

Journal of Environmental Sustainability Advancement Research

J. Env. Sust. Adv. Res., ISSN: 2409-966X

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VOLUME: 4, YEAR: 2018

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Dear Stakeholders, Below are abstracts from the Journal of Environmental Sustainability Advancement Research Volume 4 published by Chuka University. For full articles, contact the Editor in-Chief using contacts provided below. Thank you. Editor in-Chief

FOOD SECURITY MITIGATION THROUGH DROUGHT TOLERANT CROP VARIETIES AND IRRIGATION IN SEMI-ARID TANA-RIVER COUNTY

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ABSTRACT

The major constraint to food production in Arid and Semi-Arid Lands (ASALs) of coastal Kenya is low soil moisture and lack of improved drought tolerant maize varieties. Average annual rainfall is low in most areas and total annual evapo-transpiration is high. The evapo-transpiration exceeds rainfall in most months of the year hence the need for water harvesting or irrigation strategies. Though the ASAL have traditionally been considered best suited to extensive livestock grazing, this have changed as more people have moved into these areas and introduced crop farming. Despite the adversity of the marginal areas, farming is practiced, notwithstanding the frequent crop failures. In these areas farmers grow maize varieties recommended for the medium to high rainfall zones resulting to crop failures. This state of affairs has been aggravated by prevailing climate change conditions. Research work was therefore carried out to present various options of mitigating adverse effects of climate change and determine the most effective ones among drought tolerant maize varieties, grain legume crops and irrigation. Three drought tolerant maize varieties: PH1, DH01, DH02 were evaluated against PH4 (check) and along three different planting spacings of 90 x 30 cm, 90 x 60 cm and 90 x 90 cm with varied number of seeds per hill and leading to the same plant population of 37,037 plants ha⁻¹. Pulse crop trial comprised of three cowpea varieties: K80, M66 and Kenkunde. The performance of three tomato, two capsicum and three kale varieties was evaluated under two irrigation methods i.e drip and sprinkler irrigation. Results showed that DH01 had significantly ($P<0.05$) same yield as PH4 (check). Significantly ($P<0.05$) higher grain yield was observed between the spacing of 90 cm x 30 cm and the rests of the spacings. There were no significant ($P<0.05$) yield differences among the three cowpea varieties. Tomato variety Tegemeo had the best performance of 38.7 t ha⁻¹. Kale leaf yields were significantly different ($P<0.05$) among the varieties. Collards had the best performance of 34 t ha⁻¹. Capsicum fruit yields were significantly different ($P<0.05$) between the two varieties evaluated. Commandant had the best performance of 22.67 t ha⁻¹. The irrigation methods did not show any significant yield differences among vegetable type and varieties. The study showed that drought tolerant maize varieties, cowpea and irrigation technology could be used to mitigate effects of frequent droughts in the ASAL and improve food security situation in the affected areas

Keywords: ASAL, Climate change, Dry land farming, Maize, Cowpea, Tomato, Capsicum, Kale

APPLICATION OF DESIRABILITY FUNCTION FOR OPTIMIZATION OF MULTIPLE RESPONSES OF WATERMELON USING ORGANIC MANURE

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ABSTRACT

Field experiment was conducted at horticultural research and teaching farm of Chuka University to evaluate the responses of watermelon to organic manure using Central Composite Design (CCD) to formulate optimal organic manure that maximizes growth and yield of watermelon. The objective was to optimize the multiple responses of watermelon to organic manure using desirability function. A 5-level-3-factor central composite design was employed where optimization required 20 experimental runs. The parameters assessed were vine length, number of branches per plant and fruit weight of watermelon. A statistical model of the second-order that best fits the data was used to achieve the objective. Desirability function approach for simultaneous optimization of several response variables was adopted in this study. The findings revealed that the process was well optimized, because the indices

were very close or equal to the condition great value of one. The study found that the optimal values of watermelon responses are 93.73 t/ha of fruit weight at maturity, 9 branches/plant and vine length of 225.43 cm at 8 weeks. Based on the findings of the present study, it was recommended that farmers in the study area apply 17.64 t/ha, 11.17 t/ha and 18.05 t/ha of poultry, goat and cow manure, respectively, for increased growth and yield of watermelon. Further research may be commissioned with CCD, Box–Behnken and Doehlert design approach to plan the experiments for growth and yield of watermelon with an overall objective of optimizing the responses (such as number of fruits per plant and number of leaves per plant) of watermelon to organic manure (poultry manure, goat manure, rabbit manure and donkey manure). The study exemplified that the development of statistical models for crop production can be useful for predicting and understanding the effects of experimental factors.

