



Africa RISING West Africa Project Book of Abstracts 2015 - 2023

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The [Africa Research In Sustainable Intensification for the Next Generation](#) (Africa RISING) program comprises three research-in-development projects supported by the United States Agency for International Development (USAID) as part of the U.S. Government’s Feed the Future initiative.

Through action research and development partnerships, Africa RISING is creating opportunities for smallholder farm households to move out of hunger and poverty through sustainably intensified farming systems that improve food, nutrition, and income security, particularly for women and children, and conserve or enhance the natural resource base.

The three regional projects are led by the International Institute of Tropical Agriculture (in West Africa and East and Southern Africa) and the International Livestock Research Institute (in the Ethiopian Highlands). The International Food Policy Research Institute leads the program’s monitoring, evaluation and impact assessment.




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Introduction

This book summarizes the published journal articles, theses/dissertations, and book chapters from the research studies developed or supported by the Africa RISING West Africa Project. The content highlighted through this publication provides an insight of the breadth of scientific rigor of the Africa RISING projects and program over the past 11 years as they worked to contribute to the aspirations of the US Government's Feed the Future Initiative of improving agricultural production, strengthening the resilience of communities to shocks, reducing hunger, and improving nutrition. This publication has been prepared for review by all project stakeholders.

Year 2023

Expanding the adaptive capacity of cotton-producing smallholders to cope with (un)expected climate and market variability in southern Mali {Thesis and Dissertation}

Citation

Dissa, A. 2023. Expanding the adaptive capacity of cotton-producing smallholders to cope with (un)expected climate and market variability in southern Mali [PhD thesis, Wageningen University & Research]. Netherlands.

Abstract

Smallholder farmers in sub-Saharan Africa depend on agriculture to sustain their livelihoods, but they are facing challenges to raise their low productivity due to resource degradation, limited access to fertilizer and land, and unexpected variation in weather and economic conditions. The seasonal nature of agricultural production further challenges smallholders' farm management to sustain their livelihoods. Farmers are diverse in terms of resource endowments, objectives, and adaptive capacity with implications on their ability to respond to the challenges. This research used a case study of the old cotton basin of Koutiala in southern Mali to understand and support the ability of smallholders and the farming system to cope with the above challenges to improve productivity and livelihoods. I used a longitudinal approach combining different data collection techniques i.e. focus group discussions, (semi)-structured interviews, observations, field/farm-level monitoring, and workshops. First, I developed an adapted transaction cost framework and applied it to describe and explain farmers' involvement in the production and commercialization of multiple crops. I found that farmers diversify crop production through participating in both cotton and cereal value chains for several reasons, including to diversify the sources and timing of income, to secure access to credit and agrochemicals through cotton cultivation, and to strike a balance between the security provided by cotton sales and the flexibility in cereal sales. Participation in the two value chains also implied tradeoffs in the allocation of limited resources, such as labour. Second, I described and explained the exposure and responses of farms of different resource endowments to weather variability. While diversification provided opportunities for increased adaptive capacity, it also created interdependencies among farming system components, leading to reinforced positive outcomes in good years and negative outcomes in bad years. All farm types were equally exposed to weather change, however the magnitudes of changes in synergies and trade-offs among objectives were less pronounced for medium resource endowed farmers because of their more balanced people- and herd-to-land ratio compared to high resource endowed farmers. Thus, the sensitivity and adaptive capacity varied among farm types. Third, I examined the responses of different resource endowed farmers to cope with a major institutional shock induced by the COVID-19 pandemic that is referred to as a 'cotton crisis'. The total cropped area and area devoted to maize reduced as a result of the cessation of cotton production in 2020-21, while the area allocated to millet, sorghum and cowpea increased. These trends were more pronounced for farmers with a large cotton area. In addition, the nitrogen use intensity dropped at the farm level and particularly for the cereal crops, but without negative effect on their yields, suggesting the robustness of the farming system. Food self-sufficiency and income per capita significantly increased for the medium

resource farms, while income dropped for the high resource farms with large herds, demonstrating differentiated adaptability among farm types. Finally, I designed and explored in a participatory way an innovative farm management approach and a support tool to help farmers make their farming objectives explicit and inform decision-making to achieve these objectives, while coping with unanticipated circumstances. The results of this study suggest that the livelihoods of farmers are tied to their involvement in cotton and cereal production and commercialization due to a lack of on-farm alternatives, but also limited opportunities outside of agriculture. Transformative changes are needed to support agricultural productivity but also to expand the adaptive capacity of smallholders to cope with unexpected changes and to enhance the resilience of the farming system.

Keywords: smallholders, case study, longitudinal approach, unpredictable changes, diversification, decision-making, farm diversity, decision support tool.

DOI: <https://doi.org/10.18174/582566>

Farmers' willingness to invest in mechanized maize shelling and potential financial benefits: Evidence from Tanzania {Journal article}

Citation

Kotu, H.B., Manda, J., Mutungi, C., Fischer, G., and Gaspar, A. 2023. Farmers' willingness to invest in mechanized maize shelling and potential financial benefits: Evidence from Tanzania

Abstract

Sub-Saharan Africa has the least mechanized agriculture in the world due to various reasons including low effective demand at farm level, low policy attention, and ineffective mechanization strategies. However, the situation has changed since recently in favor of mechanization while limited empirical evidence is available on how mechanization can be enhanced among smallholder farmers. In this study, we explore farmers' willingness to invest in mechanization services by considering the group business model (GBM) and the individual business model (IBM) of mechanized maize shelling in Tanzania. Moreover, we analyze the potential financial benefit for those farmers who would like to invest in mechanized maize shelling. We use data mainly collected through a household survey and apply econometric and mathematical models for analysis. The results show that about 65% of the sample farmers are willing to invest in mechanized maize shelling within the GBM, while about 10% of them would like to do so within the IBM. Moreover, the results show that investment in mechanized maize shelling is profitable considering both small-scale (4 and 7 HP engine capacity) machines and medium-scale (16 and 20 HP engine capacity) machines. The results show that expanding agricultural mechanization in Tanzania through investments coming from smallholder farmers, as also experienced elsewhere, is possible while they suggest that policy instruments such as targeted loan programs, entrepreneurial and technical trainings, and smart subsidies or tax exemptions are important to encourage and enable smallholder farmers to participate in the mechanization supply chain. [EconLit Citations: Q120, Q130, D250].

Keywords: maize shelling, mechanization, profitability, Tanzania, willingness to invest

DOI: <https://doi.org/10.1002/agr.21801>

Impacts of fertilization management strategies on improved sorghums varieties in smallholder farming systems in Mali: Productivity and profitability differences {Journal article}

Citation

Akinseye, M.F., Birhanu, Z.B., Ajeigbe, A.H., Diancoumba, M., Sanogo, K., and Tabo, R. 2023. Impacts of fertilization management strategies on improved sorghums varieties in smallholder farming systems in Mali: Productivity and profitability differences

Abstract

Sorghum is an important cereal crop cultivated by smallholder farmers of Mali, contributing significantly to their food demand and security. The study evaluated different fertilization strategies that combined organic and inorganic fertilizer applications with three sorghum varieties. The experiments were conducted over three cropping seasons (2017–2019) in three sites (Bamako, Bougouni, and Koutiala respectively) within the Sudanian region of Mali. Our results showed a significant effect of season, variety, and fertilization strategies on grain and stalk yields. Grain yield increased by 8–40% in Koutiala, 11–53% in Bougouni, and 44–110% in Bamako while the average stalk yield was above 5000 kg ha⁻¹ with fertilized treatment compared to unfertilized treatment in the three sites. Fadda performed the best variety, mean grain yield was 23% and 42% higher than that of Soumba and Tieble, respectively. Similarly, there was a progressive increase in grain yield with an increasing level of poultry manure (PM) from 0 to 150 g/hill and cattle manure (CM) from 0 to 100 g/hill. However, the application of 100 g/hill of CM and PM plus 3 g/hill of Di-ammonium Phosphate (DAP) increased yield by 8% and 12% respectively compared to only CM or PM treatments. The results further revealed higher yield gain by 51% (Bamako), 57% (Koutiala), and 42% (Bougouni) for T₁₀- [PM (100 g/hill) + Micro-D_DAP (3 g/hill)] equivalent to 73 kgNha⁻¹ than others (T₂-T₉), but not proportionate to the highest value-cost ratio (VCR). Radar charts used to visualize sustainable intensification (SI) performance in the three domains (productivity, profitability, and environment) showed that the environmental variable has a direct influence on productivity, meanwhile profitability across the strategies ranged from low to moderate value across sites and different fertilizer strategies. Our study, therefore, recommends the use of multiple-choice fertilizer strategies including T₂-CM (50 g/hill) +PM (50 g/hill), T₅-DAP-Micro-D (3 g/hill), T₆-DAP41:46:00 and T₉-PM(50 g/hill) alongside with improved sorghum varieties tested, for higher productivity and profitability across the region.

Keywords: Agronomy efficiency, Micro-dosing, Productivity, Gross margin, Fertilization strategies, And sorghum varieties, value:cost-ratio(VCR)

DOI: <https://doi.org/10.1016/j.heliyon.2023.e14497>

Leveraging spatial technology for agricultural intensification to address hunger in Ghana {Book chapter}

Citation

Odame, P.K and Ebenezer Nana Kwaku Boateng, E.N.K. 2023. Leveraging Spatial Technology for Agricultural Intensification to Address Hunger in Ghana. P. Solís, M. Zeballos (eds.), Open Mapping towards Sustainable Development Goals, Sustainable Development Goals Series,

Abstract

Youth Mappers are using open geospatial tools in support of initiatives seeking to achieve SGD 2 Zero Hunger and SDG 1 No Poverty in Northern Ghana. Students and researchers designed survey questions and a field data collection workflow using simple but cost-effective technology to catalogue a database of farmers, properly demarcate farm sizes, and give farmers, in particular impoverished women, the opportunity to project farm yields and increase the efficiency of their output.

Keywords: Hunger, Agriculture, Spatial analysis, Fieldwork, Ghana, Poverty

DOI: https://doi.org/10.1007/978-3-031-05182-1_3

Year 2022

Amélioration de la productivité des cultures et des fourrages ligneux par l'utilisation de la technique d'aménagement en courbes de niveau dans la zone sud soudanienne du Mali {Thesis and Dissertation}

Citation

Dembele, C.O. 2022. Amélioration de la productivité des cultures et des fourrages ligneux par l'utilisation de la technique d'aménagement en courbes de niveau dans la zone sud soudanienne du Mali : cas des villages de Kani et Noumpinesso (Koutiala).

Abstract

L'étude a été menée dans les terroirs villageois de Kani (cercle de Koutiala) et Noumpinesso (cercle de Yorosso) de la région de Sikasso. Ces terroirs renfermant des bassins versants très actifs, l'érosion est la cause principale de dégradation des sols, de la réduction de la productivité des cultures et des ligneux fourragers. A Kani ainsi qu'à Noumpinesso, les méthodes de travail du sol sont inefficaces pour la gestion du ruissellement pluviométrique. La technologie de l'aménagement en courbe de niveau (ACN) permet de réduire l'érosion, d'augmenter l'humidité et les éléments nutritifs du sol, ensuite d'accroître les rendements des cultures et des arbres. La microdose est un système d'application de petite quantité d'engrais permettant d'augmenter les rendements des cultures et la rentabilité économique des producteurs. Le système association de légumineuse aux céréales est un système plus profitable, il permet de fertiliser le sol en azote à travers l'absorption de l'azote atmosphérique.

La technologie ACN a annuellement réduit le ruissellement et l'érosion de 37 à 75 % ; elle a augmenté l'humidité volumétrique du sol de 2 à 20 % à la profondeur de 0 à 100 cm. La même technologie a augmenté le niveau de l'eau souterraine de 1,95 m à Noumpinesso. La hauteur, le diamètre, les rendements grain et paille du cotonnier, du sorgho et du soja sont significativement ($p < 0.05$) augmentés par la technologie ACN de 18 à 52 %. Le système micro-dose a été le traitement le plus économique, avec 2,6 de Ratio Valeur sur coût (RV/C).

Le système association des cultures a augmenté les mêmes paramètres du sorgho de 22, 21, 65 et 53 % respectivement et du soja de 29, 26, 49 et 31 % respectivement. Ce système est profitable avec 1,54 de Surface Equivalente Assolée (SEA).

La hauteur, le diamètre, le rayon de houppier et le rendement biomasse fraîche du *Gliricidia sepium* et de *Leucaena leucocephala* ont été significativement augmentés par la technologie ACN. Le rendement biomasse fraîche des deux arbres a augmenté de 24 % en 2018.

Keywords: Bassin versant, érosion, productivité, ligneux fourragers, aménagement en courbe de niveau.

Link:

Bias correction of daily chirps-v2 rainfall estimates in Ghana {Thesis and Dissertation}

Citation

Johnson, R. 2022. Bias correction of daily chirps-v2 rainfall estimates in Ghana. MSc thesis in Meteorology and Climate Science. Kwame Nkrumah University of Science and Technology-Kumasi, Ghana.

Abstract

A wide range of economic sectors in Ghana, including agriculture, health care, and energy, heavily rely on climate data; as a result, having access to reliable climate data is crucial for research and economic growth yet rainfall gauge data in Ghana scarcely available, therefore, researchers tend to depend on satellite estimates for hydrological studies and impact assessments. However, biases in satellite rainfall estimates and the ability for these rainfall products to effectively capture rainfall indices poses major issues for researcher and various key stakeholders. In this study, CHIRPS-v2 rainfall estimates were bias corrected using four (4) different bias correction algorithms (Linear Scaling (LS), Local Intensity Scaling (LOCI), Quantile Mapping (QM) and Bias Correction and Spatial Disaggregation (BCSD) methods) using 28 selected stations across Ghana and spatio-temporally over the entire country. At the station level the Linear Scaling method produced the best results, although after correction no significant changes were observed especially on a daily scale, using the day to compute seasonal indices yielded improved results. Spatio-temporally, The BCSD approach outperformed the other bias corrective correction strategies, most likely because it can capture the development of the average rainfall while matching statistical moments. The rainfall seasonal indices were then calculated from bias corrected CHIRPS-v2 data and the spread and the distributing of the various indices were well represented. Moreover, the extreme rainfall analysis produced results consistent with gauge values measured at the same time duration. Bias correction was able to minimize the errors and uncertainties that existed within the daily CHIRPS-v2 dataset, making it more suitable to derive agro-advisories.

Keywords:

Link:

Bulb yield stability study of onion lines over locations and seasons in Ghana and Mali {Journal article}

Citation

Tignegre, J.B.D.L.S.; Traore, A.S.; Konate, M.; Zaato, P.A.; Diarra, B.G.; Hanson, P.; Kizito, F.; Birhanu, B.Z., and Afari-Sefa, V. 2022. Bulb Yield Stability Study of Onion Lines over Locations and Seasons in Ghana and Mali.

Abstract

Onion is one of the most economically and nutritionally important vegetable crops in West Africa. Onions are very important for consumers due to the antioxidants and compounds they contain that may reduce inflammation, lower triglycerides and reduce cholesterol levels, resulting in lower risks of heart disease and blood clots. However, high-yielding varieties that are accessible to farmers remain scarce. The objective of the present study was to identify adapted onion genotypes for sustainable production in Northern Ghana and Southern Mali. Nine onion lines, including a check variety, were assessed for yield stability using a randomized complete block design. The trials were carried out in “technology parks”

under the joint management of farmers and researchers. Onion bulb weight was recorded for each plot after harvest. Separate analyses of variances were performed for each location and season. Analysis of variance of combined locations, seasons and lines was performed to determine the most stable varieties using the line-superiority measure and ecovalence stability coefficients. Results indicated that the lines AVON1310 and AVON1325 were most stable for yield performance over locations and seasons ($W_i = 2.20$ and 11.60 , respectively; $P_i = 1.32$ and 6.56 , respectively). From the genotype main effects and genotype-by-environment interaction biplots, the best performing lines were AVON1310 (33.32 t.h^{-1}), AVON1308 (28.81 t.h^{-1}) and AVON1325 (31.68 t.h^{-1}). The stability of these lines makes them potential candidates for commercial release in West Africa to contribute to sustainably intensifying onion production in the region.

Keywords: multilocation; additive main effects and multiplicative interaction; genotype by environment; vegetable; *Allium cepa*

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DOI: <https://doi.org/10.3390/agronomy12123037>

Coping with cereal production risks due to the vagaries of weather, labour shortages and input markets through management in southern Mali {Journal article}

Citation

E.K. Huet, M. Adam, B. Traore, K.E. Giller, and K. Descheemaeker. 2022

Coping with cereal production risks due to the vagaries of weather, labour shortages and input markets through management in southern Mali. *European Journal of Agronomy*, Volume 140,

Abstract

Production of cereals (maize, sorghum, millet) in southern Mali is challenged by several hazards that affect yield and yield variability. The research aims to inform decision making towards effective risk management by quantifying cereal yield losses at field level due to production hazards under different management strategies. Five hazards relevant for farmers were analysed: late onset of rains, insufficient total rainfall, dry spells, low fertiliser quality and sudden lack of labour. The frequency and impact on yield of these hazards were assessed by combining a long term weather database (1965–2019) with outputs of the DSSAT crop model (baseline and optimised variety, fertiliser rates and sowing dates), and visualised in a risk matrix. The prevalence of the weather hazards was common, with all of them occurring at least once every five years. Frequency of non-weather hazards were perceived to occur once every five years (labour hazards) and once every ten years (fertiliser hazards). Under baseline conditions maize (3.39 t / ha) outperformed sorghum (1.74 t / ha) and millet (1.33 t / ha), except in cases of fertiliser hazard when sorghum yielded more than maize. Maize responded relatively well to N application, and sorghum performed relatively well without N application. The benefit of millet resided in low yield variability, and lower sensitivity to the weather hazards. Changing management to optimise yields generally involved early sowing (22 days, 2 days and 27 days after onset for maize, sorghum and millet), increased N applications (66 kg N / ha , 27 kg N / ha and 111 kg N / ha for maize, sorghum and millet), and using short duration varieties. For millet the long duration variety was more beneficial. For maize there was opportunity to increase the yield without affecting the risk of yield loss, while for sorghum there was a synergy and for millet a trade-off

between yield and risk. The different interactions between hazards and management for the three cereals stress the importance of maintaining farm diversity, as well as operational farm flexibility to respond to production risks.

Keywords: Hazard, Maize, Millet, Sorghum, West-Africa, Crop model

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DOI: <https://doi.org/10.1016/j.eja.2022.126587>

Cowpea living mulch effect on soil quality and grain yield in smallholder maize-based cropping system of northern Ghana {Journal article}

Citation

Abdul Rahman, N., Larbi, A., Berdjour, A., Kizito, F. and Hoeschle-Zeledon, I. 2022. Cowpea Living Mulch Effect on Soil Quality and Grain Yield in Smallholder Maize-Based Cropping System of Northern Ghana. *Journal of Soil Science and Plant Nutrition*, 22, 3925-3940.

Abstract

Low soil fertility is a major constraint for maize production in West Africa, the use of legumes as living mulch improves soil fertility and yield of main crops. However, there is limited literature on the appropriate time to plant living mulch in maize-based cropping system in West Africa. A 2-year (2017–2018) study was conducted to determine the effect of cowpea living mulch (CPLM) on soil quality and grain yield in maize-based cropping system of northern Ghana. A factorial treatment combination of three maize maturity types (extra-early, early and medium) and four CPLM methods (control, CPLM with maize planted on the same day, CPLM planted 1 week after maize and CPLM planted 2 weeks after maize) was laid out in a randomized complete block design with four replications in Northern and Upper East regions of Ghana. Principal component and correlation matrix analyses were used to select minimum data set for soil quality index (SQI) calculation. The SQI for CPLM improved by 50–100% relative to that of the control in both seasons and regions. The CPLM significantly increased maize grain by 34–37% during both seasons in Northern Region and 84% during 2017 in the Upper East Region compared with that of the control. The effect of time of planting CPLM on grain yield showed negative correlation with amount of rainfall received during vegetative growth of CPLM. The results suggest that smallholder maize-based farmers in northern Ghana and similar agro-ecologies in West Africa can plant CPLM 1–2 weeks after planting maize to improve soil quality and increase maize grain yield.

