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Research Application Summary

Can banana-coffee intercropping improve nutrition security? Evidence from Uganda National Panel survey data

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Abstract

Ugandan farmers, like in other Sub-Saharan Africa (SSA) countries are disproportionately vulnerable to the impacts of climate change due to over reliance on rain fed agriculture (less than 1 percent practice irrigation). In the event of climate change, it negatively affects crop yields and threaten food security. Since 2010 when climate smart agriculture became practiced in Uganda, banana-coffee intercropping has become widely prioritized as one of the key climate smart practices to enhance the adaptive capacity of farmers, to mitigate food security risks associated with climate variability, and to meet sustainable development goals of access and quality foods. However, available literature on impacts of banana-coffee intercropping and nutrition security in Uganda remains scanty and is not nationally representative. We address this research gaps using two waves of the Uganda National Panel survey data. Poisson regression models were estimated. Preliminary results from both national and regional level regression show that banana-coffee intercropping is positively associated with nutrition security of farming households. We cautiously conclude that banana-coffee intercropping and associated intensification can contribute to nutrition security and therefore the broader national goals. Therefore, policy instruments that aim at increasing adoption of banana-coffee intercropping are likely to have positive effects on household nutritional levels.

Key words: Banana-coffee intercropping, climate change, dietary diversity, panel data, smallholder farmers, Uganda

Résumé

Les agriculteurs ougandais, comme dans beaucoup d'autres pays d'Afrique subsaharienne, sont disproportionnellement vulnérables aux impacts du changement climatique en raison d'une dépendance excessive à l'agriculture pluviale. Le changement climatique affecte négativement les rendements des cultures et menace la sécurité alimentaire. Depuis 2010, lorsque l'agriculture climato-intelligente est devenue une pratique en Ouganda, la culture intercalaire banane-café est devenue l'une des principales pratiques climato-intelligentes pour améliorer la capacité d'adaptation des agriculteurs, atténuer les risques de sécurité

alimentaire associés à la variabilité climatique et assurer les objectifs de développement durable d'accès et de qualité des aliments. Cependant, la littérature disponible sur les impacts de la culture intercalaire banane-café et de la sécurité nutritionnelle en Ouganda est très rare et n'est pas représentative au niveau national. Nous avons comblé ces lacunes de recherche en utilisant deux vagues de données d'enquête du Panel national de l'Ouganda. Des modèles de régression de Poisson ont été estimés. Les résultats préliminaires de la régression au niveau national et régional montrent que la culture intercalaire banane-café est positivement associée à la sécurité nutritionnelle des ménages agricoles. Nous concluons avec prudence que la culture intercalaire banane-café et l'intensification associée peuvent contribuer à la sécurité nutritionnelle et donc aux objectifs nationaux plus larges. Par conséquent, les instruments politiques qui visent à accroître l'adoption de la culture intercalaire banane-café sont susceptibles d'avoir des effets positifs sur les niveaux nutritionnels des ménages.

Mots clés: Culture intercalaire banane-café, changement climatique, diversité alimentaire, données de panel, petits exploitants agricoles, Ouganda

Introduction

Due to over reliance on rain-fed agriculture as a source of livelihood, climate change is expected to have peculiar impacts on the diets of poor populations in low and middle income countries across Sub-Saharan Africa (Black *et al.,* 2013; IFPRI, 2017). Projections by the International Food Policy Research Institute (IFPRI) show that medium-high climate change will result in an additional 4.8 million undernourished children by 2050, with 2.4 million living in Sub Saharan Africa (IFPRI, 2017). Ugandan farmers, like in other SSA countries are disproportionately vulnerable to the impacts of climate change due to over reliance on rain fed agriculture (less than 1 percent practice irrigation). In the event of climate change, this will negatively affect crop yields and threaten food security.

Efforts to increase coping and adaptive capacity of farmers to climate change have accelerated in recent years, resulting in adoption of risk mitigation strategies (Bryan *et al.,* 2017; Kristjanson *et al.,* 2017). More recent efforts by Food and Agriculture Organization (FAO) emphasize climate smart agricultural (CSA) practices that simultaneously increase agricultural productivity, food security, and farmers' adaptive capacity to climate extremes, while also lowering greenhouse gas emissions (Campbell *et al.,* 2014; Lipper *et al.,* 2016).

To meet multiple sustainable development goals of access and quality foods and at the same time achieve the multiple goals of CSA, Government of Uganda with support of local and international partners recently prioritized a number of CSA practices among which is banana-coffee intercropping, a proxy for agro-forestry, to build farmers adaptive capacity and enhance dietary diversity. However, it is not clear if banana-coffee intercropping practice will lead to improvements in nutritional status of target population, given the fact that the amount of food produced and available at a farm household does not absolutely translate into food quality, nutritional value or diversity of household diets.

Available literature (Van Asten *et al.,* 2011) used a district level analysis of farmers' perceptions on the benefits of coffee–banana intercropping on Uganda's food security. Findings revealed that banana-coffee intercropping provides smallholder with double-wins of income and food security amidst increased population pressure and diminishing farm size. Therefore, this study addresses the observed research gaps by using a nationally representative data set "Uganda National Panel survey data" to analyze the impact of banana-coffee intercropping on dietary diversity. Evaluating the impact of banana-intercropping on nutrition enables a better understanding of how banana-coffee intercropping practice is likely to deliver dietary diversity. It will also aid prioritization of accompanying policies required to improve smallholder nutritional status. Therefore, the objective of this study is to assess the impact of banana-coffee intercropping on household nutrition security.

