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Agricultural Transformation in Kamrup District of Assam: Evidence from Selected Farm Households

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Abstract:
Agricultural transformation encompasses changes in production methods, resource use, technology and rural livelihoods. This study examines these dimensions among 68 farm households in six purposively selected villages across Rangia, Hajo and Palashbari Revenue Circles of Kamrup district, Assam. Primary data collected during 2024–25 were analysed using descriptive statistics and area-based indicators. Improved rice varieties were reported by 66 households (97.06%), and 50 households (73.53%) reported using improved vegetable varieties. The reported irrigated area accounted for 70.59% of gross cropped area, while cropping intensity was 119.95%. Mechanised ploughing was reported by 79.41% of households, although most users relied on hired services. Own funds represented 88.12% of reported agricultural finance, and 23 households (33.82%) reported off-farm income. The results suggest partial and uneven agricultural transformation within the sample. Improved practices were common, but their use, ownership of equipment and access to financial resources did not follow the same pattern. Given the cross-sectional design and non-probability sampling, the findings describe the surveyed households and cannot be generalised statistically to all farm households in the district.

Keywords: agricultural transformation; farm households; improved varieties; irrigation; mechanisation; agricultural finance; livelihood diversification; Assam.

1. INTRODUCTION

Agricultural transformation is reflected in changes in how farms use land, labour, capital and technology. It also concerns the relationship between agricultural production, markets and rural livelihoods. Timmer (1988) places agricultural transformation within broader economic development, while Ruttan (1977) examines the conditions shaping technological innovation in agriculture. These perspectives indicate why the adoption of improved seeds or machinery should not be treated as a complete measure of transformation.

The resources available to farm households affect the choices they can make. Irrigation, finance, machinery, extension services and access to buyers may influence the adoption and use of improved practices. A household might cultivate an improved variety while continuing to face limitations in

irrigation or relying on hired machinery. Examining these dimensions together provides a more informative account of farming conditions than considering technology adoption in isolation.

Household circumstances also matter because farming is connected with decisions about labour, expenditure and income. Ellis (1993) examines farm households in the context of agrarian development, while Pingali (1997) discusses the transition towards more commercial agricultural systems. These perspectives help frame questions about the relationship between farming practices, resource access and livelihood choices.

Against this background, the present study examines selected dimensions of agricultural transformation among farm households in Kamrup district, Assam. It considers landholding and cropping patterns, improved-variety adoption, irrigation, mechanised ploughing, agricultural finance, extension contact, paddy marketing and off-farm income. Primary data from 68 households in six purposively selected villages provide a descriptive account of these conditions. The study does not measure change over time or establish causal relationships, and its findings are not statistically representative of all farm households in the district.

2. LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1 AGRICULTURAL TRANSFORMATION AND TECHNOLOGICAL CHANGE

Timmer (1988) treats agricultural transformation as part of the wider process of economic development. This perspective extends the analysis beyond individual technologies to include the organisation of production and the changing role of agriculture in the economy. Improved varieties and machinery are relevant indicators, but they do not capture every aspect of change in farming.

Ruttan's (1977) discussion of induced innovation highlights the economic conditions associated with technological development. At the farm level, the practical use of a technology depends on more than its availability. Households also need access to complementary resources, which may differ across farms. Consequently, the presence of improved technology in a locality does not necessarily imply that every household can use it in the same way.

Pingali (1997) examines the transformation of Asian agriculture towards more commercial production systems. This work draws attention to the relationship between production decisions and markets. The use of improved varieties may indicate a change in cultivation practices, but commercial orientation requires additional evidence, such as the quantity of output sold and the extent of market participation.

These perspectives inform the present study's multidimensional approach. Improved-variety adoption is considered alongside land use, irrigation, mechanised ploughing, finance and marketing. The purpose is to describe how these features appear together among the surveyed households, rather than to infer transformation from a single indicator.

2.2 FARM HOUSEHOLDS AND LIVELIHOOD DIVERSIFICATION

Farm households allocate resources among agricultural production and other activities. Ellis (1993) provides a household-level perspective on agrarian development, making it relevant to an analysis that considers farming alongside other income sources.

