IMPACT ASSESSMENT OF NIRSAL ON SMALL-SCALE RICE FARMERS INCOME IN SELECTED LOCAL GOVERNMENT AREAS OF NASARAWA STATE, NIGERIA

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DOI No. 10.528 / zenodo 10558777

Abstract

The study aimed at the impact of the Nigeria Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL) on small-scale rice farmers income in selected LGAs of Nasarawa State, Nigeria. The specific objectives were to estimate the profitability of rice farmers, assess the effect of NIRSAL on farmers income, and assess the socio-economic factors influencing the income. A multi-stage sampling procedure was employed for the selection of 177 rice farmers. Primary data were collected with the aid of a well-structured questionnaire and analyzed with the budgeting technique, farmers household income exchange, and quantile regression analysis. The finding shows that rice production is a profitable venture in Nasarawa State, with beneficiaries and non-beneficiaries making a net farm income of ₦2,805,769.64 and ₦1,845,974.71, respectively, per hectare. The result of the Farmer Household Income Exchange value showed a 39% increase in income of beneficiaries. Quantile regression results revealed that at the 25th quantile, the coefficient of household size was positive and significant at a 1% level for non-beneficiaries, while educational level was positive and significant at 10% for beneficiaries. At the 50th quantile, the coefficient of farming experience and farm size was positive and significant at 1% and 10%, respectively, for non-beneficiaries. At the 75th quantile, membership of the cooperative society had a positive coefficient and was significant at 10% for beneficiaries, whereas farming experience had a positive coefficient and was significant at 1%. The study recommended that government at all levels should replicate similar intervention initiatives for greater impact since the NIRSAL scheme was found to be impactful.

Keywords: *NIRSAL, farmers, income, beneficiaries, non-beneficiaries*

INTRODUCTION

Nigeria's agricultural sector holds immense potential for driving Nigeria's economy. The sector is contributing around 24-29% to the nation's Gross Domestic Product and supporting the livelihoods of millions of small-scale farmers (National Bureau of Statistics (NBS), 2024). These farmers cultivate many staple food crops, but rice is the most important staple food crop in Nigerian diets (Awotide *et al.,* 2015 and Rukwe *et al.,* 2023). It is a crop that is highly important in the attainment of national food security and livelihood for millions of Nigerians and for the eradication of rural poverty and overall economic growth. Yet, rice farmers have long grappled with chronic underinvestment, high risk, limited access to finance, high production costs, and

low productivity, which perpetuate low income and food crises and inhibit growth (Ademiluyi *et al.,* 2021). This is because rural finance policies implemented by Nigeria some decades ago have not yielded the desired impact on the well-being, farmers access to credit, and productivity of small-scale farmers. These factors, coupled with the use of low external inputs, have been responsible for the low rice productivity in Nigeria, which has brought about the importation of produce to the country either legally or illegally (Ositanwosu and Qiquan, 2016).

In response, successive Nigerian governments have tried to avert any risk that could lead to inaccessibility to finance, low rice productivity, and low farmers income by establishing the Nigeria Incentive-Based Risk Sharing System for Agricultural Lending (NIRSAL) through the Central Bank of Nigeria (CBN) in 2011 to facilitate increased lending to the agricultural sector by reducing risks for financiers. NIRSAL offers a suite of tools, including Credit Risk Guarantees (CRG), Technical Assistance Facility (TAF), insurance products, and the Agro Geo-Cooperative model to support smallholder farmers (NIRSAL, 2020). Specifically for rice farmers, NIRSAL has played a strategic role in facilitating access to affordable credit through partnerships like the Anchor Borrowers' Programme (ABP). In Kebbi State, for example, over ₦3.3 billion was disbursed to more than 31,800 rice farmers, enabling them to purchase improved inputs and mechanize operations. These interventions have been linked to increased yields, market access, and, in some cases, significantly higher income for beneficiaries (Ecofin Agency, 2020). Moreover, NIRSAL's Agro Geo-Cooperative model, which aggregates smallholder farms into structured clusters, has improved economies of scale and strengthened market linkages. In Edo State, NIRSAL-backed rice projects reportedly doubled farmers' revenue through better land management, mechanization, and coordinated off-take arrangements (NIRSAL, 2020).

