

Dr. Collins Okello (PhD) - CURRICULUM VITAE

Gender: Male
Year of birth: 1974
Nationality: Ugandan
Address: Gulu University, Faculty of Agriculture and Environment
P. O. Box 166, Gulu, Uganda
Tel: +256 787 279336
Email: c.okello@gu.ac.ug

Dr. Collins Okello is a Senior Lecturer and Dean, Faculty of Agriculture and Environment, Gulu University. He holds a PhD from University of Naples Federico II, and Masters' and Bachelors' Degrees from Makerere University. Dr. Okello is an accomplished scholar and administrator with a research, teaching and administrative experience spanning over 15 years. He joined Gulu University in 2005 after working in the Tea Industry as an Engineer for five years. He was the Head of Department of Biosystems Engineering for from 2014 to 2021. His expertise is in the field of agricultural machinery and power systems, with particular research interest in renewable energy applications in agriculture and off-grid communities. Dr. Okello is a team player, and has participated in several collaborative research projects aimed at developing solutions to contemporary development challenges. He is an accomplished scholar who has published scientific articles in peer reviewed journals, and has served as a reviewer for journals. Dr. Okello is passionate about empowering the youth to acquire skills for gainful employment through application of science, technology and innovation in solving community development challenges.

EDUCATION *(starting with highest degree)*

2011 – 2014 - Doctor of Philosophy, University of Naples Federico II, Naples, Italy

2006 – 2011 - Master of Science in Agricultural Engineering, Makerere University

1996 – 2000 - Bachelor of Science in Agricultural Engineering, Makerere University

EMPLOYMENT RECORD

2021 – present – DEAN, Faculty of Agriculture and Environment, Gulu University, I am responsible for the management of teaching, research, outreach and all administrative functions in the faculty. In this capacity, I also sit in various decision-making committees of the University including the University Senate and Management.

2014 – 2021 - Head of Department of Biosystems Engineering Gulu University, Faculty of Agriculture and Environment, Gulu University. I was I was responsible for providing oversight for teaching, research and outreach activities at the department level. I was also a member of the decision-making organs of the faculty including the Faculty Board and the Research and Higher Degree Committee

2005 – 2016 - He was progressively promoted from the rank of Teaching Assistant to Lecturer then to Senior Lecturer, main responsibility being teaching, research and community outreach

2000 – 2005 - James Finlay Uganda Limited, where I rose in rank from Engineering Management Trainee, to Project Engineer and Estate Engineer. My main roles were to ensure that, engineering project are executed according to plan, and the engineering function of the estate runs with minimum downtime, it involved planning, managing the workforce and implementation of activities of the engineering department

RELEVANT SKILLS AND COMPETENCES *(provide most relevant skills, if any)*

Leadership Currently I am the Dean, Faculty of Agriculture and Environment, I have well-developed leadership and organizational skills required to keep a multidisciplinary team well-motivated and focussed to achieve agreed goals. I have worked hard to improve my skills in leadership including pertinent aspects such as communication, networking, teamwork, motivation, delegation, time keeping etc..

Research Grants I have developed my project management skills over the years by participating in various project some of which are listed below.

May 2022 - up to 2026. Co-Principal Investigator - "Unlocking the Potential of Green Charcoal Innovations to Mitigate Climate Change in Northern Uganda (UPCHAIN)", funded by DANIDA under the Consultative Research Committee for Development Research (FFU) programme. The project is sponsoring 6 PhDs, 12 masters students and 1 postdoc fellow. <https://upchain.gu.ac.ug/>

2022 – to date: Project Lead for Skilling in Agripreneurship for Increased Youth Employment (SAY) project, under a memorandum of understanding with AVSI Foundation with funding from the Kingdom of Netherlands. The Project focusses on skilling youth (18 to 30 years) in the agribusiness sector for increased gainful employment.

2023 – 2027 – Team member of Building Stronger Universities Four (BSU IV) a multidisciplinary research and institutional capacity development project, project funded by DANIDA. <https://bsu.gu.ac.ug/>

2015 – To date: Leader of the Water Management Technologies and development and customization of low-cost water drilling technologies. Trained 138 youth in WASH in general and in groundwater drilling using Baptist well drilling technology.

2022-2024. Torrefaction of Banana Value Chain-Based Wastes Available in Uganda for Fuel (TorrCoal Project) where I am a Mentor of Postdoc fellow, Dr. Menya Emmanuel research topic: Project is managed by Makerere University and funded by Carnegie Corporation of New York.

