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# CUCUMBER ECONOMICS IN NIGERIA: PROFIT, RISK AND DRIVERS

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## ABSTRACT

This study performed assessment on the profitability of cucumber production on farm-level in Ughelli North LGA, Delta State, Nigeria. Cost-returns, household survey and regression analysis were done through the survey. Average farm seasonal output was 1,453 kg, while average market price was ₦200/kg, giving average seasonal revenue of ₦289,750 and average seasonal total cost of ₦134,037. Average net farm profit was ₦155,713 (which is profiting ₦107.18 per kg). This means the net profit margin is 53.6%, and ROI is 1.16. The analysis on sensitivity showed that price and yield are the most dominating factors, because a simultaneous 30% drop in yield and price gave a ROI of 5.6%. Yield, access to market, and available labour, were determined to be net margin per kg positive predictors in the multiple regression (R2 = 0.68). The margins were reduced due to input cost, and post, harvest loss, and quality. Deficient technical knowledge, low finance, and weak value addition were identified the key constrains. Prioritize market linkage, post-harvest, input access, extension, to enhancing returns and reducing risks especially small, mostly women producers, is the findings. Programs aimed at providing low cost irrigation, cold chain, and producer aggregation along with credit based on gender,

demonstration plots, and irrigation are recommended.

**Keywords:** Cucumber, Net Profit margin, Cost, Price, Output

## INTRODUCTION

Vegetable farming is important for the livelihood of smallholder farmers in Sub-Saharan Africa. It provides rural households with economically sustaining jobs and nutritionally diverse foods (Onuwa et al, 2023; FAO, 2020).

From a cyclical production standpoint, cucumbers (*Cucumis sativus*) are one of the most versatile and profitable vegetables. It is highly profitable, with a quick economic turnover, and with the added benefit of unbroken demand in rural and urban marketplaces (World Bank, 2025; Nwadiolu et al, 2025). These attributes of the cucumber perennial cultivation position it as an excellent enterprise for quick financial returns and frequent market activity. In Nigeria, smallholder horticulture is prioritized in the national agenda for poverty alleviation and youth employment, as smallholder vegetable farming increasingly contributes to household cash flow, even in small, and highly fragmented land holdings (Omodero, 2021). While some researchers suggest vegetable profitability, Green (2020) and Analadurai et al. (2021) suggest that vegetable profitability remains unproven, as they fail to consider how a lack of profit evidence constrains policy makers and investors on resolving specific economic problems (Adeagbo and Adejumo, 2020).

Extensive water resources, high rainfall, and fertile alluvial soils help the Niger Delta, and especially Delta State, which possess positive agroecological attributes for intensive vegetable production. Ughelli North Local Government Area (LGA), as a critical agricultural region in Delta State, typifies the Nigerian smallholder systems of close urban market access, inadequate formal financing, intermittent input supply, and unyielding post-harvest and sales (Nwamuoh, 2024). For the smallholders of Ughelli North, cucumbers are a potentially lucrative crop that is labor intensive. However, it requires proper management of production costs (seed, labor, irrigation, and pest control) and timely access to market for the crop to be able to realize favorable prices (Adeoye, 2021).

Net profit margin as a significant metric allows a relative comparison of performance on different enterprises and different farms regardless of scale and sales to profit systems (Ishita et al, 2025). Profit margins can be influenced by the type of production system (open-field versus protected systems), production scale, the intricacies of the input and output systems, the production and marketing seasons, and the market access opportunities, which can explain the varied margins reported in literature (Wudi and Musa, 2025).

There is inadequate empirical literature on the profitability of cucumber farming at the farm level in Delta State and, in particular, studies that fit specific farm characteristics, such as size of the farm, head of the household (male/female), type of production system (capital intensive vs. labor intensive production systems such as staking and/or mulching and greenhouse production), and type of marketing (local, urban

supermarket, and/or informal/trader). This scarcity of research and farm level data on cucumber farming profitability constrains the local development planners and cooperating development agencies from formulating sector specific policy instruments (e.g., input subsidy, low-cost irrigation, collective marketing, and/or training on post-harvest handling) that can potentially increase the net margins and decrease the production-related risks of the smallholder farmers (Tibi and Oyem, 2019).

This study seeks to fill this research gap by undertaking a net profit margin analysis of cucumber production on smallholder farms in Ughelli North Local Government Area (LGA). The study hopes to enhance local extension services, provide guidance to local farmer organizations, and contribute to the development of value chain investments by the public and private sectors in the vegetable sector in the Niger Delta. The authors therefore argue that no studies on economics of cucumber as relate to profit, risk and drivers have been conducted.

### 2.1 Theoretical framework

This study draws on production and household-level economic theory, augmented by value-chain and risk perspectives relevant to perishable horticulture such as cucumber production. At the microeconomic core is the farm-household/firm model, where a farm chooses inputs to produce output, subject to a production function and resource constraints, maximizing profit or household utility (Mugabo et al, 2024). Net Profit Margin (NPM) is an outcome of these joint decisions, rising with revenue per unit (price and realized yield) and falling with unit production costs.

The farm-household model recognizes multiple objectives, including consumption smoothing, risk reduction, and labor allocation, as well as market imperfections such as costly credit and imperfect output markets. Smallholders' intensity of cultivation, crop portfolio, and investment in post-harvest handling reflect trade-offs between expected returns and liquidity or risk. Limited finance, for instance, can lead to under-investment in yield-raising inputs, compressing margins (Khan and Kim, 2025).