Keywords: Maize · Cowpea · Living mulch · Soil quality · Savanna

Link: <https://link.springer.com/article/10.1007/s42729-022-00942-5>

DOI: <https://doi.org/10.1007/s42729-022-00942-5>

Disseminating sustainable intensification practices: Empirical evidence from Ghana {Thesis and Dissertation}

Citation

Mellon S.B. 2022. Disseminating sustainable intensification practices: Empirical evidence from Ghana. PhD Dissertation. University of Bonn, Germany.

Abstract

Adoption of sustainable intensification (SI) of agricultural practices is essential for increasing food production in more sustainable way. Dis-adoption of agricultural technologies is pervasive among smallholder farmers in sub-Saharan Africa after withdrawal of most programme interventions. Based on data elicited from households in northern Ghana, this study i) examines alternative ways of inducing farmers into adopting SI practices, ii) determines the marginal farm household entrants that must be targeted during scaling up and -out SI practices, and iii) identify the farm households that benefited most from SI adoption during diffusion. Econometric approaches that account for sample selection issues were used in addressing the objectives of the study.

The empirical results show that inducing farmers to adopt SI practices resulted in an increase in maize yield and net income of farmers. Results also suggest that the continuous inducement of farmers led to positive and significant increase in maize yield and net income of induced farmers. Point estimates reveal that stopping the inducement could have led to a decrease in maize yield and net income of induced farmers. The findings also indicate that farmers' resource endowment and unobserved factors influence the marginal benefits of adopting SI practices, and that scaling up SI practices will favour marginal farm household entrants associated with the least probability of adoption based on observed socioeconomics characteristics. Finally, the results show that the adopters that benefited most from SI adoption during its diffusion are much more likely to live in highly resource endowed farm households with relatively younger household heads and fewer household members, and are more likely to travel longer distances before reaching the nearest weekly market and motorable road.

Overall, the study provides empirical evidence that the adoption of SI practices enhances farm performance and household welfare, and that scaling up should be targeted. The study also suggests that the provision of support services is a necessary condition for sustaining adoption and thus collaboration between programme interventions with key government ministries and private business mechanization firms are needed in the scaling up policy decision-making.

Keywords:

Link:

Economic analysis of youth participation in agripreneurship in Benin {Journal article}

Citation

Akrong,R. and Kotu, H.B. 2022. Economic analysis of youth participation in agripreneurship in Benin. Heliyon, 8: e08738.

Abstract

The study assessed the factors affecting youth participation in rural entrepreneurship in Benin using data from the School-to-Work Transition Survey (SWTS) and applying the binary logit and the multinomial logit models. The results showed youth who have a larger number of children are more likely to choose agricultural businesses (agripreneurship) while those who have formal education, who have received training on entrepreneurship, who have registered business, and those who have located in urban areas are more likely to engage in non-agricultural businesses. Within agripreneurship, youth who belong to a larger household are more likely to engage in farming while those who are educated, who have access to credit, and who are located in urban areas are more likely to be engaged in non-farming agri-businesses. The study also revealed that cash crop production among Beninese youth was positively influenced by access to credit. The findings suggest that it would be necessary to promote development programmes that are geared towards enhancing the capacities of the youth with regards to concepts and skills of entrepreneurship in agriculture and measures to overcome challenges associated with different agribusiness activities.

Keywords: Agribusiness, Agripreneurship, Cash crop, Entrepreneurship, Youth

Link: <https://doi.org/10.1016/j.heliyon.2022.e08738>

DOI: <https://doi.org/10.1016/j.heliyon.2022.e08738>

Farmers' preferences for sustainable intensification attributes in sorghum-based cropping systems: Evidence from Mali {Journal article}

Citation

Badolo, F., Kotu, B., Oyinbo, O., Sanogo, K. and Birhanu, B. 2022. Farmers' preferences for sustainable intensification attributes in sorghum-based cropping systems: Evidence from Mali. Renewable Agriculture and Food Systems

Abstract

Sorghum plays a crucial role in the rural economy and nutrition of rural households in Mali. Yet the productivity of this crop is constrained by limited adoption of agricultural intensification technologies, which could be partly because technology development does not properly consider farmers' preferences. This study with smallholder farmers in southern Mali aimed to assess farmers' preferences for different attributes of sorghum technologies through the lens of sustainable intensification. The study used a discrete choice experiment, a method which involves asking individuals to state their preference over hypothetical alternative scenarios, goods or services. We considered six attributes corresponding to different domains of sustainable intensification: grain yield, risk of yield loss, soil fertility, nutrition, labor requirement and fodder yield. We analyzed the data using the mixed logit model, while considering the multinomial logit model as a robustness check. The findings revealed that smallholder farmers are strongly interested in transitioning from their existing

sorghum-based cropping systems to those that closely align with these domains of sustainable intensification. However, there were diverse preferences among all the smallholder farmers studied, and between distinct sub-groups of smallholder farmers characterized by their social networks and agroecological zones, which yield relevant policy implications. Overall, these results support the growing research and development prioritization and policy interests toward scaling sustainable intensification among farmers, with a particular focus on human nutrition.

Keywords: intensification; sustainable agriculture; smallholders; Mali; sorghum; farmer experiences; choice experiment

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DOI: <http://dx.doi.org/10.1017/S1742170522000345>

Fathers' level of involvement in childcare activities and its association with the diet quality of children in northern Ghana {Journal article}

Citation

Saaka, M., Awini, S., Kizito, F., & Hoeschle-Zeledon, I. 2022. Fathers' level of involvement in childcare activities and its association with the diet quality of children in Northern Ghana. *Public Health Nutrition*, 1-8.

Abstract

Design: A community-based comparative analytical cross-sectional study. Participants: A sample of 422 rural mother–father pairs who had at least one child aged 6–36 months.

Results: The overall level of fathers' involvement in childcare and feeding activities was high among 63.5 % of the respondents in the 6 months prior to the study. The most common childcare activity men were involved in was providing money for the purchase of food for the child. Minimum acceptable diet was higher for children with a higher level of paternal involvement in childcare activities (adjusted OR = 3.33 (95 % CI: 1.41, 7.90)), compared to their counterparts whose father's involvement was poor. Fathers who had a positive attitude to childcare and feeding were 2.9 more likely to get involved in childcare activities (adjusted OR = 2.90 (95 % CI: 1.87, 4.48)).

Conclusions: The findings confirm earlier studies that show that fathers' involvement in childcare activities including feeding is positively associated with improved child feeding practices. The findings point to the need to have a policy shift in which both men and women are key actors in interventions designed to improve child nutritional status in rural settings of Northern Ghana.

Keywords: Fathers' involvement, Childcare, Fathers' nutrition-related knowledge, Fathers' attitude, Rural settings, Northern Ghana

Link: <https://pubmed.ncbi.nlm.nih.gov/36210797/>

DOI: [10.1017/S1368980022002142](https://doi.org/10.1017/S1368980022002142)

Influence de la technologie de l'aménagement en courbe de niveau sur des ligneux fourragers et l'association des cultures (sorgho, soja) dans la zone soudanienne du Mali {Thesis and Dissertation}

Citation

Toure, O. 2022. Influence de la technologie de l'aménagement en courbe de niveau sur des ligneux fourragers et l'association des cultures (sorgho, soja) dans la zone soudanienne du Mali (Kani et Noumpinesso). Présenté et soutenu par Ousmane TOURE pour l'obtention du Diplôme de Master de l'Institut Polytechnique Rural de Formation et de Recherche Appliquée (IPR/IFRA) de Katibougou. Spécialité : Agroforesterie

Abstract

La dégradation des sols et la diminution des ligneux fourragers est devenu un défi pour les villageois de la zone soudanienne en général et particulièrement ceux de Kani et Noumpinesso. La technologie d'aménagement en courbe de niveau (ACN) est un système de conservation des eaux et des sols. Elle augmente l'humidité et les éléments nutritifs du sol et par conséquent la croissance et le développement des cultures et les arbres associés dans les champs. La production de plantes fourragères telles que les arbres à croissance rapides demeure une nécessité dans ces villages dont l'élevage est la seconde activité principale après l'agriculture. L'application de la micro-dose des engrais et l'association des cultures (légume et céréale) sont des systèmes qui favorisent la croissance et le développement des cultures.

La technologie ACN avait significativement ($P < 0.05$) impacté la croissance et le développement des arbres à croissance rapides à Kani et à Noumpinesso ; la hauteur, le diamètre à base, le diamètre à 1,30 m, le rayon de houppier et la biomasse fraîche du *Glicidia sepium* et de *Leucaena leucocephala* étaient augmentés de 20, 29, 38, 40, 54 et 42, 40, 32, 48, 38 % respectivement après les mesures à la fin de la saison pluvial (30/11/2020).

Le système association des cultures avaient augmenté la hauteur, le diamètre, le rendement grain et le rendement paille du sorgho et du soja de 13, 21, 46, 44 % et 25, 17, 89, 44 % respectivement. La technologie ACN avait aussi augmenté la hauteur, diamètre le rendement grain et le rendement paille du sorgho et du soja par 32, 33, 39, 32 % et 36, 27, 48, 44 % respectivement.

Keywords: aménagement en courbe de niveau, plantes fourragères, association des cultures.

Link:

Intercropping sorghum and soybean efficiency using contour ridges technology in southern Mali {Journal article}

Citation

Dembele, C.O., Traore, K., Karembé, M., Zemadim, B., Traore, B., Cisse. F. and Samake, O. 2022. Intercropping sorghum and soybean efficiency using contour ridges technology in southern Mali. *Journal of Agricultural Science* 14(4):126-135.

Abstract

Kani and Noumpinesso are two neighboring villages in which soil degradation is mainly caused by runoff and erosion. Contour ridges tillage (CRT) was identified as a runoff and erosion controlling technology while improving soil moisture and nutrient availability for crops. CRT technology associated with sorghum and soybean based intercropping system was assessed during 2017 and 2018 cropping season in an experiment under split plot design.

Intercropping systems highly increased sorghum and soybean growth and yields. Sorghum grain yield, biomass yield, height and diameter were increased by 62, 51, 22 and 19%, respectively by intercropping. Soybean grain yield, biomass yield, height and diameter increased by 47, 30, 25 and 25%, respectively. Intercropping sorghum with soybean had an advantage with a Land Equivalent Ratio (LER) of 1.54 and 1.44 in 2017 and 2018 respectively. The technology of CRT added 40, 39, 25 and 21% on sorghum grain yield, straw yield, height and diameter respectively. The same parameters with soybean were greater by 52, 48, 38 and 35%, respectively. The application of CRT was economically profitable with a Value to Cost Ratio (VCR) of 3.3 and 3.0 in sorghum production and 12.8 and 9.2 in soybean production during 2017 and 2018 respectively.

Keywords: sorghum, soybean, contour ridges tillage, intercropping, yields, Land Equivalent Ratio, Value to Cost Ratio

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DOI: <https://doi.org/10.5539/jas.v14n4p126>

Microdosing of compost for sustainable production of improved sorghum in southern Mali {Journal article}

Citation

Guindo, M.; Traoré, B.; Birhanu, B.Z.; Coulibaly, A.; Tabo, R. 2022. Microdosing of Compost for Sustainable Production of Improved Sorghum in Southern Mali. *Agronomy* 2022, 12, 1480.

Abstract

The depletion of soil organic matter is one of the major challenges constraining agricultural production in the southern zone of Mali. This study evaluated the effects of compost types, methods, and dose applications on the productivity and sustainability of sorghum. Two types of compost (farmer practice and cotton stems) were applied to sorghum at two rates (microdosing at 2.5 t ha⁻¹ and broadcasting at 5 t ha⁻¹) and evaluated on 30 farmer fields in 2019 and 2020. The treatments used included CPA (cotton stem compost at 5 t ha⁻¹ + 100 kg ha⁻¹ DAP), CPA (cotton stem compost at 2.5 t ha⁻¹ + 100 kg ha⁻¹ DAP), CP (farmer compost at

5 t ha⁻¹ + 100 kg ha⁻¹ DAP), CP (famer compost at 2.5 t ha⁻¹ + 100 kg ha⁻¹ DAP), control (100 kg ha⁻¹ DAP), and control. The results showed that regardless of the compost type, applying a microdose of 2.5 t ha⁻¹ improved the growth rate, plant height, grain yield, and biomass yield by 15%, 18%, 47%, and 27%, respectively, when compared to the control. No statistical difference was observed in the yield of 2061 kg ha⁻¹ between applying compost by microdosing at 2.5 t ha⁻¹ and broadcasting at 5 t ha⁻¹. It can be inferred that the application of compost by microdosing makes it possible to achieve a 100% fertilized surface compared to broadcasting, with a nitrogen use efficiency of more than 55%. The application of compost by microdosing at 2.5 t ha⁻¹ resulted in an economic gain of 334,800 XOF ha⁻¹, which was 27% higher than that obtained with the application of compost by broadcasting at 5 t ha⁻¹. Conversely, the contribution to the improvement of soil nitrogen stock varied from 12–20% with a microdose of 2.5 t ha⁻¹ compared to 100% for broadcasting compost at 5 t ha⁻¹ per application. Therefore, the availability of cotton stems in the southern zone of Mali presents an opportunity for farmers to implement compost microdose technology to double the fertilized area and improve sorghum productivity.

Keywords: organic manure; broadcasting; yield; fertilizer; Sahel

Link: <https://www.mdpi.com/2073-4395/12/6/1480>

DOI: <https://doi.org/10.3390/agronomy12061480>

Optimizing food and feed in maize–livestock systems in northern Ghana: the effect of maize leaf stripping on grain yield and leaf fodder quality {Journal article}

Citation

Abdul Rahman, N., Larbi, A., Addah, W., Sulleyman, K.W., Adda, J.K., Kizito, F. and Hoeschle-Zeledon, I., 2022. Optimizing Food and Feed in Maize–Livestock Systems in Northern Ghana: The Effect of Maize Leaf Stripping on Grain Yield and Leaf Fodder Quality. *Agriculture*, 12, 275.

Abstract

Access to feed for livestock during the cropping season is a constraint to the smallholder crop–livestock farming system in northern Ghana due to backyard farming. A two-year (2017–2018) study was conducted to determine the effect of leaf stripping on yield and feed quality in maize–livestock farming systems in the Northern, Upper East, and Upper West regions of Ghana. A factorial treatment combination of three maize-maturity types (extra-early: Abontem, early: Omankwa, and medium: Obatanpa) and three leaf stripping methods (control, leaf stripping at 50% tasseling, and leaf stripping at 50% silking of maize) were laid out in a strip-plot design with four replications per region. Stripped leaf biomass, grain yield, stover, cob size, and nutritional quality of stripped maize leaf were measured.

The stripped leaf biomass, stover, and cob width of Obatanpa increased significantly relative to the other maize types in the Northern and the Upper West regions. Abontem recorded a higher ($p < 0.01$) grain yield than that of the other maize types in the Upper East Region. Leaf stripping had no significant effect on the grain yield and the crude protein (CP) content of maize leaf. The CP of the maize leaf (93–100 g/kg) was above the minimum CP requirement of a quality feed for body weight maintenance of ruminants. This suggests that smallholder maize–livestock farmers could strip maize leaves at either tasseling or silking to feed their

livestock during the cropping season in northern Ghana and similar agro-ecological zones in West Africa.

Keywords: feed quality; grain yield; leaf stripping; maize; savanna

Link: <https://www.mdpi.com/2077-0472/12/2/275>

DOI: <https://doi.org/10.3390/agriculture12020275>

Perceptions on sack gardening in rural areas: The case of vegetable stakeholders in Koutiala and Bougouni, Mali {Journal article}

Citation

Govoeyi, B., Tignégré, J.-B.D.L.S., Badolo, F., Zaato, P.A.; Sanogo, K., and Birhanu, B.Z. 2022. Perceptions on Sack Gardening in Rural Areas: The Case of Vegetable Stakeholders in Koutiala and Bougouni, Mali. *Sustainability* 2022, 14, 14896.

Abstract

Understanding the perception of sack gardening technology is important in order to better support the adoption of sack gardening in households, given the nutritional role vegetables play. This notwithstanding, research has not yet been carried out to understand the stakeholders' perception of sack gardening technology in the zones of Bougouni and Koutiala, where sack gardening technology was introduced under the Africa Research in Sustainable Intensification for the Next Generation (Africa-RISING) project. This study assessed the perception of farm households on sack gardening technology and specifically to understand to what extent this innovation responds to household needs. Q-methodology was used to identify rural household's viewpoints and principal component analysis (PCA) was performed to compare stakeholders' opinion typologies to discourses retained by Q-method results. Focus group discussions were used to identify the statements used for the q-set in the individual surveys. Our findings showed three factors or discourses which reflected the stakeholders' viewpoints. A nutritional role, the role of making vegetables available for household consumption and the role of environment protection, specifically soil protection, were indicated in the stakeholders' opinions. The understanding of the different discourses retained provides insights that can be used to design public and private interventions to support the usage of the technology in households or the adoption of this technology.

Keywords: sack gardening; balanced diet; environment protection; stakeholders' discourses; Mali

Link: <https://www.mdpi.com/2071-1050/14/22/14896>

DOI: <https://doi.org/10.3390/su142214896>

Potential impact of groundnut production technology on welfare of smallholder farmers in Ghana {Journal article}

Citation

Kotu, B.H., Nurudeen, A.R., Muthoni, F., Hoeschle-Zeledon, I. and Kizito, F. 2022. Potential impact of groundnut production technology on welfare of smallholder farmers in Ghana. PLoS ONE 17(1): e0260877.

Abstract

This study was conducted to assess the potential impact of applying a new groundnut planting density on welfare of smallholder farmers in northern Ghana. We used data from on-farm experiments, focus group discussions, and a household survey. We followed three steps in our analysis. First, we conducted cost-benefit analysis in which we showed the economic advantage of the new technology over the farmers' practice. Second, we predicted adoption rates along timeline using the Adoption and Diffusion Outcome Prediction Tool (ADOPT). Third, using the results of the first and the second steps, we estimated the potential impact of the technology on poverty at household level using a combination of methods such as economic surplus model and econometric model. The cost-benefit analysis shows that increasing plant density increases farmers' financial returns i.e., the benefit-cost-ratio increases from 1.05 under farmers' practice to 1.87 under the best plant density option, which is 22 plants/sqm. The adoption prediction analysis shows that the maximum adoption rate for the best practice will be 62% which will take about nine years to reach. At the maximum adoption rate the incidence of extreme poverty will be reduced by about 3.6% if farmers have access to the international groundnut market and by about 2% if they do not have. The intervention will also reduce poverty gap and poverty severity. The results suggest that policy actions which can improve farmers' access to the international market will enhance farmers' welfare more than the situation in which farmers have access to domestic markets only. Furthermore, promoting a more integrated groundnut value-chain can broaden the demand base of the produce resulting in higher and sustainable impact of the technology on the welfare of groundnut producers and beyond.

Keywords:

Link: <https://hdl.handle.net/10568/118107>

DOI: <https://doi.org/10.1371/journal.pone.0260877>

Prevalence and predictors of appropriate complementary feeding practice among mothers with children 6–23 months in northern Ghana {Journal article}

Citation

Saaka, M., Awini, S., and Nang, E. 2022. Prevalence and Predictors of Appropriate Complementary Feeding Practice among Mothers with Children 6–23 Months in Northern Ghana. *World Nutrition* ;13(2):14-23

Abstract

Introduction: Adequate assessment of appropriate complementary feeding practices requires an indicator that can measure its key components concurrently, but past studies often described the practice using single indicators. This study in the region of Northern Ghana therefore assessed the prevalence and predictors of appropriate complementary feeding practices as measured using a composite indicator.

Methods: The source of data for this analysis is from baseline studies of a community-based quasi-experimental study conducted prior to implementing a nutrition behaviour change communication intervention on radio. The study population comprised mothers and their children selected using a two-stage cluster sampling procedure. Multivariable logistic regression was used to identify factors associated with appropriate complementary feeding practices.

Results: The overall prevalence of appropriate complementary feeding practices combining three key indicators (timely introduction of complementary food, adequacy of meal frequency, and meeting minimum dietary diversity) was 29.8% (95% CI: 27.4 - 32.3). Children aged 12-23 months [AOR = 2.26 (95% CI:1.41 - 3.61)], higher nutrition related knowledge of caretakers [AOR 1.51; 95% CI (1.15 - 1.98)], higher educational level of mothers [AOR 1.95; 95% CI (1.17 - 3.25)], and positive nutrition related attitudes towards appropriate complementary feeding practices [AOR 1.59; 95% CI (1.21 - 2.09)] were significantly associated with appropriate complementary feeding practice.

