P-ISSN: 2618-0723
E-ISSN: 2618-0731

Extension Journal

NAAS Rating: 5.04
www.extensionjournal.com

International Journal of Agriculture Extension and Social Development

Volume 8; Issue 4; April 2025; Page No. 210-219

Received: 02-01-2025
Accepted: 09-02-2025

Indexed Journal
Peer Reviewed Journal

Changes in Cropping Pattern Over Time in Kathua District of Jammu Region

[1]Chanchal, [2]Rakesh Nanda, [3]JS Manhas and [1]Tsewang Dolma

[1, 4]Ph.D. Scholar, Division of Agricultural Extension Education, SKUAST-Jammu, Jammu and Kashmir, India

[2]Ret. Professor, Division of Agricultural Extension Education, SKUAST-Jammu, Jammu and Kashmir, India

[3]Associate Professor, Directorate of Extension, SKUAST-Jammu, Jammu and Kashmir, India

DOI: https://www.doi.org/10.33545/26180723.2025.v8.i4d.1766

Corresponding Author: Chanchal

Abstract

This study investigates changes in cropping patterns in Kathua district, Jammu and Kashmir, focusing on food and non-food crops. The present study is based on primary and secondary data. For secondary data, multistage random sampling technique was employed and data were collected from 120 respondents. The analysis of cropping patterns from 2008 to 2017 reveals a decline in the total area under food crops from 121,160 hectares to 107,704 hectares. This decrease is associated with a negative growth rate and a low instability index (0-15), indicating stable trends despite the reduction. The area under total food crops also showed a negative growth rate and a medium instability index (15-30), reflecting variability in cropping patterns. From 2015 to 2018, the trend continued, with a decrease in food crops maintaining a negative growth rate and low instability index (0-15). Conversely, the area under non-food crops increased, showing a positive growth rate and a low instability index (0-15). This shift suggests a transition towards non-food crop cultivation, driven by changing economic and environmental factors. The study highlights the evolving agricultural landscape in Kathua and underscores the need for targeted policy interventions to address challenges and harness opportunities arising from these changing patterns.

Keywords: Cropping patterns, instability index, food crops

Introduction

Agricultural transformation is a dynamic process that entails a transition from subsistence farming to market-oriented production. This shift is supported by the adoption of modern techniques, including machinery, high-yield seeds, and efficient irrigation methods (Sandhu & Sohal, 2015) [21]. These advancements aim to increase productivity and profitability by enhancing the marketable surplus and farm income. The sector is deeply influenced by socio-physical and politico-economic factors, which impact land use intensity, farming systems, and crop choices. Agriculture in India is largely dependent on the monsoons, which are characterized by variability in both amount and timing. This dependency makes the sector vulnerable to rainfall fluctuations, affecting a significant portion of the population during periods of scarcity (Nair *et al*., 2023) [16]. With an annual population increase of approximately 18 million, there is an urgent need to boost food production. Emphasis on dryland agriculture could help address this challenge, given the potential for enhancing productivity through region-specific cultivation techniques (Kumar *et al*., 2023) [13]. In the face of dwindling natural resources and rising food demand, agricultural intensification is crucial for future growth. This can be achieved through changes in cropping patterns or crop diversification, which Kumar *et al*. (2023) [13] identify as a key component of small farm development strategies. Since the early 1980s, India has seen a surge in agricultural diversification as farmers adapt to market opportunities by shifting to higher-value crops (Kumar *et al*., 2023) [13]. Diversification not only enhances income and employment but also helps stabilize income flow and preserve natural resources like land and water. It can stabilize farm income at a higher level, particularly benefiting small farmers striving for viability (Kumar *et al*., 2023) [13].

