Are Farm Households Willing-to-Pay for Organic Soil Amendments? The Case of Biochar and Compost in Northern Ghana

Charles Yaw Okyere[1]*, Benjamin Musah Abu[2], Akwasi Mensah-Bonsu[1], Irene Susana Egyir[1] and Daniel Bruce Sarpong[1]

[1]Department of Agricultural Economics and Agribusiness, College of Basic and Applied Sciences, University of Ghana, Legon-Accra, Ghana;
[2]Department of Agricultural and Food Economics, Faculty of Agriculture, Food and Consumer Sciences, University for Development Studies, Tamale, Ghana

*Presenting author: cyokyere@ug.edu.gh; okyerecharles@gmail.com

Introduction and Problem Statement

- Agriculture remains crucial to rural livelihoods in Africa, yet productivity in Sub-Saharan Africa remains low compared with other regions (Adjognon et al., 2017; Aguilar et al., 2015; Bjornlund et al., 2020; Shimeles et al., 2018).
- Agriculture in Sub-Saharan Africa is highly vulnerable to land degradation, soil erosion and biodiversity loss (Bolo et al., 2025; Mahmoud et al., 2021; Kihara et al., 2020).
- Concerns about inorganic chemicals and the climate crisis have renewed interest in improving soil health through organic products (Kihara et al., 2020; Atakora et al., 2014; Vanlauwe, 2015; Sudradjat et al., 2018).
- Organic soil amendments, particularly biochar and compost, have been recommended for climate change adaptation and mitigation (Adjognon et al., 2017; Aguilar et al., 2015; Bjornlund et al., 2020; Shimeles et al., 2018). Biochar improves soil moisture retention, while compost supplies nutrients.
- However, adoption remains low in developing countries, and markets for these products are still emerging in many low-income settings (Thomas et al., 2021). This raises questions about farmers' demand and willingness to pay for organic soil amendments.

Objective and Research Methodology

- **Objective:** Assess farm households' willingness to pay for biochar and compost and the factors influencing maximum bids in Northern Ghana.
- **Data:** Household survey conducted in March–April 2022 under the 2021 DAAD climapAfrica Postdoc Fellowship.
- **Sample:** 472 farm households, 165 training participants, and 307 non-participants.
- **Data collection:** Computer-assisted personal interviews using CSPro questionnaires.
- **Valuation method:** Contingent valuation using a single-bounded dichotomous bidding game.
- **Bids:** GHS 20 (US$ 2.81), 50 (US$ 7.03), 70 (US$ 9.84), and 100 (US$ 14.06) per 50 kg bag of biochar or compost, plus respondents' maximum willingness to pay.
- **Estimation:** Ordinary least squares (OLS) with standard errors clustered at the community level. $WTP_i = \alpha_0 + \alpha_1 X_i + \alpha_2 H_i + \alpha_3 C_i + \mu_i$
- **Models:** Maximum willingness to pay for compost, biochar, and both products, using socio-economic, household, and community-level factors.