Conclusions: The prevalence of appropriate complementary feeding practices was quite low among children aged 6–23 months. Sustainable nutrition education to mothers/caretakers during prenatal, delivery, postnatal, and child welfare clinic on appropriate complementary feeding should be strengthened to increase nutrition related knowledge and attitude towards appropriate complementary feeding practices.

Keywords: Appropriate complementary feeding; Nutrition-related knowledge, positive attitude, composite indicator; Northern Ghana

Link: <https://worldnutritionjournal.org/index.php/wn/article/view/865>

DOI: <https://doi.org/10.26596/wn.202213214-23>.

Smallholder farmers' preferences for sustainable intensification attributes in maize production: Evidence from Ghana {Journal article}

Citation

Kotu, B.H., Oyinbo, O., Hoeschle-Zeledon, I., Nurudeen, A.R., Kizito, F. and Boyubie, B. 2022. Smallholder farmers' preferences for sustainable intensification attributes in maize production: Evidence from Ghana. *World Development* 152:105789

Abstract

While sustainable intensification has been aggressively promoted as an agricultural development strategy among smallholder farmers since the beginning of the last decade, there is a dearth of evidence on whether farmers are interested in practicing it and how much value they put to its different components. This study aims at analyzing farmers' preferences for maize production technologies within the lens of sustainable intensification. Employing a discrete choice experiment to generate over 12,500 observations from a sample of about 700 maize-producing households in northern Ghana, we analyze farmers' preferences with respect to five domains of sustainable intensification including productivity, economic, human, environmental, and social conditions. We find that farmers are favorably disposed to maize-based cropping systems that align with the domains of sustainable intensification over their current cropping practices. While farmers value all the sustainable intensification attributes considered in the study, we observe substantial heterogeneities among them in the pooled sample and in the sub-samples between regions and gender categories. The findings suggest that sustainable intensification is not just a fad within the academic and research circles but something farmers are interested in and that development actions are more likely to succeed when they consider preference heterogeneities among farmers and adapt to local conditions. The findings can be used to set an evaluation criterion in designing and testing technologies (or a mix of technologies) for sustainable maize production among smallholder farmers in northern Ghana as well as similar socio-cultural and agroecological settings, supporting national and regional level efforts for R&D prioritization.

Keywords: Sustainable intensification; Maize; Preferences; Choice experiment; Ghana

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DOI: <https://doi.org/10.1016/j.worlddev.2021.105789>

Year 2021

Assessing the effect of improved feed trough on feed utilization by small ruminants in northern Ghana **{Journal article}**

Citation:

Ayantunde, A.A., Salifu, S., Konlan, S.P. and Shaibu, M.T. 2021. Assessing the effect of improved feed trough on feed utilization by small ruminants in northern Ghana. *Tropical Animal Health and Production* 53:440.

Abstract

The feeding systems of small ruminants in Northern Ghana are characterized by waste which necessitates efficient use of the available feed resources, particularly in the dry season. To this end, the use of improved feed trough was demonstrated in three communities in Northern Ghana, namely Duko and Tibali in Northern region; Gia in Upper East region in the late dry, wet, and early dry seasons between March 2019 and February 2020. This study involved 10 farmers randomly selected in each community. The participating farmers were provided with one improved feed trough each which was then compared to the traditional feed trough. Data were collected on the quantity of feed offered, amount wasted, and time spent feeding the animals for six consecutive days in the three study sites across seasons. To document the perception of the farmers on the improved feed trough, a semi-structured questionnaire was administered. Results showed that improved feed trough reduced feed waste significantly in the study sites across seasons. For example, the percentages of waste in feeding the animals using the traditional feed trough were 35%, 22%, and 27% in Duko, Gia, and Tibali, respectively, in the late dry season compared to less than 1% with the improved feed trough during the same season. The farmers' perceptions were similar to the findings of this study which suggest that efficient feed utilization by small ruminants can be enhanced with the use of improved feed trough.

Keywords: animal feeding; crop-livestock; farming systems; feeds; goats; intensification; sheep; small ruminants

Link: <https://hdl.handle.net/10568/114693>

DOI: <https://doi.org/10.1007/s11250-021-02847-4>

Assessment of feed resources for ruminant production in northern region of Ghana {Thesis and Dissertation}

Citation

Wachiebene, S.K. 2021. Assessment of feed resources for ruminant production in northern region of Ghana. MSc thesis in Animal Science (Animal Nutrition). Tamale, Ghana: University of Development Studies.

Abstract

An evaluation of crop residue utilization in smallholder crop-livestock systems was investigated in two different experiments. The first experiment determined grain and haulms yields of groundnut, and growth performance of Djallonké sheep fed groundnut haulms, cultivated at three different inter-row plant spacings of 30x15cm², 45x15cm², 60x15cm² and 75x15cm². The experiment was arranged as a randomized complete block design. A total of 60 Djallonké sheep were divided into 12 groups and replicated 3 times. In the second experiment, grain and stover yields, and nutritional quality. In the second experiment, grain, stover yields nutritional quality of leaf stripping of different varieties of maize at different physiological stages of maturity was assessed in a 3 × 3 factorial treatment arrangement. The three maize varieties (Obatanpa, Omankwa and Abontem) and physiological stage (silking and tasselling) were arranged in a split plot design with four replications. In experiment I, plant spacing significantly ($P < 0.05$) influenced grain and fodder yields with haulm and grain yields decreasing with increasing inter-row plant spacing. Plant spacing also affected feed intake ($P < 0.001$), final weight ($P = 0.008$), weight gain ($P = 0.010$) and ADG ($P = 0.010$). Sheep fed haulm obtained from 30x15cm², inter-row spacing had lower feed intake compared to 45x15cm² and 75x15cm². However, the growth performance (final weight, weight gain and ADG) of sheep fed haulms obtained from 30 x15cm² were superior ($P < 0.05$) to those fed haulms from 45 x15cm², 60 x15cm² and 75 x15cm² plant spacing. In the second experiment, interaction of leaf stripping and maize maturity-type was not significant on grain, stover, and fodder yields. Similarly, leaf stripping did not have any effect on ($P > 0.05$) grain, stover, and feed yields. Moreover, leaf stripping by maize-maturity type's interaction and its main effects had no significant effect on crude protein, neutral detergent fibre, acid detergent fibre, metabolizable energy, and in vitro organic matter digestibility. The study recommends that crop-livestock farmers are encouraged to cultivate groundnut at a spacing of 30x15cm to obtain the highest results with regards to fodder yield, grain yield and growth performance of sheep. Moreover, farmers adopt the technology of leaf stripping to solve the perennial feed challenges encountered during the rainy season.

Key words: agronomy; farming systems; maize; smallholder farmers animal feeding; crop residues; crop-livestock; farming systems; intensification.

Link: <https://hdl.handle.net/10568/115599>

Contour ridge tillage for improved crops and fodder trees production in the villages of Kani and Noumpinesso, Southern- Mali {Journal article}

Citation

Dembele C. O., Traore K., Karembe M., Zemadin B., Fotigui, C. & Samake O. (2021). Contour Ridge Tillage for Improved Crops and Fodder Trees Production in the Villages of Kani and Noumpinesso, Southern, Mali. *Journal of Agricultural Studies*, 9(2), 550-572.

Abstract

In rural Mali shortage of livestock feed is a challenging phenomenon worsening day by day, particularly in the villages of Kani and Noumpinesso. The significant decrease in crops yield and livestock are due to persistent and continuous land degradation and over grazing. Soil water erosion and inappropriate or ineffective farming systems led to land degradation over the many years. A purposeful growing of fodder plant (fast growing trees species) and crops in interacting combinations for a range of benefits would be required using a technology that is easily adaptable by the rural farming communities. Contour ridge (CR) technology is a holistic approach that protects farmlands from erosion; increases soil moisture, nutrient availability for crops and associated fast growing trees. The CR technology in combination with forage and improved crop production systems were applied in Kani and Noumpinesso villages of southern Mali and resulted indicated that at the end of rainy season of 2017 and 2018 the application of CR technology significantly increased ($p < 0.05$) *Gliricidia sepium* and *Leucaena leucocephala* growth and development. Similar to 2017, in 2018 CR technology significantly increased ($p < 0.05$) sorghum, millet, maize, and cotton growth, yield, and economic benefit. At Kani during 2017 and 2018 season soil moisture was always significantly higher ($p < 0.05$) under fodder planted area than non-fodder planted area, and the difference was high with respect to farmlands without CR.

Keywords: fodder plant, crops, contour ridge, and soil moisture

Link: <https://cgspace.cgiar.org/handle/10568/117340>

DOI: <https://doi.org/10.5296/jas.v9i2.18513>

Effect of nutrition behaviour change communication delivered through radio on mothers' nutritional knowledge, child feeding practices and growth {Journal article}

Citation

Saaka, M., Wemah, K., Kizito, F. and Hoeschle-Zeledon, I. 2021. Effect of nutrition behaviour change communication delivered through radio on mothers' nutritional knowledge, child feeding practices and growth. *Journal of Nutritional Science*, 10, E44.

Abstract

Childhood undernutrition coupled with poor feeding practices continues to be public health problems in many parts of the world and efforts to address them remain elusive. We tested the hypothesis that women who are exposed to radio health/nutrition education will demonstrate greater nutrition and health knowledge, positive attitudes towards preventive health and better dietary diversity practices for improved child growth. We used a two-arm, quasi-experimental, non-equivalent comparison group design with pre- and post-test observations to evaluate the intervention. The study population comprised 712 mothers with children aged 6-36 months who were randomly selected from five intervention districts and one comparison district in Northern Ghana. Difference-in-difference (DID) analysis was performed to assess study outcomes. After 12-month implementation of intervention activities, the minimum dietary diversity and the minimum acceptable diet improved significantly (DID 9.7 percentage points, P 0.014 and DID 12.1 percentage points, P 0.001, respectively) in the intervention study group, compared with the comparison group. Mothers in the intervention communities had a nutrition-related knowledge, attitudes and practices score that was significantly higher than their colleagues in the comparison communities (DID 0.646, P < 0.001). The intervention did not have significant effects on the nutritional status as measured by height-for-age Z-score or weight-for-height Z-score. The data provide evidence that health and nutrition education using radio drama significantly increased health-/nutrition-related knowledge but had little effect on nutritional status.

Keywords: Mothers' nutritional knowledge; nutrition related attitudes; minimum dietary diversity; nutrition education on radio, Northern Ghana

DOI: 10.1017/jns.2021.35

Effect of nutrition education on nutrition-related knowledge, attitudes, and consumption of diversified diets among families owning a home garden in northern Ghana {Journal article}

Citation

Saaka M., Kizito F., Hoeschle-Zeledon, I. 2021. Effect of nutrition education on nutrition-related knowledge, attitudes, and consumption of diversified diets among families owning a home garden in northern Ghana. *World Nutrition* 12(4):15-31

Abstract

Introduction

Micronutrient deficiencies are widely prevalent, especially in low- and middle-income countries, and this may be addressed by increased consumption of fruits and vegetables (FV). However, the consumption of FV in many households is below the recommended levels. Though home gardens have the potential to increase this, their mere ownership may not be sufficient to ensure an increased consumption of FV. However, home gardens coupled with nutrition education can help in improving household diets. In this study, we evaluated the apparent effect of an ongoing nutrition education intervention on nutrition related knowledge, attitudes, and consumption of diversified diets in households with home gardens in rural areas of Northern Ghana.

Results

After the nutrition education intervention had been ongoing for 7 months, the mean nutrition knowledge scores regarding appropriate child feeding practices in the intervention group was significantly higher than in the comparison group (28.33 ± 6.60 versus 25.38 ± 5.22), $p = 0.009$. Similarly mean nutrition-related attitudes (NRAs) towards childcare and feeding practices were higher in the intervention than the comparison group 31.70 ± 2.32 versus (29.52 ± 2.85) , $p < 0.001$. Members in households owning a home garden and who also received nutrition education were 3.53 times more likely to consume vitamin A- rich fruits and vegetables [AOR = 3.53, (95% CI: 1.68 - 7.43)], compared with their counterparts which had only home gardens.

Conclusions

Nutrition education in households possessing home gardens appeared to result in significantly higher over-all nutrition knowledge and attitude scores among fathers. The intervention also improved actual consumption of fruits and vegetables in the households. This study contributes to the already existing evidence that joint nutrition education and home gardening have a positive effect on the consumption of diversified diets including FV in low-income countries.

Keywords: Home gardens; Nutrition education; Fruit and vegetable consumption; Nutrition knowledge; Nutrition attitudes; Northern Ghana

Link: <https://worldnutritionjournal.org/index.php/wn/article/view/833>

DOI:

Growing cotton to produce food: Unravelling interactions between value chains in southern Mali

{Journal article}

Citation

Dissa, A., Bijman, J., Slingerland, M., Sanogo, O. M., Giller, K. E., and Descheemaeker, K. 2021. Growing cotton to produce food: Unravelling interactions between value chains in southern Mali. *Development Policy Review*, 40(5).

Abstract

Motivation

Most transaction cost economic frameworks, commonly used to examine and explain the co-ordination of agricultural transactions, use a linear approach for a single product transaction. This ignores the concurrence of multiple transactions by smallholder farmers in developing countries.

Purpose

This study aims to understand co-ordination among multiple product transactions by smallholder farmers and to identify ways to remove impediments to market participation. It develops an adapted transaction cost framework, considering contract types and forms of market participation as building blocks for co-ordination structures.

The framework was applied to explain co-ordination structures between smallholders and buyers of cotton and cereals in southern Mali.

Findings

The majority of farmers grew cotton and sold it to a parastatal company, the sole buyer, that also supported the provision of inputs. Inputs were used to grow not only cotton, but also cereals. Most farmers sold cereals on spot markets to collectors and traders.

Using different structures allowed smallholders to obtain inputs and services, to pursue different income sources over the year, and to balance flexibility and security.

Policy implications

Collective organizations of smallholder farmers should be supported to improve their financial and managerial capacities to allow them to co-ordinate better with buyers and input suppliers.

Institutional innovations to better balance risks for smallholders and buyers deserve consideration. These innovations include crop insurance, long-term credit, and warehouse receipts.

Keywords: smallholders; market participation; coordination; transaction costs; crop diversification.

Link: <https://onlinelibrary.wiley.com/doi/10.1111/dpr.12605>

DOI: <https://doi.org/10.1111/dpr.12605>

***In vitro* digestibility and methane gas production of fodder from improved cowpea (*Vigna unguiculata* L.) and groundnut (*Arachis hypogaea* L.) varieties {Journal article}**

Citation

T. Ansah, A. Sahoo, N. Abdul Rahman, P.K. Kumawat, R.S. Bhatt. 2021. *In vitro* digestibility and methane gas production of fodder from improved cowpea (*Vigna unguiculata* L.) and groundnut (*Arachis hypogaea* L.) varieties, *Scientific African*, Volume 13, 2021.

Abstract

In vitro substrate degradability and methane gas production of fodder from cowpea and groundnut plants were evaluated in this study. Duplicate samples and three batch replicates (n = 3) of three groundnut varieties (Samnut 22, Chinese and Samnut 23) and two cowpea varieties (Padi Tuya and Songotra) were incubated in a buffered rumen fluid. The crude protein (CP) concentration of Songotra and Padi Tuya varieties was in the range of 112 to 154 g kg⁻¹ dry matter (DM), respectively. Both neutral detergent fiber (NDF) and acid detergent fiber (ADF) were found to be higher in Samnut 22 with the other varieties having values below 400 g kg⁻¹ DM. Significant differences were found among treatments for all the *in vitro* kinetic parameters. The highest (P < 0.05) DM and organic matter (OM) degradability were observed in cowpea variety Padi Tuya. Methane gas production expressed as ml g⁻¹ DM incubated and ml g⁻¹ DM degraded were both higher (P < 0.05) in cowpea varieties Padi Tuya, Songotra and groundnut variety Chinese. Total volatile fatty acid and the ratio of acetate: propionate did not differ among the treatments. Pearson correlation showed a significant positive association between CP and metabolizable energy (ME) and a negative association between CP and methane. The association between NDF, ADF and methane production, IVOMD and IVDMD was found to be negative. It can be concluded from the study that the cowpea varieties possessed superior and efficient degradability compared to the groundnut varieties.

Keywords: Cowpea fodder, *In vitro* digestibility, Groundnut fodder, Methane gas

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DOI: <https://doi.org/10.1016/j.sciaf.2021.e00897>

Maize–legume strip cropping effect on productivity, income, and income risk of farmers in northern Ghana

{Journal article}

Citation

Abdul Rahman, N., Larbi, A., Kotu, B., Asante, M.O., Akakpo, D.B., Mellon-Bedi, S. and Hoeschle-Zeledon, I. 2021. Maize–legume strip cropping effect on productivity, income, and income risk of farmers in northern Ghana. *Agronomy Journal*, 113, 574-1585.

Abstract

Maize (*Zea mays* L.)–legume intercropping is common cropping system among smallholder farmers in West Africa. However, little is known about the income risk reduction associated with maize–legume strip cropping in West Africa. A 3-yr study was conducted in Upper West and Northern regions of Ghana to determine the effect of maize–legume strip cropping on productivity, income, and income risk using a randomized complete block design with five replications in each region. Seven treatments were used: sole crops of maize (M) cowpea [*Vigna unguiculata* (L.) Walp.] (C) and groundnut (*Arachis hypogaea* L.) (G), a combination of two rows of M and two rows of legumes (L) (2M:2C and 2M:2G), and two rows of M and four rows of L (2M:4C and 2M:4G). Maize–legume strip cropping options (2M:2L and 2M:4L) on the average saved 90–100% of agricultural land, significantly increased income by about threefold, and reduced risk of operating at a financial loss by 75% compared with sole cropping. Smallholder farmers, especially sole legume cropping farmers in the Guinea savanna of northern Ghana and similar agro-ecologies in West Africa, could adopt maize–legume strip cropping systems (2M:4L or 2M:2L) to mitigate production risk and increase financial return.

Keywords:

Link: <https://access.onlinelibrary.wiley.com/doi/10.1002/agj2.20536>

DOI: <https://doi.org/10.1002/agj2.20536>

Pigeon pea (*Cajanus cajan*) fodder cutting management in the Guinea Savanna Agro-Ecological Zone of Ghana

{Journal article}

Citation

Tenakwa, E. A., Imoro, A.Z., Ansah, T., Kizito, F. 2021. Pigeon pea (*Cajanus cajan*) fodder cutting management in the Guinea Savanna Agro-Ecological Zone of Ghana. *Agroforest Syst* (2022) 96:1–10

Abstract

This study evaluated the effect of cutting regime on biomass yield and nutrient composition of pigeon pea (*Cajanus cajan* (L) Millsp.) fodder in the Guinea Savanna Agro-Ecological Zone of Ghana. Three cutting regimes (12, 16 and 20 Week After Planting [WAP]) in RCBD were imposed on *Cajanus cajan* at both initial establishment and regrowth. At each harvest, biomass yield was estimated after which samples of the fodder were separated into leaf and stem botanical fractions for chemical composition and *in vitro* digestibility. Cutting regime significantly affected plant height, number of branches and stem diameter in both the initial establishment and regrowth. Biomass yield was significantly affected by cutting regime in the initial establishment but not the regrowth. The biomass yield was highest in the harvest at 20WAP (6515kgDM/ha) while 12WAP (3175 kg/ha) recorded the lowest biomass yield in the initial establishment. All chemical composition parameters were significantly affected by cutting regime and botanical fractions except hemicellulose in the initial establishment. Cutting regime also significantly affected DM, CP and ash concentrations in the regrowth with botanical fraction significantly ($P < 0.05$) influencing CP, NDF, ADF and ash. The highest CP was obtained in the leaf fraction harvested at 12 WAP and 20 WAP in the initial establishment and regrowth respectively. Cutting regime, botanical fraction and their interaction were significant in gas produced at 24 h, SCFA and ME in both the initial establishment and regrowth stages. In conclusion, harvest at 20WAP produced the highest biomass yield but lower CP in the initial establishment while in the regrowth, harvest at 20WAP produced higher biomass yield, CP and ME.