Value-chain and transaction-cost perspectives emphasize that profitability is shaped by off-farm institutions, including market access, buyer concentration, information asymmetries, transport and handling costs, and contractual arrangements (World Bank, 2025). For perishable crops, timeliness of sale and market structure are critical, as poor roads, weak linkages, or reliance on informal traders can depress farmgate prices and elevate losses, reducing realized revenue and NPM.

Risk, uncertainty, and post-harvest loss (PHL) theory are also central. Under expected utility and portfolio frameworks, risk-averse farmers prefer strategies that reduce downside variability, possibly at the cost of mean profit. Investments in PHL reduction, such as cooling and improved handling, can raise mean returns and reduce variance (Tahir et al, 2025; FAO, 2020).

### 2.2 Empirical studies

Empirical research on smallholder vegetables and perishable value chains supports the theoretical focus on yield, market access, input costs, and post-harvest losses as primary determinants of profitability. Studies in West Africa and Nigeria found that yield improvements and efficient input use are strongly associated with higher profit margins for vegetables (Ge et al, 2023). Market access research demonstrates

that proximity to urban markets, participation in formal buyer contracts, and membership in producer groups increase realized prices and reduce marketing costs, thereby improving margins (Van et al, 2024; World Bank, 2025).

Empirical analyses quantify the large negative effect of PHL on farmer incomes, highlighting the importance of investments in post-harvest handling (FAO, 2020). Sensitivity and Monte Carlo studies identify price and yield volatility as dominant sources of profit variability, with correlated negative shocks rapidly eroding returns (Khan and Kim, 2022).

Household-level studies underline the importance of access to finance, education, and extension services in facilitating adoption of productivity-enhancing practices and improving margins (Giang et al, 2019; Kazi et al, 2024). Nigerian case studies on smallholder cucurbits and vegetables corroborate these patterns, finding that higher yields, lower unit costs, better market linkages, and reduced PHL predict improved NPM, while labor constraints and high input prices compress margins (Onuwa et al, 2023; Nwadiolu et al 2025).

## 3. MATERIALS AND METHODS

### 3.1 Study Area

Ughelli North LGA is in central Delta State (approx. 5.4800° N, 6.0680° E). The LGA comprises communities including Ughelli, Agbarho, Evwreni, Agbara, Ogor and Ufoma. The local economy is predominantly agrarian with a population estimated (NPC 2006 ) to have grown to over 200,000; smallholder farming dominates land use. The area has bimodal rainfall, fertile soils, and proximity to larger markets in Delta State which enables frequent market outlets for vegetables. Cucumber production is commonly practiced on very small holdings (typically <0.1 ha), often by women and youth, making it important for household cash flows and employment.

