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Effect of Integrated Nutrient Management on Household Resilience in Nigeria

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Abstract

Integrated Nutrient Management (INM) is increasingly recognized as a viable approach for enhancing the resilience of farm households against shocks and stresses, particularly smallholders who dominate Nigeria's agricultural sector. This study examines the effect of INM adoption on household resilience in Nigeria, using panel data from the General Household Survey (2015/2016 and 2018/2019). The data analysis employed a combination of descriptive statistics, Resilience Index Measurement Analysis (RIMA II), Principal Component Analysis (PCA), and a Panel Fixed Effects Model. Findings reveal persistently low INM adoption rates, rising marginally from 17.2 % in 2015/2016 to 17.8 % in 2018/2019. The exclusive use of organic fertilizers declined from 11.3% to 7.5%, while inorganic-only use decreased from 28.5% to 24.2%. Similarly, the household resilience capacity remained generally low, decreasing from 0.36 in 2015/2016 to 0.27 in 2017/2018. Regression results show that INM adoption has a statistically significant positive effect on household resilience, with each unit increase in adoption improving resilience by 8.5 %. These findings underscore the need for targeted policies to increase farmers' awareness of INM practices, strengthen extension services, and provide practical support for implementing sustainable practices. Embedding INM into broader agricultural policies and programmes in Nigeria is critical for building household resilience and ensuring sustainable food production.

Keywords: INM, resilience, Fertilizer use, sustainable agriculture, Nigeria

JEL Classification

Q18, Q54, O13

Introduction

Agricultural households in Nigeria face a wide range of shocks, including erratic weather patterns, declining soil fertility, and market fluctuations, all of which undermine their resilience and long-term productivity. Enhancing the ability of farming households to adapt to change, manage risks, and sustain livelihood amid challenges is vital for the resilience and sustainability of Nigeria's agricultural systems. Integrated Nutrient Management (INM) is increasingly recognized as an effective approach for addressing these challenges. INM combines organic, inorganic, and biological fertilizers, often complemented by soil management practices like mulching and crop rotation, to optimize nutrient availability and crop uptake (Paramesh et al 2023). By improving soil fertility, enhancing crop yields, and ensuring sustainable use of inputs, INM strengthens households' resilience to shocks (Stratton et al, 2020; Pinjari et al., 2009).

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Beyond productivity gains, INM also contributes to resilience by diversifying income sources, improving nutrition, and supporting climate adaptation (Gezahegn, 2021; Pinhari et al., 2009).

Given the multiple stressors facing the sector, understanding how sustainable agricultural practices such as INM influence household resilience is crucial for developing effective policy interventions. The study therefore examines the nexus between INM adoption and household resilience in Nigeria.

Material and Methods

The study primarily relied on secondary data sourced from the General Household Survey (GHS) Panel for 2015/2016 and 2018/2019. Statistical and econometric techniques were employed to address the study objectives. Descriptive statistics, including means, frequencies, and percentages, were used to assess the level of adoption of INM practices among the households. Household resilience to shocks and stresses in Nigeria was measured using the Resilience Index Measurement Analysis (RIMA II) framework. RIMA-II is structured around four main pillars: Adaptive Capacity, Assets, Access to basic services and social safety nets. In the context of this study, Access to Basic Services and Social Safety Nets were combined as a single dimension referred to as transformative capacity. Finally, a fixed effects panel data model was applied to examine the effect of INM adoption on the resilience of agricultural households.

Results and Discussion

4.2.2 Assessing Household Resilience Capacity

The distribution of household resilience capacity is shown in Figure 1. The data presented for 2015/2016 and 2017/2018 reveal notable changes in the different components of household resilience. While adaptive capacity and asset dimensions improved over time, the transformative capacity declined significantly. Overall, Total Resilience Capacity decreased from 0.36 in 2015/2016 to 0.27 in 2017/2018, driven largely by the sharp drop in transformative capacity. Besides the reduction in the resilience capacity of households, resilience levels remain generally low, depicting a reduced ability of households to recover from shocks and stresses. This pattern is particularly concerning for agricultural households in Nigeria, where reliance on rain-fed farming increases vulnerability to climate variability and economic shocks. Within this context, INM emerges as a valuable strategy for improving the resilience of farming households, particularly smallholders given its role in diversifying income sources, improving household nutrition, and fostering climate adaptability (Gezahegn, 2021; Pinhari et al., 2009).