Keywords: Crude protein Cutting regime Digestibility Fodder Pigeon pea *In vitro* gas

Link: <https://link.springer.com/article/10.1007/s10457-021-00679-7>

DOI: <https://doi.org/10.1007/s10457-021-00679-7>

Scaling-up agricultural technologies: Who should be targeted? {Journal article}

Citation

Bedi, S.M., Azzarri, C., Kotu, B.H., Kornher, L. and von Braun, J. 2021. Scaling-up agricultural technologies: Who should be targeted? *European Review of Agricultural Economics*

Abstract

The effects of agricultural technology adoption on farm performance have been studied extensively but with limited information on who should be targeted during scaling-up. We adopt the newly defined marginal treatment effect approach in examining how farmers' resource endowment and unobserved factors influence the marginal benefits of adopting sustainable intensification (SI) practices. We estimate both the marginal and average benefits of adopting SI practices and predict which marginal farm household entrants will benefit the most at scale. Findings indicate that farmers' resource endowment and unobserved factors affect the marginal benefits of adopting SI practices, which also influence maize yield and net returns among adopters. Finally, results imply that scaling up SI practices will favour farm household entrants associated with the lowest probability of adoption based on observed socioeconomic characteristics.

Keywords: adoption, agricultural technologies, marginal treatment effect, sustainable intensification practices, scaling-up.

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DOI: <https://doi.org/10.1093/erae/jbab054>

Spatiotemporal response of vegetation to rainfall and air temperature fluctuations in the Sahel: Case study in the forest reserve of Fina, Mali {Journal article}

Citation

Sanogo, K., Zemadim, B., Sanogo, S., Aishetu, A. and Ba, A. 2021. Spatiotemporal response of vegetation to rainfall and air temperature fluctuations in the Sahel: Case study in the forest reserve of Fina, Mali. *Sustainability* 13(11):6250.

Abstract

Forests constitute a key component of the Earth system but the sustainability of the forest reserves in the semi-arid zone is a real concern since its vegetation is very sensitive to the climate fluctuation. The understanding of the mechanisms for the vegetation–climate interaction is poorly studied in the context of African Sahel. In this study, the characteristics of the vegetation response to the fluctuations of precipitation and temperature is determined for the forest reserve of Fina. Rainfall estimates, air temperature and NDVI were re-gridded to a same spatial resolution and standardized with respect to their respective long-term mean. Lag-correlations analysis was used to estimate lag times between changes of climate variables and vegetation response at both seasonal and interannual bases. Results show increasing tendency of NDVI started from the 1990s coinciding the recovery of the rainfall from the 1980s drought, and the obtained correlation ($r = 0.66$) is statistically significant (p value < 0.01). The strongest responses of vegetation to rainfall and temperature fluctuations were found after 30 and 15 days, respectively. Moreover, at a

shorter time lag (e.g., 15 days), more pronounced vegetation responses to both rainfall and temperature were found in agriculturally dominated land while at a longer time lag (e.g., 30 days), a stronger response was observed in Bare-dominated land. The vegetation response to the climate fluctuation is modulated by the land-use/cover dynamics.

Keywords: NDVI; rainfall; air temperature; vegetation response; Fina forest reserve; Mali

Link: <https://hdl.handle.net/10568/114008>

DOI: <https://doi.org/10.3390/su13116250>

The nexuses between technology adoption and socioeconomic changes among farmers in Ghana

{Journal article}

Citation

Adams, A., Jumpah, E.T. and Caesar, L.D. 2021. The nexuses between technology adoption and socioeconomic changes among farmers in Ghana. *Technological Forecasting and Social Change* 173:121133

Abstract

Agricultural technology adoption is critical to increasing productivity, profitability, and welfare of smallholder farmers. A high number of maize and cowpea production technologies have been developed, validated, and introduced to farmers. However, the adoption of these technologies continues to remain low and uneven and what really influences farmers' decisions to adopt these technologies at the farm level is unclear. This study analysed the key drivers of the adoption of maize and cowpea technologies using recent comprehensive data collected through a household survey of 463 farmers. The study applied both the probit and logit models to estimate the factors influencing adoption in the study area. The study found a high rate of adoption among farmers with heterogeneous effects on the number of technologies adopted. Regional location of the farmer, age, FBO membership, distance to farm, access to credit, access to extension services and gender are the statistically significant factors that influence technology adoption in northern Ghana. Institutional strengthening such as FBOs and extension service provision as well as private sector participation that makes finance accessible to smallholder farmers has a great potential of catalysing the adoption of improved technologies for improving the welfare of farmers.

Keywords: Adoption; Technology; Determinants; Smallholder; Farmers

Link: <https://hdl.handle.net/10568/115080>

DOI: <https://doi.org/10.1016/j.techfore.2021.121133>

Trade-offs and synergies associated with maize leaf stripping within crop-livestock systems in northern Ghana {Journal article}

Citation

Komarek, A.M., Abdul Rahman, N., Bandyopadhyay, A., Kizito, F., Koo, J. & Addah, W. (2021). Trade-offs and synergies associated with maize leaf stripping within crop-livestock systems in northern Ghana. *Agricultural Systems*, 193, 103206: 1-13.

Abstract

Context

The accessibility and availability of forages is a common concern in crop-livestock systems in West Africa; however, options to increase forage production may entail trade-offs within the farm system that can be challenging to quantify explicitly.

Methods

Maize leaf stripping involved removing almost senesced leaves from maize plants below the cob level at silking. We combined data from three sources: on-farm maize trials with 28 farmers from two seasons (2017 and 2018), on-farm sheep feeding trials where the pasture-based diets of weaner sheep were supplemented with stripped maize leaves fed in pens (conducted in 2019), and farm survey data from 117 households (conducted in 2014), seven of which were in the on-farm maize trials and owned sheep. We examined the trial data using linear mixed-effects models.

Results and conclusion

Maize leaf stripping had no significant effect on maize grain yield but had a significant positive effect on maize forage protein yield from leaf and stover. Offering maize leaves to weaner sheep had a significant positive effect on average daily liveweight gain, estimated marginal mean was 29.3 g with maize leaves and -10.9 g without maize leaves. For the maize-sheep systems of the seven households, non-inferential statistics suggested that on average maize leaf stripping reduced total maize grain production by 12% (range -46 to 38) and increased maize forage protein production from leaf and stover by 90% (range -16 to 298). Stripping the maize leaves from one hectare of land took an extra 34 h (range 27 to 42) of labour, which was counterbalanced by reduced labour time for grazing as sheep were fed the maize leaves in pens. For the 117 farmers, heterogeneity in maize areas planted and livestock numbers resulted in heterogeneous production and labour effects of maize leaf stripping. Farmers qualitatively described how maize leaf stripping released labour so children could spend more time at school rather than shepherding. SIGNIFICANCE We quantified in northern Ghana how maize leaf stripping altered crop and livestock productivity and associated trade-offs and synergies in the farm system, including labour. Changes in crop management often have implications beyond the crop's field and examining these implications can provide insights into the suitability of alternative farm management options.

Keywords: Ghana; labour; leaf stripping; maize; sheep; sustainable intensification

Link: <https://hdl.handle.net/10568/114318>

DOI: <https://doi.org/10.1016/j.agsy.2021.103206>

Trends of rainfall onset, cessation, and length of growing season in northern Ghana: Comparing the rain gauge, satellite, and farmer's perceptions {Journal article}

Citation

Atiah, W.A.; Muthoni, F.K.; Kotu, B.; Kizito, F.; Amekudzi, L.K. 2021. Trends of Rainfall Onset, Cessation, and Length of Growing Season in Northern Ghana: Comparing the Rain Gauge, Satellite, and Farmer's Perceptions. *Atmosphere*, 12, 1674.

Abstract

Rainfall onset and cessation date greatly influence cropping calendar decisions in rain-fed agricultural systems. This paper examined trends of onsets, cessation, and the length of growing season over Northern Ghana using CHIRPS-v2, gauge, and farmers' perceptions data between 1981 and 2019. Results from CHIRPS-v2 revealed that the three seasonal rainfall indices have substantial latitudinal variability. Significant late and early onsets were observed at the West and East of 1.5° W longitude, respectively. Significant late cessations and longer growing periods occurred across Northern Ghana. The ability of farmers' perceptions and CHIRPS-v2 to capture rainfall onsets are time and location-dependent. A total of 71% of farmers rely on traditional knowledge to forecast rainfall onsets. Adaptation measures applied were not always consistent with the rainfall seasonality. More investment in modern climate information services is required to complement the existing local knowledge of forecasting rainfall seasonality.

Keywords: CHIRPS-v2; climate change adaptation; farmer perceptions; rainfall cessation; rainfall onset

Link: <https://www.mdpi.com/2073-4433/12/12/1674>

DOI: <https://doi.org/10.3390/atmos12121674>

Year 2020

Analysing the determinants, constraints, and opportunities of smallholder farmers access to input markets: Evidence from northern Ghana {Journal article}

Citation

Adams, A., Osei-Amponsah, C. and Jumpah, E.T. 2020. Analysing the determinants, constraints, and opportunities of small-holder farmers' access to input markets: Evidence from northern Ghana. *Journal of Agribusiness and Rural Development* 2(56):133–143.

Abstract

Smallholder farmers face multiple constraints in accessing input markets. This study seeks to understand the dynamics that influence input markets in northern Ghana and the opportunities that exist for smallholder farmers to increase their productivity and welfare. Using a random sample of 448 households, the study applied the probit and non-parametric methods in identifying the factors that influence farmers' access to input markets and the key constraints faced by them. The results show that access to extension services, access to finance, distance to the nearest input market, and input source are significant factors that would be likely to influence farmers' access to input markets. Lack of finance, poor road network, and low prices of output are the main critically ranked constraints limiting farmers' access to input markets. Policy initiatives should be geared toward strengthening extension service delivery, farmer education on inputs, improving feeder roads, and encouraging private sector participation in input markets. Available opportunities to leverage on and improve farmers' access to input markets include the governments' input subsidy programmes, existing large-scale agricultural projects, private agricultural companies with contract farm-ing models, and extensive network of input dealers and aggregators in the communities. These findings are relevant for farmers, input dealers and policy makers working to improve farmers' access to input markets.

Keywords: determinants, constraints, market access, smallholder farmers, input markets, northern Ghana

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DOI: <https://doi.org/10.17306/J.JARD.2020.01286>

Contour bunding technology-evidence and experience in the semiarid region of southern Mali. {Journal article}

Citation

Birhanu, B., Traoré, K., Sanogo, K., Tabo, R., Fischer, G. and Whitbread, A. 2020. Contour bunding technology-evidence and experience in the semiarid region of southern Mali. *Renewable Agriculture and Food Systems* 1-9.

Abstract

Land and water management practices have been widely implemented in rural Mali since the 1980s to improve agricultural productivity and erosion control. Under conditions of recurring droughts, these practices are expected to increase farmers' ability to cope with shocks. One of the most common practices applied in the central and southern parts of Mali is contour bunding (CB). In this study the impact of the CB technology is evaluated with a focus on biophysical and socio-economic benefits. Data were collected in two agro-ecologies of southern Mali and were generated through field experimentation and household survey. Field experimentation involved implementation of contour lines with farm ridges, agronomic trails and runoff and erosion measurements. Agronomic data was collected on sorghum, maize, groundnut and millet for three consecutive years (2015 to 2017). Socio-economic data on the use of CB was obtained from individual farmer surveys. CB involves the layout of contour lines with land leveling devices to identify points of equal elevation and construction of contour lines with draught animals and human labor. The majority of the labor input to construct and maintain the CB comes from adult men who are head of the household (58%) and youth male (33%). Results indicate that with the application of CB yield of crops was higher with the highest increase in grain yield and biomass obtained for maize and millet ($P < 0.01$). CB application was useful in retaining soil water and reduced erosion rate. In treatment fields, 162mm of rainfall per year was saved as soil moisture and on average 13,090 kg per hectare of soil was lost from farm fields without CB, and CB implementation significantly reduced the soil loss by 163% ($P < 0.01$). The improvements in crops yield and biomass, and the retention of soil nutrients positively changed farm level productivity conditions. The majority of farmers (78%) perceived higher income from the sale of crops grown on CB plots. These results suggest the landscape wide application of CB.

Keywords: contour bunding; crop yield; erosion control; Southern Mali; water productivity

Link: <https://hdl.handle.net/10568/108503>

DOI: <https://doi.org/10.1017/S1742170519000450>

Effects of ensiling cassava peels on some fermentation characteristics and growth performance of sheep on-farm {Journal article}

Citation

Niayale, R., Addah, W. and Ayantunde, A.A. 2020. Effects of ensiling cassava peels on some fermentation characteristics and growth performance of sheep on-farm. Ghana Journal of Agricultural Science 55(2): 107–121.

Abstract

This study determined the effect of drying or ensiling cassava peels on some conservation characteristics and growth performance of sheep. Fresh peels were either sun-dried to a DM of 904 g/kg or ensiled for 45 days for determination of some chemical and microbial characteristics, and growth performance of sheep. 45 Djallonké sheep were randomly assigned to three supplementary dietary treatments (Control and dried or ensiled) and fed for 70 days. Ensiling reduced the pH from 5.65 in the fresh peel to 4.15 compared to 6.15 in the dried peel. Crude protein (CP) increased from 45±0.44 g/kg DM in the fresh peel to 46±0.48 and 52±0.88 g/kg DM in the dried and ensiled peel, respectively. Reduction in neutral detergent fibre concentration was greater by ensiling than by drying. However, a greater ($P = 0.001$) reduction in HCN concentration was achieved by drying than by ensiling. Moulds were greater ($P = 0.011$) in the ensiled than dry peels. Average daily weight gain was higher ($P = 0.031$) for sheep offered the ensiled than the dried or Control diet. In conclusion, sun-drying was more effective at reducing HCN concentration whereas ensiling improved the CP content of cassava peels and growth performance of sheep.

Keywords: cassava peels; crop residues sheep; ensiling; growth performance; sun-drying

Link: <https://hdl.handle.net/10568/111197>

DOI: <https://doi.org/10.4314/gjas.v55i2.9>

Evaluating sustainable intensification of groundnut production in northern Ghana using the Sustainable Intensification Assessment Framework approach

{Journal article}

Citation

Abdul Rahman, N., Larbi, A., Kotu, B., Kizito, F. and Hoeschle-Zeledon, I., 2020. Evaluating Sustainable Intensification of Groundnut Production in Northern Ghana Using the Sustainable Intensification Assessment Framework Approach. *Sustainability*, 12, 5970.

Abstract

The sustainable intensification of crop production system requires the efficient use of resources. A 3-year on-farm experiment was conducted to determine the sustainability of plant density for groundnut production in Northern Ghana using the sustainable intensification assessment framework (SIAF). The SIAF allows the assessment of the sustainable intensification potential of the agricultural system in five domains: productivity, economics, environment, human, and social. The experiment was laid out in a strip plot design with six groundnut varieties (early maturity type: Chinese, Yenyewoso, and Samnut 23, and late maturity type: Azivivi, Mani pinta, and Samnut 22) as the horizontal plot factor and four plant densities (22, 15, 11, and 9 plant/m²) as the vertical plot factor. Using the SIAF as a guide, data on grain and fodder yield (productivity), net income and benefit cost ratio (economic), vegetative cover at 30, 40, and 50 days after planting and harvesting and biological nitrogen fixation (environment), calorie and protein production (human), and technology rating by gender (social) were recorded to calculate the sustainability indices of the treatments. The results showed that the sustainability indices for the Yenyewoso and Mani pinta groundnut varieties were above 1 in all the regions, indicating that both groundnut maturity types are sustainable for cultivation in the Northern regions of Ghana. Planting both groundnut maturity types at a density of 22 plant/m² increased the sustainability index threefold compared with the farmer practice (9 plant/m²) and 79% compared with the 11 and 15 plant/m². This suggests that planting groundnut at a density of 22 plant/m² will sustainably intensify groundnut production in Northern Ghana and similar agro-ecologies across West Africa.

Keywords: *Arachis hypogaea*; plant density; SIAF; savanna

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DOI: <https://doi.org/10.3390/su12155970>

Field efficacy of two atoxigenic biocontrol products for mitigation of aflatoxin contamination in maize and groundnut in Ghana {Journal article}

Citation

Agbetiameh, D., Ortega-Beltran, A., Awuah, R.T., Atehnkeng, J., Elzein, A., Cotty, P.J. and Bandyopadhyay, R. 2020. Field efficacy of two atoxigenic biocontrol products for mitigation of aflatoxin contamination in maize and groundnut in Ghana. *Biological Control* 150:104351.

Abstract

Biological control is one of the recommended methods for aflatoxin mitigation. Biocontrol products must be developed, and their efficacy demonstrated before widespread use. Efficacy of two aflatoxin biocontrol products, Aflasafe GH01 and Aflasafe GH02, were evaluated in 800 maize and groundnut farmers' fields during 2015 and 2016 in the Ashanti, Brong Ahafo, Northern, Upper East, and Upper West regions of Ghana. Both products were developed after an extensive examination of fungi associated with maize and groundnut in Ghana. Each product contains as active ingredient fungi four *Aspergillus flavus* isolates belonging to atoxigenic African *Aspergillus* Vegetative Compatibility Groups (AAVs) widely distributed across Ghana. An untreated field was maintained for each treated field to determine product efficacy. Proportions of atoxigenic AAVs composing each product were assessed in soils before product application, and soils and grains at harvest. Significant ($P < 0.05$) displacement of toxigenic fungi occurred in both crops during both years, in all five regions. Biocontrol-treated crops consistently had significantly ($P < 0.05$) less aflatoxins (range = 76% to 100% less; average = 99% less) than untreated crops. Results indicate that both biocontrol products are highly efficient, cost-effective, environmentally safe tools for aflatoxin mitigation. Most crops from treated fields could have been sold in both local and international food and feed premium markets. Adoption and use of biocontrol products have the potential to improve the health of Ghanaians, and both income and trade opportunities of farmers, aggregators, distributors, and traders.

Keywords: Aflatoxin; Biocontrol; Efficacy; Maize; Groundnut; Ghana

Link: <https://hdl.handle.net/10568/109102>

DOI: <https://doi.org/10.1016/j.biocontrol.2020.104351>

Maize–soybean intercropping effect on yield productivity, weed control and diversity in northern Ghana {Journal article}

Citation

Berdjour, A., Dugje, I.Y., Dzomeku, I.K. and Abdul Rhaman, N. 2020. Maize–soybean intercropping effect on yield productivity, weed control and diversity in northern Ghana. *Weed Biology and Management* 20(2):69-81.

Abstract

The cereal–legume cropping system is a common practice across the tropical world. However, there are limited quantitative data on the effect of cereal–legume intercropping on weed species diversity. A study was conducted in the Guinea savanna zone of Ghana to evaluate the effect of maize–soybean intercropping on yield productivity and weed species control. The treatments used include three maize maturity types (extra-early: Abontem, early: Sammaz 27 and medium: Obatanpa) intercropped with soybean at three intraspacing (10, 20 and 30 cm), and their sole crop treatments were laid in a randomized complete block design with three replications. Results showed that the land equivalent ratio (LER) for the intercrops was above 1, indicating better intercrop productivity than the sole crops. An average of 40% land was saved for the intercrops compared with the sole crops. Intercropping Sammaz 27 maize with soybean significantly increased LER by 9% compared to the other types. Intercropping maize with soybean significantly reduced weed biomass at 6 and 9 weeks after planting (WAP) and at harvest relative to the sole maize. The weed biomass at 6 and 9 WAP and harvest increased ($p < .05$) with increasing soybean intraspacing. The grass and broadleaf weed species count at 6 WAP and harvest from the sole crops were significantly higher than that of the intercrops. The results suggest that intercropping early maize maturity type with soybean at 10 cm intraspacing could be used to increase grain yield, LER and control of grass and broadleaf weeds in a maize-based cropping system in the Guinea savanna zones of West Africa.

Keywords: agronomy; farming systems; maizecrops; farming systems; legumes

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DOI: <https://doi.org/10.1111/wbm.12198>

Motivational factors influencing farming practices in northern Ghana {Journal article}

Citation

Mellon-Bedi S., K. Descheemaeker, B. Hundie-Kotu, S. Frimpong, and J.C.J. Groot. 2020. Motivational factors influencing farming practices in northern Ghana. NJAS - Wageningen Journal of Life Sciences, 92:100326.

