

ABSTRACTS

JOURNAL OF THE GHANA SCIENCE ASSOCIATION, VOL. 12, NO.2, DEC., 2010

TABLE OF CONTENTS	PAGE
Length-Weight Relationship and Distribution of <i>Tympanotonus Fuscata</i> (Mollusca: Potamididae) in Brenu Lagoon, Ghana - <i>J. Aggrey-Fynn</i>	1-6
The Effect of Thermal Annealing on the Optical Band Gap of Cd _{1-x} Zn _x S Thin Films Deposited by the Dip Technique - <i>D. Ompong, K. Ampong, and F. Boakye</i>	7-13
The Effect of Thermal Annealing on the Optical Band Gap of Cadmium Sulphide Thin Films, Prepared by the Chemical bath Deposition Technique - <i>F. K. Ampong, N. K. Asare Donkor and F. Boakye</i>	14-20
Pen Culture of the Black-Camponotus, an Ant Genus from the Tropics in the Great Lagoon in Ghana - <i>F.A. Anani, P.K. Ofori-Danson and E. K. Abban</i>	21-30

JOURNAL OF THE GHANA SCIENCE ASSOCIATION, VOL. 12, NO.2, DEC., 2010

Gamma Radiation Processing
Estuary for Microbiological

Measurement and Enhancem
Kwawukume, A. Essuman et

Improvement of Strength on
Kwawukume, A. Essuman et

The Determination of Mass,
Samples Collected at Kwabe

Determination of Heavy Me
Motorway and Tetteh Quar
Aboh and P.O. Yeboah

Epidemiological Survey of S
School Going Children in th
H.H. Abruquah

New Sources of Resistance i
(Homoptera: Aphididae) - *F.*

Anti-Typhoid Properties of I
Adotey, G. Fuachie-Sobreh,

Clenbuterol-Stimulated Gluc
Adrenoceptor in Mouse Isol

Improving the Efficiency of
J.A. Awuni and R. Namara

LENGTH-WEIGHT RELATIONSHIP AND DISTRIBUTION OF *TYMPANOTONUS FUSCATA* (MOLLUSCA: POTAMIDIDAE) IN BRENU LAGOON, GHANA

J. Aggrey-Fynn

Department of Fisheries and Aquatic Sciences,
University of Cape Coast, Ghana

ABSTRACT

*A total of 1894 specimens of *Tympanotonus fuscata* were obtained by random sampling with Ekman grab from Brenu Lagoon to determine the size distribution of the organism as a result of perceived human predation on the resource in the area. Samples of the edible snail were collected monthly from November 2003 to October 2004, and the physico-chemical parameters determined for the entire study period. Variations were observed in the quarterly mean density (numbers/cm³) of the snails in all the four sampling stations A to D with values ranging from 18.67±4.81 to 99.00±17.80 at station A, 21.67±7.06 to 29.33±4.41 at station B, 21.70±10.50 to 71.70±12.30 at station C and 9.67±7.22 to 41.30±5.70/cm³ at station D. There were patchy distributions of the snail in the lagoon at replicate stations which might be due to the variation of physical conditions in the water. The height-weight relationship of the snail indicates negative allometric growth with high individual variability and the body weight was most closely related to the shell height ($R^2 = 0.89$). The snails in Brenu Lagoon were not growing to the large size this was observed in size frequency distribution. The modal size class was 1.5 – 1.9 cm. The domination of smaller snail size could be due to human predation pressure on the larger snails and or the effect of physical and chemical factors that prevail in Brenu Lagoon.*

THE EFFECT OF THERMAL ANNEALING ON THE OPTICAL BAND GAP OF Cd_{1-x}Zn_xS THIN FILMS DEPOSITED BY THE DIP TECHNIQUE

D. Ompong, K. Ampong, and F. Boakye

Department of Physics,
Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

ABSTRACT

The effect of thermal annealing on the optical band gap of Cd_{1-x}Zn_xS (x= 0.2, 0.4, 0.6, 0.8) thin films have been investigated. The films were deposited using the dip technique. The fundamental optical property which has been investigated here is the absorbance of light at room temperature, using the KLB Ultraspec II 4050 (UV/Visible) spectrophotometer over the wavelength range 300 – 900 nm. The energy band gap and absorption coefficient of the films were determined from the absorption spectrum. The optical band gap of the as-deposited films varied from 2.42 eV (x=0.2) to 3.61 eV (x=0.8), that is, the band gap increased with increasing Zn concentration of the alloy. These values compare favorably well with that obtained from literature of similar films prepared using other deposition techniques. The as-deposited samples were thermally annealed in air for an hour at temperatures of 100°C, 200°C and 300°C and the absorption spectra again recorded. It was observed that thermal annealing decreased the band gap of the samples; this may be due to improving crystallinity or alternatively, a phase transformation taking place in the samples as a result of the heat treatment.