2019 – March 2022: Principal Investigator – Transforming Energy Access Learning Partnership (TEA-LP) Curriculum Development. The project supported development of Master of Science in Renewable Energy and Energy Access at Gulu University. <https://tea-lp.org/>

2014-2016 – Team member for the SATIFFS project (Strengthening innovation and technology dissemination for sustainable development in cereals, cocoa and coffee value chains in Western and Eastern Africa). EU-Intra ACP funded project. <http://www.sattifs.unimol.it/>

2014–2016 – Gulu University Team Member in "Mobility to Enhance Training of Engineering Graduates in Africa (METEGA)" project promoting engineering education and mobility in Africa. The project is funded by the European Union.

Workshop facilitation My workshop facilitation skill is quite good. I have participated in various workshops under different projects. I have also been the lead person in organizing stakeholder workshops for curriculum development and reviews.

Advocacy I am developing my advocacy skills, through networking with key stakeholders, including those in NGOs, Private Sector and Government Ministries. Most projects that we undertake have components where we advocate for policy review based on the project findings.

Specialized software

Some of the relevant software are: MATLAB, AutoCAD, DesignExpert, SimaPro, PROMETHEE GAIA

POSTGRADUATE STUDENTS TRAINING EXPERIENCE

Was Faculty Graduate training coordinator from 2014 to 2021.

Currently I am a supervisor of 3 PhD students.

I have supervised 5 masters students to completion.

As Dean, I have arranged and chaired examination *viva voce* of six PhD students, who have completed their PhD successfully. In addition, I have chaired *viva voce* examination of over 70 masters' students.

PUBLICATIONS***Journal articles***

1. Olum, S., Wesana, J., Odongo, W., Mogendi, J., Okello, C., Webale, D., ... & De Steur, H. (2020). Agronomic biofortification from a stakeholder's viewpoint: evidence from studies on iodine-enriched foods in Uganda. *Vitamins and minerals biofortification of edible plants*, 163-189. <https://doi.org/10.1002/9781119511144.ch8>. Citations: 1

Summary This chapter provides an overview of two case studies that examine stakeholder reactions toward iodine biofortification in Uganda. The first case applies the protection motivation theory and evaluates the intention of school heads and parents of school-aged children to include iodine-biofortified legumes in school feeding programs. The second case study takes a broader scope of stakeholder groups and applies the analytical hierarchy process, a multicriteria decision-making tool, to understand the stakeholders' evaluation of the relative importance of Strengths, Weaknesses, Opportunities, and Threats (SWOT) factors in implementing agronomic iodine biofortification in Uganda. Results from the two cases demonstrate that stakeholders are generally optimistic about the iodine biofortification strategy to improve iodine intake and address the prevalent iodine deficiency disorders. Both cases provide insights into key factors that need to be considered in implementing iodine biofortification technology in a developing country.

2. Olum, S., Gellynck, X., Okello, C., Webale, D., Odongo, W., Ongeng, D., & De Steur, H. (2018). Stakeholders' perceptions of agronomic iodine biofortification: a SWOT-AHP analysis in Northern Uganda. *Nutrients*, 10(4), 407. <https://doi.org/10.3390/nu10040407>. Citations 20

Abstract

Agronomic biofortification (i.e., the application of fertilizer to elevate micronutrient concentrations in staple crops) is a recent strategy recommended for controlling Iodine Deficiency Disorders (IDDs). However, its success inevitably depends on stakeholders' appreciation and acceptance of it. By taking Northern Uganda as a case, this study aimed to capture and compare the perceptions of seven key stakeholder groups with respect to agronomic iodine biofortification. Therefore, we employed a SWOT (Strength, Weaknesses, Opportunities & Threats) analysis in combination with an Analytical Hierarchy Process (AHP). Findings show that stakeholders ($n = 56$) are generally positive about agronomic iodine biofortification in Uganda, as its strengths and opportunities outweighed weaknesses and threats. Cultural acceptance and effectiveness are considered the most important strengths while the high IDD prevalence rate and the availability of iodine deficient soils are key opportunities for further developing agronomic iodine biofortification. Environmental concerns about synthetic fertilizers as well as the time needed to supply iodine were considered crucial weaknesses. The limited use of fertilizer in Uganda was the main threat. While this study provides insight into important issues and priorities for iodine biofortification technology in Uganda, including differences in stakeholder views, the application of the SWOT-AHP method will guide future researchers and health planners conducting stakeholder analysis in similar domains.