Abstract

Socio-economic factors that influence the adoption of management practices and technologies by farmers have received wide attention in the adoption literature, but the effects of socio-psychological farmer features such as perceptions and motivations have been analysed to a lesser extent. Using farm household survey data from three regions in northern Ghana, this study explores farmers' motivations and perceived adoption impediments for three sustainable intensification practices (SIPs): improved maize varieties, cropping system strategies, and combined SIPs (i.e. improved maize and cropping system strategies), and the effect of motivational factors on decisions to adopt SIPs. First, explorative factor analysis (EFA) was used in identifying factors of motivations and impediments for adoption of SIPs. Then, a multinomial logit model was used to analyze the effect of socio-economic farm characteristics and motivational factors on farmers' decisions to adopt SIPs. EFA identified three motivational factors: personal satisfaction, eco-diversity and eco-efficiency, which differed in importance between the three regions. Across these regions, higher scores for aspects of personal satisfaction were associated with lower interest in improved maize varieties compared to cropping system strategies, while the opposite was true for eco-efficiency which was related to a stronger preference for improved maize varieties. Uncertainty, absence of social support, and resource constraints were identified as impediment factors. The logit model demonstrated that extension services seemed to support the use of improved maize varieties more than the implementation of cropping system strategies. We conclude that motivational factors significantly influence farmer adoption decisions regarding sustainable intensification practices and should be considered systematically in combination with socio-economic farm features and external drivers to inform on-farm innovation processes and supporting policies.

Keywords: Motivations, Impediments, Sustainable intensification, Adoption, Factor analysis

DOI: <https://doi.org/10.1016/j.njas.2020.100326>

Realizing Inclusive SAI: Contextualizing indicators to better evaluate gender and intergenerational inequity in SAI processes and outcomes - cases from Southern and Western Africa {Journal article}

Citation

Zulu, L., Djenontin, I.N.S., Darkwah, A., Kamoto, J., Kampanje-Phiri, J., Fischer, G., Grabowski, P. and Egyir, I. 2020. Realizing Inclusive SAI: Contextualizing indicators to better evaluate gender and intergenerational inequity in SAI processes and outcomes—Cases from Southern and Western Africa. *International Journal of Agricultural Sustainability*

Abstract

Despite increasing sustainable agricultural intensification (SAI) investments, indicators for detecting gender and intergenerational inequities in SAI costs and benefits sharing often remain overgeneralized, theoretical, or locally irrelevant. We examine the relative value of, and how to, customize standard SAI indicators to detect such inequities in specific socio-cultural contexts to enhance data collection for evidence-based decision making in fostering gender/youth inclusive SAI. Using focus-group discussions and key informant interviews among farmers and diverse government, NGO, private sector, and academic stakeholders in two districts in Malawi and three in Ghana, we assess the perceived roles, differentiated needs/ priorities of men, women and youth, and the sharing of SAI burdens and benefits within farming households. We investigate what context-appropriate questions to ask, to whom, and how, to collect reliable information on indicators of SAI investment inequities. Results illuminate context-specific, gendered and intergenerational factors shaping access to and ownership of productive resources, household decision making, SAI participation, and appropriateness of selected indicators. Combining farmers' and local field-expert' perspectives offer practical insights for customizing inequity indicators. Findings highlight advantages of local contextualization of SAI indicators, including insights on appropriate data-collection approaches that challenge orthodox survey/quantitative methods for detecting and assessing gender/age inequities to foster inclusive SAI.

Keywords: Sustainable agricultural intensification (SAI); gender inequity; youth inequity; participatory contextualization; SAI indicators; Malawi; Ghana

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DOI: <https://doi.org/10.1080/14735903.2020.1737356>

Row spacing of annual peanut (*Arachis Hypogaea* L.) and the conservation of peanut haulm as hay or silage: Effects on nutritive value and growth performance of sheep {Journal article}

Citation

Addah, W., Ayantunde, A., and McAllister, T.A. 2020. Row spacing of annual peanut (*Arachis Hypogaea* L.) and the conservation of peanut haulm as hay or silage: Effects on nutritive value and growth performance of sheep. Ghanaian Journal of Animal Science, Vol. 11 No.1

Abstract

This study investigated the effects of planting annual peanut at inter-row spacings of 30, 45, 60 or 75 cm on haulm yield and nutritional quality (Experiment I), in vitro digestibility (Experiment II) and growth performance of sheep fed peanut hay or silage diets (Experiment III). At harvest, peanut haulms were either sun-dried as hay or ensiled and used to formulate two diets that were fed to sheep. Twenty West African Dwarf ram-lambs (29.7±0.99 kg) were randomly assigned to these two dietary treatments in a completely randomized design. Grain (P=0.033) and haulm (P=0.045) yields were highest at 30 cm as compared to the other spacings; whereas yeasts populations, and butyric acid and ammonia N concentrations were higher in the silage than hay (Experiment I). In vitro NDF digestibility linearly decreased (P=0.001) with increasing row space (Experiment II). In experiment III, the DM intake of the silage-based diet was depressed (P=0.069) by 235.8 g/d compared to the hay-based diet; whereas feed efficiency (P=0.053) and average daily gain (P=0.012) were lower for the silage- than hay-based diet. In conclusion, in vitro NDF digestibility of peanut haulm was higher at narrow row spacing whereas growth performance was superior for sheep fed the hay-based rather than the silage-based diet.

Keywords: Crop residues, growth performance, peanut haulm, plant spacing, sheep, in vitro digestibility

Link: <https://hdl.handle.net/10568/115698>

Spatial-temporal trends of rainfall, maximum and minimum temperatures over West Africa {Journal article}

Citation

Muthoni, F. 2020. Spatial-temporal trends of rainfall, maximum and minimum temperatures over west Africa. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 13, 2960-2973.

Abstract

This article investigates the magnitude and significance of spatial-temporal trends of 37 years' time series of the gridded data for rainfall, maximum (Tmax) and minimum (Tmin) temperature for West Africa. A modified Mann-Kendall test and Theil-Sen's slope estimator were utilized to test the significance and the magnitude of trends, respectively. The magnitude of significant trends for three variables between six agroecological zones (AEZs) was compared. Gridded climate data represented gauge data with high accuracy and, therefore, can reliably complement the sparse observation network in West Africa. The three variables showed significant positive and negative trends of varying magnitude and spatial extent. June to September rainfall showed a positive increase (0.1-5 mm/month/year) that mostly occurred north of 11° latitude. October rainfall showed a positive trend across the region, but the magnitude was higher south of the same latitude. A widespread significant warming trend was observed across all AEZs and months. However, a localized cooling in August and September over the Sahel and Sudan Savanna was an exception. The cooling over the two AEZs coincided with a positive trend of rainfall. The zonal analysis revealed that the magnitude of the positive trend of June, September, and October rain increased following a North-South gradient from the Sahel to humid forest AEZs. Results provide spatial evidence of climate change in a limited data environment to guide the targeting of appropriate adaptation measures. The information generated from this article helps the design of early warning systems against droughts and floods.

Keywords: climate change; rainfed farming; spatial data; west africa; agroecology; rain

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DOI: <https://doi.org/10.1109/jstars.2020.2997075>

The use of the wetting front detector as an irrigation-scheduling tool for pepper production in the Upper East Region of Ghana: Evidence from field experiment and farmers' perceptions {Journal article}

Citation

Adimassu, Zenebe; Balana, B. B.; Appoh, Richard; Nartey, Eric. 2020. The use of the wetting front detector as an irrigation-scheduling tool for pepper production in the upper east region of Ghana: evidence from field experiment and farmers' perceptions. *Irrigation and Drainage*, 69(4):696-713. [doi: 10.1002/ird.2454]

Abstract

We compare the effect of the wetting front detector on yield and water productivity with farmers' practices (FP) and irrigation requirements based on crop water requirement calculation (IRCWR). A field experiment was conducted to assess the effect of the wetting front detector, FP and IRCWR combined with six fertilizer rates. We also interviewed 50 farmers to understand their perception about the use and associated concerns with the wetting front detector. Analysis of variance and partial budget economic analysis were performed. The results show that the wetting front detector saved 16% of irrigation water compared to FP, which in turn led to 16% labour saving to irrigate pepper as compared to FP. Yield and water productivity of pepper were not significantly affected by the irrigation regimes. Regardless of irrigation regimes, yield of pepper was significantly influenced by fertilizer treatment in both years. Although the highest fresh fruit yield of pepper (8.6 t ha⁻¹) was recorded from Fortifer granules, the highest marginal rate of return was obtained from application of inorganic fertilizer including 173 N, 36 P, 18 K ha⁻¹. The majority of farmers perceived the wetting front detector as low risk and compatible to use. The result also suggests that farmers are interested in buying and adopting the tool for future use.

Keywords: irrigation, scheduling; wetting, front, crop yield, pepper, crop water use, water requirements, water productivity, farmers' attitudes, irrigation water, fertilizer application, soil properties, risks, field experimentation, economic analysis

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DOI: <https://doi.org/10.1002/ird.2454>

To diversify or not to diversify, that is the question: Pursuing agricultural development for smallholder farmers in marginal areas of Ghana {Journal article}

Citation

Bellon, M.R., Kotu, B.H., Azzarri, C. and Caracciolo, F. 2020. To diversify or not to diversify, that is the question: Pursuing agricultural development for smallholder farmers in marginal areas of Ghana. *World Development*, 125: 104682.

Abstract

Many smallholder farmers in developing countries grow multiple crop species on their farms, maintaining de facto crop diversity. Rarely do agricultural development strategies consider this crop diversity as an entry point for fostering agricultural innovation. This paper presents a case study, from an agricultural research-for-development project in northern Ghana, which examines the relationship between crop diversity and self-consumption of food crops, and cash income from crops sold by smallholder farmers in the target areas. By testing the presence and direction of these relationships, it is possible to assess whether smallholder farmers may benefit more from a diversification or a specialization agricultural development strategy for improving their livelihoods. Based on a household survey of 637 randomly selected households, we calculated crop diversity as well as its contribution to self-consumption (measured as imputed monetary value) and to cash income for each household. With these data we estimated a system of three simultaneous equations. Results show that households maintained high levels of crop diversity: up to eight crops grown, with an average of 3.2 per household, and with less than 5% having a null or very low level of crop diversity. The value of crop species used for self-consumption was on average 55% higher than that of crop sales. Regression results show that crop diversity is positively associated with self-consumption of food crops, and cash income from crops sold. This finding suggests that increasing crop diversity opens market opportunities for households, while still contributing to self-consumption. Given these findings, crop diversification seems to be more beneficial to these farmers than specialization. For these diversified farmers, or others in similar contexts, interventions that assess and build on their de facto crop diversity are probably more likely to be successful.

Keywords: Crop diversity, Production diversification, Agricultural development, Ghana

Link: <https://www.sciencedirect.com/science/article/pii/S0305750X19303304>

DOI: <https://doi.org/10.1016/j.worlddev.2019.104682>

Year 2019

Comparative yield performance and fodder quality of napier grass varieties in the dry savanna Region of Ghana. {Journal article}

Citation

Shedrack, C., Ansah, T. and Kadyampakeni, D. 2019. Comparative yield performance and fodder quality of napier grass varieties in the dry savanna Region of Ghana. Ghanaian Journal of Animal Science. Vol. 10 (1).

Abstract

Pennisetum purpureum (Napier) is known to be a high-yielding and nutritious grass species for ruminant livestock. In Ghana, it is found predominantly within the humid/forest and transition zones. Meanwhile ruminant livestock production is relatively minimal in these areas, the savanna zone is a major contributor of livestock to the Ghanaian economy. In this study the fodder yield and nutritive value of 3 varieties (ILRI accessions 16837, 16798, 16840) of *Pennisetum purpureum* (Napier) grass were compared with those of the Local variety in the savanna region of Ghana. A randomized complete block design was used to assess yield performance over a 90-day period. After 90 days, the grasses were harvested to a stubble height of 15 cm and samples of the harvested fodder were separated into leaves and stems, while some remained whole. These samples were analyzed for nutrient composition and in vitro organic matter digestibility (IVOMD). There was no significant effect of variety on biomass yield (1,354–3,339 kg DM/ha), tiller number (9.5–16.1/plant), plant height (1.1–1.4 m) or leaf: stem ratio (0.9–1.2). Plant height was positively correlated ($P < 0.001$) with biomass yield. The stem fraction for all varieties had consistently ($P > 0.05$) lower crude protein (CP) concentrations than the leaf fraction with the lowest levels recorded in the Local variety. Gas production at 12, 24 and 48 h were significantly ($P < 0.05$) higher in the stem fraction than in leaf. There was no significant difference among the fractions for IVOMD and metabolizable energy. The study revealed a superior yield performance for the Local variety but not significantly, with the improved varieties having a higher CP. From these results, there is no justification for introducing the improved cultivars studied in place of the Local variety.

Keywords: Crude protein, forage, leaf: stem, Napier, organic matter digestibility

Link: https://www.researchgate.net/profile/Terry-Ansah/publication/341550090_COMPARATIVE_YIELD_PERFORMANCE_AND_FODDER_QUALITY_OF_NAPIER_GRASS_VARIETIES_IN_THE_DRY_SAVANNA_REGION_OF_GHANA/links/5ec6ad5c458515626cbd1c7f/COMPARATIVE-YIELD-PERFORMANCE-AND-FODDER-QUALITY-OF-NAPIER-GRASS-VARIETIES-IN-THE-DRY-SAVANNA-REGION-OF-GHANA.pdf

DOI:

Corralling, planting density, and N fertilizer rate effect on soil properties, weed diversity, and maize yield {Journal article}

Citation

Abdul Rahman, N., Larbi, A., Opoku, A., Tetteh, F.M. and Hoeschle-Zeledon, I. 2019. Corralling, planting density, and N fertilizer rate effect on soil properties, weed diversity, and maize yield. *Agroecology and Sustainable Food Systems*, 43(3), pp.243-260.

Abstract

The interaction effect of stocking density of sheep and goat corralling (SDSG), maize planting density (MPD), and N fertilizer rate (NFR) on soil properties, weed diversity, and maize yield were evaluated on-farm in a smallholder maize-livestock farming system of Northern Ghana during the 2014 and 2015 cropping seasons. A split-split plot design replicated on eight farms was used to study the effect of three SDSG (0, 70, and 140 head ha⁻¹), three MPD (66 667, 100 000, and 133 333 plants ha⁻¹), and three NFR (0–40-40, 60–40-40, and 90–40-40 NPK kg ha⁻¹). The SDSG at 70 and 140 head ha⁻¹ increased ($P < 0.01$) soil chemical and biological properties and weed diversity compared with the control in both cropping seasons. Maize growth, yield and yield components, and weed biomass were affected ($P < 0.05$) by the SDSG, MPD, and NFR interactions. Maize-livestock farmers with smaller flock size could use SDSG at 70 head ha⁻¹ with NFR at 90 kg ha⁻¹, whilst those with large flock size could stock at 140 head ha⁻¹ with NFR at 60 kg ha⁻¹ and MPD at 133 333 plants ha⁻¹ for increased maize yield and weed management.

Keywords: Density, soil amelioration, maize-livestock system, interaction effect, northern Ghana

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DOI: <https://doi.org/10.1080/21683565.2018.1516264>

Crop–Livestock Interaction Effect on Soil Quality and Maize Yield in Northern Ghana {Journal article}

Citation

Abdul Rahman, N., Larbi, A., Opoku, A., Tetteh, F.M. and Hoeschle-Zeledon, I. 2019. Crop–livestock interaction effect on soil quality and maize yield in Northern Ghana. *Agronomy Journal*, 111, 907-916.

Abstract

Keeping livestock overnight on fallow arable lands (Corralling) is a traditional method of soil fertility amendment in West Africa. However, there is limited quantitative data on the interaction effects of stocking density of sheep and goats corralling (SDSG), maize plant density (MPD) and nitrogen fertilizer rate (NFR) on soil quality and yield of maize. A 2-yr study was conducted to determine the interaction effects of three SDSG (0, 70, and 140 head ha⁻¹), three MPD (66,667, 100,000, and 133,333 plants ha⁻¹) and three NFR (0, 60, and 90 kg ha⁻¹ N) on soil quality index (SQI) and maize yield in northern Ghana. The study was conducted using a split-split plot experiment replicated on eight farms. An adult sheep or goat was corralled in an area of 4 m² and 1 m² for the 70 and 140 head ha⁻¹ SDSG respectively for five nights during the dry seasons of 2014 and 2015 cropping seasons. Principal component and correlation matrix analysis were used to select minimum data set

for SQI. The SQI for sheep and goats corralling increased by 51% compared with the control. The SDSG×MPD, SDSG×NFR and MPD×NFR interactions were significant on maize grain and biomass yields. The results suggest that small-scale maize-livestock farmers could use either SDSG of 70 head ha⁻¹ with 90 kg ha⁻¹ NFR or SDSG of 140 head ha⁻¹ with 60 kg ha⁻¹ NFR and MPD at 133,333 plants ha⁻¹ to increase grain yield on Ferric lxisols in northern Ghana and similar ecologies in West Africa.

Keywords:

Link:<https://access.onlinelibrary.wiley.com/doi/10.2134/agronj2018.08.0523>

DOI: <https://doi.org/10.2134/agronj2018.08.0523>

Cultivar and insecticide spraying time effects on cowpea insect pests and grain yield in northern Ghana

{Journal article}

Citation

Kusi F., Nboyine J. A., Abudulai M., Seidu A., Agyare Y. R., Sugri I., Zakaria M., Owusu R. K., Nutsugah S. K. and Asamoah, L. 2019. Cultivar and insecticide spraying time effects on cowpea insect pests and grain yield in northern Ghana. *Annals of Agricultural Sciences* 64: 121-127.

Abstract

Insecticide application is the recommended practice for control of insect pests in cowpea (*Vigna unguiculata* (L.) Walp). However, these have negative effects on humans and the environment, apart from being costly for resource poor farmers. This study aimed at identifying appropriate combinations of cultivar and insecticide spraying times for the management of economically important insect pests of cowpea in northern Ghana. The experimental layout was a complete randomized split plot design with main plots consisting of different numbers and timings of insecticide application and sub-plots consisting of 6 different cowpea cultivars. Data collected included insect pest abundances, components of yield and yield. Thrips (*Megalurothrips sjostedti* Trybom), legume pod borer (*Maruca vitrata* Fabricius). and a complex of pod-sucking bugs were the dominant insect pests. Their abundance and damage were not significantly different between the untreated control and cowpea sprayed once at 50% flowering stage. In contrast, protecting cowpea with either two (i.e. flower bud initiation and early podding) or three rounds of insecticide sprays (i.e. flower bud initiation, 50% flowering and 50% podding) significantly lowered insect pest abundance and increased grain yield. Apart from the farmers cultivar which was susceptible to pest attack, the improved ones showed variable levels of tolerance to the different pest categories. Combining at least two rounds of insecticide sprays with any improved variety suppressed pest populations and increased grain yield.

Keywords: Cowpea, insecticide treatments, Savannahs, yield, damage levels and integrated pest management

DOI: <https://doi.org/10.1016/j.aogas.2019.03.001>

Effets de la fertilisation et de la date de semis sur des variétés de sorgho à double usage {Thesis and Dissertation}

Citation

Togo, A. 2019. Effets de la fertilisation et de la date de semis sur des variétés de sorgho à double usage. Thèse pour l'obtention du diplôme d'Ingénieur Agronome. Bamako, Mali: Institut Polytechnique Rural de Formation et de Recherche Appliquée, Mali.

Abstract

Le sorgho est une importante culture céréalière à usage-multiple pour les communautés rurales du Mali à cause de ses graines utilisées pour la consommation humaine et de son fourrage utilisé pour nourrir le bétail. Cependant, malgré cette importance, la production du sorgho demeure largement inférieur à son potentiel bien que des avancées significatives ont été récemment réalisées dans le domaine de l'amélioration variétale notamment l'introduction de nouvelles variétés. L'intensification des pratiques agronomiques s'avère une meilleure approche pour accroître de façon significative la production et la productivité du sorgho. Decefait, un essai a été mis en place à Samanko pour évaluer l'effet de la date de semis et de la fertilisation sur le nombre total de feuille, la hauteur et les rendements grain et fourrage des variétés à doubles usages Soubatimi et Peke. En conséquence, trois types de fertilisation (la fertilisation avec DAP+Urée, bouse de vache et zéro fertilisation) et trois dates de semis (04/07/2019; 18/07/2019; 02/08/2019) ont été considérés. Le dispositif utilisé était un split-split-plot avec fertilisation comme bloc principal et les dates de semis étaient en sous-bloc. L'analyse des résultats montre que la bouse de vache est la fertilisation qui impacte positivement tous les paramètres étudiés. Pour les 3 types de fertilisation, Peke a produit plus de feuille que Soubatimi, et Soubatimi a eu une hauteur supérieure à celle de Peke. On remarque que lorsque la fertilisation est apportée Peke produit plus de fourrage que Soubatimi et sans fertilisation, c'est l'inverse que l'on observe. Contrairement au fourrage, le rendement grain le plus élevé a été observé avec Soubatimi sous fertilisation. Et sans fertilisation, on observe l'inverse (1117,2 kg/ha pour Peke contre 518,5 kg/ha pour Soubatimi). Par rapport aux dates de semis, on remarque une décroissance du nombre total de feuille du semis précoce au semis tardif de 17% et 19% respectivement pour Soubatimi et Peke. Des résultats similaires ont été obtenus avec la hauteur. On constate aussi que Peke produit plus de fourrage lorsqu'il est semé tôt et son rendement fourrage baisse lorsque le semis est tardif tandis que Soubatimi produit plus lorsque le semis est moins précoce, son rendement fourrage baisse également lorsque le semis est tardif. Le rendement grain le plus élevé pour les 3 dates de semis a été observé avec Peke 1522,6 kg/ha contre 1238,7 kg/ha pour Soubatimi. L'analyse de l'effet de l'interaction des différents facteurs sur les paramètres étudiés montre que l'interaction dates de semis x variétés et l'interaction fertilisation x dates de semis x variétés a un impact hautement significatif sur le rendement fourrage ($p\text{-val} < .001$).