Keywords: Central composite design; Response surface methodology; Fruit weight

FACTORS AFFECTING ECONOMIC BENEFITS OF INDIGENOUS VEGETABLES GROWN BY SMALL-SCALE FARMERS IN KENYA: A CASE STUDY OF MWEA SUB-COUNTY, KENYA

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ABSTRACT

Indigenous vegetables have long been part of traditional diets in communities worldwide. They are valuable sources of nutrients with some having significant medicinal properties and contributing greatly to food security. Their consumption is by-passing the production in Kenya due to health check by many consumers. In Kenya, indigenous vegetables have been faced by various challenges that include land size, quality, and cost of input and agronomic factors that in turn reduce returns earned by farmers. This research was conducted in Mwea sub-County to assess the major factors that affect the profits earned by indigenous vegetables small-scale farmers. Stratified sampling and snowballing techniques were used in carrying out the research in four locations where indigenous vegetables are rigorously grown. Data was collected using questionnaires and observations and the population targeted was indigenous vegetables farmers only. The survey results demonstrate that land size affected profitability of small-scale farmers since cost of many inputs was constant regardless of farm size. More than 80% of farmers reported that size of land determined the profit returns of indigenous vegetables. Furthermore, agronomic factors like mode of management and type of seed used also affected production. Water availability, soil fertility, pests and diseases had a negative effect on leaf quality and therefore affected production. The study recommends policy interventions to reduce transaction costs as well as awareness creation on agronomic and post-harvest management on cultivation of indigenous vegetables.

Keywords: Indigenous vegetables, Profitability, Small-scale farmers, Agronomy

IMPORTANCE OF PRODUCT ATTRIBUTES IN SUCCESSFUL BRANDING OF FRESH FRUITS AND VEGETABLES

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ABSTRACT

The objective of this study was to establish the importance of specific product attributes in the successful branding of fresh fruits and vegetables (FFV). The population of study consisted of 213 commercial farmers of FFV in Kiambu County. The study adopted stratified random sampling in which 140 farmers were sampled from the seven sub-counties in Kiambu County. The study adopted a descriptive cross sectional survey design. Data was collected using a semi structured questionnaire and analyzed using both descriptive and inferential statistics. The study established that among the seven identified product attributes; longer shelf life had the highest contribution followed by special taste/colour while unique place of origin had the least contribution followed by special medical value. It was observed that since the branding of FFV had low adoption, the average contribution of the attributes to successful branding of FFV was low. The generalizability of the study findings was limited by the limited number of

respondent farmers engaging in branding of FFV and lack of corroborative secondary data. The study recommends that farmers should establish available attributes for their products and utilize them in the branding of FFV as a means of adding value to their products. The government should identify and protect special product attributes of the FFV grown in various parts of the country and avail them to only farmers from these areas for branding purposes. Future studies should focus on product attributes of other fresh agricultural products and also target other counties with differing social economic and climatic conditions. A study should be done to establish why branding of FFV has low adoption despite availability of requisite product attributes. A study with collaborative secondary evidence would increase objectivity in the collected data. The study recommends exporting of branded FFV to Europe, Asian and USA markets to boast social economic status of FFV farmers in Kiambu County and Kenya in general.

Keywords: Product attributes, Commercial farmers, Fresh fruits and vegetables

USE OF LANGUAGE IN ENCODING BELIEFS AND STEREOTYPES ABOUT MONEY AND WEALTH CREATION

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ABSTRACT

Language plays a significant role in personal financial education and creation of wealth in line with the attainment of the Kenya's vision 2030. The words, phrases and common sayings people use to talk about money issues either inhibit or promote their personal financial growth. The words or phrases constitute the myths or stereotypes often used to describe money. The myths about money have been handed down from one generation to another over the ages. This paper analyses the language used in encoding beliefs and stereotypes about money and wealth creation. First, it identifies and describes common myths associated with money and wealth creation. Two, it analyses the linguistic strategies used in encoding financial myths. The paper uses the framework of Critical Discourse Analysis to analyse 20 purposively sampled age-old financial sayings. The paper underscores the compulsive need for financial education in deconstructing unsubstantiated beliefs about money and the significance of reprogramming people's mindset. It advocates for the incorporation of financial literacy skills in the education curriculum.

Keywords: Language, Encoding financial beliefs, Stereotypes, Myths, Wealth creation

A DISCURSIVE ANALYSIS OF POLITICAL DISCOURSE DURING THE 2010-2014 MAU FOREST RESTORATION DEBATE IN KENYA

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ABSTRACT

Climate change and global warming are challenges facing the world today. This problem is aggravated by the fast disappearance of forest cover in the world. The Mau Complex is not only Kenya's largest water tower but also the largest closed canopy ecosystem. The forest is therefore of great importance nationally and globally. In spite of its national and global importance, there has been a proliferation of political utterances against the efforts to rehabilitate this water tower. This paper seeks to describe the linguistic features manifest in political discourse and their social implications for forest conservation in the country. This study was guided by a combination of Corpus Linguistics and Norman Fairclough and Ruth Wodak's Critical Discourse Analysis (CDA) framework. Downsampling procedure was used to select 10 speeches by political leaders on Mau Forest saga. This study focused on the utterances of the political leaders who were opposed to the conservation cause. These speeches were obtained from the national archives for transcription and analysis. The CDA analysis was carried out on a sample of texts from the corpus and the data analysed using qualitative and quantitative techniques. The T-Test and Mutual Information (MI) score were employed as measures of significance. The t-score ranking was used to measure the certainty of the collocation while the MI-score was used to test the strength of the collocation in the corpus. Further, the CDA analysis on linguistic features indicated that political leaders' utterances influence the way people think about the Mau Forest conservation. The results indicated that the co-occurrence of keywords and their collocations were strong and their frequency was higher than expected. The findings showed that utterances laden with negative

