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Commercial Assessment of Horned Melon (*Cucumis metuliferus*) Cultivation in Local Economic Development and Social Well-being in Rural Livelihood of Zimbabwe

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ABSTRACT

Background: Horned melon shows substantial potential for agricultural progress and improved climate resilience within Zimbabwe. While its cultivation by small-scale farmers in Mashonaland East is expanding, its wider economic and community contributions have yet to be thoroughly investigated.

Methods: To address this gap, a mixed-methods study was undertaken in ward 20, 21 and 27 of Mutoko district, involving 135 randomly selected smallholder farmers. Data were collected via interviews, observations and semi-structured questionnaires, with quantitative data subsequently analyzed using SPSS.

Result: A key finding revealed a strong positive Pearson correlation (r = 0.801) between perceived income benefits and the land area allocated to horned melon, indicating that economic incentives are primary drivers of cultivation decisions. Farmers reported an average market price of USD 75.00 per 50 kg bag, with typical seasonal sales ranging from 15 to 18 sacks; however, a positively skewed distribution indicated that some farmers achieved significantly higher volumes. Beyond direct sales, the crop contributes to multiple living dimensions, including education, food security, healthcare, income generation and environmental sustainability, with its financial impact on schooling and essential services being especially notable. Despite its growing importance, investments in critical infrastructure, equipment and training for horned melon cultivation remain limited. These outcomes collectively underscore the horned melon's rising economic relevance and highlight the crucial need for targeted support to fully maximize its role in rural livings and sustainable agriculture. And policies should strengthen targeted extension programs for horned melon agronomy to equip smallholders with skills that boost productivity, quality and income.

Key words: Economic development, Horned melon, Rural livelihoods, Smallholder agriculture, Social well-being.

INTRODUCTION

Agriculture stands as the dominant economic activity and the principal source of living for the majority of the rural population in Zimbabwe, particularly within the smallholder sector (Hove *et al*., 2024; Mhaka and Runganga, 2023). Its role is central to ensuring national food security, alleviating poverty and supporting broader socio-economic development. However, this sector continues to face persistent and interlinked challenges; climate variability, recurrent droughts and floods, soil degradation, limited access to inputs and finance and market instability, that threaten its sustainability and exacerbate rural vulnerability (Kaur and Sangha, 2025; Prathima *et al*., 2024; Ndlovu *et al*., 2020; Mutsvangwa-Sammie *et al*., 2013).

Located in Zimbabwe's highveld, Mashonaland East Province is a key agricultural region contributing significantly to national food production through crops such as maize, tobacco and various horticultural products. Yet, despite its agricultural potential, many rural households in this province continue to experience food insecurity, poverty and limited access to essential services (Sukulao *et al*., 2025). Crop diversification, particularly toward resilient, underutilized and high-value species, has been increasingly recognized as a strategic approach for enhancing smallholder livelihoods and improving resilience to environmental and economic shocks (Mihrete and Mihretu, 2025; Nepali *et al*., 2024; Sammauria *et al*., 2019).

The horned melon (*Cucumis metuliferus*), a drought-tolerant, nutrient-rich fruit crop indigenous to sub-Saharan Africa, offers promising attributes for climate-smart agriculture. Its expanding cultivation in areas such as Mashonaland East, driven by growing urban and export

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market demand, positions it as a crop of emerging commercial interest (Šeregelj *et al*., 2022; Mutetwa *et al*., 2025). However, despite anecdotal reports and observable trends in adoption, its actual contributions to local economic development and social well-being remain poorly documented. There is a clear need to empirically assess how horned melon cultivation affects smallholder living, both economically and socially and to identify barriers to its broader uptake and impact.