Off-farm earnings can supplement income from agriculture, but their significance depends on their amount, stability and use. Such earnings may help meet household expenses or finance agricultural inputs; they may also be necessary when farm income is insufficient. The mere presence of off-farm income cannot establish whether diversification improves welfare or farm performance.

This study therefore uses the reported presence of off-farm income as a limited indicator of livelihood diversification. It identifies households reporting an income source beyond farming but does not measure the amount earned, its contribution to total income or its effect on agricultural investment.

2.3 RESEARCH GAP

The literature provides perspectives on technological change, farm-household decisions and the movement towards more commercial agriculture. The present study applies these ideas to a specific sample by examining several dimensions together: improved-variety adoption, irrigation, mechanised ploughing, finance, marketing and off-farm income.

Its contribution is descriptive rather than causal. It documents how these practices and resource conditions are distributed among 68 farm households in six selected villages in Kamrup district. The findings provide a local account of the surveyed households and identify questions for further investigation; they do not establish a district-wide pattern or claim that previous research on the district is absent.

2.4 CONCEPTUAL FRAMEWORK

The study examines five connected dimensions of agricultural transformation:

1. **Technology adoption:** reported use of improved crop varieties and agricultural inputs.
2. **Land use and cropping:** cultivated area, gross cropped area, crop composition and cropping intensity.
3. **Production infrastructure:** irrigation access, reported irrigated area and mechanised ploughing.
4. **Economic and institutional conditions:** agricultural finance, extension contact and marketing arrangements.
5. **Livelihood diversification:** reported income from activities outside agriculture.

These dimensions provide a structure for comparing the farming practices and resource conditions of the surveyed households. They are not assumed to change together or at the same rate. No composite transformation index is calculated because the study has not established a validated method for weighting and combining the indicators. The framework is used to organise the descriptive analysis, not to assign a single score to each household or estimate the rate of agricultural transformation.

3. OBJECTIVES OF THE STUDY

The study aims to:

1. Describe the landholding and agricultural characteristics of the selected farm households.
2. Examine reported adoption of improved varieties, irrigation and mechanised ploughing.
3. Document agricultural finance, extension contact, marketing arrangements and off-farm income.
4. Assess whether the observed patterns indicate partial or more comprehensive agricultural transformation within the sample.

4. METHODOLOGY

4.1 STUDY AREA AND SAMPLE DESIGN

The survey covered six villages in three Revenue Circles of Kamrup district, Assam: Balagaon and Kalmoni in Rangia; Singimari and Ramdia in Hajo; and Tiniali and Cimina in Palashbari. The villages were selected purposively for the study of agricultural practices and household livelihoods.

Primary data were collected during 2024–25 from 68 farm households. A snowball approach was used to identify households because a complete list of eligible farm households was unavailable. Field visits and discussions with local contacts, including village-level informants, assisted the identification process.

The sample comprised 24 households from Rangia, 24 from Hajo and 20 from Palashbari. Both village selection and household identification were non-probabilistic. The findings therefore describe the participating households and do not provide a statistical basis for generalisation to all farm households in Kamrup district.

4.2 DATA COLLECTION

Two schedules were used. The village-level schedule recorded local facilities and basic characteristics, including household numbers, farm-household numbers, roads, electricity, markets, schools, health facilities, banking services and transport.

The household schedule covered household composition, landholding and tenure, cropping patterns, improved varieties, agricultural inputs, irrigation, mechanised ploughing, finance, extension contact, marketing and income from activities outside agriculture.

The analysis uses the completed records of the 68 participating households. Percentages for comparisons across Revenue Circles use the number of surveyed households in the relevant circle as the denominator unless otherwise specified. Area-based measures use the relevant land-area totals.

4.3 METHODS OF DATA ANALYSIS

The data were tabulated and analysed using descriptive statistics. Frequencies and percentages summarised household characteristics and reported farming practices, while area totals and ratios described land use, cropping patterns and irrigation coverage. Revenue-Circle comparisons were used to identify descriptive differences within the sample.

The principal indicators were calculated as follows.