THE EFFECT OF THERMAL ANNEALING ON THE OPTICAL BAND GAP OF CADMIUM SULPHIDE THIN FILMS, PREPARED BY THE CHEMICAL BATH DEPOSITION TECHNIQUE

F. K. Ampong¹, N. K. Asare Donkor² and F. Boakye¹

¹Department of Physics,

²Department of Chemistry,

Kwame Nkrumah University of Science and Technology, Kumasi

ABSTRACT

Cadmium sulphide thin films have been prepared by the chemical bath deposition technique (pH 11, 70°C). Two different sets of films were prepared under varied conditions and concentrations of their ions sources (Cd²⁺ from cadmium nitrate, S²⁻ from thiourea) and Na₂EDTA as a complexing agent. A UV mini Shimadzu UV-VIS Spectrophotometer was used to determine the optical absorbance of the films as a function of wavelength at room temperature over the wavelength range 200 – 600 nm. The samples were then thermally annealed for thirty (30) minutes, at temperatures of 100°C, and 200°C, after which the absorbance of the films were again recorded. The band gap values obtained for the sample with 0.5 M CdS as deposited, annealed at 100°C and annealed 200°C were 2.1 eV, 2.2 eV and 2.3 eV respectively. Whilst the values obtained for the sample 0.15M CdS as deposited, annealed at 100°C and annealed at 200°C were 2.0 eV, 2.01eV and 2.02 eV respectively. The increase in band gap with annealing temperature might be attributed to the improvement in crystallinity in the films.

PEN CULTURE OF THE BLACK-CHINNED TILAPIA, SAROTHERODON MELANOTHERON IN THE AGLOR LAGOON IN GHANA

F.A. Anani¹, P.K. Ofori-Danson² and E. K. Abban¹

¹CSIR-Water Research Institute, P.O. Box M 32, Accra-Ghana

²Department of Oceanography and Fisheries,
University of Ghana, Legon, Ghana

ABSTRACT

Pen-fish-culture as a culture-based fisheries approach was investigated in the Aglor Lagoon from December 2003 to June, 2004. The fish used in the study was the Black-chinned tilapia Sarotherodon melanothereon. The growth performance of S. melanothereon cultured for six months in the Aglor Lagoon under three different treatments were monitored. In the first treatment, the cultured fish was fed with a feed of 29.80 % protein at 3 % body weight once a day. In the second treatment, bamboo was stacked at a density of 6 per metre square in pens to serve as substrate for periphyton growth and development. In the third treatment, there was no feeding (control). There was significant difference in growth between the fed and the unfed S. melanothereon in the pens, with no significant difference in growth between the fish that subsisted on periphyton developed on bamboo and the other treatments. S. melanothereon cultured in the bamboo equipped pens had the best condition factor of 3.57 ± 0.23. The experimental values of b obtained from the length-weight relationship ($W = aL^b$) for the three treatments were 2.07, 2.13 and 2.80 for feeding, unfed and bamboo respectively. From the results, the least yield was obtained from the unfed control pen (0.045 kg/m²), whilst the highest was from the bamboo equipped pens (0.183 kg/m²).