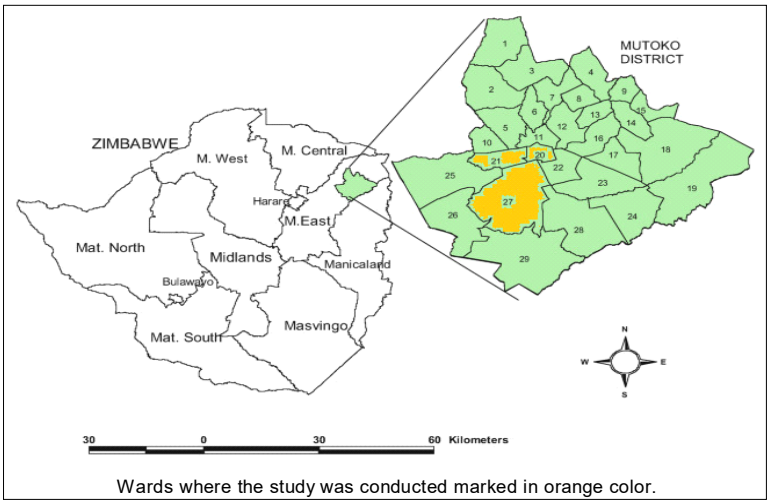
This study aims to address this knowledge gap by investigating the influence of horned melon cultivation on local economic development and social well-being indicators among smallholder farming households within the selected district of Mashonaland East Province, Zimbabwe.

MATERIALS AND METHODS

The researchers from Midlands State University, Gweru, conducted the study in 3 Wards (20, 21 and 27; colored orange) of Mutoko district, Mashonaland East Province (Fig 1) from a period 2023-2025. Based on 2022 Zimstats figures, the province spans 32,230 km^2, has a population of roughly 1.73 million and an 85% literacy rate. ZIMVAC (2021) notes that Mashonaland East contains nine districts and Marondera is its capital. Key economic sectors in the province encompass mining, agriculture, tourism, horticulture and animal husbandry. The province ranks among the nation's top regions for maize cultivation and is also regarded as one of the country's most vital areas for agriculture in general. Smallholder farmers in these districts engage in intensive vegetable production intended for sale via diverse marketing channels (Heri, 2006). Smallholder vegetable producers throughout these districts can choose from various marketing methods, such as selling produce at urban horticultural marketplaces (like Mbare Musika), directly from their farms (farm gate), in rural service centres, or through roadside sales.

For this study, a district recognized for its intensive small-scale vegetable farming was purposively chosen due to its direct relevance. Within this selected district, a random sample of households cultivating horned melon were drawn from three distinct wards. Purposive sampling, as defined by Sharma (2017) involves the deliberate selection of subjects based on researcher judgment, utilizing techniques such as maximum variation, homogeneous, or typical case sampling. These methods facilitate the drawing of meaningful inferences despite the non-probability basis of the sample. To be eligible, respondents needed to be household members actively engaged in horned melon cultivation who possessed comprehensive knowledge of local and household farming practices. Adopting a mixed-methods approach, the study integrated both qualitative and quantitative techniques for data collection and analysis, a strategy recommended by Leech *et al*. (2010) for enhancing research robustness. Due to the scarcity of prior research concerning the socio-cultural dynamics, production practices and perceived genetic diversity of horned melon in the region, direct data collection was conducted *via* face-to-face interviews and self-administered questionnaires. Local residents and authorities provided essential assistance during this process. The questionnaire design incorporated a majority of pre-coded questions along with some open-ended responses, thereby ensuring the capture of both structured data and nuanced contextual information.

This study utilized a multi-method approach to gather comprehensive insights into horned melon production, employing semi-structured interviews, direct observations and a self-designed, pre-tested household questionnaire. Following a pilot test, minor revisions, simplifying language, shortening questions and clarifying wording, were made to enhance clarity and participant engagement. Local assistants then administered the final questionnaire through face-to-face interviews conducted in local languages. From 135 questionnaires distributed, 118 were fully completed and included in the analysis. Semi-structured interviews, each lasting approximately 15 minutes, used a



Wards where the study was conducted marked in orange color.