Cropping patterns, which refer to the distribution of crop areas over time, play a vital role in agricultural geography and regionalization. They are influenced by both physical factors and socio-economic relationships, with crops often grown in combinations rather than as sole crops (Nair *et al*., 2023) [16]. However, changing cropping patterns can lead to imbalances with significant economic and environmental impacts. Instability in agriculture leads to variations in crop area, production, and yield over time (Anjum, 2018) [3]. Analyzing these fluctuations in conjunction with growth trends is essential, as they impact prices and disrupt farmers' incomes (Bisht & Kumar, 2018) [4]. Issues such as over-exploitation of irrigation, excessive use of chemical fertilizers and pesticides, and deterioration of soil and water resources highlight the need for sustainability. Indicators like declining yields, total factor productivity, and the quality of water resources are crucial in assessing the sustainability of India's agrarian economy (Kumar & Sharma, 2023) [13].

Literature review

Some studies highlights the need for targeted interventions to address the implications of these cropping pattern changes. Akhter and Acharya (2015) [1] analysed to understand the changes in the cropping pattern in order to see causal relationship between area and production. The study revealed that the crop sector of Jammu and Kashmir agriculture at an aggregate level is gradually diversifying in favour of high-value crops. However, while analyzing the diversifying, the Jammu division is witnessing a specialization in food-grain crops, while as Kashmir division depicting a trend toward diversification. The farmers are gradually diversifying to commercial crops for the sake of higher earnings. The study suggested that the Government should come forward to provide an adequate amount of credit facilities and introduce new techniques of crop production for the farmer's community. Sangral (2015) [22] studied the changes in cropping pattern and crop diversification in Jammu and Kashmir and found the trend of shift from food grains to non-food grains has been observed by the process of development which indicates an increasing tendency towards crop diversification. The area under other cereals had decline. He also stated that the real difficulty in adopting a better cropping pattern is that farmers may not have adequate amount of capital to invest and therefore the farmers should know the new techniques. Government should come forward to help them. Some studies contributes to the growing body of literature on agricultural land-use changes, providing valuable insights into the socio-economic and environmental drivers shaping cropping patterns. It emphasizes the importance of integrated approaches to agricultural planning that address the challenges of declining food crop cultivation and harness the potential of non-food crops in regions like Kathua.

In the present study, an attempt has been made to visualize the changes in the cropping pattern overtime in study area. As the green revolution has grown, our country's agricultural sector has undergone significant change.

Methodology

For analyzing changes in cropping patterns over time, Kathua district in Jammu and Kashmir was purposively selected due to its diverse topography and terrain. The district exhibits significant climatic variation, ranging from very hot conditions in the sub-tropical plain and Kandi belt to severe cold in the hilly areas. Rainfall is relatively sparse, with average precipitation varying between 200 mm and 1200 mm across different regions. A multi-stage sampling design was employed for selecting villages and respondents. Kathua district comprises 19 blocks, out of which four blocks—Marheen, Nagri, Barnoti, and Hiranagar—were purposively chosen. These roadside blocks were selected because they are more susceptible to changes in agricultural land use patterns. The list of blocks was obtained from the Directorate of Economics and Statistics, Jammu. In the second stage, three villages were randomly selected without replacement from each of the chosen blocks, with the list of villages provided by the Directorate of Economics and Statistics, Jammu, and the Panchayat. This resulted in a total of 12 villages being included in the study. In the final stage, a list of potential respondents from the selected villages was obtained from the Sarpanch and the Agriculture Extension Office. From this list, ten respondents were randomly selected without replacement from each village, resulting in a total of 120 respondents for the study.

Table 1: Distribution of sample respondents in the study area

Sr. No.	Block	Village	No. of respondents/village
1.	Marheen	Malwan	10
		Chak Sardar Attar Singh	10
		Partyal	10
2.	Nagri	Malwan	10
		Chak Sardar Attar Singh	10
		Partyal	10
3.	Barnoti	Nihal pura	10
		Jandi	10
		Nagrota	10
4.	Hiranagar	Mela	10
		Karwal	10
		Pathwal	10
Total		12	120

Period of study

The period of the study was from 2008-09 to 2017-18. In secondary data, time series data from 2008-09 to 2016-17 is used to study the changes in agricultural land use pattern over time. The year 2008-09 was selected as base year. Whereas, in primary data, time series data from 2015-16 to 2017-18 is used to study the changes in agricultural land use pattern over time. The year 2015-16 was selected as base year. The present study is based on primary and secondary data. The secondary data was collected from the Directorate of Economics and Statistics, Jammu pertaining to the period of 2007-08 to 2016-17. Primary data pertaining to the period of three years (2015-16 to 2017-18) was collected during 2019-20 through personal interview technique. For collecting primary data, personal interview method was the most suitable instrument for primary data collection.

