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DETERMINANTS OF ADOPTION OF LIVESTOCK INTEGRATION AMONG ORGANIC PINEAPPLE GROWERS IN CENTRAL UGANDA

DÉTERMINANTS DE L'ADOPTION DE L'INTÉGRATION DE L'ÉLEVAGE CHEZ LES PRODUCTEURS D'ANANAS BIOLOGIQUE EN OUGANDA CENTRAL

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ABSTRACT

The organic sector is one of the fastest-growing sectors, providing significant market opportunities for pineapple farmers and agribusinesses in the global market. The sector offers opportunities to Ugandan farmers, particularly in the area of export of certified organic pineapples (*Ananas comosus* (L.) Merr). Despite ongoing efforts to promote livestock integration in pineapple farms to leverage the benefits of manure as fertiliser and pineapple residues as animal feed, the socioeconomic factors influencing farmers' adoption of this practice remain poorly understood. The objective of this study was to identify the primary socioeconomic factors influencing the adoption of livestock integration in organic pineapple farming in Uganda. Data were collected from 250 pineapple farmers (165 organic and 85 non-organic) in two purposively selected districts (Luwero and Kayunga), using a semi-structured questionnaire. The decision to adopt was analysed using a probit logistic regression model. The levels of livestock integration were classified in three categories: namely, no integration (NI, n= 87, 34.8 %), partial integration (PI, n=133, 53.2 %), and total integration (TI, n=30, 12 %). These categories differed significantly by gender, family size, farming experience, herd size, total land area, and land allocated to pineapple growing. Furthermore, PI and TI were categorised as integration adopters; and NI as non-adopters. Livestock integration was influenced by farmers' experience, organic pineapple acreage, and herd size. These findings highlight the significance of farmers' experiences, resource

endowments, and social capital in influencing the adoption of livestock integration in organic pineapple farming. Policymakers and development agencies ought to consider these priority factors when designing strategies to promote livestock integration in organic pineapple farming in Uganda.

Key Words: *Ananas comosus***,** animal feed, manure

RÉSUMÉ

Le secteur biologique est l'un des secteurs connaissant la croissance la plus rapide, offrant des opportunités de marché importantes pour les producteurs d'ananas et les entreprises agroalimentaires sur le marché mondial. Ce secteur présente des opportunités pour les agriculteurs ougandais, en particulier dans le domaine de l'exportation d'ananas certifiés biologiques (*Ananas comosus* (L.) Merr). Malgré les efforts continus pour promouvoir l'intégration de l'élevage dans les plantations d'ananas afin de tirer parti des avantages du fumier comme engrais et des résidus d'ananas comme aliments pour animaux, les facteurs socio-économiques qui influencent l'adoption de cette pratique par les agriculteurs restent mal compris. L'objectif de cette étude était d'identifier les principaux facteurs socio-économiques influençant l'adoption de l'intégration de l'élevage dans la culture de l'ananas biologique en Ouganda. Les données ont été collectées auprès de 250 producteurs d'ananas (165 biologiques et 85 non biologiques) dans deux districts sélectionnés à dessein (Luwero et Kayunga), à l'aide d'un questionnaire semi-structuré. La décision d'adopter cette pratique a été analysée à l'aide d'un modèle de régression logistique probit. Les niveaux d'intégration de l'élevage ont été classés en trois catégories : à savoir, aucune intégration (NI, n = 87, 34,8 %), intégration partielle (PI, n = 133, 53,2 %) et intégration totale (TI, n = 30, 12 %). Ces catégories différaient de manière significative selon le genre, la taille de la famille, l'expérience agricole, la taille du cheptel, la superficie totale des terres et la superficie allouée à la culture de l'ananas. De plus, les catégories PI et TI ont été qualifiées d'adoptants de l'intégration, et la catégorie NI de non-adoptants. L'intégration de l'élevage était influencée par l'expérience des agriculteurs, la superficie consacrée à l'ananas biologique et la taille du cheptel. Ces résultats mettent en évidence l'importance de l'expérience des agriculteurs, de leur dotation en ressources et de leur capital social dans l'adoption de l'intégration de l'élevage dans la culture de l'ananas biologique. Les décideurs politiques et les agences de développement devraient prendre en compte ces facteurs prioritaires lors de la conception de stratégies visant à promouvoir l'intégration de l'élevage dans la culture de l'ananas biologique en Ouganda.