Fig 1: Map of Zimbabwe's provinces showing the wards in Mutoko.

guide similar to the questionnaire, enabling open-ended discussions for deeper exploration. Concurrently, direct observations documented practices such as photo covering, cultivation techniques and marketing strategies, thus enriching the socio-economic context. Stringent ethical standards were maintained throughout the study. All participants were thoroughly informed of the study's purpose, assured of anonymity and provided informed consent. Their participation was entirely voluntary, with the explicit right to withdraw at any time. No coercion was employed, ensuring all respondents willingly engaged in the surveys and interviews.

Analysis of quantitative and qualitative data, derived from coded questionnaires, was carried out using SPSS (Statistical Package for the Social Sciences) version 21. The use of SPSS was selected due to its robust capabilities for managing, analyzing and visualizing complex data Descriptive statistics, specifically frequencies and percentages, were applied to analyze respondent demographics and socio-economic characteristics, providing insights into their impact on local economic development and social well-being. For the qualitative data, content analysis was performed. Findings were also presented in tabular and graphical formats. A Pearson correlation coefficient, which is used to assess the strength and direction of linear associations among parameters, was used to determine the relationship between perceived income benefit and the acreage allocated for horned melon cultivation.

RESULTS AND DISCUSSION

Household socio-cultural demographic characteristics

An analysis of household respondents provides insight into their key demographic and socioeconomic characteristics. Demographically, the sample was predominantly male (53.4%), with females making up 46.6%. The age profile showed a concentration in the middle age groups: 35-44 (50.8%), 25-34 (22.0%) and 45-54 (20.3%), while individuals aged 18-24 and 55-64 each accounted for 3.4%. The majority of respondents were married and had completed primary education. Economically, farming was the dominant characteristic, identified as the primary occupation for 78.0% of respondents and the main source of income for 85.6% (Fig 2). Household respondents typically supported children, spouses and extended relatives. Crop production served multiple purposes beyond income, including providing food for 94.1% of households and medicine for 44.9%. The smallholder farmers participating in the survey cultivated a diverse range of crops: maize, tobacco, sunflower, groundnuts, beans, tomatoes, pepper, peas, paprika, cabbages, covo, carrots, rape, butternut, onion, watermelon and sweet potatoes.

Average unit price per 50 kg sack

Data collected from 118 farmers provides important insights into the market behavior and pricing patterns for horned melon, specifically the average unit price per 50 kg sack. This information is also relevant to understanding the economic returns realized by these farmers. The reported prices spanned a range from 50.00 to 100.00 (Table 1). Looking at central tendencies, both the mean and median price were 75.00, with the most frequently reported price (mode) being 70.00. The closeness of the mean and median suggests a relatively symmetrical distribution of these prices. Regarding specific frequencies, the price of 70.00 was the most common, reported by 22 farmers (18.6%). Other prices frequently mentioned by farmers included 80.00 (16.1%), 60.00 (13.6%) and 75.00 (13.6%) (Table 2). The consistent pricing observed in horned melon trade is rooted in underlying socio-economic and agronomic dynamics. Key factors driving price variation include marketing channels, with retail sales typically fetching higher prices than wholesale, along with farmers' proximity to urban markets, the perceived quality of the fruit (*e.g.,* size, sweetness, visual appeal) and seasonal fluctuations in demand. Furthermore, farmer-specific attributes such as market literacy, cooperative involvement and negotiation capacity significantly influence price outcomes (Claude *et al*., 2025). These results highlight

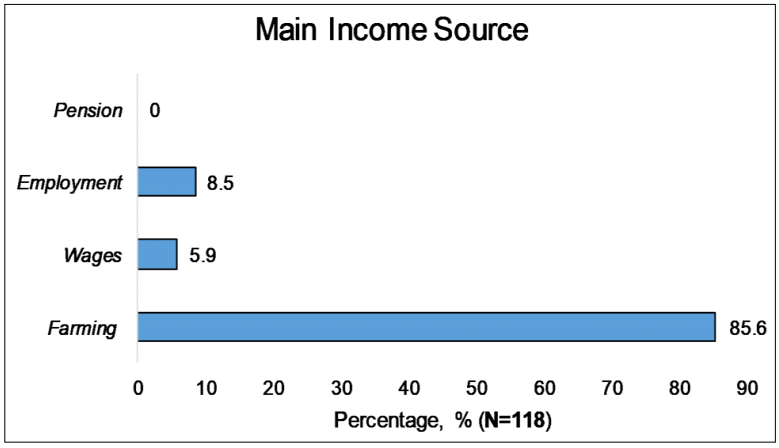


Fig 2: Demographics for the income sources of the respondents.

the critical importance of improving market access, quality control and farmer training to enhance price stability and income reliability within the horned melon market.

