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Status and Growth Trend of Major Crops in Adopted Villages Under Krishi Vigyan Kendra, Udalguri, Assam, India

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ABSTRACT

Assam's agricultural sector is diverse, with rice as the dominant crop alongside pulses, oilseeds and vegetables. Udalguri district, situated in the North Bank Plain Zone, faces challenges such as limited irrigation, low mechanization and restricted market access. Krishi Vigyan Kendra (KVK), Udalguri, has implemented interventions in two adopted villages i.e Kacharital and Habigaon, aiming to improve the status of agriculture through enhancing productivity and optimize cropping patterns. However, variability in farmer adoption rates and climatic uncertainties posed difficulties in assessing long-term sustainability. This study analyses the impact of KVK's interventions on crop area expansion, production trends and diversification between 2018-19 to 2022-23 for Kacharital and 2015-16 to 2022-23 for Habigaon. Data was gathered through farmer interviews, Participatory Rural Appraisal (PRA) and Focus Group Discussions (FGD), and analysed using statistical tools such as Percentage Change, Coefficient of Variation, Simpson's Index of Diversification (SID) and Compound Annual Growth Rate (CAGR). Findings reveal a shift towards diversified cropping. Rice cultivation declined (-5.26 ha in Kacharital, -6.36 ha in Habigaon) due to water constraints and market shifts. Pulses, oilseeds and vegetables expanded significantly, improving farm income and soil fertility. Cropping intensity increased from 100.35% to 155.07% in Kacharital and from 106.53% to 129.84% in Habigaon, reflecting better land utilization. The Simpson Index of Diversification rose to 0.55 in Kacharital and 0.53 in Habigaon, highlighting adaptive farming practices. This study contributes to the understanding of how targeted interventions influence cropping diversification, demonstrating that strategic support can improve land-use efficiency and farmer resilience despite systemic constraints.

Keywords: *Agriculture, Krishi Vigyan Kendra, Cropping intensity, Simpson's Index of Diversification, Compound Annual Growth Rate, Participatory Rural Appraisal, Focus Group Discussions, Udalguri, Assam*

INTRODUCTION

Assam's agricultural landscape is diverse, with rice as the dominant crop alongside pulses, oilseeds like sesamum and a variety of vegetables. Rice is cultivated over 2,467,000 hectares, yielding 5,127,000 tonnes. Pulses are grown on 146,000 hectares, producing 108,000 tonnes. Oilseed crops including sesamum, cover 338,000 hectares with a production of 204,000 tonnes. Udalguri district, situated at the North Bank Plain Zone of the state has a mix of sandy loam and clay loam soils supporting crops like rice, maize, oilseeds and vegetables. The district receives an annual rainfall of around 1971.7 mm. Rice is cultivated over 110,200 hectares with a cropping intensity of 151 %. Pulses contribute to diversified cropping patterns. Sesamum is grown as part of oilseed cultivation. Udalguri has a strong horticultural presence, with vegetables grown across multiple seasons.

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While Assam demonstrates large-scale agricultural production, Udalguri exhibits localized challenges and opportunities in optimizing its agricultural output. The district can further enhance productivity through better irrigation, mechanization and market expansion. The district, with its diverse cropping patterns and strategic location, holds significant potential to contribute more substantially to the state's Gross Domestic Product (GDP). Despite its strong agricultural base, the district faces challenges such as limited irrigation, low mechanization, restricted market access and monsoon dependency. Targeted interventions through Krishi Vigyan Kendra (KVK), Udalguri, can significantly boost productivity, value addition and economic returns for farmers, thereby enhancing the district's share in the state's agricultural GDP. By integrating technology, enhancing mechanization, promoting scientific farming and expanding market access, the agricultural scenario of the district can be transitioned into a higher-value and more sustainable sector. Looking into the matter, KVK, Udalguri has adopted two villages namely Kacharital and Habigaon under its jurisdiction.

Moreover, agricultural sustainability depends on the ability of farmers to adapt to changing climatic and economic conditions.

Diversification plays a crucial role in ensuring resilience in farming systems and enhancing food security as stated by [12] [17]. Several studies emphasize how diversification contributes to economic stability by reducing dependence on a single crop as mentioned by [4] [11]. Climate variability, a major determinant of cropping patterns, has been shown to significantly affect land use choices, necessitating adaptive strategies for sustainable agricultural growth [9] [16].

Keeping in view the above facts, this study has been undertaken to study the status of growth as well as the trend in area, production and productivity of major crops after interventions in adopted villages under KVK, Udalguri.