attitude undermined the Mau Forest conservation efforts. Further the dominant use of the pronominal “we” “me” and “my” were for identity and inclusion with regard to the Mau Forest conservation. It is recommended that conservationists should interpret the potent messages of language and its ability to influence people and society. Thus linguists should use their expertise with language to complement the efforts of natural scientists in the field of conservation. This study would be beneficial to Government and policy makers by indicating that language can help us achieve shift in attitudes and behaviour on conservation issues. The study is also of significance to Ecolinguistics because it would endeavour to reveal the interrelationship between language and forest conservation.

Keywords: Persuasive strategies, ideology, attitude, political discourse, environmental conservation

ASSESSING KNOWLEDGE LEAKAGE ON PERFORMANCE AMONGST TEACHING STAFF IN PUBLIC UNIVERSITIES IN KENYA

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ABSTRACT

Although universities in Kenya recognize that knowledge retention amongst teaching staff enhance universities' performance, there are gaps that hinder collaboration, linkages, knowledge sharing and management, and improved Information Communication Technology physical infrastructure. Today, poorly established platforms where knowledge can be shared amongst the teaching staff are common in most of the universities. Technologies that speedily transfer knowledge are poorly retained and maintained, reliable knowledge management systems that are integrated in the available IT infrastructure are missing and knowledge sharing and management policies have not been understood. The objective of the study was to determine the ways in which knowledge leakage has impacted on innovations amongst teaching staff in public universities in Kenya and; Propose suitable knowledge sharing and management strategies that can be used to enhance performance of knowledge workers in public universities in Kenyan. The study adopted descriptive research. The study population consisted of twenty three (23) chartered public universities. The study used systematic random sampling to select six universities from 23 chartered universities. The sample size was three hundred and eight (308) respondents. Data was collected through structured questionnaires. Data was analyzed using quantitative method. Data was analysed using descriptive statistics aided by Statistical Package for Social Sciences (SPSS) and presented in percentages, frequencies, means, tables and graphs. The study established that knowledge leakage lead to the loss of specialized expertise with a high significant association between knowledge leakage and impact on innovations ($\chi^2(6) = 21.631, p=.001$) which was less than 0. The study recommends that public universities provide for consistent skill training to mitigate knowledge leakage and provide incentives to ensure knowledge retention

Keywords: Knowledge, knowledge leakage, knowledge retention, innovation, performance, teaching staff

EFFECTS OF DIVORCE ON ACADEMIC ACHIEVEMENT AMONG PRIMARY SCHOOLS PUPILS IN KANGETA DIVISION, KENYA

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ABSTRACT

Divorce is dissolution of a marriage relationship. Divorce jeopardizes children emotionally, psychologically and intellectually. It affects the pupils' psychological well-being, as they go through adjustment of living without one parent. Therefore, this study sought to investigate the effects of divorce on academic achievement among primary schools pupils in Kangeta Division, Kenya. The study adapted a descriptive survey research design. The population of the study was 18,697, comprising of 398 teachers, 26 head teachers and 18,247 pupils from in the study area. The sample size was 343 respondents, derived from 8 primary schools. Simple random sampling and purposive sampling methods were used to obtain the sample size. Three sets of questionnaires were employed as research instruments for data collection. Validity of the research instruments was improved through opinions and judgement of University experts. Reliability of the questionnaires was improved through a pilot study conducted in two primary schools in Maua Division. The reliability was estimated using Cronbach's Alpha Coefficient and an average reliability

coefficient 0.778 was obtained. Reliability for pupils' questionnaire was 0.846, class teachers were 0.782 and head teachers were 0.707. Data was coded for analysis through a computer programme; the Statistical Package for Social Sciences (SPSS) version 20.0. Data analysis was by descriptive and quantitative statistics where qualitative data was analyzed thematically. The study findings revealed that pupils from divorced homes were psychologically affected. Therefore, this affected their academic achievement as they were easily irritated, depressed, and lacked attention in class. The study established that primary school pupils from divorced homes are psychologically affected hence affecting their academic achievement. The study recommends that Guidance and Counselling Services in primary schools should be encouraged to enhance positive psychological and social well-being with respect to academic achievement. The findings and recommendations should provide valuable reference for parents, teachers, school administrators, child psychologists and policy makers in education on effects of divorce on academic achievement among pupils from primary schools.