Mots Clés: *Ananas comosus*, aliments pour animaux, fumier

INTRODUCTION

The growing demand for organically produced pineapples has created significant market opportunities for farmers and agribusinesses globally. This demand is primarily attributed to increasing consumer awareness of food safety and environmental issues; positioning organic foods as safer and more sustainable choices (Barwant *et al*., 2025; Kumar *et al*., 2025; Uma and Kumar, 2025). Uganda has benefited from these opportunities by exporting certified organic pineapples (*Ananas comosus* (L) Merr.) to international market destinations (Kwikiriza *et al*., 2016). The export value of organic products, including pineapples in Kayunga, Luweero, Mukono, and Masaka districts, reached US$159 million in 2021 (NOGAMU *et al*., 2022).

Organic pineapple farming in Uganda requires farmers to transition beyond "organic by default" to the adoption of organic production in compliance with established organic principles and standards. Despite its potential to improve livelihoods and enhance ecosystem health, only 1.8% of Uganda's

agricultural land is under certified organic production, and of this, total organic fruit production (including pineapple) accounts for only 0.2%. Moreover, according to Bendjebbar and Fouilleux (2022), there is a decline in certified land and a slow growth in the number of organic producers. Furthermore, integration of livestock is reportedly difficult for pineapple farmers due to labour intensity, unfavourable land tenure, and feed shortage (Kiggundu *et al*., 2014; Nalubwama *et al*., 2019).

The growing restrictions on the use of mineral fertilisers, and hence the paralleled promotion of organic farming; have increased the quest for alternative safe soil fertility management practices. Integration of livestock within organic pineapple production offers synergies where animal manure is utilised as organic fertiliser to improve soil fertility and pineapple residues as animal feed, and ecological benefits such as nutrient cycling (Mkuhlani *et al*., 2020; de Souza Filho *et al*., 2021: Kiatti *et al*., 2023). Although most organic pineapple farms in Uganda are diversified, there are minimal or no deliberate efforts to integrate livestock into the organic pineapple production system (Kiggundu *et al*., 2014; Nalubwama *et al*., 2016).

Decisions to adopt certified organic production are influenced by multiple factors, including price premiums, social networks and environmental benefits; such as improved soil health and biodiversity (Badu-Gyan, 2015). Access to information, farmers' social networks, proximity to where certified organic production is promoted, farmers' socio-economic characteristics, and attitudes also influence adoption of organic farming practices (Kleemann, 2013; Läpple, 2013; Sodjinou *et al*., 2015). According to Xia *et al*. (2023), perceived behavioural control, subjective norms, and descriptive norms positively drive the intention to adopt organic farming practices; while farm size impacts behaviour. Understanding these factors could enable policymakers to develop effective interventions to promote the desired organic farming practices and support existing practitioners. The objective of this study was to identify the priority socioeconomic factors influencing the adoption of livestock integration into organic pineapple production systems in central Uganda.

MATERIALS AND METHODS

The study area. The study was conducted in Luwero and Kayunga districts in central Uganda, which are among the main organic pineapple production areas (UIA, 2020). Luwero district lies 68 Km North of Kampala: at 1000 - 1500 m altitude, with well-distributed annual rainfall of 1300 mm and a mean annual temperature ranging from 15 - 30 °C. It features a generally undulating to flat topography, and is predominantly characterised by red sandy loam soils, which are typically acidic and vary in fertility, with the southern areas being more fertile than the northern parts.

Kayunga district is 74 Km East of Kampala and lies at an altitude of 1000 - 1200 m above sea level. Kayunga experiences bimodal rainfall (March - May and September - December), with a mean annual temperature of 24.7 °C. It features a flat topography and a variety of soils that often exhibit acidity and low to medium fertility, particularly in phosphorus and nitrogen.

Study design and sampling. This study employed a cross-sectional study design, along with a purposive and a random sampling approach, to select respondents. First, sub-counties in each district were purposively selected based on the concentration of pineapple growing in the area. Secondly, a pre-survey with the district agricultural office and farmer-based organisations allowed us to identify the pineapple farmers. From the provided lists, farmers were randomly selected to participate in the study.

The sample size was calculated to achieve 95% statistical power and 5% precision, using

Equation 1 for determining the sample size of proportions, with corrections applied for finite population sample size (Israel, 1996).

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}} \quad \text{..... Equation 1}$$

Where:

n is the corrected sample size; n_0 is the computed sample size; and N is the population size.