- Cervelli, E., Pindozi, S., Capolupo, A., Okello, C., Rigillo, M., & Boccia, L. (2016). Ecosystem services and bioremediation of polluted areas. *Ecological Engineering*, 87, 139-149. <https://doi.org/10.1016/j.ecoleng.2015.09.045> Citations 27

Abstract

Contaminated areas represent a crucial concern in contemporary planning all over the world. The absence of shared value for such areas leads to abandonment and soil sealing specially if such areas have lost their agricultural potential. The European Project LIFE/ENV/IT/275 Ecoremed has implemented a protocol for the bioremediation of contaminated soils in Campania region. The cultivation of no food crops (Poplar and Giant reed) is proposed as buffer crops waiting for the characterization of the areas. This facilitates the uptake of the mineral contaminants and the biodegradation of organic compounds reducing the risk for leaching and the run off of harmful contaminants that would occur on bare soils. The study discusses a new approach to land use change (LUC) assessment based on environmental and socio-economic factors, evaluated through GIS tool and decision support software (ArcGIS/ILWIS). Literature data have been used to assess the current value of the ecosystem services (ES) provided by such crops (€/ha/year) and the benefits that people obtained from ecosystems. Three scenarios have sorted out and compared through multicriteria analysis. Moving from the deep knowledge of the environmental condition of the territory the study shows the alternative ES values of the land use change starting from no-change scenario to energy crops (Poplar and Giant reed), to abandonment. Results show that is possible to asses an increase of the ES value, both in case of a private and public action, also referring to the opportunities for farmers income in the short and medium-long period.

- Pindozi, S., Cervelli, E., Capolupo, A., Okello, C., & Boccia, L. (2016). Using historical maps to analyze two hundred years of land cover changes: case study of Sorrento peninsula (south Italy). *Cartography and Geographic Information Science*, 43(3), 250-265. <https://doi.org/10.1080/15230406.2015.1072736> Citations 48

ABSTRACT

Historical maps are effective sources of geographical information and useful for historical and territorial research. In this study, the examination of landscape dynamics on the basis of historical maps over a period of more than 200 years was conducted. The study area is Sorrento peninsula and part of the near Sarno river basin in South Italy. This study provides a general framework for the assessment of the overall quality and accuracy of historical maps. The application of the methodology used in this specific case study can contribute to a better understanding of the dynamics of the landscape in the long term. The derived knowledge can be applied in the planning of the landscape in order to implement correct conservation strategies. The comparison was made on four maps 1817, 1875, 1960, and 2006. Geodetic accuracy of the sheet maps of 1817 and 1875 offer a right basis for a macro analysis of land cover dynamics, evaluating conversion from one land cover category to another. Main transformation, identified in the period between 1875 and 1960, was the disappearance of vineyards, which covered 25% of the total study area in 1875. Agricultural areas increased in this period to cover 57% of the total area.

- Faugno, S., Pindozi, S., Okello, C., & Sannino, M. (2015). Testing the application of an automatic milking system on buffalo (*Bubalus bubalis*). *Journal of Agricultural Engineering*, 46(1), 13-18. <https://doi.org/10.4081/jae.2015.437> Citations 3

Abstract

The automatic milking systems (AMS) have been deeply studied in dairy cows applications, but not in the case of buffaloes; although, a few applications to the species can be found in literature. The objective of this study is to compare some important functional aspects of AMS with the conventional milking systems. Aspects such as adaptation of buffalo to AMS and the possible relationship between milking frequency and daily milk yield were evaluated. Two groups of *Bubalus bubalis* were reared in the same barn, in a farm located in Piana del Sele (SA) southern Italy. Forty primiparous buffaloes were milked using an AMS, and at the same time another herd of 40 were milked twice a day using traditional milking system (tandem). The adaptation period of buffaloes to AMS was 2 months. Milking frequency with the AMS was significantly higher compared to the one of traditional methods (2.3±0.17 times/d vs 2 times/d). Daily milk yield with the AMS was observed to be significantly higher than with

traditional milking system (7.9 ± 1.3 kg/d vs 6.9 ± 1.06 kg/d). In this study, there was no significant relationship between the increase of daily milking frequency and daily milk yield. We can conclude that a positive AMS effect on daily milk yield and milking frequency is possible and so we can expect successful applications of the AMS to dairy buffalo farms

6. Capolupo, A., Pindozi, S., Okello, C., Fiorentino, N., & Boccia, L. (2015). Photogrammetry for environmental monitoring: The use of drones and hydrological models for detection of soil contaminated by copper. *Science of the Total Environment*, 514, 298-306.
<https://doi.org/10.1016/j.scitotenv.2015.01.109> Citations 93