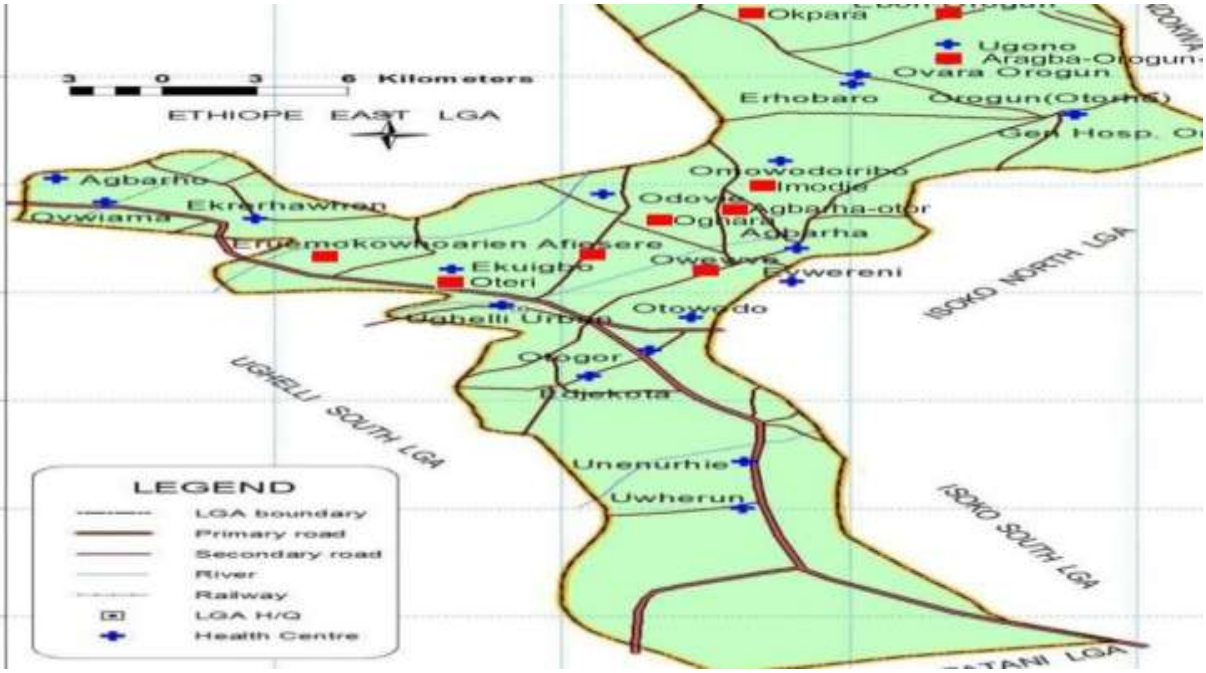


**Fig 1.0; Map of Ughelli North Local Government Area, Delta State, Nigeria**

### 3.2 Sampling Procedure

A multistage design was used. Six communities with a high concentration of cucumber farms (Ughelli, Agbara, Evwreni, Ufoma, Oteri, Orogun) were purposively selected. A sampling frame of N = 1,430 active cucumbers-producing farmers were compiled from agricultural extension records, cooperative membership lists and community registers and was verified on-farm by enumerators prior to sampling. Using Kothari's finite population correction with Z = 1.96, p = 0.5, e = 0.05 and N = 1,430, the required sample was n = 303; 303 names were selected by simple random sampling (random number draw using method) and 300 completed questionnaires were obtained (response rate 300/303 = 99.01%).

Inclusion criteria were: age ≥ 18 years, actively cultivating cucumber in the most recent season in one of the six communities, primary residence or primary farm in the community, and ability to provide informed consent. Exclusion criteria were non-cultivators, non-residents, persons < 18 years, and those who declined consent.

Because community selection was purposive, findings are representative of the verified frame within the six communities but cannot be straightforwardly generalized to a wider population without appropriate weighting or a fully probabilistic multistage design.

### 3.3 Ethical consideration and data quality

Ethical approval for the study was obtained from the relevant institutional review board, and all participants provided informed consent prior to interview. Data collectors were trained and the frame and sampled households were verified in the field to minimise coverage error and duplication. Non-response

was minimal (three refusals or unusable questionnaires out of 303), and reasons for non-response were documented.

### 3.4 Data Collection

Primary data was used for the study and was collected through the use of a structured questionnaire administered to the sampled cucumber farmers. The questionnaire captured Socio-economic characteristics of producers (age, education, farming experience, etc.), marketing information (costs, output, prices) and constraints to cucumber.

### 3.5 Data Analysis

Descriptive Statistics such as frequency, percentage and mean were used to summarize socio-economic characteristics (such as gender, age, marital status, education level, farming experience, household size, farm size and income). Major constraints common to Cucumber Producers in the study area employed five point likert scale (Strongly disagree =1, Disagree =2, Undecided = 3, Agree = 4, Strogly agree =5). While inferential statistics such as such as multiple regression was used to determine the variables that influence Net Profit per kg of Cucumber producers. Sensitivity analysis assessed the impacts of price, yield and post harvest loss (PHL) scenerios on revenue, profit and ROI.

### 3.6 Model Specification

The study employed a multiple regression model to determine factors influencing Net Profit per Kg. The model was specified as:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + e_i \ldots\ldots\ldots (1)$$

Where:
Y = Dependent variable (Net profit per kg measured as N /kg)
$\beta_0$ = Intercept
$\beta_1, \beta_2, \ldots, \beta_5$ = Coefficients of independent variables
ε is the error term

- Dependent variable
Y= NPM (Net profit margin), Naira per kg (N/ kg). Define explicitly as absolute percent net margin (net profit ÷ revenue × 100)

-Independent variables (continuous unless otherwise noted)
X1= Yield: Kg per hectare (kg/ha)
X2Price: Sale price, Naira per kg (₦/kg)
X3= Input cost: Input cost per kg (₦/kg).
X4= Market access: Distance to market in kilometers (km).

X5= Water irrigation: Volume per area per season, cubic meters per hectare per season ($m^3$/ha/season)
X6= Post-harvest loss: Kg lost per hectare (kg lost/ha)
X7= Labour: Persons per day (persons/day) — hired labour

## 4. RESULTS AND DISCUSSION

### 4.1 Socioeconomic Charateristics of Farmers

The socioeconomic characteristics of farmers in the study showed some notable patterns. From the total respondents, 54% were female, while 46% were male. This indicated that women were prominently involved in cucumber production, which corroborates recent studies on the role of women in the production of vegetables (Edeoghon, 2016; Nakwe, 2018). Nonetheless, the women involved in this study still faced the challenge of land, labor, and credit. Respondents had an average age of 45 years, with 31-50 years being the dominant range. This signified the presence of a matured farming population as noted by Van touch (2024); a phenomenon that characterizes the majority of African horticultural systems. This age group provides experience to farming, but also poses a risk of youth out-migration.

Majority of the respondents (60%) were married, which likely meant they had access to household labor. As such, they possess risk-sharing factors, which are linked to the adoption of labor-intensive crops (Anderson et al, 2017; Tenhardt et al, 2024)). On average, the result showed that a household comprised of 3 members. In addition, more than half of the surveyed households (53%) reported having 1-3 members. This indicated a small labor pool for each household, which may constrain on-farm labor and heighten dependence on hired labor.

Regarding the educational background of the respondents, majority had completed secondary education (48%), while 14% had no formal education. Moderate educational levels tended to favor the adoption of improved practices and record keeping This also was implied in the study of other researchers who equally saw a correlation between education and adoption of better farming techniques (Meiguran and Basweti, 2016). The result also revealed that the average experience of the farmers was 7 years, while most (42%) had between 5-10 years of experience. This implied that many farmers could have shifted from other crops or enterprise. This finding was also echoed by Fazli et al, (2025), who observed that many farmers are new to this enterprise.