The study targeted 385 pineapple farmers across both districts, yielding a sample of 317 respondents. However, a total of 250 farmers (78%) were reached for the face-to-face interviews. One hundred and fifty respondents (60%) were randomly selected from Luwero district, and 100 respondents (40%) from Kayunga district. This yielded 165 for organic and 85 for non-organic pineapple farming.

Data collection. Data were collected using a semi-structured questionnaire, owing to the respondents being semi-literate. The questionnaire was pretested, and the necessary revisions were subsequently made. Trained enumerators, after obtaining verbal informed consent from each participant, conducted interviews in the proper conceptualisation of questions and capture of correct responses during data collection. The enumerators asked the questions in the '*Luganda*' local language, while the responses were recorded directly in English in the questionnaire. The questionnaire included questions on, among other things, the socio-economic and demographic characteristics of farmers, herd structure, farm practices, and farming experiences, in association with organic pineapple production.

Data analysis

Specification of the model used in the study. The categorisation of farmers into "adopters" and "non-adopters" was based on the dichotomous outcome of the adoption decision, which characterises the dependent variable (Y). Thus, a firm was defined as an "adopter", where $y = 1$ or as a "non-adopter" where y = 0. An adopter is an individual who accepts, integrates, and begins using the practice or technology, in this case, related to integrated organic pineapple farming.

This study hypothesised that, because of farmers' knowledge, perceptions and socioeconomic factors, some farmers choose not to integrate livestock into organic pineapple production, while others continue with the integration despite these factors. The choice by the farmers to integrate livestock is discrete (dichotomous). The Logit and Probit models can therefore be used to model dichotomous variables (Payne *et al*., 2003; Guerre and Moon, 2006).

The binary outcome $y = 1$ is a function of independent variables that models the probability (Equation 2).

$$p = \text{pr}[y = 1|x] = F(x'\beta) \quad \text{..... Equation 2}$$

This study applied the probit regression model (Equation 3) over the others because of its good properties, especially the assumption of the normal distribution (Wooldridge *et al.*, 2016).

$$F(x'\beta) = \phi(x'\beta = \int_{-\alpha}^{x'\beta} \phi(z)dz$$

..... Equation 3

Where:

$F(x'\beta)$ = is the cumulative function distribution of the standard normal distribution whose predicted probabilities are limited between 0 and 1.

The probit model was estimated using the maximum likelihood method. Instead of reporting the coefficients, which only tell about the direction of the independent variables x_i on the dependent variable *y,* but not the magnitude; this study reported marginal effects, which measure both the magnitude and direction.

Marginal effects reflect the change in the probability of y = 1 given a unit change in the independent variables.

Thus: $\frac{\delta p}{\delta_{xi}} = \phi(x'\beta)\beta_j$ ..... Equation 4

Since is always positive (Amemiya, 1981) the marginal effects take the same sign as the coefficients.

The reduced form model was estimated as:

$y = \alpha + \beta_{i's} + X_{i's} + \epsilon$ ..... Equation 5

Where:

y = dependent variable; α = Constant; X_{is}= Independent variables; β_{is} = Vector of explanatory variables; and ε = Error term.

From the reduced form model, an empirical model was estimated as:

$C_1 = \alpha + \beta_1 gender + \beta_2 age + \beta_3 edcl + \beta_4 pineapple_exp + \beta_5 farmsize + \beta_6 Egarden\ loca + \beta_7 infosoces + \beta_8 dist\text{-}markt + \beta_9 pineappleland + \beta_{10} pipedwater + \beta_{11} cattle + \beta_{12} poultry + \beta_{13} small\ livest + \beta_{14} pigs + \beta_{15} livestock_exp + \beta_{16} knowl + \beta_{17} percep + \varepsilon$

Where:

ε = the intercept term; and β_1 - β_{17} are the parameters to be estimated.

The dependent variable; livestock integration adoption, C_1; is a dichotomous variable, where: C_1 1= farmers integrate livestock and 0 = farmers don't integrate livestock. The variables are summarised and defined in Table 1.

RESULTS

The significant socioeconomic factors that affected the integration of livestock in organic pineapple farming are presented below.

Education level. Most of the respondents had formal education, with a significant ($P<0.05$) variation between organic and non-organic farmers (Table 2). Level of education had no significance ($P>0.05$) across integration levels (Table 3) and did not influence farmers' decision to integrate livestock in organic pineapple farming (Table 4).