GAMMA RADIATION PROCESSING OF CLAM (*GALATEA PARADOXA* BORN 1778) FROM THE VOLTA RIVER ESTUARY FOR MICROBIOLOGICAL DECONTAMINATION

C.M. Amoah^{1,2}, G.T. Odamtten¹ and P. Akpedonu¹
¹Department of Botany, University of Ghana, P. O. Box LG 55 Legon
²Volta Basin Research Project, VBRP, University of Ghana
³Noguchi Memorial Institute for Medical Research, NMIMR,
College of Health Sciences, University of Ghana

ABSTRACT

The Clam (Galatea paradoxa Born 1778) is a dermesal dweller of riverine water and filter feed by passing water through gut concentrating particulate matter including bacteria in the gut and mantle. Microbial profile of contaminating bacteria and their sensitivity to gamma irradiation (0 – 20 kGy) were ascertained in vivo and in vitro under laboratory conditions. Conventional cultural and morphological characteristics were used to detect the resident Total Aerobic Bacteria (TAB), Total Heterotrophic and Total Coliform bacteria (TC) populations in the clam and the species encountered were confirmed using biochemical methods and the API 20E identification kit. Twenty (20) bacteria species in the samples belonged to 18 genera (Acinetobacter, Aeromonas, Chromobacterium, Citrobacter, Enterobacter, Escherichia, Flavobacterium, Klebsiella, Micrococcus, Morganella, Proteus, Pseudomonas, Salmonella, Serratia, Staphylococcus, Streptococcus, Vibrio and Yersinia) predominated by Acinetobacter (22%), Staphylococcus aureus (12%) and Klebsiella ornitholytica (11%) in the clam mantle and Pseudomonas aeruginosa (32%), Klebsiella ornitholytica (24%) and Flavobacterium meningosepticum (12%) in the water. A dose of 20 kGy eliminated all microorganisms in the “in vitro” studies; at 15 kGy only two bacteria species Micrococcus radiodurans and Vibrio cholera survived. The most radio resistant species was M. radiodurans ($D_{10}=6.19$ kGy), followed by Vibrio cholera ($D_{10}=5.2$ kGy). A dose of 10 kGy eliminated Staphylococcus aureus ($D_{10}=1.7$ kGy). Practical implications from these findings are discussed in the light of food safety of preserved clams.

MEASUREMENT AND ENHANCEMENT OF PLASTICITY INDICES OF SOME EXTRUDED GHANAIAN CLAYS

P.S Kwawukume, A. Essuman and R. Amoanyi
Department of Industrial Art,
Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

ABSTRACT

The use of simple equipment that can reliably calculate plasticity indices of three local clays (Cape Coast, Fosu and Teleku Bokazzo) in both aqueous and organic media by extrusion method was studied. Experimental procedures were followed and one basic modification was made to Worrall and Khan measurement of rate of flow of plastic clays in order to prevent sudden rush of compressed air. Results indicate that plasticity brought about by ageing can be measured for clays in aqueous and organic medium. Clays aged for a further period of six months in aqueous medium showed greater plasticity index values confirming the reliability of the measuring instrument. The study revealed that Teleku Bokazzo Kaolin in organic medium has high plasticity that can be exploited in various product developments especially in refractory production where low iron content clays are usually needed. Plasticity of local clays can be measured accurately and reliable plasticity indices can be controlled by the length of ageing time for consistent manufacturing results.

IMPROVEMENT OF STRENGTH ON LOCAL POTTERY CLAYS BY TRADITIONAL AGEING OF CLAYS

P.S. Kwawukume, A. Essuman and R. Amoanyi
*Department of Industrial Art,
Kwame Nkrumah University of Science and Technology, Kumasi, Ghana*

ABSTRACT

The effect of ageing on various parameters such as particle size distribution, specific surface area, dry strength, shrinkage, fired strength, bulk density, and moisture content of clay was studied. The results indicate that ageing introduces finer particle sizes due to a progressive increase in the proportion of the fine particles as the system is aged, the critical moisture content of the aged clays are higher than the unaged clays and the strength of all the aged clays tested showed improvement in strength characteristics than the unaged clays. Ageing affects the bulk density of local clays as the inherent porosity is replaced by fine particles that are produced as the clays are aged. Both bulk density and particle size are recognized as powerful indicators of product quality in both manufacturing and strength of the clays.