Despite these apparent successes, the overall effect of NIRSAL on rice farmers' income remains an area of inquiry due to varying outcomes across states, challenges in fund disbursement, and socio-political constraints. The aforementioned background necessitates this study. The specific objectives were to:

I. estimate the costs and returns of rice production by NIRSAL beneficiaries and non-beneficiaries in Nasarawa State;
ii. assess the influence of the NIRSAL scheme on the income of beneficiaries compared to non-beneficiary smallholder rice farmers and
iii. Examine the socio-economic determinants affecting the income of NIRSAL beneficiaries and non-beneficiaries.

METHODOLOGY

Study Area

The study was conducted in selected LGAs in Nasarawa State. The state is one of the North Central States in Nigeria. The state has 13 local government areas, namely Akwanga, Awe, Doma, Karu, Keana, Kokona, Lafia, Nasarawa, Nasarawa Eggon, Obi, Toto, Wamba, and Keffi, with its headquarters in Lafia. The people of Nasarawa state include, among others, the Gwandara, Alago, Eggon, Gbagi, Egbira, Migili, Kantana, Fulani, Hausa, Tiv, Afo, Gade, Nyankpa, Koro, Jukun, Mada, Ninzam, Buh, Basa, Agatu, Arum, Kulere, and also settler groups like the Igbo, Yoruba, and Hausa. The state lies in the Guinea Savannah region between Latitudes 7°N and 9°N and Longitudes 7°E and 10°E '(Rahman *et al.,* 2013) and shares a boundary with the Federal Capital Territory (FCT) to the northwest; Kaduna and Plateau states to the northeast; Benue state to the south; Kogi State to the west;

and Taraba State to the southeast (Salau and Attah, 2012). The state has a total land area of 27,137.8 square kilometers. The National Bureau of Statistics (NBS) (2021) report indicated that Nasarawa State's population was 2,712,349 in 2020. Nasarawa State is predominantly an agricultural catchment area, with an estimated 75% of her population engaged in rain-fed subsistence farming. Nasarawa State experiences both dry and rainy seasons during the year; its climate is characterized as tropical sub-humid, according to Koppen's classification. The dry season lasts from November to February; between the months of March and April, the temperature becomes very high; the rainy season lasts for seven months (April to October) with an average annual rainfall of about 226 mm. Crops grown in the state include cereals like rice, sorghum, and millet, which are produced in abundance; roots and tubers like yams, cassava, potatoes, and sweet potatoes; and oil seeds like pigeon peas, sesame seeds, and groundnuts, while tree crops include citrus, mangoes, oil palm, guava, cashew, and sugarcane.

Sampling Technique and Sample Size

This study used a multistage sampling procedure. In the first step, Awe, Doma, Nasarawa Egon, Akwanga, and Lafia were purposively selected based on the high level of involvement in rice production activities across the rice value chain and based on the presence of NIRSAL in the study area. In the second stage, two (2) farming communities were purposively selected from the five local government areas based on their prominence in rice production, making a total of ten (10) communities. In the final stage, 177 rice farmers were randomly selected at 5% proportionate based on the farmers list obtained from the Nasarawa Agricultural Development Programme (NADP).

Method of Data Collection

Cross-section data was collected from farmers with the use of well-structured questionnaires for this study. 177 questionnaires were administered, out of which 165 were properly filled and retrieved. Data analysis was done based on the number retrieved.

Method of Data Analysis

Budgeting technique, Farmers' Household Income Exchange (FHIE), and quantile regression analysis were deployed for data analysis in this study.

Budgeting Technique

This was used to estimate the profitability of rice production in the study area. Farm budgeting enables the estimation of the total expenses as well as total revenue within a production period (Olukosi and Erhabor, 1988). Its usefulness and simplicity help to highlight the relationship between costs and returns of agricultural projects as compared to other complex and sophisticated techniques such as linear programming and multi-period budgeting (Tigner, 2018).

Model specifications

Net farm income analysis is a budgeting tool used in evaluating the costs and returns in rice farming.

Net farm income is expressed as follows:

NI = TR – TC……...(1)

Where;

NFI = Net farm Income (Naira),

TC = Total Revenue (Naira), and

TR = Total Cost (Naira).