The farmers also had very small farms, as most of them (63%) had between 0.05-0.09 hectares of land under their cultivation. This was in accordance with the smallholder horticulture predominance in the region and emphasized the problems associated with very small plot sizes for mechanization and economies of scale (Omotilewa et al, 2021). Most annual farm income was in the mid-range band of N400,001 - 800,000 naira with 62% and an average of N746,334. This showed result-able income which suggested that more returns are possible with more access to inputs, markets and financial resources (Aminu et al, 2021; Nnabueyi et al, 2022).

The results indicated that the profile of farmers suggest need to develop specific targeted strategies to cope

with the specific nature of the challenges they face. Such strategies may be the development of gender sensitive strategies that address access to credit and land, youth strategies, specific tailoring of extension services to the needs of farmers, and the formation of groups for the purpose of marketing to deal with the limitations associated with marketing in small volumes as it affects their farm income.

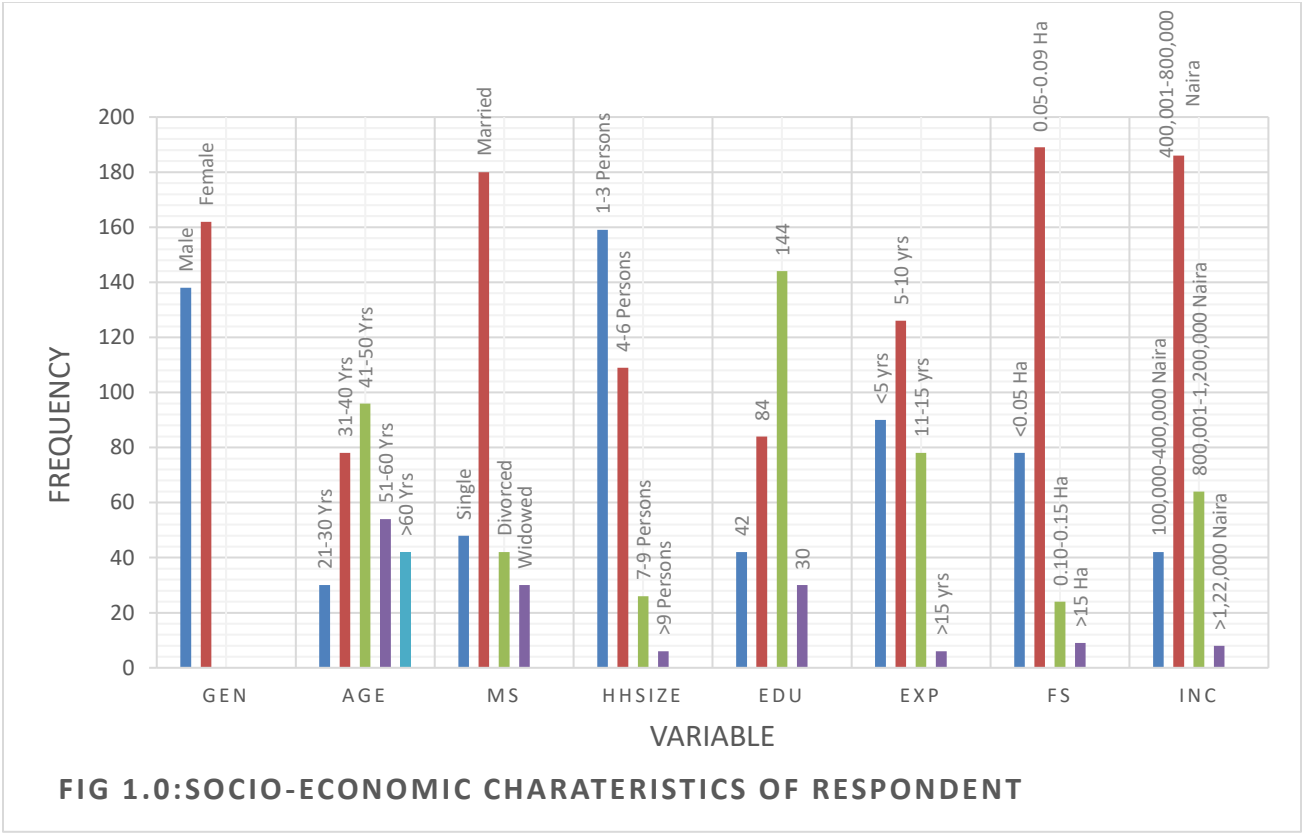


FIG 1.0:SOCIO-ECONOMIC CHARATERISTICS OF RESPONDENT

Note: GEN= Gender, AGE= Age, MS= Marital status, HHSIZE= Household size, EDU= Education, EXP= Experience, FS= Farm size, INC= Income

### 4.2 Cost Structure of Cucumber Producers

As depicted in Fig. 2.0, cucumbers production in the study area has the greatest share of meager variable costs, which made for a dominating 94.4% of the total costs per production season per farm which is estimated to be N134,037. Major cost factors consisted of land preparation, (N44,180; 31.5%), seed (N 20,367; 15.9%) and weeding (N20,130; 15.0 %) which all indicated that cucumber production is a highly labor intensive production activity. This finding is also fine tuned in numerous studies on cost effectiveness involved in cucumber production (Okonkwo-Emegha, 2024; Elum et al, 2017).