Data analysis

The collected data were analyzed through Compound Annual Growth Rate (CAGR), Cuddy-Della Valle instability index.

Growth rate estimation

The log linear form of compound growth rate was used to find the trend of different land use categories and cropping pattern for the district from the period of 2008 to 2018. The natural logarithm of the variable (Yo) is calculated for which the CAGR is calculated. Then, regression is calculated and

CAGR is given by, = (antilog R2 - 1)*100

Where, R^2 is known as coefficient of determination

Estimation of instability index

Cuddy-Della Valle Instability Index was used to measure the extent of change in time series data. Coefficient of Variation measures instability in time-series data. The Cuddy Della Valle Index (1978) shows the exact direction of the instability.

Cuddy-Della Valle Index (CDVI):

I = CV* √1-Ad R2

Where, I= Instability index CV= Coefficient of variation
Adjusted R^2 = Coefficient of determination
The range of instability index is given as follows:
Low instability = between 0 to 15
Medium instability = between 15 to 30
High instability = greater than 30

Results and Discussion

Changes in cropping pattern

Cropping pattern is a dynamic concept as it changes over space and time. Thus, its studies are important in view of the rapidly growing population and consequent pressure on the existing land.

The cropping pattern of Kathua district from 2008 to 2017

The cropping pattern of Kathua district for food crops from 2008-09 to 2016-17 shows that, the cereals (wheat, rice and maize) were important crops. In *kharif* season, rice and maize were the major cereal crops. Table 2 shows that, area under rice and fruits and vegetables and sugarcane had increased from 33710 ha to 35973 ha, 330 ha to 415 ha and 20 ha to 28 ha, respectively. These findings are in accordance with the findings of Dobariya *et al*. (2016) [7] and Venkatesh and Sen (2018) [28] who found the increase in area under rice and decline in area under the minor crops like millets/gram and rapeseed/mustard.

In *rabi* season, wheat was the major cereal crop and occupied the maximum area and it had decreased from 53370 ha to 50195 ha. It was noted that the area under maize, millets/gram, pulses, barley, condiments and spices and had decreased from 20469 ha to 15304 ha, 5760 ha to 32 ha, 4390 ha to 2403, 1831 ha to 1698 ha and 280 ha to 232 ha, respectively. The results are in accordance with the findings of Majumder (2014) [15] who found that area under pulses have lost both in terms of acreage and production in West Bengal. Similar trends were observed by Gosh (2011) [9] and Nayak (2015) [17], who noted reductions in areas allocated to certain cereals, *rabi* pulses, oilseeds, and cash crops, while rice and maize areas expanded. However, other fruit crops were not grown until 2016, but in 2016-17 area under other fruit crops had an area of 35 ha. Total area under food crops had also decreased from 121160 ha to 107704 ha during the study period. his decline is consistent with the findings of Pawar (2018) [20], who observed a reduction in the area dedicated to food grains.

Table 2: Cropping pattern of Kathua district for food crops from 2008 to 2017 (ha)