Keywords: agronomy; natural resource management crops; farming systems; intensification

Link: <https://hdl.handle.net/10568/108798>

Improved *Arachis hypogaea* variety effect on grain yield, fodder quality and livestock growth {Journal article}

Citation

Abdul Rahman, N., Ansah, T., Sadia Osuman, A., Frimpong, S., and Arnold, A. 2019. Improved *Arachis hypogaea* variety effect on grain yield, fodder quality and livestock growth. Agriculture and Natural Resources. 2019. 53.

Abstract

The hypothesis that improved groundnut (*Arachis hypogaea*) varieties could improve seed and fodder yield and livestock growth performance was evaluated in two experiments: 1) an agronomic trial to determine the yield and yield component of groundnut varieties; and 2) fodder quality of groundnut varieties and its effect on growth performance of sheep. Four improved groundnut varieties (early-maturing: Yenyawoso, late-maturing: Azivivi, Obolo and Mani pinta) were evaluated for 2 yr in a randomized complete block design with four replications in the agronomic and livestock feeding trials. The results from the agronomic trial showed that the late-maturing varieties had significantly higher pods/plant, pod size, seed and fodder yields than Yenyawoso. Obolo had significantly higher seed yield whilst Azivivi had significantly higher fodder yield among the late-maturing varieties. The fodder quality and feeding trial showed that Yenyawoso had significantly higher dry matter, crude protein and resulted in significantly higher live weight gain of Djallonké rams than the other varieties. The Mani pinta variety had significantly higher live weight gain among the late-maturing varieties. Smallholder crop-livestock farmers interested in both seed and livestock growth could use Mani pinta, those interested in only seed yield could use Obolo and those interested in quality fodder for fattening of small ruminants could use Yenyawoso. Thus, groundnut breeding programs could consider fodder quality in addition to seed and fodder yield as selection criteria to develop varieties that best fit into crop-livestock farming systems.

Keywords: groundnuts; body weight; savannas; livestock; growth; grain; fodder

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DOI: <https://doi.org/10.34044/j.anres.2019.53.3.05>

Influence du parbage de nuit des bovins sur la fertilité du sol et la productivité du sorgho à Koutiala en zone Mali-sud {Thesis and Dissertation}

Citation

Kasse, H. 2019. Influence du parbage de nuit des bovins sur la fertilité du sol et la productivité du sorgho à Koutiala en zone Mali-sud. Thèse pour l'obtention du diplôme de d'Ingénieur Agronome. Bamako, Mali: Institut Polytechnique Rural de Formation et de Recherche Appliquée, Mali.

Abstract

Le maintien de la fertilité des sols est une préoccupation pour les exploitations agricoles en zone Mali-sud. Cette préoccupation est de plus en plus d'actualité avec des exportations d'éléments minéraux par les récoltes. C'est pour contribuer à l'amélioration de la fertilité des sols et la productivité des cultures par le parbage de nuit des bovins au Mali-sud que la présente étude a été initiée. La méthodologie utilisée a d'abord consisté à mener des enquêtes pour comprendre l'intégration de l'élevage dans l'agriculture pour la gestion de la fertilité des sols par exploitation et évaluer la perception des agro-éleveurs sur la pratique du parbage de nuit des bovins au champ. Ensuite un essai agronomique en plein champ a été conduit dans trois villages. Deux facteurs ont été étudiés : la nuitée de 10 Unité Bétail Tropical (UBT) avec 6 niveaux de variation (0N, DAP, 3N, 7N, 10N et 15N) et la densité de semis du sorgho à 3 niveaux de variation (0,75 m x 0,20 m ; 0,75 m x 0,30 m et 0,75 m x 0,40 m). Les traitements étaient disposés en Split-plot dispersés chez 6 agro-éleveurs dont chaque paysan constituait un bloc. Les résultats des enquêtes ont montré que 57,78% des exploitations interrogées pratiquent le parbage de nuit des bovins contre 42,22% dans les trois villages d'étude. Les contraintes à cette pratique sont principalement liées au manque de fourrage, manque de point d'eau, l'insécurité et enfin la rotation du dispositif. Les résultats obtenus de l'essai agronomique en plein champ, montrent que le dépôt direct de déjections de bovin par le parbage est plus élevé avec 15 nuitées faisant une moyenne de 14,4 t/ha, suivi de celui de 10 nuitées et 7 nuitées produisant respectivement une moyenne de 9,6 t/ha et 6,72 t/ha. La plus faible quantité de matière sèche est obtenue avec le parbage de 3 nuitées produisant une moyenne de 2,88 t/ha. Les 15 nuitées ont permis d'obtenir le plus grand rendement en poids paille de 4,43 t/ha suivi des 7 nuitées avec 4,29 t/ha et des 10 nuitées pour 4,16 t/ha. Le plus faible poids paille a été enregistré avec la parcelle témoin (sans parbage) une quantité de 2,79 t/ha. Nous constatons que, plus la durée du parbage est élevée, plus le rendement en biomasse et en poids paniculaires sont significativement importants.

Keywords: soil fertility; intensification; crop yield; farming systems; cattle; crops

Link: <https://hdl.handle.net/10568/108797>

Interseeding timing of cowpea (*Vigna unguiculata* L. Walp.) living mulch on weed diversity, physical soil properties and performance of maize (*Zea mays* L.)

{Thesis and Dissertation}

Citation

Berdjour, A. 2019. Interseeding timing of cowpea (*Vigna unguiculata* L. Walp) living mulch on weed diversity, physical soil properties and performance of maize (*Zea may* L.). MPhil thesis in Crop Science. Tamale, Ghana: University for Development Studies.

Abstract

This trial was conducted to determine cowpea living mulch and maize maturity type effect on soil physical properties, maize yield and weed management. The study was a 3 x 4 factorial experiment laid out in Randomised Complete Block Design with 3 replications. Three maize maturity types: extra early Abontem, early Omankwa and medium Obatanpa and four living mulch systems: cowpea living mulch interseeded same day with maize (SDWM), cowpea living mulch interseeded 1 Week after planting maize (WAPM), cowpea living mulch interseeded 2 WAPM and sole maize (control) were used as treatments. The maize was planted at a spacing of 75 x 40 cm and interseeded with cowpea living mulch planted in between maize rows at an intraspacing of 20 cm, resulting in a 1:1 row arrangement. Data was collected on soil physical properties, maize growth, yield and yield components, weed biomass and diversity. Planting cowpea as mulch in maize reduced ($p < 0.05$) soil temperature and increased ($p < 0.05$) soil moisture content than the control at vegetative, tasselling and harvest growth stage of the maize. Maize plant height at harvest, leaf area index of maize at 6 WAPM and days to 50% tasselling were significantly affected by cowpea living mulch and maize maturity type interaction. Cowpea living mulch significantly increased maize grain yield, with cowpea living mulch at 1 WAPM recording the highest grain yield of 2285.9 kg/ha. Cowpea living mulch significantly reduced weed biomass at 6, 9 and 12 WAP. Maize maturity type affected ($p < 0.05$) parameters such as plant height, leaf area index, 50% tasselling and silking, stover yield and harvest index. Cowpea interseeded SDWM and 1 WAPM best improved soil physical properties, maize yield and reduced weed diversity and biomass. Therefore, for enhanced maize yield and optimum weed control, farmers with enough labour can inter-seed maize with cowpea live mulch on the same day (SDWM). Alternatively, those face with labour scarcity could adopt maize with cowpea interseeded at 1 WAPM

Keywords:

Link:

Land use decisions: By whom and to whose benefit? A serious game to uncover dynamics in farmland allocation at household level in northern Ghana

{Journal article}

Citation

Michalscheck, M., Groot, J.C.J., Fischer, G. and Tittonell, P. 2019. Land use decisions: By whom and to whose benefit? A serious game to uncover dynamics in farmland allocation at household level in northern Ghana. Land Use Policy

Abstract

Globally, 38% of the land area is agricultural land, of which 45% are located on drylands, mainly in Africa and Asia, constituting the basis for about 60% of the world's food production. Of all farms worldwide, 83% are smallholder farm systems, whose livelihoods depend on effective land management and allocation. While land is often cultivated by the various members of a farm household, land allocation decisions depend on the approval, the ambition and the abilities of influential household members, likely affecting all other household members, too. While intra-household decision-making processes have been described to depend on the interplay of prevailing interests and power positions, so far knowledge on interests and power positions is based on individual reports rather than actual observations. With the aim to explore the process of land allocation in a socially complex smallholder farm system, we invited members of a smallholder community in Northern Ghana to join a closed, experimental serious game, simulating a negotiation process between a male household head (HHH), a wife and the eldest son of a hypothetical local farm household. We observed an integrative negotiation style, resulting into high levels of satisfaction with the negotiation process and outcome by all parties, who reported a high level of similarity between simulated and real-life negotiations. Power was observed to be actively deployed, withheld or passively overruled depending on decision domains and process dynamics. While the HHH was the key decision maker acting as a strategic gatekeeper in a funnel-like process, the wife and the son had a significant influence on 'his decision' i.e. the household-level negotiation outcome. Model-based analysis also showed that the household-level outcome was more profitable as well as agro-biologically and nutritionally more diverse and productive as compared to the HHHs' suggestion. The proposed game proved to be a culturally adequate, simple, cost and time-effective tool to capture how household-level land use decisions may come about and whose interests they represent. Our study provides a powerful framework for further research and for policies to foster more equitable land use decisions and therewith more sustainable socio-ecological systems.

Keywords: Cooperative conflict, Customary law, Farm typology, FarmDESIGN, Funnel-model, Dagomba, Decision-making, Gender relations, Guinea Savannah, Intra-household, Negotiation, Patrilineal, Power relations, Research for development, Serious gaming, Smallholder, Social Network Analysis, Stick-score method, Sustainable resource management, Whole-farm model

Link:

<https://www.sciencedirect.com/science/article/abs/pii/S0264837719307951?via%3Dihub>

DOI: <https://doi.org/10.1016/j.landusepol.2019.104325>

Soil erosion control and moisture conservation using contour ridge tillage in Bougouni and Koutiala, Southern Mali {Journal article}

Citation

Traore, K. and Birhanu, B. (2019) Soil Erosion Control and Moisture Conservation Using Contour Ridge Tillage in Bougouni and Koutiala, Southern Mali. *Journal of Environmental Protection*, 10, 1333-1360.

Abstract

Soil erosion is among the critical environmental constraint for crop production in southern Mali. Contour ridge tillage (CRT), a water conservation technique had been locally applied since 1990. The objective of this study was to determine the effects of CRT compared with farmer conventional agriculture practice (NoCRT) on runoff, soil loss, nutrient loss, moisture conservation and cereals yields under rainfed conditions in two Southern Mali sites, in 2016 and 2017 in farmer fields. Measurements were performed on erosion plots composed of CRT and NoCRT plots from which water samples were collected to determine sedimentation levels, concentration and nutrients losses using pairwise comparison. Average runoff coefficient in NoCRT plots was 35.62% compared to 19.25% for the CRT plots explaining a runoff reduction of 46%. Mean soil losses of 12,095 t·ha⁻¹ and 4970 t·ha⁻¹ were respectively measured in NoCRT and CRT plots. Losses in calcium, magnesium and potassium nutrients in the NoCRT plots were 80%, 66%, 75% higher compared to CRT ones, respectively. Sorghum grain yield was at least two folds higher in CRT plots compared to the NoCRT plots. Maize average grain yield was 87% higher in CRT plots than in the NoCRT. For sustained soil productivity, CRT is advocated as a better soil and water management technique than the NoCRT one.

Keywords: Runoff and erosion, nutrient loss, yields

Link: www.scirp.org/journal/jep

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Year 2018

Analyse du fonctionnement des exploitations agricoles pour la gestion de la fertilité des sols {Thesis}

Citation

Sanogo, S. 2018. Analyse du fonctionnement des exploitations agricoles pour la gestion de la fertilité des sols: Mémoire de Fin de Cycle. MSc thèse pour l'obtention du Diplôme d'Ingénieur Agronome. Bamako, Mali: Institut Polytechnique Rural de Formation et de Recherche Appliquée, Mali.

Abstract

Au Mali-Sud, les exploitations agricoles issues de l'éclatement des grandes exploitations sont fragilisées sur le plan structurel, influençant ainsi sa composition en nombre de mains d'oeuvre, d'équipement agricole, de cheptel et ses modes de gestion de la fertilité des sols. Ce qui conduit certaines exploitations à une baisse de fertilité des sols et de faible rendement des cultures. Pour contribuer à l'amélioration de la gestion de la fertilité des sols, il était nécessaire de connaître les éléments caractéristiques du fonctionnement de ces exploitations agricoles et dans une large mesure, de comprendre les déterminants des modes de gestion de la fertilité de leurs sols. L'étude a consisté à mener une enquête diagnostic dans 45 exploitations de la zone de Koutiala, réparties entre les villages de N'Golonianasso, Sirakélé, et Zansoni. Les données ont été recueillies à l'aide des fiches de collectes de l'outil NUTMON, et ont porté sur les stratégies de gestion des contraintes des exploitations face au période de semis, d'entretien des cultures et sur les composantes structurelles de façon à comprendre le fonctionnement des exploitations dans la gestion de la fertilité des sols. Une analyse descriptive des données a permis de montrer, (i) quel que soit le type d'exploitation, le nombre d'actifs est de 30 %, inférieur au nombre total de la population de l'exploitation, (ii) la quantité de fumure organique produite dans les exploitations est non seulement dépendante du nombre de cheptels et plus particulièrement du nombre de bovins, mais aussi du nombre d'actifs que possède l'exploitation. Les entretiens ont montré, que lorsqu'il y'a coïncidence des travaux de semis et d'entretiens entre le coton, le maïs, le mil et le sorgho ; ceux concernant le mil et le sorgho sont retardés au profit du coton et du maïs.

Keywords: soil fertility; soil types; farms; soil

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Availability and utilization of feed resources in small ruminant production among smallholder farmers in northern Ghana {Thesis and Dissertation}

Citation

Konlan, S.P. 2018. Availability and utilization of feed resources in small ruminant production among smallholder farmers in northern Ghana. PhD thesis in Animal Science (Nutrition Option). Tamale, Ghana: University for Development Studies, Ghana.

Abstract

An evaluation of feed resource availability, utilization and options for improving efficiency of use was investigated in 2 Surveys and 3 Experiments. The first Survey was an assessment of existing feed resources in a crop-livestock production system for identification of critical seasonal shortages. Focus group discussions involving 150 crop – livestock farmers (108 men 42 women) and individual interviews with semi-structured questionnaires were used in collection of data. The results showed that existing feed resources were natural pasture, crop residues, and agro-industrial by-products. However, few farmers (18%) had stands of browse plants like *Leucaena leucocephala*, *Cajanus cajan* and *Gliricidia sepium*. Grazing of natural pasture provided 80% of annual DM requirement of ruminants and 20% supplemented by farmers with collected natural fodder, crop residues and purchased feed. Feed availability was highest between August and November; and a shortage gap occurred in the dry season which became critical between February and April. The second Survey involved an assessment of emerging feed markets in northern Ghana to determine the types and prices of feedstuffs sold. Data were collected from feed markets in Wa, Bolgatanga and Tamale in Upper West, Upper East and Northern regions respectively. A total of 170 respondents were interviewed for this study. Four categories of feedstuffs: crop residues, agro-industrial by-products (AIBPs), fresh grasses and leaves of local browse plants were found in all the three feed markets surveyed. Price of cowpea haulm was highest ($P < 0.05$) at GH¢ 1.00 /kg DM whereas rice bran was the lowest at GH¢ 0.12 /kg DM. Prices of feedstuffs differed ($P < 0.05$) among markets and were highest (GH¢ 0.58/kg DM) in Bolgatanga market and lowest (GH¢ 0.32/kg DM) in the Wa market. The CP content of feedstuffs had less influence on price variations. The effect of season on quantity and quality of forage in communal pasture was estimated in Experiment I to determine the extent of herbage variations in different seasons observed in Survey I. Data were collected in early dry (Nov-Jan) and late dry (Feb-Apr) seasons, and early wet (May-Jul) and main wet (Aug-Oct) seasons using a 1-m² wooden quadrat. This Experiment was conducted as a randomized complete block design. The 3 regions were blocked, 3 communities in each region were replicates and 4 seasons as treatments. It included 9 communal pasture fields' herbage yield estimation, 3 in each region of northern Ghana. Six quadrat samples were taken per field in each season for 4 seasons. Also, residue yields of commonly grown crops were estimated at crop harvest. Herbage yield differed ($P < 0.05$) among seasons. The values were 3.08, 1.71, 0.56 and 2.33 tonnes DM/ha for early dry, late dry, early wet and main wet seasons respectively. Season affected ($P < 0.05$) nutritive quality of pasture. Crude protein content of the commonly grazed forage species differed ($P < 0.05$) among seasons. The values obtained were 75, 45, 174 and 165 g/kg DM for early dry, late dry, early wet and main wet seasons respectively. Estimated crop residue generated as part of the feed resources showed that sorghum residue yield was 8.5 tonnes DM/ha and was highest ($P < 0.05$) whereas cowpea had the lowest value (1.8 tonnes DM/ha). In order to address the low quality and quantity of feedstuff in the pasture, on-farm feed supplementation was investigated in Experiment II. This was to determine the effect of concentrate supplementation plus healthcare and season on the intake and voiding

of DM and N and growth performance of sheep in the Northern, Upper East and Upper West regions of Ghana. The experiment was done as a randomized complete block design. Regions were blocked and communities in each region were replicates. A total of 36 smallholder sheep farms with an average of 18.6 ± 8.7 sheep per farmer were selected. The animals in each farm were randomly assigned to one of two feeding regimes as treatments. The treatments were none-concentrate supplementation (control) and application of a combined package of concentrate supplementary feed plus healthcare. Data were collected in each season. Animals on concentrate supplementation plus healthcare had higher ($P < 0.05$) intake of DM (608 g DM/d) than control group (515 g DM/d). Season significantly ($P < 0.05$) affected DM intake. The highest intake of DM was observed during early wet season (679 g DM/d) and lowest in main wet season (397 g DM/d). Faecal output was not affected ($P > 0.05$) by supplementation. Season however, affected ($P < 0.05$) faecal output. Nitrogen (N) intake was affected ($P < 0.05$) by concentrate supplementation. The highest N intake was observed during early wet season (14 g/d) and the lowest in the late dry season (7 g/d). Highest N voiding was found in early wet season (6 g/d) and lowest in late dry season (4 g/d). Average daily gain of 34 g/d was observed in animals on concentrate supplementation plus health care and was higher ($P < 0.05$) than 18 g/d in control group. The N content of faeces was higher in early dry and early wet seasons than in other seasons. Thus faeces could be collected as manure for improving poor soils. Due to the cost of concentrate feed, Experiment III was conducted to further investigate the growth performance of Djallonkè sheep on agro-residues supplementation that require minimal cost. The treatments were non-supplementation (T0), supplementation with sole groundnut haulm (T1), sole maize bran (T2) and combination of T1 and T2 in a ratio of 2:1. These 4 treatments were replicated 3 times in a completely randomized design. The supplementation affected ($P < 0.05$) average daily gain of the animals. The Average daily gains of the various treatments were 21, 32, 31 and 46 g/d for T0, T1, T2 and T3 respectively. Therefore, combined supplementation of crop residues and AIBPs improved the performance of sheep.