In order to evaluate the strength and financial position of the NIRSAL beneficiaries and non-beneficiaries, rates of return on investment and gross and operating ratios were considered.
The rate of returns on investment in a rice farm, which is a measure of financial success or failure of investment, can be estimated using the formula:

$$Average\ rate\ of\ returns\ on\ investment\ (ARRI) = \frac{Total\ Revenue}{Total\ Costs} \quad (3)$$

$$\text{Gross Ratio} = \frac{Total\ Revenue}{Total\ Cost} \quad (4)$$

Gross ratio shows the profitability or otherwise of a farm by comparing its total revenue to total costs. A higher ratio, greater than 1, indicates profitability of the enterprise, while a lower ratio, less than 1, shows that the enterprise is not profitable.
An Operating Ratio (OR), according to Olukosi and Erhabor (2005), is the total variable costs divided by the total revenue, as shown in equation (5).

$$\text{Operating Ratio} = \frac{Total\ variable\ cost}{Total\ Revenue} \quad (5)$$

Operating ratio shows the efficiency of a farm's management by comparing the total operating expense of a farm to net sales. The operating ratio shows how efficient a farm's management is at keeping costs low while generating revenue or sales. The smaller the ratio, the more efficient the company is at generating revenue versus total expenses. An operating ratio of less than 1 therefore indicates that the farmer is efficient in managing costs, while an operating ratio of 1 or greater than 1 indicates inefficiency in cost management.

Farmer Household Income Exchange

Following Kuswanto (2019), farmers' household income exchange (FHIE) was used to analyze the influence of NIRSAL on the income of rice farmers. This was done by comparing the total income received by the farmers with the total household expenditure. An FHIE>1 shows that the farm households' incomes are sufficient to cover their expenditure and even save to reinvest. However, if FHIE is less than 1, it shows that the farm households are not able to cover their expenditures. Thus, farmers with FHIE > 1 are more likely to meet their consumption and business needs.

The formula for FHIE is presented in the equation as:

$$FHIE = \frac{Y}{E}$$

Where;

FHIE = Farmer Household Income Exchange,

Y = Total Income, and

E = Total Expenditure.

Rice farmers' revenue is derived from rice cultivation as well as other farming and non-farming activities. Mathematically the income is formulated as seen in equation (7).

$$Y = Y_{sf} + Y_{of} + Y_{nfa} \quad 7$$

Where;

Y = Farmers Income,

Y_{sf} = Income from Rice Farming,

Y_{of} = Income from other Agric businesses, and

Y_{nfa} = Income from non-farm activities.

According to Kuswanto (2019), a farmer' household spending comprises production expenditures (such as seed, fertilizers, land rent, and agrochemicals) as well as extra capital and household consumption (food, processed food, housing, clothing, health, education, recreation, sports, and others). Agricultural expenditure, non-agricultural expenditure, and home consumption expenditure are the three types of spending that farmers incur.

Mathematically the expenditure is formulated as seen in equation (8).

$$E = E_{sf} + E_{of} + E_{nfa} \quad 8$$

Where;

E = Farmers expenditure,

E_{sf} = Expenditure on Rice Farming Businesses,

E_{of} = Expenditure on other Farming Businesses, and

E_{nfa} = Expenditure on non-Farming activities.

Quantile Regression Analysis

A multiple linear regression was used as a piece of baseline information, and quantile regression was employed to determine and analyze socio-economic factors influencing the income of rice farmers. Farmers income was used as a proxy for welfare because it has a direct correlation with welfare and also because data on it is simple and readily available. In quantile regression, conditional 25th (low income), 50th (middle income), and 75th (high income) quantiles for income were approximated with respect to the independent variables. The basic quantile regression model is specified as a linear function of explanatory variables. The model is stated explicitly as:

$$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \mu_i \quad 9$$

Where,

Y_i^* = Income of Rice Farmers (in naira),

i = Number of Independent Variables,

β_0 = Constant Term,

$\beta_1 - \beta_4$ = Regression coefficients,

X_1 = Households Size (Total Number of Persons),

X_2 = Age of the Farmers (Years),

X_3 = Level of Education (in Years),

X_4 = Membership of Cooperative Society (yes = 1, no = 0)

X_5 = Farming experience (Years),

X_6 = Farm size (hectares)

Ui = Error Term.