Average quantity sold per season

Seasonal horned melon sales reported by 118 farmers showed significant variation, ranging from 9 to 42 sacks. Despite an average sale of approximately 18 sacks per season, the most frequent volume and the median sale quantity were both lower, at 15 sacks. This indicates that half of the farmers sold 15 sacks or less. The presence of a few farmers reporting considerably higher sales (up to 42 sacks) results in a positive skew, pulling the mean upwards and explaining the difference between the average and the volume typical for the majority of farmers surveyed (Table 3). Horned melon sales data shows a clear disparity: a consistent median and mode of 15 sacks indicates most farmers operate on a modest commercial scale, probably limited by land, inputs and market access (Magakwe and Olorunfemi, 2024). However, the mean sales volume, slightly higher at 17.91 sacks, is inflated by a small number of high-output farmers. This uneven distribution is confirmed by a wide sales range (9 to 42 sacks) and a positive skewness of 1.357, illustrating that while most farmers sell below average, a minority achieve significantly higher volumes. These high-volume outliers likely benefit from advantages such as larger landholdings, reliable irrigation, superior farming skills, or better market integration (Gidelew *et al*., 2025; Lesala *et al*., 2025; Ma *et al*., 2024). Rectifying these structural inequalities in resources and market access is crucial for making horned melon commercialization more scalable and equitable.

Income generation and land allocation

This analysis explores how farmers in Mashonaland East prioritize horned melon based on its economic value (income generated) and land allocation. Farmers ranked the crop on a 1-10 scale (1=least, 10=most important), with actual responses falling between 3 and 8. For economic value, the highest percentage of farmers (24.6%) ranked horned melon at level 8, indicating high perceived income importance. Other significant rankings were level 4 (22.9%) and level 3 (21.2%). The mid-range ranks of 3 to 5 collectively represented 58.5% of responses. Ranks 6 (11.9%) and 7 (5.1%) were less frequent and no farmers ranked it at the extreme lowest (1-2) or highest (9-10) levels (Table 4). Regarding land allocation, rank 8 was again the most common response (24.6%), similar to the income findings. Rank 7 was the second most frequent (21.2%), followed by ranks 3 (18.6%), 5 (15.3%) and 4 (13.6%).

These mid-to-higher ranks (3-7) collectively accounted for a significant 89.3% of all responses for land allocation (Table 4). Horned melon cultivation is becoming increasingly economically relevant for smallholder farmers, fulfilling dual roles in food security and income generation. Farmers' self-reported data on both its income contribution and land allocation offer crucial insights into its evolving status. Income rankings, largely between 3 and 8 on a 10-point scale (where 10 is highest), position horned melon as a supplementary rather than primary income source. The most common scores, rank 8 (24.6%), rank 4 (22.9%) and rank 3 (21.2%), point to partial commercialization. This pattern suggests that while some farmers achieve significant income benefits, likely due to stronger market access, others remain hindered by factors such as limited pricing power, lack of value addition and yield variability. Land allocation exhibits a similar trend, with responses clustering around ranks 7 and 8, indicating a deliberate investment in the crop. This alignment implies that land-

Table 1: Statistics for the average unit price per 50 kg sack.

N	Valid	118
	Missing	0
Mean		75.0000
Median		75.0000
Mode		70.00
Skewness		.195
Std. error of skewness		.223
Range		50.00
Minimum		50.00
Maximum		100.00

Table 2: Demographic distribution for the average unit price per 50 kg sack.