Keywords: Psychological, Effects, Divorce, Academic achievement

EFFECTIVENESS OF RELIGIOUS INITIATED PROGRAMMES IN CURBING HIV/AIDS PANDEMIC IN KENYA: SOME SELECTED PROGRAMMES IN MERU SOUTH SUB-COUNTY

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ABSTRACT

HIV and AIDS pandemic has brought enormous burden upon the lives of many people throughout the world since the first cases of AIDS were identified in USA 1981. Since then, more than 70 million people are living with HIV and AIDS and more than 35 million people have died globally. As the burden of HIV and AIDS escalates, organizations are being formed to help curb its impact. Kenya has about 1.6 million people living with HIV and AIDS and in 1999 it was declared a national disaster. It is in response to this that many development partners including religious organizations, came up with programmes to help combat this scourge, yet there seems to be little success as new infections continue to be reported. The Church in Kenya has not been left behind as far as fighting this scourge is concerned. She has initiated many programmes towards this course. This study assessed the effectiveness of Church based initiated programmes in curbing HIV/AIDS in Kenya. We used the Church-based programmes in Meru South Sub-county, purposely selected because of the magnitude of the problem in this particular area. These were Redeemed Gospel Church HIV/AIDS Programme at Chuka, Presbyterian Church of East Africa HIV/AIDS Programme at Ndagani, Salvation Army Church HIV/AIDS Programme at Chuka and Baptist Church HIV/AIDS Programme at Chuka. The target population was 1040 subjects comprising 1000 Church members and 40 beneficiaries. The Church ministers/pastors were our key informants. Data was collected using questionnaires, interview schedule and focus group discussions. Systematic random sampling procedure was used to select 100 Church members. The 40 beneficiaries were obtained using snowball sampling method. The findings were that the selected programmes provided services such as HIV prevention education, orphan care, support of people living with and personally affected by HIV and AIDS, prevention activities that involved campaigns, and caring for the affected and infected. The programmes were found out to be successful particularly in supporting the people orphaned by HIV and AIDS, reducing stigma, organizing training, seminars and workshops, conducting voluntary counselling and testing among others. They were found to be effective in curbing HIV and AIDS, though they face the challenge of lack of adequate funding. There was also lack of trained personnel which hamper the effective implementation of these programmes. If the government, church, development partners and other well-wishers support these religious initiatives the war against HIV/AIDS pandemic can be easily won.

Keywords: Religious Initiated Programmes, Church, HIV/AIDS Programmes

EFFECT OF MICRO-INSURANCE SEGMENT ON INSURANCE UPTAKE IN KENYA

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ABSTRACT

Microinsurance is the protection of low-income people against specific perils in exchange for regular premium payment proportionate to the likelihood and cost of the risks involved. With insurance uptake in Kenya still low,

micro-insurance has been identified as a critical segment to deliver new products to the low-income population. Causal effect research design was used for the study. Secondary data on Microinsurance general premiums, Microinsurance life premiums and number of Microinsurance policies for the period 2009 to 2014 was obtained. The sample size was 10 insurance companies chosen to obtain the premiums, and number of scores for the years 2009 to 2014. The study used both descriptive and inferential statistics in analyzing the data. The multiple linear regression equation used took into consideration three independent variables for the 10 companies. The results revealed that Microinsurance variables influencing insurance uptake in Kenya, namely; micro-insurance general premiums, micro-insurance life premiums and number of Microinsurance policies influenced it positively. The study found out that the intercept was 0.790 for all years. Independent variables explain a substantial 69.3% of insurance uptake in Kenya as represented by adjusted R^2 (0.693). The study recommends that all insurers should invest in market analysts to help them research more on favorable Microinsurance products and this would improve insurance uptake. The study concludes that Microinsurance segment has a significant effect on the insurance uptake in Kenya. **Keywords:** Insurance, Microinsurance, Insurance Uptake, Low-income, Risks.

USING SOIL ADJUSTED VEGETATION INDEX TO ASSESS LAND DEGRADATION ALONG SECTIONS OF MUTONGA RIVER CANYON

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ABSTRACT

Mutonga River canyon forms an important social economic strip spanning about 8 km East and West along upper Mutonga River Bridge. The 8 km strip is an area of dense human activities comprising of quarry stone mining and settlements. The canyon contains extensive stone mining sites as well as a permanent river serving the communities of Meru County in the upstream and Tharaka-Nithi County in the downstream respectively. Uncontrolled quarrying along the canyon's river bank has resulted to geomorphic failures in the recent past leading to fatal landslides in 2002 and 2010. To assess the extent and effects of these mining activities on the canyon's slope stability, satellite images of years 2014 and 2017 were comparatively used. The severity of degradation was then assessed using Soil Adjusted Vegetation Index (SAVI). Calculated vegetation cover threshold values across the two epochs were taken as indicators of degradation. The study revealed that the strip along Mutonga river Canyon has undergone massive de-vegetation and slope de-stabilization. Soil creep from the quarry sites has also resettled into the watercourse way reducing the river depth, benthic life and degrading river water quality.