The impact of variable costs means profitability is susceptible to changes in yields and input prices, heightening the importance of strategies aimed at reductions in costs (Tilahun, 2021; Hoang et al, 2024). Cost items of greatest magnitude can be targeted through the adoption of conservation practices, improved seed selection, and mechanized weeding to substantially reduce unit costs and the environmental cost

(Eleduma, 2023; Shrestha et al, 2024). The adoption of practices from integrated pest management (IPM) can further reduce the use of chemicals, and the costs associated with them, while fostering environmental protection (Abah, 2025; Akiri, 2025; Sthrestha et al, 2025). The enhancement of harvesting and transport logistics via collective marketing or collaboration in logistics can lower peak periods of labor demand and thus reduce post-harvest losses, which positively affects profitability (Makule et al, 2024; Mukhamedjanova, 2018).

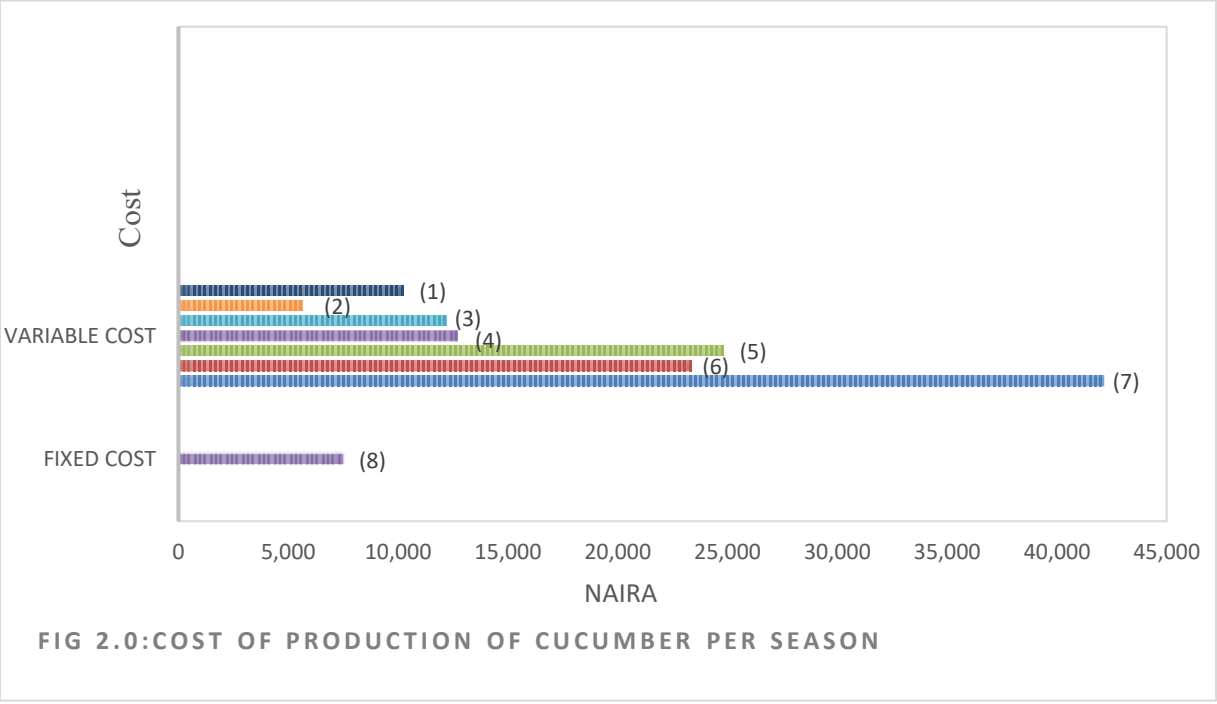


FIG 2.0:COST OF PRODUCTION OF CUCUMBER PER SEASON

Note: The various costs represented numerically in chart by variable and amount in Naira (₦)
(1)—Harvesting cost: ₦11,220;(2)—Transportation cost: ₦6,666; (3)—Chemicals cost: ₦11,246
(4)-- Chemical application cost: ₦12,728; (5)- Seeds cost: ₦20,367; (6)—Weeding cost: ₦20,130; (7)--Land preparation cost: ₦44,180; (8)-- Land Rent cost = ₦7,500

### 4.3 Net Profit Margin of Cucumber Producers

The margins of net profit from cucumber producers in Table 1.0 from this study outlines the potential profitability and economic sustainability of this farming practice. Farmers grew and harvested average seasonal yield of 1,453 kg per farm. They managed to commercially sell this output at an average farm-gate price of ₦200 per kg. Considering a post-harvest loss (PHL) of 10 kg per farm at a loss of ₦85 per kg, the total revenue of the farm was ₦289,750. Thus, after PHL, gross margins translated to ₦163,213, which suggested the possibility of substantial profit. This netted to ₦155,713 which was a return of 1.16 naira for each naira spent, an ROI of 1.16. Moreover, a benefit-cost ratio of 2.16 for the period confirmed this farming practice was economically justified.

The current findings supported recent studies in farming which noted the profitable potential the farming

of cucumber can generate, provided the price and cost control strategies are managed. Vegetable producers have shown significantly higher returns to their investment and revenue when cost control was practiced (Mukhamedjanova, 2018). Similarly, a study in another location, Southwestern Nigeria revealed an increase in profit margins relating to the management of the variable costs and the managerial economic control of the amount of inputs (Adeoye and Balogun, 2016).