Household percentage

$$\text{Household Percentage}=\frac{\text{Households reporting a characteristic}}{\text{Total surveyed households}}\times100$$

Cropping intensity

$$\text{Cropping Intensity}=\frac{\text{Gross Cropped Area}}{\text{Net Cultivated Area}}\times100$$

Irrigation coverage

[
\text{Irrigation Coverage (%)}=
\frac{\text{Reported Irrigated Area}}
{\text{Gross Cropped Area}}\times100
]

The analysis is descriptive. No causal or statistical-significance claims are made from the Revenue-Circle comparisons. The non-probability sampling design also limits the findings to the surveyed households.

5. RESULTS AND DISCUSSION

5.1 LANDHOLDING AND TENURE STRUCTURE

Most surveyed households operated between one and less than four hectares. Of the 68 households, 61 (89.71%) fell into this category, while seven (10.29%) operated less than one hectare. No household was recorded as operating four hectares or more.

Table 1 Landholding and tenure among surveyed farm households

Indicator	Households	Percentage
Operated land below 1 hectare	7	10.29
Operated land from 1 to less than 4 hectares	61	89.71
Operated land of 4 hectares or more	0	0.00
Total households	**68**	**100.00**
Own land only	36	52.94
Own land and leased-in land	31	45.59
Leased-in land only	1	1.47
Total households	**68**	**100.00**

Source: Primary survey, 2024–25.

Note: Landholding categories follow the study's classification. The 1–less-than-4-hectare category combines sizes that may be classified separately under standard Indian operational-holding classifications.

The tenure figures show that 36 households operated only owned land, while 31 combined owned and leased-in land. One household operated leased-in land only. Thus, access to operated land did not depend exclusively on ownership for all respondents. These descriptive figures do not establish whether tenure arrangements affected investment or technology adoption.

5.2 LAND USE AND CROPPING PATTERN

The households reported 100.93 hectares of net cultivated area and 121.07 hectares of gross cropped area. Rice occupied 82.00 hectares, equivalent to 67.73% of gross cropped area.

Table 2 Land use and cropping indicators

Indicator	Value
Net cultivated area	100.93 ha
Gross cropped area	121.07 ha
Rice area	82.00 ha
Rice share of gross cropped area	67.73%
Cropping intensity	119.95%

Source: Primary survey, 2024–25.

Note: Cropping intensity equals gross cropped area divided by net cultivated area, multiplied by 100.

The calculated cropping intensity of 119.95% means that gross cropped area was approximately 1.20 times net cultivated area. Rice was the dominant crop in the reported land-use pattern. Because the data represent a survey-period snapshot, they cannot establish whether cropping intensity has risen or whether cultivation has become more intensive over time.

5.3 ADOPTION OF IMPROVED VARIETIES

Improved varieties were widely reported, particularly for rice. Sixty-six households (97.06%) reported using improved rice varieties, while 50 (73.53%) reported using improved vegetable varieties.

Table 3 Adoption of improved varieties

Crop category	Households reporting adoption	Percentage of households	Reported area
Improved rice varieties	66	97.06	81.33 ha
Improved vegetable varieties	50	73.53	19.87 ha

Source: Primary survey, 2024–25.

Note: *Household percentages use 68 as the denominator. The reported areas refer to the respective crop categories and should not be added unless the underlying definitions establish that they are mutually exclusive.*

The higher reported adoption rate for rice than for vegetables indicates that the use of improved varieties differed by crop category. However, adoption figures alone do not demonstrate higher yields or profits. Such conclusions would require comparable evidence on crop yields, input costs, production expenses and prices received.

5.4 IRRIGATION ACCESS AND COVERAGE

All 68 households reported access to shallow tubewell (STW) or low-lift pump (LPP) irrigation arrangements. None reported access to deep tubewell (DTW) irrigation. The reported irrigated area was 85.46 hectares, compared with a gross cropped area of 121.07 hectares.

Table 4. Irrigation indicators among surveyed households

Indicator	Value
Households reporting STW/LPP access	68 (100.00%)
Households reporting DTW access	0 (0.00%)
Reported irrigated area	85.46 ha
Gross cropped area	121.07 ha
Indicator	**Value**
Households reporting STW/LPP access	68 (100.00%)

Source: Primary survey, 2024–25.