Keywords: SAVI, Satellite Image, Canyon, Degradation, Quarry

HERPETOFAUNAL ABUNDANCE AND LOCAL COMMUNITY PERCEPTION OF THE SPECIES IN KAKUNGA-MUKANGU REGION OF THE KAKAMEGA FOREST NATIONAL RESERVE, KENYA

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ABSTRACT

The study was conducted to determine the distribution and abundance of reptiles and amphibians in the forest and the adjacent farmlands in Kakunga-Mukangu region of the Kakamega Forest National Reserve. It also sought to determine the perceptions of the local community towards conservation of herpetofauna in the region. The data was collected between January and April 2017 using standardized time constrained searches, drift fence and pitfall trapping methods. In addition, a questionnaire survey distributed to 60 households in the Kakunga-Mukangu region was used to determine familiarity and perceptions of the community towards reptiles and amphibians. A total of 136 individual herpetofauna were recorded including 7 species of reptiles and 5 species of amphibians belonging to 8 genera. *Trachylepis megalura* was the most abundant species of reptiles and *Phrynobatrachus natalensis* was the most abundant species of amphibians. Most of the species were observed in the primary forest (29.41%) whereas the least abundance of the species was observed near or within aquatic habitats (8.82%). All the respondents (100%) were

aware of the presence of various kinds of reptiles and amphibians in the Kakunga-Mukangu region of the Kakamega Forest. Lizards and snakes were the commonest herpetes as indicated by 48.33% and 40.00% of the respondents respectively. The study established that negative values were widespread in the community. Herpetiles such as the snakes that were considered as dangerous by the majority of the communities were also least liked and enjoyed conservation support by the smallest proportion of the community members. The study established the need to enlighten the local community about the positive values of herpetofauna in the region.

Keywords: Herpetofauna, Diversity, Local community, Attitude, Perceptions, Benefits, Threats

ENVIRONMENTAL IMPACTS OF POPULATION AND CULTIVATED ECOSYSTEMS ON THE WATER RESOURCES OF THE LAKE VICTORIA BASIN: A REVIEW IN RELATION TO WATER RESOURCES PLANNING AND MANAGEMENT

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ABSTRACT

The Lake Victoria Basin spreads over 5 countries: Burundi, Kenya, Rwanda, Tanzania and Uganda. It has experienced a rapid growth in population and environmental degradation in the last 60 years. The study aimed to assess the major environmental impacts of the basin population especially as expressed in the cultivated ecosystems of the basin with respect to future contribution to the quantity and quality of water in the basin as it was part of a preliminary study leading to the formulation of a water resource management plan for the LVB. It involved mainly document review and field observations. Population estimation was based on 2012 estimated or reported district population, proportioning for the part of the district within the LVB. The basin population was estimated to be 40.4 million as of 2012, and projected to reach 88.8 by 2040 with constant growth rate; and population density was estimated to be 204 cap/km² in 2012 and projected to reach 449 cap/km² with constant growth rate by 2040. The population was found to be predominantly young, with people 14 years and younger accounting for 45% of the total. Three types of cultivated ecosystems were recognized: Mixed lowland smallholder subsistence rainfed cultivated systems, Mixed highland smallholder cultivated systems and Larger scale cultivated systems, all of which, together, covered about 13.9 million ha, or 70% of the terrestrial area of the basin. Smallholder subsistence rainfed system was found to be predominant, accounting for nearly 75% of the cultivated ecosystem. The study concluded that poverty was the defining driver of ecosystem degradation, and that reducing it requires a global integrated approach targeting poverty. It is clear that any effort to reduce ecosystems degradation may be nullified in the medium-term if it is not accompanied by a reduction in the growth of the population using agricultural land. Without this the quality of the basin's waters and livelihoods will be in jeopardy.

Keywords: Lake Victoria Basin, environmental impacts, population, cultivated ecosystems

TOWARDS FUZZY LOGIC IN PARTNER EVALUATION AND SELECTION FOR VIRTUAL ENTERPRISES

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ABSTRACT

The trend where enterprises outsource competencies is getting replaced by strategic alliances, where enterprises work together towards a common goal and share responsibilities as well as their profits. This calls for new ways of organizing work and the technological support that allows flexibility. A Virtual Enterprise (VE) is a temporary organization that pools together different member enterprise core competencies. The construction industry is a key sector in any economy. A construction project is implemented by a team of professionals and an alliance of companies. A crucial competitive factor of a VE, is its ability to form an end-user focused team which can be jeopardized if the right team is not formed. This can be attributed to poor choice of partners for the tasks due to insufficient information available about partners and lack of facilitation techniques. This study proposed definition

of multiple criteria decision making problem for construction projects. A multi criteria decision making technique is designed that can be applied to derive each partner's weight and determine the best partner that is eventually selected for each task. A technique that incorporates fuzzy logic in Analytic Hierarchy Process (AHP - a multi criteria decision making technique) to be used by construction industry project initiators to effectively evaluate and select right partners for tasks even when information available about the partners is insufficient is designed and applied. Incorporating fuzzy logic in decision making techniques can address the partners' evaluation and selection process reliability issue.