The results of the examined cucumber marketing activity in the study area showed economic benefits for the farmers, which demonstrated effective economic management of the cucumber farming business. The cost of the agricultural activity needed to be reduced to improve profitability; thus, there is scope for increasing investment in agricultural technologies and practices that improve efficiency of the level of production (Hoang et al, 2024).

**Table 1.0: Average cost and return structure of cucumber per farm**

| Items | Amount (₦) |
|---|---|
| **Total cost (TC)** | 134,037 |
| Quantity output of ((Kg) | 1,453 |
| Unit price of output(₦) | 200 |
| Revenue(₦) | 290,600 |
| Post harvest loss (PHL) in Kg | 10 |
| Unit Price (₦) | 85 |
| PHL amount (10 x 85 ) | 850 |
| Total revenue after PHL (290,600 - 850) | 289,750 |
| Gross margin after PHL (₦) | 163,213 |
| Net profit after PHL(₦) | 155,713 |
| Benefit-Cost ratio (TR after PHL / TC) | 2.16 |
| Net return as % of total cost incurred after PHL | 116.2% |
| Return on investment, ROI (Net profit after PHL/ TC) | 1.162 |
| Net Profit margin | 53.59% |

**Sensitivity Analysis of Impacts of Price, Yield and Post harvest loss (PHL) scenerios on Revenue, Profit and ROI**

The results of the sensitivity analysis presented in Table 2.0 aims to provide the uncertainties that have the greatest degree of impact on profitability. The analysis showed that profitability is primarily influenced by price and yield. An identical percentage change in ROI and revenue, as well as a change in price, resulted in a change in yield. When both factors moved together, the results compounded in a non-linear way. For example, a 30% drop in price and a 30% drop in yield resulted in revenue dropping to 49% of

the baseline, and ROI was almost profit eroding at 5.6%. Reporting an ROI of 5.6% under a "30% simultaneous decline" was seen as more of a stress test outcome than something that would most likely occur, as it is based on an extreme, perfectly coincident shock to every driver in the model. The authors provided the 5.6% result, as it showed the most vulnerable aspect of the downside, and at the same time, they provided results that are more likely in the face of uncertainty and the defined structure of the correlation, as well as results that showed a sensitivity to partial constraints.

Considering baseline assumptions, net profit in this case was ₦155,713, and the ROI was 116.2%. A 30% price shock (with a constant quantity set at 1,453 kg) would decrease the ROI to 51.1%, while a 30% price increase would increase the ROI to 181.3%. Post-harvest loss (PHL) at ₦85/kg had a lower per kg effect. Moving from 0 to 100 kg PHL, net profit decreased from ₦156,563 to ₦148,063, and the ROI decreased from 116.8% to 110.4%. Yet, if PHL was considered at market price, or if it reduces the realized price, the effect would be greater**.**

**Table 2.0 Sensitivity Analysis of Revenue, net profit and ROI under price, yield and post harvest loss scenario (baseline: Q=1,453 kg; Price=₦200/kg, Total cost =₦134,037; PHL unit =85/kg)**

| Type | Scenario | Price | Revenue | PHL loss | Adiusted revenue | Profit | ROI | ROI% |
|---|---|---|---|---|---|---|---|---|
| 1. Price sensitivity (Q=1,453;PHL=10kg) | -30% | 140 | 203,420 | 850 | 202,570 | 68,533 | 0.511 | 51.1% |
| | -20% | 160 | 232,480 | 850 | 231, 630 | 97,593 | 0.728 | 72.8% |
| | -10% | 180 | 261,540 | 850 | 260,690 | 126,653 | 0.945 | 94.5% |
| | Baseline (0) | 200 | 290,600 | 850 | 289,750 | 155,713 | 1.162 | 116.2% |
| | +10% | 220 | 319,660 | 850 | 318,810 | 184,773 | 1.378 | 137.9% |
| | +20% | 240 | 348,720 | 850 | 347,870 | 213,833 | 1.595 | 159.5% |
| | +30% | 260 | 377,780 | 850 | 376,930 | 242,893 | 1.813 | 181.3% |

| Type | Scenario | Price | Revenue | PHL loss | Adiusted revenue | Profit | ROI | ROI% |
|---|---|---|---|---|---|---|---|---|
| 2. Yield sensitivity (Price = ₦200/kg; PHL= 10 kg) | -30% | 1,017.1 kg | 203,420 | 850 | 202,570 | 68,533 | 0.511 | 51.1% |
| | -20% | 1,162.4 | 232,480 | 850 | 231,630 | 97,593 | 0.728 | 72.8% |
| | -10% | 1,307.7 | 261,540 | 850 | 260,690 | 126,653 | 0.945 | 94.5% |
| | Baseline | 1,453 | 290,600 | 850 | 289,750 | 155,713 | 1.162 | 116.2% |
| | +10% | 1,598.3 | 319,660 | 850 | 318,810 | 184,773 | 1.374 | 137.8% |
| | +20% | 1,743.6 | 348,720 | 850 | 347,870 | 213,833 | 1.595 | 159.5% |
| | +30% | 1,888.9 | 377,780 | 850 | 376,930 | 242,893 | 1.813 | 181.3% |