THE DETERMINATION OF MASS, ELEMENT AND BLACK CARBON CONCENTRATIONS IN HARMATTAN AEROSOL SAMPLES COLLECTED AT KWABENYA, GHANA

I.J.K. Aboh and F. G. Ofofu
*Physics Department, National Nuclear Research Institute,
Ghana Atomic Energy Commission,
P. O. Box LG 80, Legon, Ghana*

ABSTRACT

Aerosol particles were sampled between 27th December 2005 to 16th February 2006, using the Gent sampler and segregated into two size fractions – fine (PM_{2.5}) and Coarse (PM_{10-2.5}) from Kwabenya, near Accra. The aerosol particles were collected on Nuclepore polycarbonate membrane filters. The mass, Black Carbon (BC) and elemental concentrations in the two size fractions were determined using Gravimetric analysis, black smoke method and EDXRF analysis, respectively. The aerosol mass concentration was 8.57 µg/m³ for the fine fraction and 110.90 µg/m³ for the coarse fraction. The average Black carbon concentrations measured were 0.71 µg/m³ and 0.65 µg/m³ for the fine and coarse fractions, respectively. The results were compared with some literature values and the World Health Organisation Standard values. The high coarse to fine ratio suggest that most of the aerosol are from natural sources.

DETERMINATION OF HEAVY METALS AND HUMAN HEALTH RISK ASSESSMENT OF ROAD DUST ON THE TEMA MOTORWAY AND TETTEH QUARSHIE INTERCHANGE IN ACCRA, GHANA

S.M. Atiemo¹, F.G. Ofofu¹, I.J.K. Aboh¹ and P.O. Yeboah²
¹*National Nuclear Research Institute, Ghana Atomic Energy Commission,
P.O. Box LG80, Legon, Accra*
²*Graduate School of Nuclear and Allied Sciences, University of Ghana, Legon, Accra*

ABSTRACT

Street dust samples were collected from Tema Motorway (near Ashiaman overhead) and Tetteh Quarshie interchange in Accra. The samples were segregated into two groups of grain sizes between 100 µm - 250 µm and the other being less than 100 µm. Energy dispersive X-ray fluorescence technique was used to determine their elemental compositions. In all twenty (20) elements were identified: K, Ca, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn, Ga, Ge, As, Se, Br, Rb, Sr, Y, Zr and Pb. The results show significant concentrations levels of K, Ca, Ti Pb, Zn, Cu, Mn, Fe, Rb, Sr, Y, Zr and Cr in all the samples. Enrichment factors determined for the elements show high enrichment of V, Zn, Cu, Zr, Cr, Br and Pb from the sample sites. There was no indication of significant anthropogenic contribution of manganese (Mn) which gave average enrichment factor values of 0.60 and 0.78 in the road dust at the Tema motorway and Tetteh Quarshie Interchange respectively. Risk assessment of selected

heavy metal contaminants from both sites indicate that Pb gave Hazard Index (HI) values of 0.56 and 0.62 which falls below the safe level of one (1). It was also observed that ingestion which gave HI values of 2.1 and 2.3 was the highest risk of exposure pathway. Tetteh Quarshie Interchange gave the highest cumulative risk of exposure.

EPIDEMIOLOGICAL SURVEY OF SOIL-TRANSMITTED HELMINTHS IN OCCUPATIONAL RISK GROUPS AND NON SCHOOL GOING CHILDREN IN THE KINTAMPO NORTH DISTRICT OF GHANA

S.C.K Tay¹, W.A. Twum¹, H.H. Abruquah²

¹Department of Clinical Microbiology,
Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

²Division of Microbiology and Infectious Diseases, University Hospital,
Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

ABSTRACT

Soil-transmitted helminths (STHs) remain a major health threat to humans especially children throughout the world, mostly in developing nations including Ghana. The present de-worming programme by the Ministry of Health is only for children of school-going age; hence occupational risk groups and non-school going children may remain as sources of infection throughout the year. The aim of this study was to conduct a survey on STHs in occupational risk groups and non-school going children in the Kintampo North District of the Brong Ahafo Region of Ghana. Seven hundred and eleven (711) individuals made up of occupational risk groups and non-school going children, between the ages of 1-90 years, were recruited in a cross sectional survey in six (6) rural communities in the Kintampo North District for various STHs. All faecal samples collected were analyzed using the Kato-Katz method which is recognized as the gold standard for the diagnosis of intestinal helminths. A total of 443 (62.3%) individuals were infected with at least one intestinal parasite. Parasites isolated included hookworm, 376/711 (52.9%); *Ascaris lumbricoides*, 15 (2.1%); *Trichuris trichiura*, 6 (0.8%); *Hymenolepis nana*, 38 (5.3%) and *Taenia* spp., 8 (1.1%). Hookworm prevalence was higher in all the six communities ($p < 0.05$). More males, 180/268 (67.5%) were generally infected than females, 263/443 (59.4%) but the difference however was not statistically significant ($p > 0.05$). Hookworm intensities observed included 362/376 (96.3%) light infections, 10 (2.7%) moderate infections and 4 (1.1%) heavy infections. All the observed cases of *Ascaris lumbricoides* and *Trichuris trichiura* were of light intensities. The incidence rate of STH infection declined with age with the highest of 151/225 observed in the 1-10 age group. The highest prevalence of 81.1% (99/122) was however recorded among the 11-20 age group. Overall prevalence of intestinal parasite infection was found to be 62.3%. Hookworm is the predominant STH found among the general populace. The most affected risk groups are the non-school going children. General knowledge on STHs among the community members is low, with poor attitudes and practices towards STH prevention, control and treatment. It is recommended that future MoH de-worming programmes should include non-school going children and occupational risk groups