Keywords: Virtual Enterprises, Multi-criteria decision making, Fuzzy analytical hierarchy process, Partners evaluation and selection problem

EFFECT OF 2,4-D AND HEXAZINONE ON SOIL DEHYDROGENASE ACTIVITY IN SUGARCANE CULTIVATED SOILS IN NZOIA SUGARCANE PLANTATIONS

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ABSTRACT

Herbicides have been used extensively all over the world and have become indispensable part of high and cost effective agricultural production. The adverse effect of these herbicides is not only to their targets but also extend to non-targeted organisms. These effects may have detrimental impacts such as disruption of ecosystems, reduced soil health and fertility among other environmental hazardous. Dehydrogenase enzymes, which are intracellular enzyme in microflora of soil, play a key role in redox processes, especially in decomposition of organic matters. The aim of this experiments was to study the effects of 2,4-D and Hexazinone; commonly used herbicides to control weeds in sugarcane plantations in Nzoia sugar company nuclear estates, on the variation of dehydrogenase activity as an indicator of microbial activities on such soils. The soil for experiment were collected 0-10 cm depth using soil auger by random sampling method from three sites on each farm and a composite sample was prepared from the three sub-samples. Soil parameters such as pH, temperature, moisture content, N, P, K, Mg and Ca were analyzed. The experiments were conducted under the field conditions of soil samples collected from two farms which had history of application of the herbicides for five years and an out-grower farm as a control farm. The soils were spiked with the two xenobiotics at the field application rate and analyzed for the dehydrogenase activity for a period of seven days using TTC method and bacterial colony forming units using nutrient agar methods. Experiments showed that hexazinone and a boosting activity to the microbial activity as indicated by overall DHA activity of 16.375 ± 1.822 in farm F139, 21.970 ± 3.448 in farm F212, 113.45 ± 15.453 in farm OGF. On the other hand, 2,4-D had suppressing effect on microbial activity as shown by DHA activity of 0.532 ± 0.120 in farm F139, 0.541 ± 0.139 in farm F212 and 6.594 ± 1.175 in farm OGF. The noted results of DHA activity were in reference to untreated soils from the three farms which were 4.529 ± 0.408 in farm F139, 6.103 ± 0.341 in farm F212 and 21.578 ± 3.234 in farm OGF. The two herbicides effects on the total microbial activity was also backed with bacterial density results which showed there was low bacterial count upon 2,4-D application $2.463 \pm 3.693 \times 10^5$ in untreated soil $2.487 \pm 5.607 \times 10^5$ in hexazinone treated soil and $2.007 \pm 4.194 \times 10^4$ in 2,4-D treated soil. All the farms had acidic soils with other parameters with the normal range.

Key words: Herbicides, 2,4-D, Hexazinone, enzyme activities, dehydrogenase.

ANTIMICROBIAL ACTIVITY OF A STREPTOMYCETE ISOLATE FROM WHEAT FARM SOIL IN MAU FOREST COMPLEX, KENYA

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ABSTRACT

The study involved isolation of *Streptomyces* spp. from the soil of various sites in the Mau Forest Complex in Kenya. The isolates were screened for antimicrobial activity against selected bacterial and fungal plant pathogens

including; *Fusarium moniliforme*, *Ascochyta rabiei*, *Erwinia carotovora*, *Xanthomonas campestris* pv. *campestris*, *Pseudomonas savastanoi* pv. *phaseolicola* and reference cultures which were: *Staphylococcus aureus* ATCC 25923; *Escherichia coli* ATCC 25922; *Pseudomonas aeruginosa* ATCC 27853 and *Bacillus subtilis* ATCC 6633. One isolate from a wheat farm designated as WHF2B16 tested positive as a *Streptomyces* species through cultural, morphological, biochemical and molecular characterization. It was found to have antimicrobial activity against the fungal pathogens with a zone of inhibition >20 mm; one plant bacterial pathogen i.e. *Pseudomonas savastanoi* pv. *phaseolicola* with an inhibition zone of 15.5 ± 1.2 mm and was active against the Gram positive bacteria i.e. *Bacillus subtilis* and *Staphylococcus aureus*. Ethyl acetate extracts compared to culture filtrates of the isolate were found to produce significantly higher growth inhibitory effects in the test microorganisms in a t test (t-value $P > 0.05$). The isolate was further subjected to 16S RNA analysis and confirmed to be a *Streptomyces* species assigned as *Streptomyces* mau 1 (Accession No. KR780774) from the NCBI database. Thus streptomycete from a wheat farm in the Mau Complex in Kenya has the potential to be used as an antifungal and antibacterial agent.