Keywords: animal production; farming systems; intensification; small ruminants

Link: <https://hdl.handle.net/10568/98497>

A watershed approach to managing rainfed agriculture in the semi-arid region of southern Mali: Integrated research on water and land use {Journal article}

Citation

Birhanu B.Z., Traore K., Gumma M.K., Badolo F., Tabo R. and Whitbread A.M. 2018. A Watershed Approach to Managing Rainfed Agriculture in the Semiarid Region of Southern Mali: Integrated Research on Water and Land Use. *Environment, Development and Sustainability*, 21, 2459-2485.

Abstract

Soil and water conservation (SWC) practices like that of erosion control and soil fertility measures were commonly practiced in the semiarid region of southern Mali since the 1980s. The SWC practices were mainly meant to increase water availability in the subsurface, reduce farm water runoff and gully formation and improve nutrient content of the soil, thereby increasing crop yield. Despite such efforts to promote at scale SWC practices, the landscape of southern Mali is still affected by high rates of runoff and soil erosion and low crop yield in farmers' fields. Data are lacking on previous beneficial SWC practices that could be adapted for wider application. In this paper, a watershed approach to managing rainfed agriculture is presented to show potential benefits of SWC practices at field and watershed scales. The approach included (1) community participation in establishing and monitoring new sets of hydro-meteorological monitoring stations and field experiments; (2) studying the dynamics and consumptive water uses of different land uses over time; and (3) evaluating the biophysical and economic advantages of SWC practices implemented in the watershed. Results showed that over a period of 34 years (1980–2014) cropping area and consumptive water uses of crops (sorghum and cotton) increased at the expenses of natural vegetation. However, the yield of these crops remained low, indicating that soil fertility management and soil moisture were insufficient. In such cases, implementation of more SWC practices can help provide the additional soil moisture required.

Keywords: Rainfed agriculture, Consumptive water use, Soil and water conservation, Contour bunding Watershed management, Southern Mali

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DOI: <https://doi.org/10.1007/s10668-018-0144-9>

Does nitrogen matter for legumes? Starter nitrogen effects on biological and economic benefits of cowpea (*Vigna unguiculata* L.) in Guinea and Sudan Savanna of West Africa {Journal article}

Citation

Abdul Rahman, N., Larbi, A., Kotu, B., Marthy Tetteh, F. and Hoeschle-Zeledon, I., 2018. Does nitrogen matter for legumes? Starter nitrogen effects on biological and economic benefits of cowpea (*Vigna unguiculata* L.) in Guinea and Sudan Savanna of West Africa. *Agronomy*, 8, 120.

Abstract

The hypothesis that application of starter nitrogen (N) fertilizer to cowpea may increase grain and fodder yields and profitability was tested in the Guinea and Sudan savanna zones of northern Ghana. Two cowpea varieties (Apagbaala: grain-type and Padi-Tuya: dual purpose) and three N fertilizer rates (0-30-30, 15-30-30 and 30-30-30 N-P₂O₅-K₂O kg/ha) were evaluated using a 2 × 3 factorial treatments arrangement in a randomized complete block design with three replicates. Grain and fodder yields, 100 seed weight (SW) and net return of Padi-Tuya increased significantly compared with Apagbaala in both zones. Application of starter N fertilizer increased grain yield, fodder yield, N use efficiency (NUE) and net return by more than 30% compared with the control in both zones. Padi-Tuya cowpea with 15 kg/ha N fertilizer was risk efficient at all risk aversion levels when only grain was considered, but Padi-Tuya with 30 kg/ha N fertilizer becomes the most risk efficient option when the value of fodder was included. The results suggest that small-scale farmers could apply starter N fertilizer at either 15 kg/ha N for grain only or 30 kg/ha N for both grain and fodder yields improvement of cowpea in West Africa and similar ecologies.

Keywords: inorganic fertilizer, profitability; risk; agronomic efficiency; savanna

Link: <https://www.mdpi.com/2073-4395/8/7/120>

DOI: <https://doi.org/10.3390/agronomy8070120>

Model results versus farmer realities: Operationalizing diversity within and among smallholder farm systems for a nuanced impact assessment of technology packages {Journal article}

Citation

Michalscheck M., Groot J.C.J., Kotu B., Hoeschle-Zeledon I., Kuivanen K. and Descheemaeker K., Tiftonell P. 2018. Model results versus farmer realities: Operationalizing diversity within and among smallholder farm systems for a nuanced impact assessment of technology packages.

Abstract

Agricultural production in Northern Ghana is dominated by smallholder farm systems, which are characterized by low inputs and low outputs, declining soil fertility, large yield gaps and limited adoption of agricultural technologies. There is an urgent need for alternative farm designs that are more productive, yet more sustainable. Technology packages for sustainable intensification are promoted by an R4D project in the Upper East, Upper West and Northern Regions of Ghana. In this paper, we analyse differences in perceived suitability, and modelled technical impact per technology package.

We used a locally validated framework to categorise farm systems diversity that considers both, the horizontal (between households) and vertical (within households) dimension of diversity. Farm households were classified along a gradient of resource endowment. We selected one representative farm per type and per region to assess and compare their socio-economic and environmental performance (farm profitability, labour and soil organic matter inputs) using the whole-farm model Farm DESIGN. We then used Farm DESIGN to assess the potential impact of five proposed technology packages and to explore promising alternative farm configurations. We discussed model assumptions and results with farmers, including alternative cropping patterns and trade-offs. We evaluated the packages with different household members using a weighted scoring technique, subsequently juxtaposing model results with farmer perceptions.

Large differences prevailed among and within farms per type and per region, with low resource endowed farms being projected to benefit most in relative and least in absolute terms from an adoption of the packages. Farmer feedback confirmed the accuracy of alternative farm configurations, as determined by the model. However, the feedback also revealed that the most profitable farm designs would be hard to attain in reality, particularly for members of low and medium resource endowed households, due to high initial investment costs. Within households, women were more positive about the packages than men, since men heavily penalized extra costs and labour, translating into a greater congruence of model results with the male evaluation. We discuss the importance of distinguishing between technical (technology i.e. purchased tools and inputs) and managerial (techniques e.g. row planting) package components. We conclude that operationalizing inter- and intra-household diversity is a fundamental step in identifying sensible solutions for the challenges smallholder farm systems face in Northern Ghana.

Keywords: Whole-farm model Farm DESIGN, technologies, Technology adoption, Ex-ante impact assessment, Northern Ghana

Link: <https://www.sciencedirect.com/science/article/pii/S0308521X17306303>

DOI: <https://doi.org/10.1016/j.agsy.2018.01.028>

Rural pig production systems and breeding preferences of pig farmers in northern Ghana {Journal article}

Citation

Ayizanga, R.A., Kayang, B.B., Adomako, K. and Asamoah, L. 2018. Rural pig production systems and breeding preferences of pig farmers in northern Ghana. Ghanaian Journal of Animal Science 9(1):49-57.

Abstract

A questionnaire was administered to 74 purposively selected respondents in order to describe the farming system under which pigs are kept in eight randomly selected communities from the IITA/ Africa RISING intervention communities in the three regions of northern Ghana and to document their peculiar farming systems and constraints with an aim of helping the farmers find sustainable solutions to these challenges. The study also sought to help farmers identify and prioritise breeding objectives using a participatory approach. Generally, two to three pigs were kept as part of a mixed subsistence farming system with little scientific knowledge on pig husbandry since a vast majority of them are not literate and have never received any training on pig husbandry. The constraints faced by most of the pig farmers included diseases, inadequate feed and poor housing facilities. Besides, the farmers have no set breeding objectives as mating is mostly uncontrolled and haphazardly done. It will be useful if the farmers are educated and encouraged to form interest groups to enable them elicit assistance from both governmental and non-governmental organisations to help address some of their production challenges, access better markets and to enhance their bargaining power.

Keywords: Ashanti Black pig, genetic differentiation, inbreeding, sustainable utilisation

Link: <https://cgspace.cgiar.org/handle/10568/92509>

DOI: <https://hdl.handle.net/10568/92509>

Year 2017

Adoption and impacts of sustainable intensification practices in Ghana {Journal article}

Citation

Kotu, H.B., Alene, A., Manyong, V., Hoeschle-Zeledon, I. and Larbi, A. 2017. Adoption and impacts of sustainable intensification practices in Ghana. *International Journal of Agricultural Sustainability*, vol 15(5):539-554.

Abstract

Sustainable agricultural intensification requires the use of multiple agricultural technologies in an integrated manner to enhance productivity while conserving the natural resource base. This study analyses the adoption and impacts of sustainable intensification practices (SIPs) using a dataset from Ghana. A multivariate probit (MVP) model was estimated to assess the adoption of multiple SIPs. Moreover, we used a multivalued semi-parametric treatment effect (MVTE) model to estimate the effects of adopting multiple SIPs on maize productivity. The MVP model results show, among others, that access to market, capital, and information/knowledge would enhance the adoption of SIPs. The MVTE model results show that a higher number of SIPs is associated with higher productivity which is more visible when commercial inputs are used in combination with cultural practices. These results have the following policy implications. First, they imply that good rural infrastructure and agricultural services such as rural road network, village-level input delivery system, input credit, and multiple information/knowledge sharing approach (instead of the conventional singular formal information/knowledge sharing approach) can enhance adoption. Second, the results suggest that promoting an integrated use of technologies, instead of a single technology, would have a positive impact on farm productivity and farm household income.

Keywords: Sustainable intensification practices, adoption, impacts, Ghana

Link: <https://www.tandfonline.com/doi/abs/10.1080/14735903.2017.1369619?journalCode=tags20>

DOI: <https://doi.org/10.1080/14735903.2017.1369619>

Dietary Diversity Is Not Associated with Haematological Status of Pregnant Women Resident in Rural Areas of Northern Ghana. {Journal article}

Citation

Saaka, M., Oladele, J., Larbi, A., and Hoeschle-Zeledon, I. (2017). Dietary Diversity is Not Associated with Haematological Status of Pregnant Women Resident in Rural Areas of Northern Ghana. *Journal of Nutrition and Metabolism*, vol. 2017, Article ID 8497892, 10 pages.

Abstract

Background.

Information regarding how dietary diversity is related to haematological status of the pregnant women in rural areas of Northern Ghana is limited. This study therefore evaluated maternal dietary intake and how it relates to the nutritional status of pregnant women belonging to different socioeconomic conditions in Northern Ghana.

Methods.

This study was cross-sectional in design involving 400 pregnant women. Mid-upper arm circumference (MUAC) and anaemia status were used to assess the nutritional status of pregnant women.

Results.

The mean dietary diversity score (DDS) of the study population from ten food groups was 4.2 ± 1.5 (95% CI: 4.08 to 4.37). Of the 400 women, 46.1% (95% CI: 40.0 to 52.2) met the new minimum dietary diversity for women (MDD-W). The mean haemoglobin concentration among the pregnant women studied was $10.1 \text{ g/dl} \pm 1.40$ (95% CI: 9.8 to 10.3). The independent predictors of haemoglobin concentration were maternal educational attainment, gestational age, frequency of antenatal care (ANC) attendance, number of under-five children in the household, size of MUAC, and maternal height.

Conclusions

Irrespective of the socioeconomic status, women minimum dietary diversity (MDD-W) was not associated with anaemia among pregnant women resident in the rural areas of Northern Ghana.

Keywords: Haemoglobin concentration; minimum dietary diversity for women (MDD-W); pregnancy; Rural Northern Ghana

Link: <https://pubmed.ncbi.nlm.nih.gov/28168052/>

DOI: [10.1155/2017/8497892](https://doi.org/10.1155/2017/8497892)

Effects of planting date, cultivar, and insecticide spray application for the management of insect pests of cowpea in northern Ghana. {Journal article}

Citation

Abudulai, M., Kusi F., Seini S. S., Seidu A., Nboyine J. A. and Larbi, A. 2017. Effects of planting date, cultivar and insecticide spray application for the management of insect pests of cowpea in northern Ghana. *Crop Protection* 100: 168-176.

Abstract

Insect pests are a major constraint to cowpea production in northern Ghana where it is widely cultivated. Field experiments were conducted to evaluate the effects of planting date, cultivar and insecticide applications for the management of major insect pests attacking cowpea. There were 4 planting dates, 6 cowpea cultivars of medium maturity periods and 2 insecticide spraying regimes. Data were collected on densities of the major insect pests, including the legume pod borer *Maruca vitrata* F., thrips *Megalurothrips sjostedti* Trybom, and the pod-sucking bug complex dominated by *Clavigralla tomentosicollis* Stal., and grain yield. Early planting of cowpea in mid- or late July resulted in the lowest pest densities compared with those planted at later dates. Two of the six cowpea varieties (IT99-573-2-1 and IT99-573-1-1) supported the lowest numbers of insects across planting dates and irrespective of insecticide spraying regime. However, insecticide sprays significantly lowered pest densities and improved yields in all varieties, and yields were the highest when treatments were combined with early planting in mid-July. The results suggest that for maximum yield, cowpea in the study area should be planted in mid-to-late July and sprayed with insecticide. Where available, these treatments can also be integrated with varieties such as IT99K-573-2-1 and IT99k-573-1-1 which appeared to be less susceptible to insects in the current study.

Keywords: Cowpea, *Vigna unguiculata*, Insect pests, Planting date, Insecticide sprays

Link: <https://www.sciencedirect.com/science/article/pii/S0261219417301916?via%3Dihub>

DOI: <http://dx.doi.org/10.1016/j.cropro.2017.07.005>

Estimation de l'érosion des sols sous culture en zone soudanienne du Mali: cas du village de Kani (cercle de Koutiala) {Thesis and Dissertation}

Citation

Samake, O. 2017. Estimation de l'érosion des sols sous culture en zone soudanienne du Mali: cas du village de Kani (cercle de Koutiala). Thèse pour l'obtention du diplôme de Master en Sciences Agronomiques. Bamako, Mali: Institut Polytechnique Rural de Formation et de Recherche Appliquée, Mali.

Abstract

Le village de Kani bénéficie d'un régime pluviométrique annuel important permettant une bonne hydraulicité dans un environnement sensible au ruissellement. Cette recherche est basée sur la gestion conservatoire des eaux et du sol qui implique des stratégies qui réduisent les pertes d'eau par ruissellement, érosion, évaporation, infiltration et percolation profonde et augmentent la productivité. L'objectif de cette étude est de Contribuer à l'amélioration de la production des cultures par une meilleure maîtrise du ruissellement et des pertes de nutriments du sol dans les champs cultivés. Une expérimentation a été réalisée pour estimer en champ paysan le ruissellement, l'érosion des sols et les pertes de nutriments qui vont avec. Dans chaque site, la parcelle expérimentale était divisée en deux parties: l'une aménagée (ACN) et l'autre non aménagée en courbe de niveau (NACN). Il en a été de même pour l'évaluation du rendement du cotonnier et du mil. Une sonde DTR a été utilisée pour mesurer l'humidité du sol à l'aide de 6 tubes implantés dans les parcelles expérimentales. Aussi des fosses pédologiques ont été creusées et décrites, des mesures d'infiltration et de densité apparente ont été réalisées. Dans tous les sites d'étude l'infiltration et l'humidité du sol étaient toujours supérieures dans les parcelles ACN que dans celles NACN. La description des fosses pédologiques nous a permis d'identifier deux sols: un sol ferrugineux tropical lessivé à tâches et un sol ferrugineux tropical lessivé à gley de profondeur. Le coefficient de ruissellement variait de 42,37 à 45,39% dans les parcelles NACN et de 23,16 à 26,29% dans les parcelles ACN. Les pertes de terre ont été estimées à 3556 Kg/ha¹ à 4242 Kg/ha¹ dans les parcelles NACN et de 1339 Kg/ha¹ à 1796 Kg/ha¹ dans les parcelles ACN, et le maximum de perte de nutriments était observé au mois de juillet et Août. Ainsi la technologie mise en place a permis de maîtriser le ruissellement et l'érosion et aider les paysans à augmenter le rendement de leurs cultures. Les rendements coton graine étaient de 2150 kg ha⁻¹ dans les parcelles ACN contre 1 035 Kg /ha¹ pour NACN, et celui du mil 1123 kg ha⁻¹ et 807 Kg/ha¹ respectivement en ACN et NACN.

Keywords: soil erosion; water management; natural resources management

Link: <https://hdl.handle.net/10568/101930>

Household food insecurity, coping strategies, and nutritional status of pregnant women in rural areas of northern Ghana {Journal article}

Citation

Saaka M, Oladele J, Larbi A, Hoeschle-Zeledon I (2017). Household food insecurity, coping strategies, and nutritional status of pregnant women in rural areas of Northern Ghana. *Food Sci Nutr*. 00:1–9.

Abstract

There is limited information on the magnitude and determinants of household food insecurity (HFI) and how it relates to the nutritional status of pregnant women in Northern Ghana. The magnitude, determinants of HFI, and how it relates to the nutritional status of pregnant women were evaluated in the Africa RISING West Africa project intervention communities in Northern Ghana. The prevalence of moderate and severe household hunger was 25.9% (95% CI: 19.0, 34.3) and 6.8% (95% CI: 4.2, 10.9) respectively. The independent predictors of maternal thinness were region of residence, gestational age and maternal age. Compared to women in the first trimester, women in the third trimester were 2.2 times more likely of being underweight adjusted odds ratio (AOR = 2.19, CI: 1.02, 4.70). Women who were under 20 years of age were 11.9 times more likely of being thin compared to women aged more than 35 years (AOR = 11.97, CI: 2.55, 5.67). Food insecurity was highly prevalent, but it was not associated with maternal thinness of pregnant women. The risk of maternal thinness increased as the gestational age increased, and this has a great potential of adversely influencing pregnancy outcomes and overall quality of life.

Keywords: Northern Ghana; food coping strategies; food insecurity; maternal nutrition.

DOI: <https://doi.org/10.1002/fsn3.506>

Relationship between agricultural biodiversity and dietary diversity of children aged 6-36 months in rural areas of Northern Ghana {Journal article}

Citation

Saaka, M., Mohammed S, O., and Hoeschle-Zeledon, I. 2017. Relationship between agricultural biodiversity and dietary diversity of children aged 6-36 months in rural areas of Northern Ghana, *Food & Nutrition Research*, 61:1, 1391668

Abstract

In this study, we investigated the relationship between agricultural biodiversity and dietary diversity of children and whether factors such as economic access may affect this relationship. This paper is based on data collected in a baseline cross-sectional survey in November 2013. The study population comprising 1200 mother-child pairs was selected using a two-stage cluster sampling. Dietary diversity was defined as the number of food groups consumed 24 h prior to the assessment. The number of crop and livestock species produced on a farm was used as the measure of production diversity. Hierarchical regression analysis was used to identify predictors and test for interactions. Whereas the average production diversity score was 4.7 ± 1.6 , only 42.4% of households consumed at least four food groups out of seven over the preceding 24-h recall period. Agricultural biodiversity (i.e.

variety of animals kept and food groups produced) associated positively with dietary diversity of children aged 6-36 months but the relationship was moderated by household socioeconomic status. The interaction term was also statistically significant [$\beta = -0.08$ (95% CI: -0.05, -0.01, $p = 0.001$)]. Spearman correlation (ρ) analysis showed that agricultural biodiversity was positively associated with individual dietary diversity of the child more among children of low socioeconomic status in rural households compared to children of high socioeconomic status ($r = 0.93$, $p < 0.001$ versus $r = 0.08$, $p = 0.007$). Socioeconomic status of the household also partially mediated the link between agricultural biodiversity and dietary diversity of a child's diet. The effect of increased agricultural biodiversity on dietary diversity was significantly higher in households of lower socioeconomic status. Therefore, improvement of agricultural biodiversity could be one of the best approaches for ensuring diverse diets especially for households of lower socioeconomic status in rural areas of Northern Ghana.

Keywords: Agrobiodiversity; Northern Ghana; causal mediation; interaction; preschool children; socioeconomic status.