Farmer experience. Organic farmers had more experience in pineapple farming than their counterparts who practiced conventional farming (Table 2). Farming experience significantly varied ($P<0.05$) across livestock integration levels, with farmers practicing partial integration (PI) being more experienced than their counterparts who practiced total integration (TI) (Table 3). Results further showed that livestock integration was significantly and positively influenced by farmers' experience in pineapple farming. Marginal effects showed that each additional year of pineapple farming experience increased the likelihood of livestock integration by 0.8%. Whereas livestock farming experience insignificantly decreased the likelihood of livestock integration by 1% (Table 4).

Family size. The farmers had an average family size of five members (Table 2). There was a significant difference ($P<0.05$) in family size across levels of livestock integration (Table 3), with farmers who practiced total integration (TI) having more family members than their counterparts who practiced partial integration (PI).

Farm size and pineapple acreage. Farms had an average of two hectares of land, with no significant difference between organic and non-organic pineapple farms (Table 2). The farm size and pineapple acreage varied across livestock integration levels (Table 3). Farmers who practiced partial integration (PI) had significantly ($P<0.05$) larger farm size and pineapple acreage than those who practiced total integration (TI). The latter also

TABLE 1. Independent variables in the empirical model for the factors that influence livestock integration in organic pineapple production

Variables	Variable definition	Mean (SD)/ responses %		
Dependent variable		No integ	Integration	Expected sign
lev_intgratn	Crop-livestock integration	N=87	N=163	
Independent variables				
Gender	Gender of household head; male =1, female=0	34.8	65.2	+/-
Age	Age of household head	41.4 (11.69)	45.2(12.2)	+/-
a7_educl2	Education level	+		
farm_exper	Farming experience: years	14(8.69)	19(10.87)	+
farmsize_owned	Total Farm size: hectares	1.99 (5.50)	2.82(7.39)	+
gden_location	Location of the pineapple+/-			
	on the farm premises	43	57	+/-
	Away from the farm	29.3	70.7	
	Both	25.9	74.1	
Infomn_soces	Number of sources of information	4.08(2.30)	4.94(2.6)	+/-
distance_market	distance to the nearest market in walking minutes	4.69(8.17)	4.19 (5.40)	+
Pipedwater	Access to piped water			
Total_cattle	Number of Cattle in household	0.64 (1.72)	5.27(9.75)	+
Total_poultry	Number of Poultry in household	5.29(19.50)	25.31(75.99)	+
Smal_livestk_no	Number of Goats and sheep	1.14(4.32)	5.09(14.68)	+
Pigs	Number of Pigs in household	0.17(0.38)	0.33(0.47)	+
livestock_exp	Experience in livestock farming (years) (discrete)	12.43(8.17)	13.64(9.29)	+
Knowl	Index of knowledge of organic farming -			+
Perce	Index of perception towards organic farming- (in percentage)			+

+ positive influence of independent variable on dependent; +/- positive or negative influence

TABLE 2. Socio-demographic characteristics of respondents in the study of integration of livestock in pineapple farming system

Parameter	Type of farmer		P-value
	Non-organic (n=85)	Organic (n=165)	
% of female-headed households	4.7	7.9	0.891
Age of the household heads	43.85 (12.47)	43.83 (11.95)	0.992
Years spent in school	11.24 (6.57)	10.51 (5.67)	0.365
% of farmers with no formal education	42.9	57.1	0.010*
Primary	26.3	73.7	
O-level	31.5	68.5	
A-level	61.3	38.7	
Tertiary	30	70	
Years of experience in farming	15.44 (9.02)	18.32(10.98)	0.038*
% of married household heads	89.4	81.8	0.117
Family size	5.49 (2.29)	5.36 (2.81)	0.196
% of household heads with income sources other than farming	42.3	10.9	0.000**
Total farm size (hectares)	2.8 (8.05)	2.37 (6.14)	0.218
% of household heads that belong to farmer groups	71.8	65.5	0.313
% of household heads that belong to a savings group	70.6	72.7	0.205
% that own livestock on farm	75.3	77.0	0.768
Distance to nearest output market	5.36 (8.18)	6.79 (40.19)	0.758

Parenthesis ( ) are standard deviations of farmers' age, experience, duration in school in years, farm size, and distance to markets; * $p<0.05$, ** $p<0.01$

significantly ($P<0.05$) influenced farmers' decision to integrate livestock in pineapple farming (Table 4). Marginal effects showed that an increase in pineapple acreage by one hectare increased the likelihood of livestock integration by 4.1%.