Keywords: Antimicrobial activity, Plant pathogens, *Streptomyces*

SYNTHESIS, CHARACTERIZATION AND ANTIMICROBIAL ACTIVITIES OF HYDROXYTRIAZENES AND THEIR COPPER (II) COMPLEXES

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ABSTRACT

Bacterial pathogens that are resistant to current antibacterial drugs pose serious clinical challenges including high treatment costs, increased mortalities and opportunistic infections during surgical operations and in immunocompromised patients. There is therefore an urgent need to develop novel antibiotics to counter threats posed by resistant bacterial pathogens. In this study, hydroxytriazene ligands and their copper (II) complexes were synthesized by the coupling of aryl hydroxylamines and diazonium salts of aromatic amines. The synthesized compounds were characterized by micro-elemental analysis, Fourier Transform Infrared (FT-IR) spectroscopy, Ultraviolet-Visible (UV-Vis) spectroscopy, Proton-Nuclear Magnetic Resonance ($^1\text{H-NMR}$) spectroscopy and molar conductivity measurements. The target hydroxytriazene ligands and their copper (II) complexes were obtained in high yields and purity. The synthesized complexes were non-electrolytes and exhibited a 1:2 metal to ligand stoichiometry. The synthesized compounds were all inactive against *Pseudomonas putida*, *Salmonella enteritidis*, *Klebsiella pneumoniae*, enteropathogenic *Escherichia coli*, enteroaggregative *Escherichia coli*, and enterohaemorrhagic *Escherichia coli*. Ligands (**L₁-L₅**) were active against *Vibrio cholera* (25-50 $\mu\text{g/ml}$) and *Proteus mirabilis* (12.5-25 $\mu\text{g/ml}$). Complexes **Cu-L₁** and **Cu-L₂** were active against *Vibrio cholerae* (50 $\mu\text{g/ml}$) while complexes **Cu-L₁** to **Cu-L₄** were active against *Proteus mirabilis* (12.5-25 $\mu\text{g/ml}$). The synthesized compounds are promising antibacterial agents for both Gram-positive and Gram-negative bacterial strains.

Keywords: Hydroxytriazenes, Bacterial resistance, Novel drugs, Antibacterial drugs

SELECTIVE CONVERSION OF FRUCTOSE TO METHYL LEVULINATE USING SULPHATED ZIRCONIA-ALUMINA BINARY OXIDES

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ABSTRACT

Biomass constitutes a huge reservoir of renewable organic carbon that can be used for sustainable production of value-added chemicals and polymeric materials. Levulinate esters are biomass derived platform chemicals with potential applications as fuel additives, fragrances, and plasticizers. Moreover, they can be derivatized to produce herbicides, cancer therapeutics and surfactants. In this study, sulphated $\text{ZrO}_2\text{-Al}_2\text{O}_3$ binary oxides were synthesized by a modified co-precipitation method and found to be highly active and selective for direct conversion of fructose to methyl levulinate. The samples were characterized using powder x-ray diffraction (XRD), Brunauer-Emmett-Teller (BET) and Barrett-Joyner-Halenda (BJH) methods. The synthesized sulphated binary oxides were amorphous

with large mesopores (≥ 3.4 nm) and high pore volumes ($0.121-0.315$ cm³g⁻¹). The synthesized materials were used for conversion of fructose to methyl levulinate, with methanol as a solvent, in a continuously stirred pressurized reactor. The most active catalyst (ZA20), containing 20% alumina, selectively converted fructose to methyl levulinate with a high yield of 65% after 1 h at 200°C. The optimal catalyst loading, reaction time, and temperature were 40 mg, 30 min and 200°C, respectively. The catalysts were gradually deactivated with successive reuse due to surface deposition of humins but were easily regenerated by calcination in static air at 500°C for 3 h. However, activity was not fully recovered after regeneration, presumably due to leaching of sulphate species in the polar solvent media. The formation of ethers during conversion was negligible suggesting that methanol can be recycled after distillation.

Keywords: Sulphated binary oxides, mixed-metal oxides, solid superacids, biochemicals, biomass conversion, levulinate esters

DETERMINATION OF THE CRITICAL TIME WHEN LEVELS OF THE CYANIDE POTENTIAL IN CASSAVA ARE AT PEAK CONCENTRATION

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ABSTRACT

Cassava (*Manihot esculanta* Crantz) is the second most important food crop and a main source of income for the rural communities with potential for industrial use in the coastal region of Kenya. Cassava, now widely grown in the coastal region of Kenya is a domesticated plant derived from one or more species of the Genus *Manihot* in the Euphorbiaceae family. Cassava contains naturally occurring, but potentially toxic compounds called cyanogenic glycosides, which release hydrogen cyanide (HCN) as a result of enzymatic hydrolysis following maceration of the plant tissue. The objective of the study was to sustain and enhance the food security and livelihood of coastal lowland farmers and processors by assisting them to successfully produce/trade/export their produce in compliance with food safety standards for cassava and cassava products. The study was to conduct a scientific assessment to determine ways along the food chain/commodity pathway to minimize the hydro cyanic acid content in cassava and its products and thus provide methods of meeting food quality standards requirement. This was achieved by determining, through study and analysis, the effect on cyanide content based on agronomic factors (e.g. cultivars, stress,), agro ecological zone (CL 3, CL 4, and CL 5) and harvest/post-harvest practices i.e. age at harvest. The study was conducted in 2016 in Kilifi County in three agro ecological zones. They are coastal lowlands 3, 4 and 5. The genotypes studied and analyzed are Tajirika (improved), Shibe (improved), Karemba (improved) and Kibandameno (traditional). The analysis was carried out at 5, 8 and 11 months after planting. At five months after planting in loamy soils for the Kibandameno variety, the cyanide level is recorded 0.5mg/kg while at 11 months after planting in the same soils and AEZ's, the level is 0.33mg/kg. At five months after planting, Tajirika, Shibe and Kibandameno varieties in CL5 recorded cyanide levels of 0.44 and 0.48mg/kg respectively in sandy loam soils. In the eleventh month, Shibe and Kibandameno varieties in the same soil type recorded 0.41 and 0.45 mg/kg, respectively. There is a slight indication that as the plant ages the levels of the cyanogenic potential (CNP) declines.