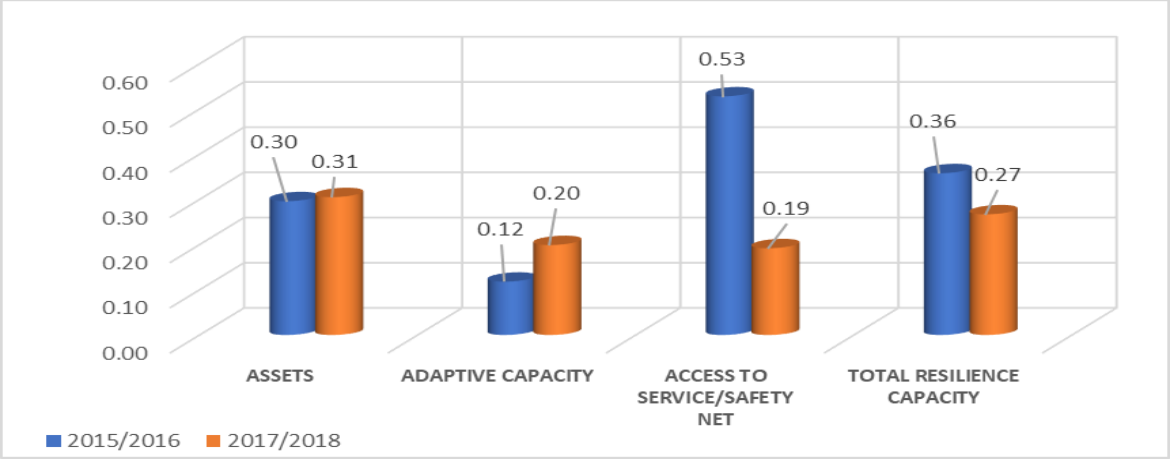

Figure 1: Decomposition of Households' Resilience by its Dimensions

Adoption of Integrated Nutrient Management Practices

Although INM is increasingly recognized as a sustainable approach to ensure long-term food production, its adoption rate in Nigeria remains low. Data presented in Figure 2 indicates that only 17.2% of farmers adopted INM practices in 2015/2016, with a modest increase to 17.8% in 2018/2019. While this growth is measurable, the slow rate of adoption raises concerns, especially given the mounting challenges of soil degradation, vulnerability to shocks, and the urgent need for sustainable agricultural practices in Nigeria. Without broader uptake of INM, efforts to secure long-term food production and strengthen household resilience may be undermined (Umesha et al., 2018; Gezahegn, 2021). Figure 2 also shows a decline in the exclusive use of both organic and inorganic fertilizers, while more than half of farmers reported using no fertilizers at all. This trend threatens food security and agricultural productivity, as farming without nutrient supplementation risks lower yields and deteriorating soil health over time.

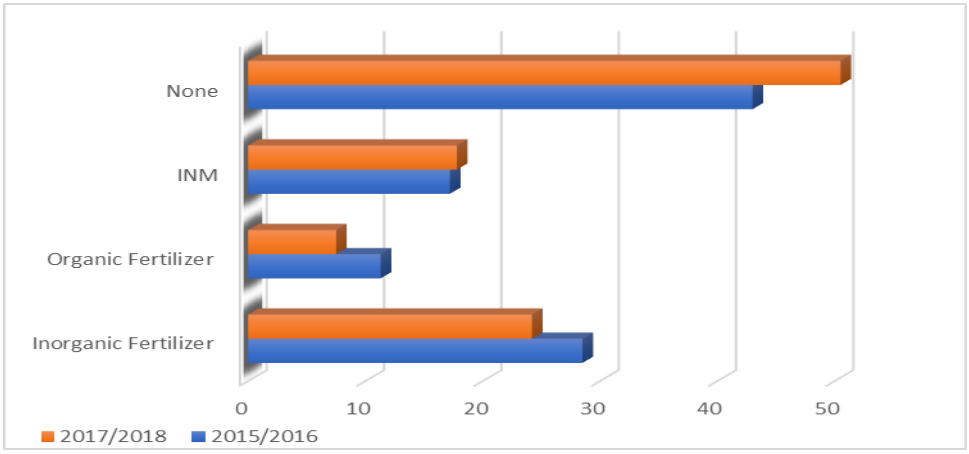

Figure 2: Distribution of Farmers by INM Adoption

4.4 Effect of INM Adoption on Household Resilience

The analysis in Table 1 presents the estimation results of the effect of INM adoption on household resilience using a fixed effect panel model. The results show that INM adoption has a positive and statistically significant effect on household resilience. Specifically, a unit increase in adoption is associated with 8.9% improvement in household resilience. This finding suggests that households that adopt INM practices exhibit enhanced resilience, allowing them to better cope with climatic, production, or economic shocks. By increasing soil fertility, improving crop yields, and reducing greenhouse gas emissions, INM strengthens household resilience to various shocks (Paramesh et al., 2023). As households adapt to changing environmental conditions, such resilience is vital for maintaining food security and sustaining livelihoods.

Table 1: Effect of INM Adoption on Household Resilience[2]

Variables		
Independent Variable **(Resilience)**	Coefficient	Robust Standard Error
Age of Household Head	-0.001	0.003
Years of Education	-0.002	0.002
Total Expenditure	0.008	5.7E-07
INM adoption	0.089**	0.047
Non-farm income	0.058***	0.019
Climate impact	0.060**	0.023
Wave	-0.0801***	0.017
Constant	0.679	0.172

Conclusions and Outlook

The study highlights limited adoption of INM practices among farming households in Nigeria, with only marginal growth from 17.2% in 2015/2016 to 17.8% in 2018/2019. The slow uptake is concerning given the challenges of soil degradation, food insecurity and climate vulnerabilities. The findings also show that household resilience remains generally low, depicting limited ability to recover from shocks and stresses. Nonetheless, the regression results reveal that INM adoption contributes positively to improving household resilience.

Looking ahead, strengthening household resilience will depend on how effectively existing and future interventions can scale up sustainable practices like INM. Broader adoption of INM has the potential to optimize nutrient availability and uptake by crops, increase productivity and enhance farmers' ability to withstand shocks. Thus, policies should be targeted at increasing farmers' awareness of INM and integrating the practice into broader climate-smart agricultural strategies to ensure resilient farming systems that can sustain long-term food production even in the face of economic and environmental challenges.

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[2] Full details on control variables and diagnostic tests are available from the author upon request