NEW SOURCES OF RESISTANCE IN COWPEA TO THE COWPEA APHID (*APHIS CRACCIVORA* KOCH) (HOMOPTERA: APHIDIDAE)

F. Kusi¹, D. Obeng-Ofori², S.K. Asante¹, F.K. Padi³

¹Savanna Agricultural Research Institute,
CSIR, P.O. Box TL 52, Tamale, Ghana ²Department of Crop Science,
College of Agriculture and Consumer Sciences,
University of Ghana, P.O. Box LG 44, Legon, Ghana

³Cocoa Research Institute of Ghana, P.O. Box 8, New Tafo, Akim, Ghana

ABSTRACT

Twenty-two advanced breeding genotypes of cowpea were evaluated for their responses to infestation by the cowpea aphid, *Aphis craccivora* Koch. The aim of the study was to identify genotype(s) of cowpea resistant to *A. craccivora* to be used as breeding line(s). Seedling screening technique and aphid growth and reproduction on each genotype were used to classify the genotypes into resistant and susceptible groups. The cowpea genotypes

SARC 1-57-2 and SARC 1-91-1 were found to be the most resistant genotypes, whereas five of the genotypes namely, Apagbaala, IT 97K-499-35, IT 98K-506-1, IT 95K-193-2 and Marfo-Tuya were highly susceptible. The high susceptibility of the IITA lines must be a cause for concern, particularly the IT 97K-499-35 line which is known to be resistant to *A. craccivora* in Nigeria. This suggests the existence of cowpea aphid biotype in northern Ghana which is more virulent than the biotypes in Nigeria. The results support earlier findings of the development of aphid biotypes that are more aggressive and are not controlled by the aphid resistance varieties of cowpea developed by IITA for Nigeria.

ANTI-TYPHOID PROPERTIES OF *PHYLLANTHUS AMARUS* EXTRACTS

G.E. Aduko¹, N.T.K. Dayie², J.P.K. Adotey³, G. Fuachie-Sobreh¹, J.T. Quaynor¹ and D.S. Agyirifo¹
¹Department of Chemistry, School of Physical Sciences, University of Cape Coast, Cape Coast, Ghana
²Department of Microbiology, University of Ghana Medical School, Korle Bu, Accra, Ghana
³Department of Molecular Biology and Biotechnology, School of Biological Sciences, University of Cape Coast, Cape Coast, Ghana

ABSTRACT

Phyllanthus amarus is a medicinal plant belonging to the family Euphorbiaceae and commonly known as 'carry-me-seed' or quinine weed. The whole plant was subjected to solvent extractions using petroleum ether and ethanol. Both crude extracts were tested for antimicrobial activity against *Salmonella typhi* using agar well-diffusion method of sensitivity testing. The crude ethanolic extract showed good inhibitory effect against the bacteria but the petroleum ether extract showed no activity. The crude ethanol extract was subjected to column chromatographic separation using dichloromethane: ethyl acetate (DCM/EA) solvent system. The column was finally eluted with methanol. The fractions eluted from the column were tested against the *Salmonella typhi*. The organism was sensitive to the methanol fractions at different concentrations (4.37mg/ml, 8.75mg/ml, 17.50mg/ml, 35.00mg/ml and 70.00mg/ml) with a zone of inhibition of 8mm, 12mm, 16mm, 20mm, and 22mm respectively. The *Salmonella typhi* was insensitive to the DCM/EA fractions. Phytochemical screening tests performed on the crude ethanolic extract revealed the presence of alkaloids, steroids, saponins, lignans, tannins and flavonoids.