Units	Frequency	Per cent	Valid	Cumulative per cent	Per cent
Valid	50.00	4	3.4	3.4	3.4
	55.00	3	2.5	2.5	5.9
	60.00	16	13.6	13.6	19.5
	65.00	9	7.6	7.6	27.1
	70.00	22	18.6	18.6	45.8
	75.00	16	13.6	13.6	59.3
	80.00	19	16.1	16.1	75.4
	85.00	4	3.4	3.4	78.8
	90.00	15	12.7	12.7	91.5
	95.00	2	1.7	1.7	93.2
	100.00	8	6.8	6.8	100.0
	Total	118	100.0	100.0	

use decisions are primarily market-driven, influenced by perceptions of profitability, local taste preferences, ease of cultivation and the resilience of particular landraces. The absence of extreme values on both scales confirms that horned melon is not yet a dominant cash crop, unlike staples such as maize or tobacco. However, the relatively high land commitment suggests untapped potential, contingent on improvements in market infrastructure and agronomic support systems. Overall, the correlation between perceived income contribution and land allocation reinforces horned melon's role as a strategic crop, cultivated for both household sustenance and targeted market engagement.

Correlation between income generated and area cropped

The relationship between Income generated (perceived importance of horned melon for income, 1-10 scale) and Area cropped (land allocated to horned melon, 1-10 scale) was investigated using Pearson correlation. Results indicated a strong positive correlation ($r = 0.801$, $p<0.001$) (Table 5). This statistically significant result shows that greater perceived income benefits from horned melon are associated with increased land dedicated to its cultivation. This association suggests that farmers' land allocation decisions are directly influenced by their perceived economic valuation of the crop: greater perceived value leads to increased acreage, whereas low perceived returns result in reduced cultivation. This observation aligns with existing research, such as Berget *et al*. (2024), which emphasizes the significant impact of smallholder perceptions on their cropping decisions, thus supporting income potential as a key determinant of land use. Consequently, horned melon is emerging as a more viable market-oriented crop, prompting farmers to strategically expand its production in response to evolving economic opportunities. Although correlation does not establish causality, the compelling strength of this relationship strongly indicates that economic incentives are central to determining the scale of horned melon cultivation.

Table 3: Statistics for the average quantity sold person.

N	Valid	118
	Missing	0
Mean		17.9068
Median		15.0000
Mode		15.00
Skewness		1.357
Std. error of skewness		.223
Range		33.00
Minimum		9.00
Maximum		42.00

Socio-economic and ecological benefits

Selling fruits, particularly horned melon, has significantly improved households' social and economic well-being by providing new opportunities and benefits (Table 6). Income from horned melon farming is primarily used for essential needs: a substantial 94.1% of respondents allocate funds to school fees and related items, 92.4% rely on it for food and nutritional supplements and 90.7% use earnings to pay crucial utility bills like hospital fees, electricity and council charges. The income also facilitates investment and improves quality of life, with approximately 30.5% investing in livestock and 38.1% spending on luxuries. Furthermore, 85.6% of respondents engage in ecological conservation activities, such as erosion reduction, alongside their horned melon farming, demonstrating its environmental benefits. Horned melon cultivation plays a vital role in

Table 4: Demographic distribution for the respondents regarding economic value of the crop and importance of land allocation to horned melon cultivation.

Category	Scale										Total
	1	2	3	4	5	6	7	8	9	10	
Income generated	-	-	25	27	17	14	6	29	-	-	118
Frequency (%)	-	-	21.2	22.9	14.4	11.9	5.1	24.6	-	-	100
Amount of land allocated	-	-	22	16	18	8	25	29	-	-	118
Frequency (%)			18.6	13.6	15.3	6.8	21.2	24.6	-	-	100

Scale: 1= Least, 10= Most important.

Table 5: Correlations for income and area cropped to horned melon.