RESULTS AND DISCUSSION

Costs and Return of Rice Production among NIRSAL Beneficiaries and non-Beneficiaries in Nasarawa State, Nigeria

The costs incurred on various resources used and the benefits (profit) received from the sales of the products were estimated based on the market price at the period under consideration (2023 farming season) and are presented in Table 1. The total revenue for beneficiaries and non-beneficiaries was estimated to be ₦3,248,405.11 and ₦2,227,484.77, respectively. Beneficiaries earned higher revenue (₦3,248,405.11) than non-beneficiaries (₦2,227,484.77), suggesting that NIRSAL beneficiaries had better performance in terms of revenue generation. The total variable costs for NIRSAL beneficiaries and non-beneficiaries were estimated to be ₦351,249.87 and ₦310,979.10, respectively. The fixed costs for beneficiaries and non-beneficiaries were estimated to be ₦91,385.60 and ₦70,530.95, respectively. The gross margin for beneficiaries and non-beneficiaries was estimated to be ₦2,897,155.24 and ₦1,916,505.66, respectively. Beneficiaries achieved a significantly higher gross margin (₦2,897,155.24) than the non-beneficiaries (₦1,916,505.66). This indicates beneficiaries' ability to generate more returns after covering variable costs. Beneficiaries and non-beneficiaries made a net farm income of ₦2,805,769.64 and ₦1,845,974.71, respectively, per hectare of rice production in the study area. Beneficiaries' net income (₦2,805,769.64) was higher than that of non-beneficiaries (₦1,845,974.71). This result also showed beneficiaries earned more after accounting for all costs. The net farm income difference between beneficiaries and non-beneficiary rice farmers was ₦959,794.93, representing a 34% increase or difference in their profits. This suggests that rice production by the NIRSAL beneficiaries was more profitable than that by non-beneficiaries, thus also suggesting that NIRSAL has a positive impact on the income of the beneficiaries. The gross margin ratio for beneficiaries and non-beneficiaries was 89% and 86%, respectively, indicating that rice production in the study area was profitable for both farmer groups; however, that for beneficiaries was higher. This implied that for every one Naira generated from sales by smallholder beneficiaries and non-beneficiaries, 89.00 kobo and 86.00 kobo were realized as gross profit, respectively. The higher ratio for beneficiaries indicates that beneficiaries are more efficient in converting cost or resources into gross margin or profit. The study also used other financial analyses like return on investment (ROI) and operating ratio (OR) to further reveal the profitability or otherwise of rice farmers in the study area. The return on investment (ROI) for beneficiaries and non-beneficiaries was 6.34 and 4.84, respectively. This indicates that for every ₦1 invested, there is a return of ₦6.3 and ₦4.8 to beneficiaries and non-beneficiaries, respectively.

The ROI of the beneficiary farmer group (6.34) was higher than that of the non-beneficiary group (4.84), indicating higher profitability by the beneficiaries. The operating ratios for beneficiaries and non-beneficiaries were 0.14 and 0.17, respectively. The operating ratios for both farmer groups were less than one, implying that both groups were able to keep their expenses below their revenue. The operating ratio of beneficiaries (0.14) was lower than that of the non-beneficiaries (0.17), indicating higher profitability for the beneficiaries as the farm business generates more revenue relative to expenses. The higher profitability could be attributed to their relationship with NIRSAL. These findings are in line with Agbonika *et al*. (2020), who posited that rice production was a profitable enterprise in Nasarawa State and FCT Abuja.

Table 1: Gross Margin Analysis of NIRSAL Beneficiaries and Non -beneficiaries Rice Farmers in Nasarawa State.