Note: Access to an irrigation source does not necessarily imply equipment ownership or irrigation of the entire operated area. The irrigated and gross cropped areas must refer to compatible periods and definitions for the comparison to be valid.

Although all households reported access to STW/LPP arrangements, the reported irrigated area accounted for 70.59% of gross cropped area. The remaining 35.61 hectares were outside the reported irrigated area. This difference illustrates why access and coverage should be treated as separate indicators. The survey does not identify why some area remained outside reported irrigation coverage; explanations involving water availability, costs or equipment capacity would require further evidence.

5.5 MECHANISED PLOUGHING

Fifty-four households (79.41%) reported mechanised ploughing. Ten reported owning equipment, while 44 relied on hired services. Fourteen households did not report mechanised ploughing.

Table 5 Mechanised ploughing among surveyed households

Category	Households	Percentage of all surveyed households
Owned equipment for mechanised ploughing	10	14.71
Used hired mechanised-ploughing services	44	64.71
Did not report mechanised ploughing	14	20.59
Total households	**68**	**100.00**

Source: Primary survey, 2024–25.

Note: Categories are treated as mutually exclusive in accordance with the reported totals; verify this against the original schedules.

The figures distinguish machinery use from machinery ownership. Most households reporting mechanised ploughing used hired services, suggesting that access to machinery did not generally require ownership within this sample. The data do not establish whether hiring was affordable, reliably available or associated with lower cultivation costs.

5.6 AGRICULTURAL FINANCE AND INVESTMENT

Own funds accounted for 88.12% of reported agricultural finance. Non-institutional sources contributed 8.52%, and institutional sources accounted for 3.36%. Three households (4.41%) reported taking loans.

These figures indicate that own funds represented the largest share of the reported financing structure. The low institutional share does not, by itself, explain whether formal credit was unavailable, difficult to obtain or not required by particular households. The finance shares and the number of borrowing households also measure different things and should not be interpreted interchangeably.

The survey records further indicate agricultural investment of ₹39.02 lakh during 2019–20 to 2023–24, with major equipment reportedly accounting for 58.20%. This figure should be retained only after confirming the investment categories, period covered and calculation against the original records. The available figures do not establish a direct relationship between financing sources and specific investments.

5.7 EXTENSION CONTACT AND SOURCES OF AGRICULTURAL ADVICE

Contact with village-level extension personnel was recorded for 67 households (98.53%). All 68 households also reported a visit during the preceding six months. Traders were identified as a source of advice on agricultural modernisation by 85.29% of households.

Extension personnel and traders therefore both appeared in respondents' reported sources of agricultural information. The two extension indicators should be presented separately if they refer to different questions or types of contact. A visit does not necessarily establish the quality or usefulness of the advice received.

The survey did not assess whether households followed recommendations or whether advice changed their farming decisions. These issues would require information on the content of advice and its influence on decisions concerning varieties, inputs, irrigation and marketing.

5.8 PADDY MARKETING ARRANGEMENTS

The reported distribution of paddy marketing was 60.97% through traders, 29.03% through village-level markets and 10.00% through procurement arrangements.

Table 6 Reported distribution of paddy marketing channel

Marketing channel	Reported share (%)
Traders	60.97
Village-level markets	29.03
Procurement arrangements	10.00
Total	**100.00**

Source: Primary survey, 2024–25.

Note: Verify the denominator in the original records and identify whether the percentages refer to marketed quantity, transactions or another measure.

Traders accounted for the largest reported share of paddy marketing. The distribution describes the marketing pattern recorded in the survey but does not establish whether farmers received favourable

prices or faced limited bargaining options. An assessment of marketing outcomes would require data on sale prices, quantities, transport costs, payment conditions and access to alternative buyers.

5.9 OFF-FARM INCOME AND LIVELIHOOD DIVERSIFICATION

Twenty-three households (33.82%) reported income from activities outside farming. The proportion varied across the three Revenue Circles.