Abstract

Campania Region of Southern Italy has a complex environmental situation, due to geogenic and anthropogenic soil pollution. Some of the pollutants such as copper are mobilized in the organic matter. It has been shown that wetlands provide physical as well as biogeochemical barriers against pollutants. Therefore, the objective of this study was to introduce and test an innovative approach able to predict copper accumulation points at plot scales, using a combination of aerial photos, taken by drones, micro-rill network modelling and wetland prediction indices usually used at catchment scales. Data were collected from an area measuring 4500 m² in Trentola Ducenta locality of Caserta Province of southern Italy. The photos processing with a fifth-generation software for photogrammetry resulted in a high resolution Digital Elevation Model (DEM), used to study micro-rill processes. The DEM was also used to test the ability of Topographic Index (TI) and the Clima-Topographic Index (CTI) to predict copper sedimentation points at plot scale (0.1–10 ha) by comparing the map of the predicted and the actual copper distribution in the field. The DEM obtained with a resolution of 30 mm showed a high potential for the study of micro-rill processes and TI and CTI indices were able to predict zones of copper accumulation at a plot scale.

7. Okello, C., Pindozi, S., Faugno, S., & Boccia, L. (2013). Development of bioenergy technologies in Uganda: A review of progress. *Renewable and Sustainable Energy Reviews*, 18, 55-63.
<https://doi.org/10.1016/j.rser.2012.10.004> Citations 112

Abstract

Biomass is a renewable energy resource; however, its exploitation raises concerns about its ability to sustain the growing demand and its negative impacts on the environment, particularly in developing countries. These concerns are more prominent on the African continent where high population growth rates is leading to high rates of deforestation due to expansion of agricultural land and increased demand for bioenergy. Use of traditional and inefficient bioenergy technologies and appliances also exacerbate the problem. This paper presents a review of the efforts and progress made by different organisations in promoting improved bioenergy technologies in Uganda. The study was based on an extensive review of available literature on improved bioenergy technologies introduced in the country. It was found that there is high level of wastage of biomass resources since an estimated 72.7% of the population use traditional cooking stoves with efficiency estimated to be less than 10%. Inefficient cooking stoves are also blamed for indoor air pollution and respiratory illness reported amongst its users. Modern bioenergy technologies such as biomass gasification, cogeneration, biogas generation, biomass densification, and energy-efficient cooking stoves have been introduced in the country but have certainly not been widely disseminated. The country should pursue policies that will accelerate proliferation of more efficient bioenergy technologies in order to reduce the negative environmental impacts of bioenergy utilisation and to ensure sustainability of biomass supplies.

8. Capolupo, A., Pindozi, S., Okello, C., & Boccia, L. (2014). Indirect field technology for detecting areas object of illegal spills harmful to human health: application of drones, photogrammetry and hydrological models. *Geospatial health*, 8(3), S699-S707.
<https://nru.uncst.go.ug/handle/123456789/5401> Citations 42

The accumulation of heavy metals in agricultural soils is a serious environmental problem. The Campania region in southern Italy has higher levels of cancer risk, presumably due to the accumulation of geogenic and anthropogenic soil pollutants, some of which have been incorporated into organic matter. The aim of this study was to introduce and test an innovative, field-applicable methodology to detect heavy metal accumulation using drone-based photogrammetry and microrill network modelling, specifically to generate wetlands prediction indices normally applied at large catchment scales, such as a large geographic basin. The processing of aerial photos taken using a hexacopter equipped with fifth-generation software for photogrammetry allowed the generation of a digital elevation model (DEM) with a resolution as high as 30 mm. Not only this provided a high potential for the study of micro-rill processes, but it was also useful for testing and comparing the capability of the topographic

index (TI) and the clima-topographic index (CTI) to predict heavy metal sedimentation points at scales from 0.1 to 10 ha. Our results indicate that the TI and CTI indices can be used to predict points of heavy metal accumulation for small field catchments.

9. Okello, C., Pindozi, S., Faugno, S., & Boccia, L. (2014). Appraising bioenergy alternatives in Uganda using strengths, weaknesses, opportunities and threats (SWOT)-analytical hierarchy process (AHP) and a desirability functions approach. *Energies*, 7(3), 1171-1192. <https://doi.org/10.3390/en7031171> Citations 47

Abstract

Poor access to clean and reliable energy technologies is a major challenge to most developing countries. The decision to introduce new technologies is often faced by low adoption rates or even public opposition. In addition, the data required for effective decision making is often inadequate or even lacking, thus constraining the planning process. In this study, a methodology for participatory appraisal of technologies, integrating desirability functions to the strengths, weaknesses, opportunities and threats (SWOT)-analytical hierarchy process (AHP) methodology was developed. Application of the methodology was illustrated with an example for participatory appraisal of four bioenergy technologies in Uganda. Results showed that the methodology is effective in evaluating stakeholder preferences for bioenergy technologies. It showed a high potential to be used to identify and rate factors that stakeholders take into consideration when selecting bioenergy systems. The method could be used as a tool for technology screening, or reaching consensus in a participatory setup in a transparent manner.