| 3. Combined Price & Yield (both move together); PHL=10 kg | Both | Price | Qty | Revenue | PHL loss | Adiusted revenue | Net Profit | ROI | ROI% |
|---|---|---|---|---|---|---|---|---|---|
| | -30 | 140 | 1,017.1 | 142,394 | 850 | 141,544 | 7,507 | 0.056 | 5.6% |
| | -20% | 160 | 1,62.4 | 185,984 | 850 | 185,134 | 51,097 | 0.381 | 38.1% |
| | Baseline | 200 | 1,453 | 290,600 | 850 | 289,750 | 155,713 | 1.162 | 116.2% |
| | +20 | 240 | 1,743.6 | 418,464 | 850 | 417,614 | 283,577 | 2.116 | 211.6% |
| | +30 | 260 | 1,888.9 | 491,114 | 850 | 490,264 | 356,227 | 2.657 | 265.7% |

| 4. PHL sensitivity (Q=1,453; Price= ₦200/KG) | PHL (Kg) | PHL loss | Adjusted Revenue (₦) | Net Profit | ROI | ROI% |
|---|---|---|---|---|---|---|
| | 0 | 0 | 290,600 | 156,563 | 1.168 | 116.8% |
| | 5 | 425 | 290,175 | 156,138 | 1.165 | 116.5% |

| | | | | | |
|---|---|---|---|---|---|
| 10 | 850 | 289,750 | 155,713 | 1.162 | 116.2% |
| 20 | 1,700 | 288,900 | 154,863 | 1.155 | 115.5% |
| 50 | 4,250 | 286,350 | 152,313 | 1.136 | 113.6 |
| 100 | 8,500 | 282,100 | 148,063 | 1.105 | 110.5% |

(Notes:
(1) Net Profit= Adjusted revenue – ₦ 134,037, Number rounded—ROI
shown to three decimals and percentage to oneee decimal)
2) Per-unit and per-hectare metrics (useful for interpretation and policy)
- Cost per kg = Total cost / Q = 134,037 / 1,453 = ₦92.28/kg
- Revenue per kg (realised) = Adjusted revenue / Q = 289,750 / 1,453 = ₦199.45/kg (₦200/kg)
- Profit per kg = Net profit / Q = 155,713 / 1,453 = ₦107.18/kg
- Yield per hectare (if farm size = 0.086 ha as stated):
- Yield per ha = Q / area = 1,453 / 0.086 = 16,895.3 kg/ha = 16.90 t/ha per season

(3) Break-even calculations:
- Break-even price (price that makes profit = 0) = (Total cost + PHL loss) / Q = (134,037 + 850) / 1,453 = ₦92.84/kg
- Break-even yield at P = ₦200/kg: Q_be = (Total cost + PHL loss) / Price = 134,887 / 200 = 674.44 kg

**4.4 Variable influencing the Net Profit Margin of cucumber producers**

Regression results in Table 3.0 shown in the case of cucumber producers from Ughelli LGA, multiple agronomic and market parameters influence the Net Margin per kilogram. Yield per hectare positively impacted net margin per kg ($\beta = 0.587$, $p = 0.001$). suggesting that increasing productivity improved profit margin. This corresponded to previous studies that identified productivity as a key determinant of farm income (Liu et al, 2021; FAO, 2019).

The market price showed a positive and marginally significant effect ($\beta = 0.897$, $p = 0.055$) on net margin / kg, indicating that net margins are impacted by market margins and by price fluctuations, but are largely attributed to market volatility. These findings are consistent with studies that identified a positive relationship between stable and profitable market access and producer profits (Hill et al, 2021; Zhang et al, 2022).

The production cost had a significantly negative effect ($\beta = -0.506$, $p = 0.013$) on net margin / kg, demonstrating that with higher production costs net margins are compromised. This was consistent with most studies pointing to input price pressures as a significant barrier to smallholder profitability (Idisi et al, 2025; Chiareka et al, 2023).

Both access to market (β = 0.442, p = 0.001) and labor availability (β = 0.467, p = 0.02) were positive and significant, stressing the role of market and labor resources in revenue generation. This was consistent with studies that demonstrated a positive relationship between reduced transaction costs, reliable labor, and improved profitability of farms (Chigeto and Haile, 2020; Rola-Rubzen, 2006).

Post-harvest losses and quality had a large, significant negative impact (β = −0.648, p = 0.006) on net margin per kg, indicating that losses and poor quality substantially eroded margins. This was a well-documented problem in perishable horticulture that policy and investment in cold chains and handling could address (Antunnes et al, 2022; Urugo et al, 2024).

The model's R-square value 0.68 (68%), indicated strong explanatory power. This implied that 68% of the NPM have been explained by Yield, Price, input cost, Market Price, Water irrigation, Post-harvest loss and Labour availability as shown in equation 2.

$$NPM = \beta 0 + 0.587\ Yield + 0.897\ Price - 0.506\ Input\ cost + 0.442\ Market\ Access + 0.332\ Water\ irrigation + 0.467 Post\ Harvest\ loss - 0.648\ Labour + e \ldots\ldots\ldots\ldots (2)$$

Overall, the results suggest policy priorities such as raising yields through extension and inputs, stabilizing and improving market access and prices, reducing input cost burdens, and investing in post-harvest handling to secure substantial gains in cucumber profitability (Balah and Che, 2023; Shaibu, 2022).