DOI: 10.1080/16546628.2017.1391668

Risk Perception in Agriculture depending on Community Characteristics - a Study of Northern Ghanaian Communities

Citation

Mewes,A. 2017. Risk Perception in Agriculture depending on Community Characteristics - a Study of Northern Ghanaian Communities. MSc Thesis, University of Passau, Germany

Abstract

Reducing risk in agriculture is the aim of many interventions in West Africa. Target groups predominantly consist of smallholder farmers threatened by the present and future impacts of climate change. Smallholder farmers in northern Ghana live in culturally and socio-economically diverse communities with similar environmental challenges. This study identifies non-environmental community characteristics related to risk perception in agriculture on the inter- and intra-community level. We want to show how risk reduction interventions such as improved seeds and sustainable planting practices affect communities and individuals differently. We use Participatory Risk Mapping (PRM) as an analytical tool to measure and identify the local ranking, frequency, and coping strategies for perceived risks in four communities in north Ghana. For every community we gather data from four focus groups with five participants. The groups are divided by the participants' gender and economic endowment. The data allows us to compare groups of individuals between and within the four communities. We identify patterns in inter- and intra-community characteristics which are linked to risk perception. By focusing on the characteristics, we collect additional data to test and support our findings. The results indicate that communities exposed to similar environmental challenges are perceiving risks in agriculture differently. Furthermore, the perceptions of groups within communities vary widely. On the inter-community level the accessibility to lucrative markets for selling and networks outside of the community have a major impact. Culturally defined roles of men and women and coping strategies are the most influential characteristics on the intra-community level. Coping strategies depend on the prevalent sharing system for labour and goods but also on business opportunities apart from farming. The results underline the complexity of

communities in northern Ghana. Similar risk reduction interventions can have diverse impacts within and on communities. The identified non-environmental characteristics provide a systematic approach to understand the diversity of communities and its influence on risk perception in agriculture.

Keywords: Agriculture, risk perception, rural development

Link: https://www.tropentag.de/2017/abstracts/links/Mewes_4vBFi8Tv.pdf

Why do smallholder farmers in northern Ghana choose to plough by hoe, with bullocks or with tractors?

{Thesis}

Citation

De Moor, T. 2017. Why do smallholder farmers in northern-Ghana choose to plough by hoe, with bullocks or with tractors? MSc thesis, Farming Systems Ecology Group. Wageningen, The Netherlands: Wageningen University and Research Centre.

Abstract

Ghana is an agricultural country, with 60% of the domestic product coming from agriculture. But even so mechanization in agriculture is still underdeveloped. In the North of Ghana ploughing can be done in three different levels of mechanisation; the land can be ploughed by hoe, with bullocks or with a tractor. All three techniques are used next to each other. Farmers were interviewed in two communities in Ghana, Duko in the Northern Region and Nyangua in the Upper East Region. There is a great heterogeneity between these two communities. The communities have a different social organisation and different access to main cities. Which leads to different forms of ploughing between the two communities. Within the communities there is also a big heterogeneity. To analyse the heterogeneity within communities, the HH's were divided into three groups according to their resource endowment. This research thus analysed why farmers chose to plough with which techniques and how it is different for both locations and for different resource endowments.

Ploughing with tractor required less time (2.12 SD 0.9 hours/ha) than with bullocks (16 SD 9 hours/ha), while farmers indicated that ploughing by hoe took the most time (171 SD 101 man-hours per ha). Farmers cultivated on average 5.7 (SD 4.4) ha and 2.3 (SD 2.4) ha per HH, in respectively Duko and Nyangua. Therefore, it is for most farmers impossible to plough all their land by hoe, as they would not be able to plough all their land on time. In Duko they used mostly tractors for ploughing and in Nyangua mostly animal traction. Farmers were unsatisfied about hired ploughing services as costs were high, operations were delayed, and the quality was poor. This is for farmers one of the reasons to buy their own bullocks, as they would save this cost. The delayed ploughing causes lower yields; farmers estimated late ploughing losses on average at 1104 (SD 964) GH¢/ ha in Duko and at 1466 (SD 1242) GH¢/ha in Nyangua. These costs were tremendously high compared to other farming costs and it can be argued that these are the main reasons to choose for a technology. This delay existed because there were not enough tractors and bullocks. Farmers complained about the difficulty to get an operator to their field as well as at the quality of the work done by the operator. When looking at the agro---economical performances of each technique there was no consensus among the farmers on which technique yields most. Nor is there a consensus on which technique requires a higher fertilizer application, causes a higher amount of weeds later in the season, compacts the ground more or gives better soil

moisture. This is surprising but similar discordance concerning ploughing was also found in literature. It can be concluded that farmers chose for one of the techniques based on what they think is economically best for them, this taking their financial potential and the social implications into account.

Keywords: farming systems; ploughing

Link: <https://hdl.handle.net/10568/89064>

Year 2016

Magnitude and factors associated with appropriate complementary feeding among children 6–23 months in northern Ghana {Journal article}

Citation

Saaka, M., Larbi, A., Mutaru, S., and Hoeschle-Zeledon, I. 2016. Magnitude and Factors Associated with Appropriate Complementary Feeding among Children 6-23 Months in Northern Ghana. BMC Nutrition 2:2

Abstract

Background: Inappropriate complementary feeding is a major contributor to child malnutrition. Previous studies have described complementary feeding practice using single indicators, but a combination of indicators is needed to better explain the role of complementary feeding practices in child growth. To adequately quantify appropriate complementary feeding, we used a composite indicator comprising three of the World Health Organization (WHO) core infant and young child feeding (IYCF) indicators that relate closely to complementary feeding.

Methods: A community-based cross sectional cluster survey was carried out in November 2013. The study population comprised mothers/primary caregivers and their children selected using a two-stage cluster sampling procedure. A total of 778 children aged 6–23 months were involved.

Results: Of the children aged 6–23 months; 57.3 % met the minimum meal frequency, 35.3 % received minimum dietary diversity (≥ 4 food groups), 25.2 % had received minimum acceptable diet and only 14.3 % received appropriate complementary feeding. Multivariable logistic regression adjusted for cluster sampling showed that children aged 12–23 months were 26.6 times more likely [AOR 26.57; 95 % CI (3.66–193.12)] to receive appropriate complementary feeding compared to children aged 6–8 months. Children who were not bottle-fed were 2.5 times more likely to have been appropriately fed [AOR 2.51; 95 % CI (1.98–6.42)] compared to children who were bottle-fed in the last 24 h prior to study.

Conclusions: Findings from this study demonstrate appropriate complementary feeding and caring practices by caregivers remain a challenge for most households in Northern Ghana

Keywords: Appropriate complementary feeding; Dietary diversity; Meal frequency; Acceptable diet; Northern Ghana

DOI: <https://doi.org/10.1186/s40795-015-0037-3>

Phenotypic characterisation and genetic diversity of the local pig of Ghana {Thesis and Dissertation}

Citation

Ayizanga, R.A. 2016. Phenotypic Characterisation and Genetic Diversity of the Local Pig of Ghana. Doctor of Philosophy thesis in Animal Science. Kumasi, Ghana: Kwame Nkrumah University of Science and Technology.

Abstract

The present study involved three separate studies. At the outset and in collaboration with the USAID funded IITA lead Africa RISING project which was being implemented in the three regions of northern Ghana, a preliminary survey was conducted to identify pig farmers who were members of the Africa RISING's Research for Development Platform (R4D) and to solicit their support and active participation in the study. However, the main focus of this research work was based on phenotypic characterisation and genetic diversity study of the local pig of Ghana.

Study one

A preliminary survey was conducted using a structured questionnaire administered to 74 pig randomly sampled pig farmers to describe the farming systems under which pigs are kept in eight purposively selected communities in the three regions of northern Ghana, to identify their production constraints and to help the pig farmers identify and prioritise their breeding objectives. Generally, two to three pigs are kept as part of a mixed subsistence farming system with little scientific knowledge on pig husbandry since a vast majority of them are not literate and have never received any form of training on animal management. The constraints faced by most of the farmers contacted included diseases, inability to provide adequate feed for their pigs and poor housing facilities. Besides, the farmers had no set breeding objectives as mating is mostly unplanned, uncontrolled and haphazardly done. It will be useful if the farmers are educated and encouraged to form interest groups to enhance their access to veterinary services, be able to elicit assistance from both governmental and non-governmental organisations to help address some of their production challenges, access to better markets and to enhance their bargaining power.

Study two

Information provided by characterisation studies is essential for planning the sustainable utilisation of indigenous animal genetic resources at both the local and national levels. To this end, a number of measurements and descriptors were adapted from the FAO descriptor list for pigs to document the physical and production parameters of the local pigs at the National Pig Breeding Station at Babile in the Upper West region of Ghana. Generally, the local pig exhibited varying plain coat colour types but mostly all black, all fawn, all white and fawn with black spots and are covered with hair that is short, curly and dense. The local pigs at the Babile Station recorded an average litter size at birth of 13.2. Data from about 180 records at the Station indicated that the piglets weighed 1kg at birth, gained about 120g/day from birth to attain 6.0kg at weaning at 42 days of age. Weaned pigs gained 90g daily to weigh 18.7kg at six months and reached 39.1kg liveweight by one year. The body measurements (such as body length, heart girth, ear length, tail length and head length) for males and females did not show any significant ($p > 0.05$) differences. The number of teats of the local pig at the Babile Pig Station ranged from 10 – 14 with a mean of 12.50. Heart girth averaged 115cm for 60-day olds and 185cm for yearlings whilst body length averaged 105cm for 60-day-old pigs and 184cm for one-year olds. The local pig of Ghana exhibits

variable plain coat colour patterns that ranges from black or fawn or white and their combinations and reaches 40kg liveweight after 12 months of age.

Study three

A knowledge of the level of genetic diversity is very important in ensuring the sustainable utilisation of animal genetic resources. In this respect, the genetic diversity of some local pigs was assessed using 30 microsatellite markers on DNA extracted from whole blood samples collected from 113 unrelated pigs in four regions of Ghana and 16 DNA samples from the DNA repository of the Wildlife Research Centre (WRC) of Kyoto University, Japan. However, meaningful genotype data was generated for 103 samples on 12 microsatellite markers. The number of alleles (N_a), number of effective alleles (N_e), observed heterozygosity (H_o), expected heterozygosity (H_e) and inbreeding coefficient (FIS) were used to assess the level of genetic differentiation among the nine populations in this study. The mean number of alleles ranged from 3.9 (Papu) to 10.2 (Babile) with an overall average of 5.8 alleles. The number of effective alleles averaged 3.6 with a range of 2.8 (Papu) to 4.6 (Babile). At all the 12 loci studied, inbreeding coefficient (FIS) deviated significantly ($p < 0.05$) from zero with a mean of 22%. When the Nei's standard genetic distance based on the proportions of shared alleles was used to construct a neighbour-joining tree, pigs from Goriyiri and Guo emerged with the highest bootstrap value of 93%. Generally, the sampled pig populations represent distinct populations with moderate amount of genetic differentiation between them with inbreeding averaging 22% and this is quite alarming. This is the first report of the genetic diversity of Ghanaian local pigs using microsatellite markers.

Keywords:

Link:

<http://ir.knust.edu.gh/bitstream/123456789/10436/1/FINAL%20PhD%20THESIS%20-%20OCTOBER%202016.pdf>

Shallow wells, the untapped resource with a potential to improve agriculture and food security in southern Mali {Journal article}

Citation

Zemadim, B. and Tabo, R. 2016. Shallow wells, the untapped resource with a potential to improve agriculture and food security in southern Mali. *Agriculture and Food Security* 5:5.

Abstract

Background

Excessive rainwater during the rainy season and lack of water in the dry season have been challenging the agricultural productivity and food security for rural communities in southern Mali. Various soil and water conservation practices were implemented in the past to improve crop yields and income and reverse the effect of land degradation. However, none of these efforts looked into the potential use of shallow wells at a spatial scale to improve the agricultural productivity and hence the food security in the region.

Results

In total 484 shallow wells were geo-referenced, mapped and studied in two districts, Bougouni and Koutiala, in southern Mali to understand the dynamics of groundwater recharge and relationship with rainfall in different seasons. The study found out that shallow

wells were mainly utilized for household and livestock water consumption and not for agricultural water use. Well construction history followed the trend of the severe drought that hit the Sahel in the years of the 1970s and 1980s. Majority of wells (87 % in Bougouni and 84 % in Koutiala) were constructed after the drought period with significant variation of construction in the two districts (p value 0.032). Well depths ranged from 1 to 150 m, with the majority of wells (64 %) within the depth range of 6.5–14.5 m (p value 0.043). During the dry season water was available in the majority of wells (73 %) at a depth range from 5.5 to 15.5 m (p value 0.996). In the rainy season on average 84 % of wells in Bougouni and 94 % of wells in Koutiala experience water level rise within the range of 0.5–10.5 m (p value 0.423/Bougouni and 0.991/Koutiala). In few of the studied villages shallow wells were found to be fast recharging, thus enabling farmers to buffer the negative effects of drought conditions.

Conclusion

Shallow wells are important sources of water in rural Mali. The wells have adequate recharging capacity during the rainy season and insignificant water level variation during the dry season. Though accessing water from shallow wells was labour-intensive and mostly done by women and the youth, water is available within an average depth ranging from 5.5 to 15.5 m from most studied wells. The issue of water scarcity in different seasons was thus attributed to accessibility due to the lack of appropriate water lifting mechanisms. Groundwater was an untapped resource in Mali, and we suggest groundwater management needs to be given consideration along with other management practices in the changing climate condition to improve the agricultural productivity and food security.

Keywords: Agriculture and food security, Bougouni district, Geo-referencing and mapping, Groundwater, Koutiala district, Monitoring shallow wells, Southern Mali, Water level variation

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DOI: <https://doi.org/10.1186/s40066-016-0054-8>

Year 2015

Effect of soil and water conservation measures on cowpea and maize performance in the Northern and Upper East regions of Ghana {Thesis}

Citation

Eliasu, S. 2015. Effect of soil and water conservation measures on cowpea and maize performance in the Northern and Upper East regions of Ghana. MPhil thesis in Agricultural Engineering. Kumasi, Ghana: Kwame Nkrumah University of Science and Technology.

Abstract

Agricultural land in Ghana is being degraded, with soil erosion becoming an increasing threat to crop production. Soil and water conservation (SWC) practices are promising intervention especially if developed to suit a given climate, soil type as well as crops. This study was set out to evaluate the impact of four treatments [contour farming (CF), half-moon (HM), contour ridges (CR) and farmer's practice (FP)] on cowpea and maize growth and yield as well as on soil moisture content.

A survey was used to assess farmers' level of knowledge on soil erosion and erosion control practices as well as factors that cause soil erosion. The study was carried out in the Northern and Upper East Regions of Ghana on-station and on-farm using cowpea and maize as test crops. The on-station experiment consisted of four replicates each of cowpea and maize with the four treatments. The on-farm experiment was carried out in six communities across the Northern and Upper East Region of Ghana with each community as a replicate. Plant height, stem girth, root biomass, number of leaves, leaf area index (LAI) at flowering/tasseling and grain yield were determined.

The on-station experiment showed that SWC measures significantly ($P < 0.05$) retained more moisture compared to the farmers' practice. In the cowpea trial, there was about 23.4%, 19.2% and 17.8% significant ($P < 0.05$) retention in soil moisture in the CF, CR and HM treatments respectively over the FP whilst in the maize trial, CF, CR and HM recorded about 24.0%, 20.4% and 19.4% significant ($P < 0.05$) retention in soil moisture over the FP respectively. Only cowpea stem girth was significantly affected ($P < 0.05$) by SWC measures. Effect of SWC measures on cowpea in the Upper East was only significant ($P < 0.05$) for the LAI whilst significant effect ($P < 0.05$) of SWC measures on cowpea in the Northern Region was observed on stem girth, LAI, root biomass and yield. The SWC measures effect on maize at the on-station trial were significant ($P < 0.05$) on v maize height, stem girth, root biomass and yield.

The Upper East maize trial recorded significant effect ($P < 0.05$) of SWC measures on maize height, LAI and yield whilst the Northern Region maize trial recorded significant effect ($P < 0.05$) of SWC measures on yield only. Where there was no significant treatment effect ($P < 0.05$) on the growth and yield components of the cowpea and maize performed better with the SWC measures (CF, HM and CR) compared to the control (FP). The survey revealed that all the respondents in both regions were aware of what soil erosion is about. All respondents had knowledge of soil erosion whilst 85% of respondents across the two regions had knowledge or were aware of SWC measures as erosion control techniques. The respondents agreed that the causes of soil erosion included cultivation on steep slopes, poor SWC

practices, excessive rainfall, population pressure, over cultivation, deforestation and over grazing.

All respondents rated erosion as a severe problem and mentioned that the rate of soil erosion has been increasing over time. They were aware that erosion can be controlled. Farmers in the Northern and Upper East Regions of Ghana should adopt soil and water conservation (SWC) measures especially contour farming (CF) for maize and cowpea production.

Effets des aménagements en courbes de niveau sur le ruissellement et la croissance du sorgho dans le village de Kani, cercle de (Koutiala) {Thesis and Dissertation}

Citation

Maiga, S. 2015. Effets des aménagements en courbes de niveau sur le ruissellement et la croissance du sorgho dans le village de Kani, cercle de (Koutiala). Thèse pour l'obtention de la Licence en Sciences Agronomiques. Bamako, Mali: Institut Polytechnique Rural de Formation et de Recherche Appliquée, Mali.

Abstract

La zone de Kani est confrontée aux problèmes de grosses pertes des eaux de pluie par ruissellement qui entraînent par voie de conséquence une grande perte de la qualité des sols et donc des rendements des cultures. . En vue d'apporter des solutions à ces contraintes, il s'avère important de disposer de données quantitatives pour mieux circonscrire le problème en utilisant une technique de conservation des eaux et du sol. L'objectif de cette étude est de diminuer la perte des eaux de pluies par ruissellement dans les champs cultivés par l'utilisation de la technique d'Aménagement en courbes de niveau. Des dispositifs de mesure de ruissellement ont été mis en place dans des parcelles où la technique est mise en oeuvre et dans d'autres où elle ne l'est pas. Des sondes TDR ont été utilisées pour suivre la dynamique de l'eau dans ces parcelles ; l'effet de la technique sur la croissance en hauteur et le diamètre des plants de sorgho a également été étudié. Le ruissellement est toujours plus élevé dans les parcelles non aménagées que dans celles aménagées. Le coefficient de ruissellement est de l'ordre de 30% pour les parcelles aménagées et jusqu'à 50% dans celles non aménagées. L'humidité est aussi plus élevée dans les parcelles aménagées que dans celles non aménagées et la différence atteint 15% d'humidité volumique le long du profil. En début septembre, la hauteur du sorgho dans les parcelles aménagées était plus du double de celle dans les parcelles non aménagées. La même tendance est observée en ce qui concerne le diamètre des plants où le rapport est d'un demi. Cette situation plaide en faveur de la diffusion de la technique auprès des agriculteurs.

Keywords: soil erosion; natural resources management; water management

Link: <https://hdl.handle.net/10568/101929>

Factors contributing to positive nutritional deviance in the growth of children aged 6-36 months in rural northern Ghana {Journal article}

Citation

Saaka M., Larbi A. and Hoeschle-Zeledon I. 2015. Factors Contributing to Positive Nutritional Deviance in the Growth of Children Aged 6-36 Months in Rural Northern Ghana. J J FoodNutri. 2015, 2(2): 009.

Abstract

The main aim of the study was to find out why some children are nutritionally better-off than others although they belong to the same environmental setting. This cross-sectional study conducted in rural Northern Ghana, compared nutritional positive deviant children (that is, neither stunted nor wasted) with children having at least one form of under nutrition with respect to household feeding care practices and other health seeking behaviours. Of the 1,168 children aged 6-36 months, 67.9 % (CI: 64.5 – 71.1) were classified as positive deviant (PD). The prevalence of stunting and wasting was 23.1 (CI: 19.4 -27.3), 12.8 (CI: 10.9 - 14.8) respectively. Multivariable logistic regression adjusted for cluster sampling showed that positive deviant children (that is, neither wasted nor stunted) were 1.9 times more likely to be female children [AOR 1.88; 95% CI (1.32 - 2.67)]. Younger children (6-8 months) were 13.7 times more likely of being positive deviant children [AOR 13.66; 95% CI (5.51 - 33.90)], compared to children aged 24-36 months. Children who were not breastfeeding were more likely to be positive nutritional deviants as compared to their counterparts who were breastfeeding [AOR 2.80; 95% CI (1.62 - 4.82)].

There was little variation in the diets of positive deviants and the rest of the children (that is negative deviants and median growers), an indication that factors other than diet may be contributing to better growth of children in Northern Ghana.

Keywords: IYCF Practices; Nutritional Status; Positive Deviance; Complementary Feeding Northern Ghana

Link:

<https://cgspace.cgiar.org/bitstream/handle/10568/73020/U15ArtSaakaFactorsNothomNodev.pdf?sequence=3&isAllowed=y>