goats, reasonably sufficient feed, human capital, and favorable conditions for improving livestock among other resources, poor herd productivity characterizes livestock farming in Nakapiripirit region.

Methodology and results: The area of study, Namalu sub-county in Nakapiripirit district, is dominated by the semi-transhumant agro-pastoralists of Pian ethnic group

Karimojong tribe. The sub-county was sampled to capture variability in socio-cultural and farming systems settings. The bulk of data used in the study was obtained semi-formally using key informant and focus group discussion procedures. Survey results showed that the major crops are maize, sorghum, ground nuts, beans and sunflower. The main crop constraints are drought, difficulty in ploughing, weeds, low soil fertility and delay in seed supply. Cattle, goats, sheep, chickens and donkeys are the priority livestock enterprises. Local breeds of cattle and shoats are commonly open grazed (herded or tethered). Chickens and turkeys are mostly reared on free range system. The main constraints to livestock production are insecurity, drought, anaplasmosis, East Coast Fever (ECF) and heart water. Challenges to production include deforestation, ploughing along slopes, termites, mono cropping, overgrazing, declining land sizes, floods, strong winds and dominance of sandy soils. Extreme conditions of water scarcity (drought) and excessive rainwater (floods) coupled with occurrence of strong winds; presence of sandy soils and the practice of ploughing along slopes are clear manifestations of an area prone to adverse effects of climate change. Experiences and lessons learnt from the study indicate that the common belief that the security situation particularly threat to human life and property is far beyond tolerable limits is highly exaggerated. Isolated attacks that occur are not different in type and scale from those reported in other parts of Uganda. Furthermore, Karamoja region and Karimojong are portrayed to be hostile and non-cooperative. Informal interviews notably FGD discussions confirmed that the Karimojongs are interactive, freely participate and contribute valuable ideas that can guide research and development agenda based on informed opinion, real local needs and circumstances. Crop production and livestock grazing areas can be favorably concentrated in specific areas

so that economies of scale are exploited. Besides, common conflicts between cultivators and pastoralists stemming from crop destruction by cattle are avoided. Mobilization and accessing individual households to foster participatory community development are facilitated by the clustered settlements headed by Manyatta heads who are elected and accorded respect by all manyatta occupants.

Conclusion and application of findings: Based on data on farm, land and water management constraints, the following strategic interventions are proposed: (i) Promotion of sustainable household and community-wide rainwater harvesting techniques to increase water availability for crop, livestock and domestic uses; (ii) Improved soil fertility and conservation technology and skills improvement to arrest soil degradation; (iii) Improved input supply for the priority crop and livestock disease and management constraints by NAADS, (iv) extension and relevant support systems in the agricultural sector; and (v) Establishing inter-district and cross border networks to curb cattle rustling.

Key words: Nakapiripirit, participatory diagnosis, research and development planning, transhumant communities