	Beneficiaries (₦)	**Non-Beneficiaries (₦)**
Revenue		
Quantity Harvested (100Kg Bags)	51.56	35.36
Price per 100Kg Bag	63,000	63,000
Total Revenue (A)	3,248,405.11	2,227,484.77
Inputs		
Seed Cost (Kg)	20,188.67	19,729.68
Fertilizer Cost (Kg)	156,698.67	152,103.88
Agro-Chemical cost (Kg)	40,022.89	36,952.97
Input Cost	216,910.22	208,786.53
Hired Labour		
Total Hired Labour Cost	69,104.00	56,639.27
Family labour		
Total Family labour Cost	30,455.11	27,286.53
Total Labour Cost	99,559.11	83,925.80
Transportation	22,977.61	12,979.93
Loading/Off	9,756.27	3,966.30
Total Fee and Commission	2,046.67	1,320.55
Total Variable Cost (B)	351,249.87	310,979.10
Fixed Cost		
Land Cost	27,528.89	25,216.89
Depreciation on Asset		
Water Pump	6,914.11	7,273.06
Sprayers	11,704.73	8,523.24
Hoe	988.78	625.84
Cutlass	970.20	1,835.59
Power Tiler	43,278.89	27,056.32
Total Depreciation Cost	63,856.71	45,314.06
Total Fixed Cost (C)	91,385.60	70,530.95
Total Cost (D)	442,635.47	381,510.06
Gross Margin (E=A-B)	2,897,155.24	1,916,505.66
Net Farm Income (F=A-D)	2,805,769.64	1,845,974.71
Gross Margin Ratio (E/A)	89%	86%
Return on investment (H=F/D)	6.34	4.84
Operating ratio (I =D/A)	13.6%	17.1%
% Change in NFI		34%

Source: Field survey (2024)

Effect of NIRSAL Credit Facilities on the Income of Rice Farmers in Nasarawa State

The effect of NIRSAL credit facilities on rice farmers welfare status is presented in Table 2. The total income of the NIRSAL beneficiaries and non-beneficiaries was ₦4,695,267.72 and ₦3,135,054.46, respectively. The table also revealed farmers household income exchange (FHIE) of 1.70 and 1.03 for NIRSAL beneficiaries and non-beneficiaries, respectively. The FHIE for both beneficiary and non-beneficiary farmer groups was above 1, implying that both farmer groups were able to cover their expenses. However, the FHIE of beneficiaries (1.70) is higher than that of non-beneficiaries (1.03), implying that the economic well-being of the beneficiary farmers received greater enhancement. The result also revealed a 39% increase in the welfare of beneficiaries, which may be attributed to the impact of the NIRSAL credit, suggesting that the NIRSAL credit facilities improved the welfare of beneficiary farmers in the study area. This is in line with the findings of Balogun *et al.* (2021) and Akinwale (2021), who posited that programs designed to provide credit to farmers helped improve their welfare in Nigeria.

Table 2: Effect of NIRSAL on income of Rice Farmers in Nasarawa (Non-Beneficiaries and Beneficiaries)

Items	Beneficiaries	Non-Beneficiaries
Income from Rice Farming Business	2,805,769.64	1,845,974.71
Income from Other Agric Businesses	1,720,473.68	1,144,200.00
Income from non-farming activities	169,024.39	144,879.75
Expenditure on Rice Farming Business	442635.47	381,510.06
Expenditure on other Agric Businesses	1,139,975.61	1,531,016.67
Expenditure on non-farm activities	1,183,617.89	1,128,416.67
Total Income	**4,695,267.72**	**3,135,054.46**
Total Expenditure	**2,766,228.97**	**3,040,943.39**
Farmer Household Income Exchange	**1.70**	**1.03**
% Change in income	**39%**	

Source: Field survey (2024)

Factors Influencing the Income of Rice Farmers in Nasarawa State

The result of quantile regression analysis of factors influencing the income of rice farmers for beneficiaries and non-beneficiaries of NIRSAL credit facilities in Nasarawa State is presented in Table 3. Quantile regression analysis helps to examine or analyze the relationship between variables at different points. For this study it showed the factors affecting income, which is used as a proxy for welfare, at the 25th, 50th, and 75th quantiles of the rice farmers in the study.

From the results of the 25th quantile, household

size had a positive coefficient and was significant at a 1% probability level (P<0.01) for non-beneficiaries. This means that adding one person to a household increases income and eventually welfare by 0.059 units for beneficiaries. Level of education had a positive coefficient and was significant (P<0.1) for beneficiaries. This suggests that a unit increase in level of education led to about a 0.098 unit increase in income of beneficiary rice farmers in the study area. This suggests that as the educational level of the beneficiary farmers increases, their income status is enhanced, possibly because their ability to read and understand innovation and agricultural teachings for possible adoption is increased.