10. Pindozi, S., Faugno, S., Okello, C., & Boccia, L. (2013). Measurement and prediction of buffalo manure evaporation in the farmyard to improve farm management. *Biosystems engineering*, 115(2), 117-124. <https://doi.org/10.1016/j.biosystemseng.2013.02.011> Citations 27

Abstract

In order to evaluate the performance of two empirical models for buffalo (*Bubalus bubalis*) manure evaporation, predictions were compared with measured data. The two models were developed by adapting the potential evapotranspiration (ET_o) models of Tombesi–Lauciani and Hargreaves. The data used for assessing the manure evaporation in situ, were derived from the manure weights recorded using an experimental platform installed within the farmyard and equipped with load cells. The experiments were carried out in Serre (SA), in the South of Italy in the period from 23 June to 24 September 2011. The most efficient model, in terms of closeness between estimates and measures, was implemented from 2006 to 2010, allowing for annualised calculation of evaporation. On this basis, an optimal management strategy was established, which corresponds to maximising manure evaporation, minimising the use of the scraper from the 100th day of the year (DOY) to the 250th DOY. This leads to a potential reduction in weight of the manure by 650 kg m⁻² [yard] year⁻¹, which corresponds to management cost reduction of about 30%.

11. Faugno, S., Pindozi, S., Infascelli, R., Okello, C., Ripa, M. N., & Boccia, L. (2012). Assessment of nitrogen content in buffalo manure and land application costs. *Journal of Agricultural Engineering*, 43(2), e13-e13. <https://www.cabdirect.org/cabdirect/abstract/20193170529> Citations 12

Abstract

Buffalo (*Bubalus bubalis*) livestock for mozzarella cheese production plays a fundamental role in the economy of southern Italy. European and Italian regulations consider nitrogen content in buffalo manure to be the same as that of cattle manure. This study aimed to assess whether this assumption is true. The first aim of the study was to assess nitrogen content in buffalo manure. Samples were taken from 35 farms to analyse nitrogen and phosphorous concentration in the manure. Analysis confirmed a lower nitrogen concentration (2%) in buffalo manure. A secondary aim of the study was to evaluate whether manure application techniques that are apparently less suitable, e.g. splash plate spreader, could be feasible. The cost of different methods of land application of manure and their characteristics were evaluated on the basis of one operational cycle. Considering losses for volatilisation, and taking into account cost assessment, the immediate incorporation of buffalo manure (nitrogen content 2%) is a suitable method of ammonia volatilisation. However, it is expensive and involves high fuel consumption in relation to the environmental benefit

12. Okello, C., Pindozi, S., Faugno, S., & Boccia, L. (2013). Bioenergy potential of agricultural and forest residues in Uganda. *Biomass and bioenergy*, 56, 515-525.

Abstract

Biomass is the major source of energy in most developing countries. However, there are concerns about the sustainability of biomass supplies and the environmental impacts resulting from their use. Use of residues could contribute to ensuring sustainable supply of biomass energy. This study presents findings of an evaluation of the energy potential of agricultural and forest residues in Uganda using census data of the year 2008/2009. Annual productions of crop and forest residues were estimated using residue-to-product ratio (RPR) method. Energy potential of each residue class was then determined basing on their respective lower heating values. The biogas generation potential of each animal category was used to evaluate the energy potential of animal manure. Results showed that the total energy potential of the residues amount to 260 PJ y⁻¹, which is about 70% of gross biomass energy requirement of Uganda for the year 2008. Crop residues had the highest contribution of about 150 PJ y⁻¹, followed by animal residues with a potential of 65 PJ y⁻¹. Maize residue is the predominant crop residue with energy potential of 65 PJ y⁻¹ followed by beans and banana, each at 16 PJ y⁻¹. This study indicates that agricultural and forest residues can be a major renewable energy source for Uganda. When sustainably utilised, biomass residues could contribute to reduction in environmental degradation in the country.