**Table 4.0: Factors influencing net profit margin of Cucumber in Ughelli LGA**

| Variable | Coefficient | t-value | SE | P-value |
|---|---|---|---|---|
| Constant | 2421.742 | 7.362 | 328.98 | .0001*** |
| Yield per hectare (X1) | 0.587 | 6.990 | 0.084 | .001*** |
| Market price (X2) | 0.897 | 1.930 | 0.465 | .055* |
| Input cost (X3) | -0.506 | -2.490 | 0.203 | .013** |
| Acces to market (X4) | 0.442 | 6.597 | 0.067 | .001*** |
| Water and irrigation management (X5) | 0.332 | 0.290 | 1.137 | .770 |
| Labour availability | 0.467 | 2.344 | 0.199 | .02** |
| Post harvest loses and Quality (X6) | -0.648 | -2.77 | 0.234 | .006** |

$R^2 = 0.68$
Adjusted $R^2 = 0.67$
F-Value= 13.33
@1% (P≤0.001)
@ 5% (P≤0.05)
@10% (P≤0.1)

n =300

**4.5 Constraints to Cucumber Production in the study area.**

The constraints were ranked using average means and top-box percentages. The top constraint was limited technical knowledge, which had an average mean of 3.81 and 69% of the respondents ranking this as a top-box constraint. This indicated most growers do not have knowledge on contemporary agronomic practices, record keeping, post-harvest handling, and other associated skills. This shortage of knowledge correlated with previous analyses that pointed out the need for increased farmer extension and training, to reduce the yield and profit gap for perishable products in vegetable value chains (Izuogu et al, 2024).

Furthermore, limited value-adding opportunities also scored highly, with an average mean of 3.78, whereby 67% of the respondents ranked this as a top-box constraint. This showed producers' inability to seize the margins that lie within processing, packaging, and coordinated market streams, which is a typical construct within vegetable value chains. These were notable highlights in several research studies on ways to improve cucumber sales (Wahab et al, 2025; Abate et al, 2023).

The score of 3.49 for the third constraint, limited access to finance, indicated another major limitation, also ranked as a top constraint by 55% of respondents. This which likely restricted the purchase of inputs, hiring of labor, and investment in storage and/or processing equipment constituted constriction to the commercialization of small-scale producers of vegetables. Well-documented literature have pointed this variable as key to smallholder vegetable producers (Bedru and Motunrayo, 2022; Mmari & Kapaya, 2022).

The constraint relating to post-harvest losses ranked fourth, with a mean score of 3.55 and 56% of respondents categorizing it as a top-box constraint. Cucumber is a highly perishable produce and the losses occurring from harvest to the market erode net profit margins. According to Yahaya (2019) and Ibironke et al. (2019), this could necessitate cold chain, improved packaging, and market timing interventions.

A mean score of 2.93 and 35% of respondents citing it as a top-box constraint indicated that substandard infrastructure of all types, including roads, marketplaces, and electricity, was a significant obstacle. Deficient transport and market facilities in rural areas heighten transaction costs and spoilage. This, Tevin-Anyali et al (2024 and Ifoghere (2019) concluded could impede farmer market access and the sale of their products.

Other respondents cited lack of access to improved varieties as a less significant constraint, with a mean score of 2.67 and 29% of respondents classifying it as a top-box constraint; and for pest and disease control with a mean score of 2.53 and 24% classifying it as a top-box constraint. Although these constraints are less apparent, attention, especially in the area of climate change and the demand for sustainable farming, was required (Olarenwaju et al, 2025; Zhang 2018).

The results as a whole indicated that, with respect to the constraints to cucumber production, there was

need for an integrated suite of training, financing, basic value addition, and infrastructure improvements, rather than a sole technical solution (Kakamba et al, 2025; Henderson and Lankoski, 2023).

**Table 6.0 : Constraints to cucumber Net profit margin in Ughelli North Local Government Area**

| Constraints | Strongly agree | Agree | Undecided | Disagree | Strongly disagree | Mean | Top box % | Ranking |
|---|---|---|---|---|---|---|---|---|
| Post harvest losses | 58 (19%) | 107 (36%) | 75 (25%) | 45 (15%) | 15 (5%) | 3.49 | 55 | 4TH |
| Limited access to improve variety | 22 (7%) | 66 (22%) | 75 (25%) | 65 (22%) | 72 (24%) | 2.67 | 29 | 6TH |
| Limited access to finance | 62 (20%) | 106 (36%) | 84 (28%) | 30 (10%) | 18 (6%) | 3.55 | 56 | 3RD |
| Limited value added opportunities | 88 (29%) | 113 (38%) | 60 (20%) | 24 (8%) | 15 (5%) | 3.78 | 67 | 2ND |
| Poor infrastructure | 43 (14%) | 62 (19%) | 75 (25%) | 70 (23%) | 50 (17%) | 2.93 | 35 | 5TH |
| Limited technical knowledge | 91 (30%) | 116 (39%) | 54 (18%) | 24 (8%) | 15 (5%) | 3.81 | 69 | 1ST |
| Pest and disease management | 10 (3%) | 62 (21%) | 78 (26%) | 78 (26%) | 72 (24%) | 2.53 | 24 | 7TH |

Source: Survey data, 2025

## CONCLUSION

Smallholder farmers have the potential to earn income from cucumber farming but some structure concerning the cucumber farming system should be developed to assist farmers in earning this income. To achieve profitability in cucumber farming, there should be an increase in the productivity, the value addition, and the accessibility to the market. More value with less currency committedt in farming cucumber may be owed to the more successful extension, the more affordable financial services, the positively collective marketed, the enhanced and improved transported, and the more value obtained from the more modern cucumber farming. There should also be encouragement to the development partners and policy makers to prioritize more modern and subsidized farming methods.

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