Methods

We made use of the Uganda National Panel survey (UNPS) that was constructed using the 2005/06 Uganda National Household Survey (UNHS). The UNPS set out to track 3,123 households that had been visited by the Uganda National Household Survey (UNHS) in 2005/06. The study used the socio-economic, consumption expenditure and agricultural modules of most recent UNPS waves of 2013/14 and 2015/16 to analyze the impact of banana-intercropping on household nutrition. The consumption expenditure module assessed household diets through a 7-day food consumption recall covering more than 100 different food items. It elicited information about types of foods consumed, sources (own production, purchases, in-kind), among others. The agricultural modules captured crop production data: household land holdings; types of crops produced, use of intercopping, coffee-banana farming system. Given that UNPS data set incorporates data on consumption and agricultural production as well as other socio-demographic characteristics, the use of weights enabled us to produce representative results at both national and regional levels.

Theoretically, smallholder farmers production and consumption decisions are non-separable i.e., production decisions are affected by consumption decisions. Therefore, we analyzed the relationship between banana-coffee intercropping and dietary diversity within the theory of agricultural household models (Singh *et al.,* 1986; Sadoulet and De Janvry 1995).

Analytical approach. Given that dietary diversity (dependent variable) is a count variable that is not normally distributed, a common approach for such count data is to use poisson model (Greene, 2012). To this effect, a poisson regression model was used to analyze the relationship between dietary diversity and explanatory variables (banana-coffee intercropping and other household characteristics):

$$DD_{ij} = \beta_0 + \beta_1 BC_{ij} + \beta_4 H_{ij} + \varepsilon_{ij}$$

Where DD_{ij} is outcome variable (household dietary diversity) for household i at time j; BC_{ij} is a vector of dummy variables indicating the application of banana-coffee intercropping, H_{ij} is a vector of other socio-demographic household characteristics like farm size, household size, gender of household head, age; εi is random error term and β_0 and β_4 are coefficients to be estimated; ε_{ij} is the error term.

Measurement of dietary diversity. In terms of the outcome variables, we concentrated on household dietary diversity as a key indicator of nutrition. Different studies have measured nutrition outcomes in different ways, including anthropometric indicators, food based measures and household's subjective assessment of food access (Shiferaw *et al.,* 2014; Kabunga *et al.,* 2014; Chiputwa and Qaim, 2016). In this paper, we measured nutrition using household dietary diversity scores (HDDS), because food consumption data were collected at the household level. The study adopted dietary diversity scores count "number of different food groups consumed over a specified recall period" to assess food security and dietary quality as applied in previous studies (Jones *et al.,* 2014; Koppmair *et al.,* 2017). Using the 7-day recall data on food consumption, we computed HDDS with 12 food groups (pulses, legumes and nuts; milk and milk products; cereals; vegetables; fruits; meat and poultry; eggs; fish; oil and fats; sugar and honey; and spices, condiments, and beverages).

Measurement of banana-coffee intercropping. The National Agricultural Research Organisation **(**NARO) undertakes adaptive and strategic research to breed climate smart nutrient enhanced varieties/breeds, develop drought resistant varieties/breeds of coffee and banana. These have been distributed to farmers through the National Agricultural Advisory Services (NAADS) and Operation Wealth Creation (OWC). In addition, banana-coffee intercropping (to produce a greater yield on a given piece of land by making use of resources that would otherwise not be utilized by a single crop) have been promoted as key mechanisms to guard against crop related risks in events of weather calamities. To analyze the role of banana-coffee intercropping on dietary diversity, we constructed a dummy variable (taking a value of 1 if household applied banana-coffee intercropping during any of the two main cropping seasons and zero otherwise)

Results and discussion

In terms of application of banana-coffee intercropping, there has been a slight increase in the proportion of farming households that apply the practice from 16.5% in 2013/14 to 17.1% in 2015/16. This shows that banana-coffee intercropping is increasingly being adopted by smallholder farmers in Uganda, which could partly be attributed to increasing efforts by Operation Wealth Creation to distribute these planting materials.

For the nutrition security indicator (HDDS), there has been a decline in the number of food groups households consume per week from 8 food groups in 2013/14 to 7 in 2015/16. This shows that increase in farmers' adoption of banana-coffee intercropping has not been matched with increasing dietary quality of farmers. When banana-coffee intercropping was regressed on nutrition diversity, poisson results showed a positive relationship between banana-coffee intercropping and dietary diversity. This points to the important role of the system for farm household diets

Conclusion

The study aimed at estimating the link between banana-coffee farming system and nutrition diversity for Uganda using a nationally representative data set. Results from the poisson

regression model showed that banana-coffee intercropping is positively associated with dietary diversity in Uganda. Hence, on-farm crop diversification on a single plot of land by farming households may help to improve household diets to some extent. In addition, access to farm income from selling crops can be used for buying food to improve farmers' diets. Different models were used to compare effects of banana-coffee intercropping on DDS across the four regions of the country. Overall, the results were positive. This similarity suggests that household-level food consumption data from nationally representative data sets can be used for policy formulation to improve household nutrition.

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