13. Faugno, S., Okello, C., Infascelli, R., Audino, F., Ardito, L., & Pindozi, S. (2013). Experimental tests on a new harvesting system for Burley tobacco. *Journal of Agricultural Engineering*, 44(s2). <https://www.proquest.com/docview/2417569793?pq-origsite=gscholar&fromopenview=true> Citations 0

The globalization of the tobacco production has led to a drop in competitiveness of the Italian tobacco on the world market. Burley is the main variety of tobacco cropped in Campania region of Southern Italy. Its leaves have to be sewn, in the curing phase. Aim of this work is to show the results of the implementation of a new harvest machine prototype. Basically, the machine used for Bright tobacco, totally mechanical harvested, which doesn't need to be sewn because it requires an indirect-fire treatment into the curing furnaces. The machine was modified in order to mechanize harvesting of Burley tobacco, and tested on four cultivars of Burley tobacco under three different planting layouts. The Burley tobacco leaves can be harvested mechanically by pulling individual leaves off the stalk; leaves are then sorted and tied in bundles prior to sewing. A mechanical burley tobacco harvesting system was evaluated. This machine consists in realizing a leaves orientation system based on the different weight between the leaf blade and the stalk enhanced by an air flow. The measurements taken were harvest timing, work capacity, and quality standards of the work carried out. The results, in terms of user time, range from 6.67 h/ha to 7.80 h/ha while in terms of operational efficiency are between 88% and 89%. The average user capacity recorded for the four cultivars is equal to 0.14 ha/h, a value far from the one recorded for the same harvesting machine used for Bright tobacco (0.25 ha/h). The harvest timing capacity, range from 0.51 t/h to 0.99 t/h. The work productivity goes from 0.17 t to 0.33 t per hour of human unit respectively. The average number of detached leaves, depending on the cultivar, has been between 523 and 744. Concerning the leaf orientation, a general percentage of 73% was achieved

Conference proceedings

1. di Perta, E. S., Boccia, L., Faugno, S., Okello, C., Sorrentino, G., Agizza, M. A., & Pindozi, S. (2015). Study and set-up of a wind tunnel for assessing ammonia emissions from the field. In *AIIA 2015 International Mid-Term Conference* (p. 58). <https://www.iris.unina.it/handle/11588/611069> Citations 1

Abstract

Livestock and agricultural activities contribute significantly to atmospheric ammonia emission in Europe. The volatilization process depends on many factors especially the wind speed and rainfall. The most important methods to evaluate ammonia volatilization are the dynamic flux chamber and micrometeorological method. The chambers are more flexible and simple to use in every situation. Few studies have been carried out to determine, which conditions are established inside the tunnel and how they could influence the measurements. For that purpose, in this paper an assessment of the effects of the wind tunnel configuration and flow rate was performed with CFD simulations and wind speed measurements in order to verify that airflow is completely developed. The wind tunnel consists in a mixing chamber situated between a divergent and a convergent duct, on which is possible to mount

an axial fan. Each part of the tunnel is equipped with sampling points and measurements were performed with a portable anemometer. During the test the tunnel is flushed with incoming air, for simulating the wind action on the soil surface. Two conditions were accomplished: air blowing and air suction. The vertical profiles of the air velocity in three cross sections were then investigated with more measurements made in the vicinity of the emitting surface. Results of velocity profiles demonstrate that the wind tunnel works better in the air suction conditions, for which there is less influence of the geometry of wind tunnel on the air flux.

2. Okello, C., Pindozi, S., Faugno, S., & Boccia, L. (2015). Multi-criteria sustainability assessment of the of cooking energy systems in Uganda. In *New frontiers of biosystem and agricultural engineering for feeding the planet* (pp. 123-123). <https://www.iris.unina.it/handle/11588/611071> Citations 0

Abstract

The need to provide clean and reliable energy for cooking that is compatible with socio-economic status of the population, technologically appropriate and environmentally friendly is a major challenge to sustainable development in developing countries. Efforts to simultaneously fulfil the social, economic, environmental and technological objectives of systems are hampered by conflicting nature of the objectives. The multi-criteria decision methods are suitable for solving such conflicting decisions. In this study, we proposed a multi-criteria decision analysis method that attempts to incorporate all these conflicting objectives to make more sustainable choices of cooking energy systems in a developing country. The method involves selection and quantification social, economic, environmental and technological criteria and incorporating them in a decision-making framework using Preference Ranking and Organisational Method for Enrichment Evaluation (PROMETHEE) and Graphical Analysis for Interactive Aid (GAIA) methods. The framework was used in a case study to aid the decision choice between domestic biogas system and traditional charcoal system in Uganda. Impacts on human health and climate change impacts were used as environmental criteria and determined using Life Cycle Analysis (LCA). Efficiency and maintainability of combustion appliances were used as technical criteria, while economic criteria were based on capital and operating costs. Job creation and acceptability comprised the social criteria. Results showed that the biogas system is more competitive than charcoal under both the PROMETHEE I partial ranking and the PROMETHEE II complete ranking. However, the major challenges of biogas systems were the high capital costs and impact on human health attributed to use of chemical fertilizers in grass feed production. In an alternative scenario with increased recycling of slurry as substitute to chemical fertilizers, the performance of the biogas systems showed improvement. In both scenarios, the main challenges of the charcoal system were the high operating costs, climate change impacts and inability to create formal jobs. The study therefore suggests that biogas is a more sustainable household cooking energy than charcoal in Uganda, but still faces the challenge of high capital costs