METHODOLOGY

The present study was conducted in two adopted villages i.e Kacharital and Habigaon to examines the impact of interventions made by KVK on crop area expansion and production trends between 2018-19 to 2022-23 (5 years) for village Kacharital and from 2015-16 to 2022-23 (7 years) for Habigaon village. This study integrates qualitative and quantitative research methods. The personal interview method was applied for in-depth discussions with 212 farmers of Kacharital and both Participatory Rural Appraisal (PRA) and Focus Group Discussions (FGD) with 127 farmers of Habigaon to assess the data. The given following statistical tools were employed to analyze the data:

***Percentage Change*:** Present value-previous value/previous value x 100

Coefficient of variance: SD/Mean x 100 where SD is standard deviation

Simpson Index of Diversification: A Simpson's diversity index has been used in the present research to study the speed of crop diversification and its extent. It provides the index range from 0 to 1. If the value moves towards 0 or 1 it refers to specialization or diversification respectively.

$$SID = 1 - \sum_{i=1}^{n} Wi2$$

Where, SID: Simpson's index of crop diversification

$Wi = Xi/\Sigma xi$

Growth Analysis: The growth rates refer to the percentage change of a particular variable over a certain period of time in a particular situation. Compound growth rates were calculated by fitting the time-series data in an exponential function in the form given below to the data, in order to quantify the growth in area, production and productivity of crops [1] [6].

$$Yt = ABt \quad (1)$$

Where, Yt is, Index number of area/production/ productivity of vegetables for the year 't' as dependent variable; t, Time variable as independent variable; A is intercept; B is, Regression coefficient. Equation (1) can be expressed in logarithmic form as follows:

$$\log y = \log a + t \log b$$

$$\log y = A + Bt$$

Where, A, log a and; B, log b. Student's t- test was used to test the significance of CAGR. Per cent annual compound growth rate "r" can be computed as:

$r = (\text{Antilog of b-1}) \times 100.$

RESULTS AND DISCUSSION

Changes in Cropping Pattern: The table 1 represents a comparative analysis of cropping patterns before and after intervention in Kacharital and Habigaon, highlighting changes in area expansion and cropping intensity. It was revealed that in the case of Rice crops, there is a reduction in cultivated area by 5.26 ha in Kacharital and 6.36 ha in Habigaon post-intervention. The reasons may be possibly due to water constraints or diversification into higher-value crops. Studies indicate that declining rice acreage is often linked to climate variability and economic incentives favoring alternative crops. These findings align with existing diversification models, where farmers shift from staple grains to high-value crops due to market demands, climate adaptation and intervention programs [2] [8].

In the case of pulses, there is an expansion from 0.26 ha to 6.59 ha in Kacharital and from 1.23 ha to 4.26 ha in Habigaon, indicating a preference for drought-resistant crops. The significant increase in pulse cultivation suggests a strategic shift towards crops with lower water requirements and higher market value. Research highlights that pulses contribute to soil fertility through nitrogen fixation, enhancing sustainability [5]. Further, for the crops i.e Sesamum & Oilseeds (Toria), the growth from negligible levels pre-intervention to 1.23 ha and 60.56 ha respectively post-intervention in Kacharital and Habigaon village, there is an expansion in area under sesamum from 0.25 ha to 2.66 ha and for Toria, it went from 4.23 to 15.69 which is highly significant in area expansion.

For vegetables, it was observed an increase in diversification, growing from 0.46 ha to 8.24 ha in Kacharital and 2.12 ha to 6.53 ha in Habigaon which aligns with trends in diversified cropping systems aimed at improving nutritional security and economic returns. Studies emphasize that vegetable cultivation enhances farm income and optimizes land use efficiency.

The rise in cropping intensity from 100.35% to 155.07% in Kacharital and from 106.53% to 129.84% in Habigaon indicates improved land utilization. Higher cropping intensity is often associated with better irrigation facilities, improved seed varieties, and enhanced agronomic practices. These findings correlate with the research findings of [7] [13].

Table 1. Changes in the cropping pattern of the adopted villages

Crops	Before Intervention (Area in Ha)		After Intervention (Area in Ha)		Area Expansion (Area in Ha)	
	Kacharital	Habigaon	Kacharital	Habigaon	Kacharital	Habigaon
Rice	115.22	65.23	109.96	58.87	-5.26	-6.36
Pulse	0.26	1.23	6.59	4.26	6.33	3.03
Sesamum	0	0.25	1.23	2.66	1.23	2.41
Toria	0.40	4.23	60.56	15.69	60.16	11.46
Vegetables	0.46	2.12	8.24	6.53	7.78	4.41
Gross cropped area	116.34	73.06	186.58	87.41	70.24	14.35
Net cropped area	115.94	68.58	120.32	70.04	4.38	1.46
Cropping Intensity (%)	100.35	106.53	155.07	129.84	54.53 % increase	21.88 % increase

Table 2. Growth in Area, production and productivity of major crops

Crops	Mean area (ha)	CV	CAGR	Mean production (MT)	CV	CAGR	Mean productivity (q/ha)	CV	CAGR
Village: *Kacharital*									
Rice	111.12	3.24	-0.01	432.31	0.99	-3.31E-05	38.39	2.90	0.01
Pulse	3.15	85.13	0.91	2.42	91.63	1.18	6.86	21.82	0.14
Sesamum	0.70	65.13	0.24	0.42	77.77	0.37	4.75	54.08	0.10
Toria	33.99	79.93	1.73	27.18	83.15	1.97	7.52	14.19	0.09
Vegetables	3.82	91.14	0.78	41.80	93.54	0.85	104.30	9.10	0.04
Village: *Habigaon*									
Rice	61.53	4.69	-0.01	243.08	2.58	0.01	39.58	5.03	0.02
Pulse	2.13	63.55	0.19	1.32	80.94	0.32	6.13	24.53	0.11
Sesamum	1.96	70.74	0.40	1.18	73.01	0.48	5.71	11.30	0.05
Toria	12.07	45.36	0.21	8.58	56.74	0.28	6.73	16.29	0.07
Vegetables	5.00	37.65	0.17	57.02	52.44	0.24	108.65	17.78	0.06