Herd size. Most farmers owned livestock on their farms (Table 2). The number of livestock species varied across levels of livestock integration (Table 3). Farmers who practiced partial integration (PI) owned significantly ($P<0.05$) more cattle and pigs than their counterparts. Further analysis showed that the number of cattle and small ruminants significantly ($P<0.05$) influenced farmers' decision to integrate livestock in pineapple farming (Table 4). One additional head of cattle and small ruminants increased the probability of adopting livestock integration practices by 11% and 3.4%, respectively.

DISCUSSION

The main socio-economic factors that had a significant effect on the adoption of livestock integration in organic pineapple farming included farmer age, education level, experience, and family size (Table 4).

Farmer age. The mean age of organic pineapple farmers was 43 years (Table 2). According to Kiggundu *et al*. (2014) and Odhong *et al*. (2014), farmers in East Africa aged 40-50 years are a productive, experienced demographic most likely to adopt technologies

TABLE 3. Variation in integration levels according to farmers' socio-economic characteristics

Variables		Respo nses (%)/Means			
Dependent variable		NI (n=87)	PI (n=133)	TI (n=30)	P-value
Crop-livestock integration		34	53.2	12	-
Independent variables					
Sex	Male	93.1	97.0	76.7	0.000**
	Female	6.9	3.0	23.3	
Age	Years	41.4 (11.7)	45.2 (12.1)	44.9 (12.4)	0.060
Education level	Primary	33.3	31.60	16.70	0.184
	Secondary	50.6	43.60	60.0	
	Tertiary	10.3	18.00	23.3	
Family size	Number	5.1 (2.1)	6.1 (2.6)	6.7 (3.5)	0.002**
Total land size	Hectares	1.98 (5.5)	3.03 (8.0)	1.94 (3.1)	0.011*
Pineapple garden location	On-farm premises	52.9	36.1	43.3	
	Away	39.1	51.1	46.7	0.183
	Both	8.0	12.8	10.0	
Farming experience	Years	14.0 (8.7)	19.2 (11.1)	18.7 (10.0)	0.001**
Land for pineapples	Hectares	0.48 (1.4)	0.80 (1.9)	0.64 (1.0)	0.013*
Cattle	Number	0.6 (1.7)	5.7 (10.7)	3.2 (1.9)	0.000**
Poultry	Number	5.3 (19.5)	24.8 (71.9)	27.6 (93.4)	0.055
Pigs	Number	1.1 (4.3)	5.8 (16.1)	2.0 (3.0)	0.016*
Knowledge of OF	Number	64.0 (15.9)	66.8 (17.9)	66.0 (16.7)	0.506
Perceptions of OF	Number	80.5 (13.8)	75.1 (1.06)	76.3 (10.5)	0.004*

NI = not integrated; PI = partially integrated; TI = totally integrated; parenthesis ( ) = standard deviation; * P<0.05, ** P<0.01; OF = Organic farming

and certified organic practices to improve income. This group balances technical knowledge with the labor capacity to manage intensive organic certification standards and value addition, overcoming barriers to entry.

Formal education. Most pineapple farmers had formal education (Table 2), which is often the basis for facilitating learning and information sharing, which improves adoption of new technologies (Dissanayake *et al*.,2022; Oli *et al*., 2025). According to several authors, education plays multiple, multi-faceted socio-economic roles among adopters of livestock integration in organic pineapple production: mainly as the driver of knowledge acquisition, technology adoption, and technical efficiency (Badu-Gyan, 2015; Koura *et al*., 2016; Nalubwama *et al*., 2019; Asante *et al*., 2021). From a socioeconomic standpoint, it facilitates farmers in better managing the complexities of combined crop-livestock systems, ensuring

TABLE 4. Determinants of livestock integration in organic pineapple production system in central Uganda