Table 7 Households reporting off-farm income by Revenue Circle

Revenue Circle	Surveyed households	Households with off-farm income	Percentage within circle
Rangia	24	8	33.33
Hajo	24	10	41.67
Palashbari	20	5	25.00
Total	**68**	**23**	**33.82**

Source: Primary survey, 2024–25.

Note: Percentages use the number of surveyed households in each Revenue Circle as the denominator. Differences are descriptive and do not establish statistical significance.

The reported proportion was highest in Hajo (41.67%), followed by Rangia (33.33%) and Palashbari (25.00%). These are sample-level differences, not estimates for all households in the respective Revenue Circles.

The figures establish the reported presence of off-farm income but do not indicate its value or contribution to total household earnings. The role of such income in household welfare or agricultural investment cannot be assessed without information on income amounts, regularity and expenditure.

5.10 OVERALL ASSESSMENT

The survey records widespread use of improved rice varieties, substantial reported adoption of improved vegetable varieties and mechanised ploughing among most households. Yet the indicators also show important distinctions. Irrigation access did not correspond to full reported coverage of gross cropped area, and machinery use was much more common than ownership. Own funds dominated reported agricultural finance, while around one-third of households reported off-farm income.

Taken together, these patterns support a description of **partial and uneven agricultural transformation within the sample**. They do not establish higher productivity, greater profitability or a transition to commercial farming. The study provides a cross-sectional account of farming practices and resource conditions; it cannot show how these conditions have changed over time or identify the effects of individual practices on farm outcomes.

6. POLICY IMPLICATIONS

The results identify several issues that merit further local assessment. Because the sample is non-probabilistic, these implications should not be treated as district-wide estimates of need.

Irrigation: All surveyed households reported STW/LPP access, but the reported irrigated area was smaller than gross cropped area. Further assessment could identify plots outside irrigation coverage and

investigate whether the difference relates to water availability, operating costs, equipment capacity or seasonal requirements.

Mechanisation: Hired services were more common than equipment ownership among households reporting mechanised ploughing. Local planning could examine the cost, timing and reliability of custom-hiring services, rather than relying on ownership alone to assess access to machinery.

Agricultural finance: Own funds dominated the reported financing structure. Further investigation could examine formal-credit access, eligibility requirements, application procedures, repayment conditions and awareness of available schemes. The current survey does not explain the limited institutional share.

Extension and agricultural information: Extension personnel and traders were both reported as sources of information. Further research could examine the relevance and accuracy of advice, farmers' information needs and the feasibility of recommendations under different resource conditions.

Marketing: Traders accounted for the largest reported share of paddy marketing. To assess whether marketing arrangements disadvantage farmers, additional evidence is needed on sale prices, transaction and transport costs, payment conditions and the availability of alternative buyers.

Livelihood diversification: About one-third of the surveyed households reported off-farm income. Research on income amounts, source activities and regularity would help clarify how these earnings contribute to household budgets and whether they are used for agricultural inputs or investment.

These are areas for investigation, not interventions whose effectiveness has been demonstrated by this study.

7. CONCLUSION

This study examined selected dimensions of agricultural transformation among 68 farm households in six purposively selected villages in Kamrup district, Assam. Improved rice varieties were widely reported, improved vegetable varieties were also common, and most households reported mechanised ploughing. The reported irrigated area represented 70.59% of gross cropped area, and cropping intensity was 119.95%. Hired services were more common than machinery ownership among households reporting mechanised ploughing. Own funds accounted for most reported agricultural finance, while 33.82% of households reported off-farm income.

The findings indicate partial and uneven agricultural transformation within the surveyed sample. The use of improved practices was widespread, but access to irrigation, machinery ownership and the financing of agricultural activities did not follow a uniform pattern. The evidence is descriptive: it does not establish changes over time, causal relationships or improvements in yield, profitability or household welfare.

Further research using a larger and more representative sample, comparable observations across years and detailed information on yields, production costs, prices, credit and household income would help establish whether these patterns are associated with measurable changes in farm performance. For the present study, the defensible conclusion is that several dimensions of agricultural transformation are visible among the surveyed households, but their extent and consequences remain to be established.

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