3. Okello, C., Pindozi, S., Faugno, S., & Boccia, L. (2014). Environmental benefits of valorising cattle manure for household cooking energy in Uganda. In *Proceedings of Fifth International Symposium on Energy from Biomass and Wastes-Venice*. <https://www.iris.unina.it/handle/11588/592011> Citations 0

Abstract

This study employed the Life Cycle Assessment (LCA) methodology to evaluate the environmental impacts of utilizing cattle manure as a substrate for biogas generation for cooking energy in Uganda. Results of the study showed that biogas energy systems based of cattle manure has potential environmental benefits in comparison to charcoal produced from natural forests. Under baseline scenario, without recycling of slurry as fertilizer, the biogas system leads to total environmental impacts of over 80% less than that of charcoal system. When slurry is utilized as substitute mineral fertilizers, the environmental impact of biogas system was found to be less than that of charcoal by close to 95%. The study further showed that that use of biogas could lead to considerable reduction on human health impacts compared to charcoal. In conclusion, utilization of cattle manure for biogas production has potential benefit of reducing the environmental impacts due to charcoal production and use in Uganda.

4. Bongomin, O., Okello, C., Ocen, G. G., & Tigalana, D. (2021). Agriculture 4.0: The Promises for Sustainable Agricultural and Food Systems. Busitema University Science, Technology and Innovation Symposium. <https://nru.uncst.go.ug/handle/123456789/5398> Citations 0

Abstract

The transformative power of industry 4.0 in agricultural and food systems (Agri-food) can be attested from the explosive disruption of agricultural production infrastructures such as connected farms, new farm equipment, and connected tractors and machines which is well-known today as Agriculture 4.0 or Agri-food 4.0. The driving force behind the emergence of Agriculture 4.0 is the dire need to increase efficiency, productivity and quality in agri-food systems, and environmental protection. This has gained attention of many researchers in the recent past and thus, making Agriculture 4.0 a buzzword among the academic literature today. Despite the fact that a number of studies have covered the applications of several disruptive technologies in agri-food, the key technologies that are transforming the agri-food have been ill-defined. Therefore, the present paper aimed at identifying the key disruptive technologies and highlighting their application areas in agri-food. Massive exploratory literature search was conducted on the published papers obtained from the electronic databases including Scopus, ScienceDirect, Wiley, Emerald insight, Taylor & Francis, and Springer. The applications of 11 disruptive technologies in agri-food were analyzed based on 119 published papers. The results showed that 5 key disruptive technologies including Internet of things, Drones, Blockchain, Big Data, and Robotics are emblematic of Agriculture 4.0 epoch. The application areas of these technologies in agri-food are clearly highlighted. The present study revealed the need for extensive research to expand the application areas of the disruptive technologies in agri-food.

5. Okello, C., Kasisira, L. L., & Okure, M. (2011). Optimising densification condition of coffee husks briquettes using response surface methodology. In Proceedings Second International Conference on Advances in Engineering Technology Entebbe, Uganda.
<https://nru.uncst.go.ug/handle/123456789/5408> Citations 12

This study was carried out to establish the optimum conditions for converting coffee husks with molasses as binder into a densified biomass fuel. The study was conducted following the response surface methodology (RSM) using rotatable central composite experimental design (CCD). Briquette samples were made by compressing the coffee husks-molasses mixture in a piston and die assembly. The factors in the study were the quantity of binder, die pressure, moisture content, material particle size and dwell time. The density, durability and stability of the densified coffee husks were the response variables. The results of the study indicated that a combination of die pressure of 14.91MPa, moisture content of 8.00% wb, and binder content of 45.00% wb was optimum. Under the optimum settings of the variables, the briquettes produced had a particle density of 718.09 kg/m³, durability of 80.77% and stability of 14.98%. The study shows that coffee husks can be converted into durable briquettes that can be used to provide the energy required for the development of industry in Uganda.