Keywords: Cassava, Domesticated, Genotypes, Species, Cyanogenic glycosides, Enzymatic hydrolysis

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The introduction should indicate the importance, define the problem, state the hypotheses and objectives, and give a brief survey of the relevant literature. It should follow the abstract after skipping only one space.

Materials and Methods

This section describes the methodology employed to conduct the research and hence it should clearly describe in prose format, not list, the individuals/items/materials used, their sources, conditions, research design, steps or procedures followed in experimentation to enable others adopt or double-check findings.

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Results support or reject the hypotheses, or answer the questions stated in the introduction. The discussion section interprets the data and draws conclusions, inferences and recommendations for adoption and further research.

Tables

Tables should be used to present material not included in the text or Figures. Tables should be inserted in the text near where they are first mentioned. Tables should be numbered using Arabic numerals (e.g. Table 1) and given specific titles at the top. Tables should not be enclosed in grid lines, but should be given the top, bottom and subheading borders only. Example: Table 1

Table 1: Treatments used for evaluation of performance of grain amaranth

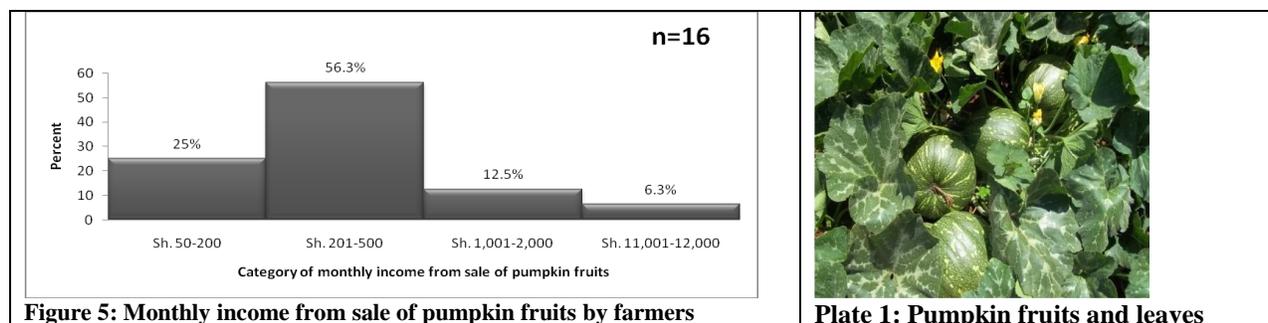
Treatment	Inter-row spacing (cm)	Fertilizer applied (units ha ⁻¹)	Number of plants ha ⁻¹
S1F1	90	0	37,037
S2F1	75	0	44,444
S1F2	90	5 tons FYM	37,037
S2F2	75	5 tons FYM	44,444
S1F3	90	10 tons FYM	37,037
S2F3	75	10 tons FYM	44,444
S1F4	90	20 kg P ₂ O ₅	37,037
S2F4	75	20 kg P ₂ O ₅	44,444

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Journal articles:
 -Ekesa, B.N. 2009. Agricultural biodiversity for food and nutrient security: The Kenyan perspective. *International Journal of Biodiversity and Conservation*, 1(7):208-214.
 -Siddiqui, Z.A. and Akhtar, M.S. 2007. Biocontrol of chickpea root-rot disease complex with phosphate-solubilising microorganisms. *Journal of Plant Pathology*, 89(1): 67-77.

- Oswell, F.N., Rufaro, M.M., Susan, K. and Arnold, B.M. 2007. Indigenous knowledge of the traditional vegetable pumpkin (*Cucurbita maxima/moschata*) from Zimbabwe. *African Journal of Agricultural Research*, 2(12):649-655.
- Book:** Ochapa, C. O. 1984. *Introduction to Tropical Soil Science*. Macmillan Intermediate Agriculture Series. Macmillan Education Ltd, London, UK.
- Chapter in a book:** Kauffman, C.S. and L.E. Weber. 1990. Grain amaranth. p. 127-139. *In: J. Janick and J.E. Simon (Eds.). Advances in New Crops*. Timber Press, Portland, Oregon, USA.
- Proceedings:** Chweya, A.J. 1997. Genetic enhancement of indigenous vegetables in Kenya, p. 90-99. *In: L. Guarino (Ed.). Proceedings of IPGRI International Workshop on Genetic Resources of Traditional Vegetables in Africa: Conservation and Use*. 29th-31st August, 1995, ICRAF Headquarters, Nairobi, Kenya.
- Thesis/dissertation:** Wekesa, F.S. 2010. Socio-economic analysis of production and response of grain amaranth (*Amaranthus caudatus* L.) to fertilizer application and intercropping with maize or beans in Kisumu West district, Kenya. Master of Science Thesis, University of Nairobi, Kenya.

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Journal of Environmental Sustainability Advancement Research

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