From the results of the 50th quantile, farming experience had positive coefficients and was significant (P<0.05) for beneficiaries. This suggests that a unit increase in experience led to about a 0.011 unit increase in income for beneficiaries. This result suggests that as the farmers get more experience, their income status and eventually welfare improve, possibly because of profit they would have made over the years. This result opposed the finding of Jarita and Nur (2020), who found that at the 50th quantile of household size and age, microfinance women participants contribute negatively and significantly to per capita income at a 10% significance level.

Farm size had positive coefficients and was significant (P<0.01) for beneficiaries. This suggests that a unit increase in experience led to about a 1.077 unit increase in welfare for beneficiaries. This suggests that as the farmers get more land area, their income status and eventually welfare improve, possibly because of profit they would have made over the years.

At the 75th quantile, the coefficient of membership of the cooperative society and farming experience had a positive coefficient and was significant at 10% and 1% for beneficiaries and nonbeneficiaries, respectively. This result suggests that a unit increase in membership of the cooperative society led to about a 1.005 unit increase in income of beneficiary rice farmers in the study area. This suggests that membership in a cooperative society helped to improve the income status of farmers. This might be because cooperative societies are able to access credit and support from NIRSAL and other agricultural agencies more easily than non-members of cooperative societies.

Table 3 : Factors Influencing Income of NIRSAL Beneficiaries and Non -Beneficiary Rice Farmers in Nasarawa State

		Non-Beneficiaries			Beneficiaries		
	Factors	Coef.	Standard Error	t-value	Coef.	Standard Error	t-value
25%	Household Size	0.059***	0.010	5.900	0.033	0.024	1.360
	Age of the Farmer	-0.001	0.005	-0.160	0.007	0.010	0.630
	Level of Educational	-0.012	0.056	-0.210	0.098*	0.058	1.710
	Member of Cooperative Society	-0.104	0.144	-0.720	0.167	0.416	0.400
	Farming Experience	-0.009	0.006	-1.440	-0.009	0.011	-0.770
	Farm Size	1.077***	0.406	2.650	-0.089	0.856	-0.100
	Constant	0.049***	0.009	5.400	0.039**	0.015	2.600
50%	Household Size	0.003	0.003	0.820	0.000	0.011	-0.010
	Age of the Farmer	-0.011	0.044	-0.250	-0.010	0.076	-0.130
	Level of Educational	-0.079	0.112	-0.710	-0.092	0.332	-0.280
	Member of Cooperative Society	-0.009	0.007	-1.250	0.000	0.008	0.000
	Farming Experience	0.971***	0.345	2.820	1.076	0.788	1.370
	Farm Size	0.036*	0.019	1.870	0.010	0.018	0.550
	Constant	-0.001	0.005	-0.120	0.005	0.010	0.510
75%	Household Size	0.073	0.062	1.170	0.023	0.024	0.960
	Age of the Farmer	-0.017	0.180	-0.100	-0.144	0.234	-0.620
	Level of Educational	0.010	0.009	1.110	0.004	0.008	0.470
	Member of Cooperative Society	0.579	0.452	1.280	1.005*	0.592	1.700
	Farming Experience	0.059***	0.010	5.650	0.033	0.024	1.360
	Farm Size	-0.001	0.005	-0.160	0.007	0.010	0.630
	Constant	-0.012	0.056	-0.210	0.098	0.058	1.710
0.25	**Pseudo R-Squared**	0.198			0.14		
0.50	**Pseudo R-Squared**	**0.196**			**0.09**		
0.75	**Pseudo R-Squared**	**0.163**			0.14		

***** = significant at 1%, ** = significant at 5% and * = significant at 10%**

Source: Field survey (2024)

Conclusion and Recommendations

Rice production in Nasarawa State is a profitable venture, with beneficiaries and non-beneficiaries making a net farm income of ₦2,805,769.64 and ₦1,845,974.71, respectively, per hectare of rice production. Also, there was a 39% increase in income for beneficiaries, which may be attributed to the effect of the NIRSAL credit facilities on their welfare. Therefore, it is recommended that NIRSAL stakeholders should continually reach out to more smallholder farmers in the country, especially in rural areas, to attain sustainability and productivity in rice farming. Also, government at all levels should replicate similar intervention initiatives for greater impact since the scheme showed significant impact on farmers income.

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