CLENBUTEROL-STIMULATED GLUCOSE UPTAKE ACTIVATES BOTH G_s AND G_i PATHWAYS THROUGH β_2 -ADRENOCEPTOR IN MOUSE ISOLATED SOLEUS MUSCLE

R.A. Ngala¹, J.R.S. Arch², M.A. Cawthorne²
¹Department of Molecular Medicine,
School of Medical Sciences,
Kwame Nkrumah University of Science and Technology, Kumasi, Ghana
²Clore Laboratory, University of Buckingham, UK MK18 1EG

ABSTRACT

β_2 -adrenoceptors activated by adrenaline can also couple to both G_s and G_i proteins. The former is associated with an increase in cAMP to illicit the effect of the catecholamine. In the later, β_2 -AR induces PKA-catalysed phosphorylation of the receptor, which intends couples to G_i, at high concentration. We proposed that, clenbuterol which stimulates glucose uptake at low concentration and inhibits it at high concentration might have identical signalling pathway as adrenaline. Mouse isolated muscles were pre-incubated in flasks containing 3 ml of Krebs-Henseleit Bicarbonate buffer. After 120 min of pre-incubation, with the appropriate concentration of PTX the muscles were transferred to another incubation flask containing 3 ml of the same buffer and 0.3 μ Ci 2-deoxy[1-¹⁴C]glucose containing varying concentrations of adrenaline, clenbuterol or 1nM insulin with or without PTX concentrations of 100ng/ml for adrenaline and clenbuterol and 0.1 or 1.0ng/ml for insulin, or 1M acetylcholine for 45 minutes. Adrenaline stimulated glucose uptake in isolated mouse soleus muscle at low concentration (10^{-10} M) and inhibited it at high concentration (10^{-5} M). The effect of the lower concentration was mediated through the β_2 -AR coupling to the G_s protein and to the G_i protein at high concentration. Similarly, clenbuterol stimulated glucose uptake at lower concentration (10^{-11} M) is mediated through the β_2 -AR coupling to the G_s protein and to the G_i protein at the higher concentration (10^{-7} M). These effects of high concentration of

adrenaline and clenbuterol were supported by the fact that 100ng/ml PTX relieved their inhibitory effects. The higher concentration effect of clenbuterol was additionally supported by the fact that, 1M acetylcholine, relieved the inhibitory effect.

IMPROVING THE EFFICIENCY OF INLAND VALLEY RICE PRODUCTION IN NORTHERN GHANA

S.A. Donkoh¹, J.A. Awuni¹ and R. Namara²

*¹Department of Agricultural and Resources Economics ,
University for Development Studies, Tamale, Ghana*

*²International Water Management Institute (IWMI),
West Africa Office, Accra Office, Ghana*

ABSTRACT

In northern Ghana rice cultivation is believed to have a great potential in reducing poverty levels. Despite this, present yields are generally low due to lack of water control systems, high level of risks caused by uneven rainfall distribution, and inefficient farming practices. Against this background three interventions have been introduced in the Tamale area of the Northern Region of Ghana, namely: the Agence Francaise de Development /Ministry of Food and Agriculture Lowland Rice Development Project (AFD/MOFA-LRDP); the Transfer of Effective Irrigation and Water Resources Management Project (TEIWRMT); and the Gollinga Irrigation Scheme of the Ghana Irrigation Development Authority (GIDA). The objective of this paper is to identify the socio-economic factors that influence the inefficiency of farmers under the three rice cultivation schemes. The method of analysis involves a one-step estimation of a stochastic frontier model. Though the average efficiency is low, it is relatively high for intensive rice cultivation with improved water harvesting schemes such as bunds and water regulating structures. Other factors that reduce farmers' inefficiency are: education; extension visits; farmers' experience and group membership. However, general inaccessibility increases farmers' inefficiency. To help bring the much needed development in northern Ghana it is important that rice cultivation be supported with more of the following: water harvesting and regulating structures; improvement in the road net-work; as well as education and extension services, among others.