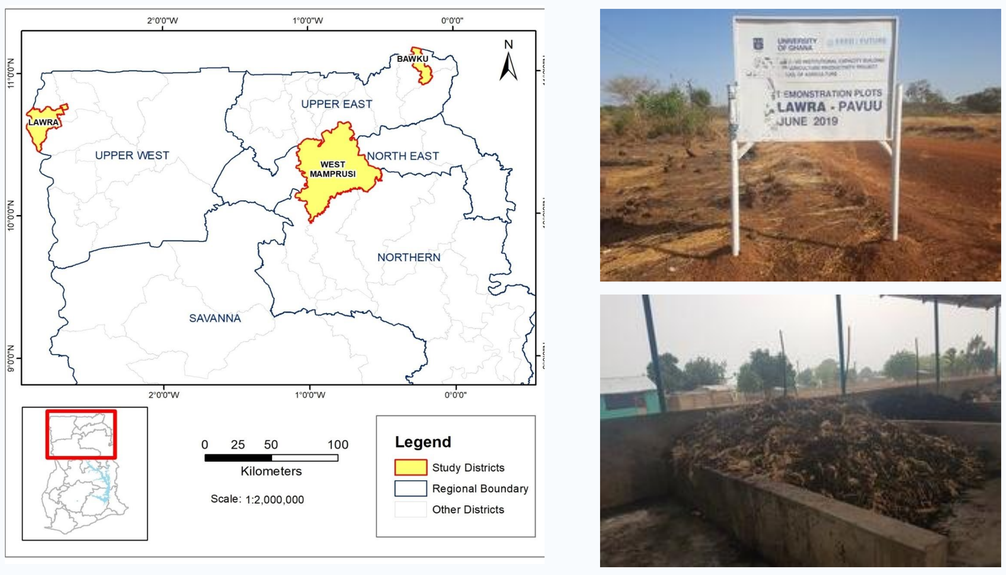

Fig. 1: Project sites in Northern Ghana

Fig. 2: Biochar and compost preparation activities

Results and Discussion

- Most households accepted the minimum bid: 90.9% for compost and 87.3% for biochar.
- Willingness to pay declined as bid amounts increased.
- The average maximum bid was GHS 45.74 (US$6.43) for compost, GHS 43.08 (US$6.057) for biochar, and GHS 88.82 (USD 12.49) for both, all below market prices.
- Training significantly increased farmers' willingness to pay.
- Savings and credit challenges reduced willingness to pay.

Table 1: Contingent Valuation of Organic Soil Amendments

Bid	Compost	Biochar
GHS 20 (US$ 2.81)	0.909 (0.288)	0.873 (0.333)
GHS 50 (US$ 7.03)	0.681 (0.467)	0.617 (0.487)
GHS 70 (US$ 9.84)	0.449 (0.498)	0.413 (0.493)
GHS 100 (US$ 14.06)	0.489 (0.502)	0.467 (0.501)
Average maximum bid	**Mean (s.d.)**	**Mean (s.d.)**
Average maximum bid, GHS	45.735 (25.294)	43.083 (25.109)
Average maximum bid, US$	6.430 (3.556)	6.057 (3.530)

Notes: s.d. reported in parentheses. Exchange rate: GHS 7.1124 = US$1.00, based on the Bank of Ghana mid-rate on 19 April 2022.

The results suggest that demand for organic soil amendments in Northern Ghana is influenced by:

- training or capacity building
- distance to the extension office
- risk attitude of household heads
- access to digital technologies
- education of household heads
- receipt of social protection programs

Table 2: Determinants of Farm Households' Willingness to Pay for Organic Soil Amendments

Variable	Compost	Biochar	Both
Participation in biochar and compost training	0.272***	0.309***	0.282***
	(0.084)	(0.109)	(0.095)
Natural log of distance to extension office (km)	0.140**	0.261***	0.171***
	(0.054)	(0.080)	(0.058)
Head's risk attitude (number)	0.074***	0.054***	0.068***
	(0.011)	(0.018)	(0.012)
Mobile phone ownership (dummy)	0.362**	0.227	0.368*
	(0.167)	(0.161)	(0.197)
Head completed at least basic school (dummy)	0.156**	0.097+	0.155**
	(0.066)	(0.066)	(0.064)
Household received/participated in social protection programs	-0.220***	-0.272***	-0.246***
	(0.061)	(0.078)	(0.068)
Additional controls	Yes	Yes	Yes

Notes: Clustered standard errors in parentheses. p<0.15, * p<0.10, ** p<0.05, *** p<0.01. All regressions include household, socio-economic, community, and location controls.

Conclusions and Policy Recommendations

- Organic soil amendments such as biochar and compost can support soil health and climate resilience.
- Farm households in Northern Ghana are willing to pay, but generally below prevailing market prices.
- The average willingness to pay was USD 6.43 for compost and USD 6.06 for biochar per 50 kg bag.
- Wider adoption may require partial cost recovery, farmer training, and support for local production systems.

Acknowledgements

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DAAD Deutscher Akademischer Austauschdienst German Academic Exchange Service