		Income generated (scale, 1-10)	Area cropped (scale, 1-10)
Income generated (Scale, 1-10)	Pearson correlation	1	.801**
	Sig. (2-tailed)		.000
	N	118	118
Area cropped (Scale, 1-10)	Pearson correlation	.801**	1
	Sig. (2-tailed)	.000	
	N	118	118

**; Correlation is significant at the 0.01 level (2-tailed).

Table 6: Demographic distribution for socio-economic and ecological benefits of the respondents.

Benefit	Household's respondents, % (N=118)
Basic needs (*e.g.* food, clothes and groceries)	10.0
Paying school fees and school items	94.1
Luxuries	38.1
Livestock	30.5
Source of food and nutritional supplements	92.4
Source of medicine	30.5
Purchased farming tools and machinery	22.9
Pay bills (*e.g.* hospital, electricity, council bills, house/farm labor)	90.7
Purchased household tools	23.7
House maintenance	24.6
Homestead building(s)	6.8
Social networking	5.1
Training	5.9
Knowledge sharing	17.9
Ecological conservation (*e.g.* erosion reducing)	85.6

bolstering household livings and fostering environmental sustainability, thereby supporting key rural development pillars like income generation, food and nutritional security, education, health and ecological conservation (Rajbhandari, 2015). The crop's economic impact is substantial. A significant majority (94.1%) of farmers channeled sales income into educational expenses, demonstrating its role in human capital development. Nearly as many (90.7%) utilized funds for critical household needs including healthcare, utilities and labor, serving as a crucial financial buffer. While only 10% used the income for daily consumption, this indicates its primary function as a periodic cash crop rather than a staple. Furthermore, 38.1% of farmers reported spending on non-essential items, pointing to increased disposable income and improved rural quality of life. Beyond economics, horned melon offers significant nutritional and health benefits. A substantial 92.4% of respondents considered it a valuable supplementary food, especially during lean seasons, attributing its benefits to a rich vitamin and mineral profile (Saore *et al*., 2024). Moreover, 30.5% reported its use in traditional medicine, suggesting untapped ethnobotanical potential worthy of future nutraceutical research. Socially, cultivation fosters community engagement and informal knowledge exchange. Farmers reported benefits such as knowledge sharing (17.9%), access to training (5.9%) and strengthened social networks (5.1%). These outcomes highlight the crop's contribution to reinforcing local agricultural knowledge systems, especially valuable for neglected and underutilized species. Ecologically, horned melon shows clear environmental advantages, with 85.6% of farmers noting benefits like soil stabilization and erosion control. Its inherent drought tolerance and minimal input requirements establish it as a climate-resilient crop ideal for marginal lands (Mabhaudhi *et al*., 2019), thereby promoting agroecological sustainability and enhancing long-term adaptation to climate variability.

CONCLUSION

In Mashonaland East, horned melon prices are generally stable, yet many farmers struggle with low profits due to limited market access, insufficient pricing information and poor post-harvest practices. Addressing these issues could significantly boost their income and profitability. Current sales data reflect small-scale, inconsistent production; however, stronger support systems could improve both yield and marketing efficiency, especially for less productive farmers, thereby contributing to food security and rural development. While currently of moderate economic importance, horned melon shows great promise for generating income, evidenced by its increasing cultivation. With targeted support and investment, it could evolve from a niche crop into a commercially vital one. The positive link between land allocated to horned melon and socio-economic gains highlights how economic incentives can encourage its cultivation, a key insight for policymakers, researchers and extension agents working to promote the crop for better rural livings and sustainability. Beyond income, horned melon offers numerous advantages, including improved nutrition, health, knowledge sharing and environmental resilience. Given these diverse benefits, it should be integrated into Zimbabwe's broader agricultural development and climate adaptation strategies. Policies should fund targeted extension programs to disseminate best practices in horned melon agronomy, pest and disease management and postharvest handling. These programs would equip smallholders with the technical skills necessary to optimize productivity and quality, thereby enhancing income potential, to amplify its contribution to rural transformation and agro-biodiversity conservation.

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Disclaimers

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Conflict of interest

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