Growth in Area, production and productivity of major crops: It was reflected in Table 2 that in Kacharital village, there is a relatively stable rice cultivation area with a mean value of 111.12 ha and CV (3.24) having minimal fluctuations in productivity (CV-2.90). However, the CAGR value for rice production is nearly stagnant (-3.31E-05), indicating a lack of significant improvement over time. These findings are in line with the findings of [16]. Pulses and oilseeds (sesamum and toria) show high variability in area and production, suggesting inconsistent cultivation patterns. The high coefficient of variation (CV) for pulses (85.13 for area, 91.63 for production) implies unstable yield trends, possibly influenced by climatic or market conditions. This goes parallelly with the findings of [3] [10]. Vegetable cultivation, though limited in area (mean-3.82 ha), demonstrates high productivity (104.30 q/ha), reflecting efficient land use.

Further, the rice cultivation in Habigaon village is lower in area (mean 61.53 ha) compared to Kacharital, but productivity is slightly higher (39.58 q/ha). The variability in rice production (CV-2.58) is moderate, indicating relative stability. Pulses and oilseeds exhibit similar trends to Kacharital, with high CV values suggesting fluctuating yields. Notably, vegetable cultivation in Habigaon is more extensive (mean-5.00 ha) and maintains high productivity (108.65 q/ha), reinforcing the importance of horticultural crops in the region.

Similar findings were found in the studies done by [15] [18].

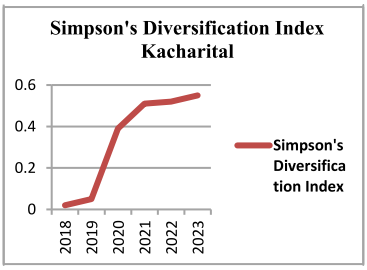
Crop Diversification Analysis: The Simpson Diversification Index (SDI) was used to analyze the crop diversification of the two villages. It is a measure of crop diversity, indicating how evenly agricultural land is distributed among different crops. A higher SDI value suggests greater diversification, while a lower value indicates specialization in fewer crops.

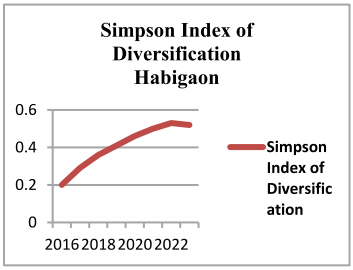
The diversification index for Kacharital starts at 0.02 in 2017-18 and steadily increases to 0.55 in 2022-23. This suggests a gradual shift towards diversified cropping patterns. The sharp increase between 2018-19 (0.05) and 2019-20 (0.39) indicates a significant expansion in crop variety, possibly due to policy interventions, climate adaptation strategies, or market-driven diversification. The stabilization around 2021-22 (0.52) and 2022-23 (0.55) suggests that diversification has reached a consistent level, indicating a balanced approach to crop selection.

Further, the diversification index in Habigaon starts at 0.20 in 2015-16 and rises to 0.53 in 2021-22, showing a steady increase in crop diversity. The consistent growth trend suggests that farmers in Habigaon have been actively adopting diversified cropping systems, possibly influenced by climatic resilience strategies or economic incentives. The slight dip in 2022-23 (0.52) compared to 2021-22 (0.53) may indicate a shift back to staple crops or external factors affecting diversification, such as market fluctuations or climatic constraints. These findings resemble the findings of [4] [14].

Table 3. Crop Diversification Analysis

Year	Kacharital	Habitation
2015-16	-	0.20
2016-17	-	0.29
2017-18	0.02	0.36
2018-19	0.05	0.41
2019-20	0.39	0.46
2020-21	0.51	0.50
2021-22	0.52	0.53
2022-23	0.55	0.52





CONCLUSION

From the findings, it can be concluded that there is an agricultural shift toward diversification, enhancing both productivity and resilience. High-value crops (oilseeds, pulses, vegetables) replacing monoculture practices. There is an increased cropping intensity and area expansion, improving food security and economic opportunities along with diversification strengthening farm sustainability, supported by government programs and climate-adaptive strategies. Policy interventions focusing on climate-resilient cropping models, market support, and soil health improvement could further reinforce sustainable agricultural growth.

CONFLICT OF INTEREST: The authors declare no conflict of Interest.

RESEARCH CONTENT: The research content and the data of the manuscript is original and have not been published elsewhere.

SCOPE OF THE STUDY: The same kind of study can be undertaken in different villages of different district by their respective Krishi Vigyan kendras in Assam with slight modifications and changes in the methodology and may be with different field crops as well for plantation crops also.

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