6. Pindoizzi, S., Faugno, S., Okello, C., & Boccia, L. (2012, July). Experimental evaluation of manure evaporation in the paddock for a management algorithm development. In Proceedings of international conference of agricultural conference (pp. 8-12).
<https://nru.uncst.go.ug/handle/123456789/5400> Citations 3

Abstract

The aims of this study was to evaluate the possibility of reducing the weight of manure in paddocks by natural evaporation according to an appropriate management plan. The weight of buffalo manure was recorded by an experimental platform equipped with load cells and installed within the paddock. The data was used for assessing the real evaporation of manure in situ. A model for predicting manure evaporation was developed by adapting a soil evapotranspiration model. On the basis of the model an optimal management strategy was established, which corresponds to minimizing the use of the scraper from the 100th day of the year (DOY) to the 250th DOY. This lead to a potential reduction in weight of the manure by 650 kg/m²/year which corresponds to management cost reduction of about 30%. This approach is effective for reducing the bulkiness of buffalo manure for which the spreading costs per kg of nitrogen and the fuel needs for land application is very substantial considering its low nitrogen content of about 2 mg/m³

Thesis and dissertation

1. Okello, C. (2009). Evaluating thermochemical properties and optimising densification conditions of coffee husks under low pressure. MSc Dissertation Submitted to Makerere University.
<http://dspace.mak.ac.ug/handle/10570/930> Citations 1
2. Okello, C. (2014). Assessing sustainability of bioenergy systems in developing countries: methodological development and application. PhD Thesis, Submitted to University of Naples

Pre-print articles

1. Anywar, D., Shaban, K. S., Labeja, R. L., Loki, R. O., & Okello, C. (2022). Fast-growing exotic tree species as fuelwood alternative for refugees and host communities in Northern Uganda. Research Square. <https://nru.uncst.go.ug/handle/123456789/5419>. Citations 0

Abstract

The high demand for firewood and charcoal has exerted high pressure on the indigenous trees in Uganda. Communities believe that the indigenous trees are better fuel sources despite limited evidence to support this claim. This study was carried out in 2021 to evaluate the fuelwood properties of selected indigenous tree species in comparison to three exotic tree species that have been promoted for use by refugees and host communities in Lamwo District of Northern Uganda. Wood samples were collected from three different locations from the study area in Lamwo District and transported to Gulu University for laboratory analysis of their physical and chemical properties. Data were analysed using one way analysis of variance (ANOVA) at 5% level of confidence and the means were separated using Tukey HSD test. Results showed that moisture content, fixed carbon, volatile matter, and Fuel Value Index (FVI) did not significantly vary among the indigenous and exotic tree species. Fuel value index was observed to be negatively correlated with moisture content of the wood, implying both species' categories retard in fuel quality when their moisture contents increase. Overall, the results show that there were no significant differences in the FVI of all the indigenous and exotic tree species investigated in this study. It is recommended that fast-growing exotic species such as *Eucalyptus grandis*, *Caliandra calothyrsus*, and *Senna siamea* that are grown in the region be promoted to ensure regeneration and reduction of pressure on the use of natural forest.

2. Bongomin, O., Lamo, J., Guina, J., Okello, C., Ocen, G., Obura, M., ... & Ojok, S. (2022). Applications of Drones and Image Analytics in Field Phenotyping: A Potential Breakthrough in Uganda's Agricultural Research. Available at SSRN 4158755. <https://nru.uncst.go.ug/handle/123456789/5417>. Citations 0

Abstract

We are in the race against time to find new solutions amidst the threat of climate change, to increase food production by 70% to feed the ever-growing world population which is expected to double by 2050. Agricultural research plays astonishing roles in crop and livestock improvement through breeding programs and good agronomic practices to enable sustainable agriculture and food systems. The advanced molecular breeding or modern breeding technologies in genotyping have been well-embraced by most research institutions worldwide. However, phenotyping which plays great role in agricultural research and breeding programs has achieved little development or still a traditional method in most institutions across African countries. Noteworthy, the advancement of phenotyping has been gaining momentum and attracted a number of researchers in the recent past, this led to the coining of high-throughput phenotyping concept. Nevertheless, the comprehensive understanding of this concept remains limited in most research institutions in developing countries, especially Uganda. Therefore, the present review aimed to provide a summary of drone-based high throughput phenotyping used across different crops. The electronic literature search was conducted from non-academic and academic databases. The literature sources in the form of peer-reviewed journal articles, books, book sections, conference papers, thesis and dissertations, policy papers, organisation or company manuals, working papers, and reports were considered. In this review, the concepts of field phenotyping are discussed, drone classification and specifications are elaborated, the use cases of the drone-based high-throughput phenotyping are presented, drone imaging systems for phenotyping are discussed, and high-throughput image analytics method is explained. In this paper, it was found that cereals have been the most studied crop for drone-based phenotyping application in academic literature. However, root crops were the list studied, hence, extensive research is needed for drone-based phenotyping adoption in root crops. Moreover, limited studies have been focused on the effect of drones' operation parameters. Therefore, research focusing on the optimization of the drones' performance is required.