	Coef.	Marginal effects	P>z
Gender (Ref=Male)	-0.707	-0.118	0.179
Age of household head (years)	0.000	0.000	0.982
Education (years)	-0.042	-0.007	0.053
Experience in pineapples (years)	0.045	0.008	0.046*
Total farm size (hectare)	-0.067	-0.012	0.116
Pineapple garden location (Ref=On-farm premises)			
Off-farm	0.126	0.022	0.705
Both on and off-farm	0.503	0.087	0.382
Information sources	0.057	0.010	0.360
Land under pineapples (hectare)	0.235	0.041	0.038*
Distance to market (Km)	0.006	0.001	0.801
Piped water access	0.077	0.013	0.820
Number of cattle	0.638	0.110	0.000**
Number of poultry	0.006	0.001	0.132
Number of small ruminants	0.198	0.034	0.008**
Number of pigs	0.445	0.077	0.184
Experience in livestock (years)	-0.055	-0.010	0.061
Knowledge of organic farming	-0.010	-0.002	0.286
Perceptions of organic farming	-0.016	-0.003	0.220
Constant	0.864		0.583
Prob>chi2 =0.000			
Pseudo R2 = 0.5164			
n=197			

* P<0.05, ** P<0.01

that nutrient cycling (manure for pineapple) is managed optimally while maintaining organic certification standards (Kumar *et al*., 2023; Golijan Pantoviæ *et al*., 2025)

Farmer experience. Organic pineapple farmers had more experience in farm production than non-organic pineapple farmers (Table 2). A similar inference was drawn by Koura *et al*. (2016) and Hinzpeter (2025) ; who attributed this to the fact that organic pineapple farming is a knowledge-intensive, labour-intensive, and management-intensive endeavour that requires years of experience to manage soil fertility and pests without synthetic chemicals. This also agrees with other studies, which indicated that experienced farmers cope better with organic farming compared with farmers with fewer years of experience (Rana *et al*., 2012; Kumar *et al*., 2025)

Family size. Pineapple farmers who practiced total integration (TI) were generally those who had large family sizes (Table 3). This was possibly due to the provision of more readily available labour for the intensive labour activities of composting manure, and handling of livestock feeds and fodder associated with livestock integration in farming (Dhehibi *et al*., 2025; Domínguez-Hernández *et al*., 2025). What would be of interest to investigate further is the reconciliation between the requirement for labour from school-going children, and yet

to comply with the current government policy of universal education (Otyola *et al*., 2022; Nyanzi and Mahmood, 2026). On the other hand, it might be timely to intervene with labor-saving, cost-effective, simple mechanised interventions to offset the over-reliance on family children labour, which is otherwise currently associated with other policy contradictions.

Priority ranking predictors for livestock integration. Overall, this study has established three key predictors for the adoption of integration of livestock in the organic pineapple production system in central Uganda (Table 4). These included herd size, pineapple land area, and farmer experience.

Herd size and pineapple acreage. These factors were the most influential for farmers' decisions to integrate livestock into organic pineapple production positively (Table 4). Integration relies on nutrient recycling, where an adequate number of animals is required to supply sufficient manure for the cultivated fields (Koura *et al*., 2016). This implies that farmers with large herds tend to possess large volumes of manure generated and, in turn, are expected to support the integration practice. Similar associations between number of cattle ownership and crop-livestock integrations have been reported elsewhere (Koura *et al*., 2016; Shanmugam *et al*., 2024). Integrating livestock manure for soil fertility and pineapple residues for animal feed can create a sustainable, low-cost circular organic pineapple production system (Ramadhani, 2018; Kyawt *et al*., 2020; Sukri *et a*l., 2023).

Farmers' experiences. The number of years a farmer had spent in pineapple farming had a positive and significant effect, suggesting that greater familiarity with organic pineapple farming increases the likelihood of adopting livestock integration practices. In contrast, livestock farming experience *per se* had a negative effect. Experienced livestock farmers may be more aware of the production risks and management demands associated with livestock, such as diseases, labor shortages, and feed scarcity (Kiggundu *et al*., 2014; Nalubwama *et al*., 2016). So specialised livestock farmers may view pineapples as a distraction rather than a synergy.

CONCLUSION

Integration of livestock in organic pineapple production was mainly influenced by farmers' experiences, pineapple acreage, and herd size; highlighting the need for integration plans for farmers with substantial land and livestock. Effective plans should involve rotational grazing, using livestock for waste-to-resource cycling, and diversifying income sources, which improves soil health, reduces reliance on chemical inputs, and enhances economic resilience. Experience-sharing should enhance the uptake of crop-livestock integration practices among pineapple farmers. Policymakers and development agencies ought to consider these priority factors when designing strategies to promote livestock integration in organic pineapple farming in Uganda.

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