Sr. No.	Crops	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
1.	Rice	33710 (26.4)	33165 (25.6)	31380 (25.1)	31243 (24.7)	31861 (25.9)	31865 (26.3)	31255 (25.9)	36137 (35.9)	35913 (30.6)
2.	Wheat	53370 (41.9)	53570 (41.4)	54543 (43.6)	52511 (41.6)	52493 (42.8)	52495 (43.3)	52596 (43.7)	48516 (48.2)	50195 (42.8)
3.	Maize	20469 (16.08)	19818 (15.3)	22304 (17.8)	24735 (19.6)	19620 (16.0)	17950 (14.9)	19452 (16.17)	18852 (18.7)	15304 (13.0)
4.	Barley	1831 (1.43)	1890 (1.4)	1878 (1.5)	0	0	0	0	1200 (1.1)	1698 (1.45)
5.	Millets/ gram	5760 (4.5)	5450 (4.2)	2897 (2.3)	2984 (2.3)	3207 (2.6)	3585 (2.9)	3150 (2.6)	30 (0.02)	32 (0.02)
6.	Pulses	4390 (3.4)	4250 (3.2)	4053 (3.2)	4027 (3.1)	4045 (3.3)	4027 (3.3)	4135 (3.4)	1961 (1.9)	2403 (2.0)
7.	Sugarcane	20 (0.01)	0	0	0	0	0	0	0	28 (0.02)
8.	Condiments & spices	280 (0.22)	250 (0.01)	319 (0.2)	281 (0.2)	301 (0.2)	290 (0.2)	270 (0.2)	284 (0.2)	232 (0.1)
9.	Fruits & vegetables	330 (0.2)	350 (0.2)	371 (0.2)	379 (0.3)	320 (0.2)	330 (0.2)	350 (0.2)	415 (0.4)	415 (0.3)
10.	Other fruit crops	0	0	0	0	0	0	0	0	35 (0.03)
	Total food crops	121160 (95.2)	118743 (91.8)	120745 (96.5)	116160 (92.1)	111847 (92.4)	110542 (91.3)	111208 (92.4)	105484 (99)	107704 (92.04)

*Figures in parentheses are percentages to total cropped area, Source= DES, 2008-09 to 2016-17

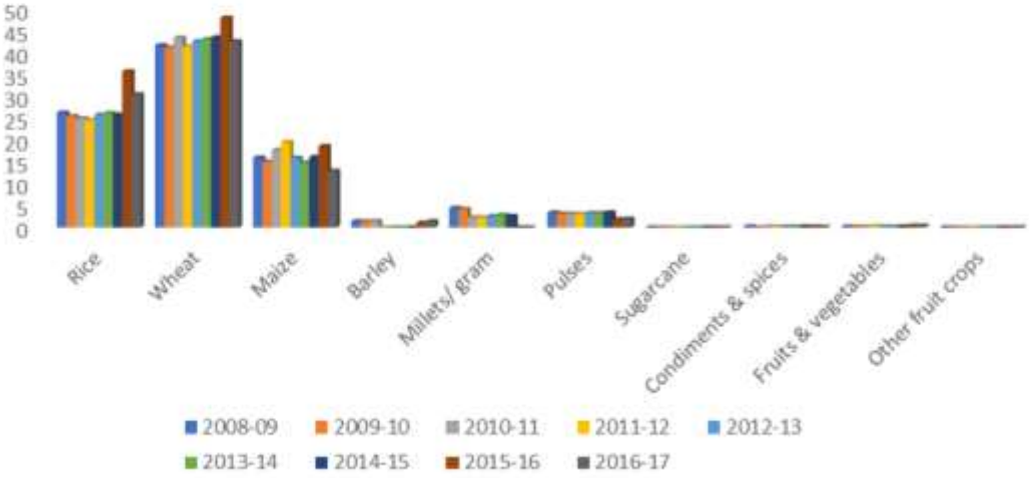

Fig 1: Cropping pattern of food crops

The cropping pattern of Kathua district for non-food crops from 2008-09 to 2016-17 is presented in table 3, which reveals that among non-food crops, fodder crops occupied the maximum area. However, it had decreased from 6690 ha to 5768 ha during the study period. Area under oilseeds had decreased from 5070 ha to 3366 ha and other non-food crops was not grown until 2010, but in 2011 other non-food crops had grown and area under other non-food crops had increased from 7 ha to 168 ha from 2011 to 2017. Area under fibre crops was ceased to exist from 2011 to 2017. Area under total non-food crops had also decreased from 11783 ha to 9302 ha during the study period. The reduction in non-food crop areas could be due to several factors, such as market fluctuations, changing profitability, and the growing emphasis on high-value crops like horticulture. As noted by Pattanaik and Mohanty (2017) [19], a similar trend was observed in Odisha, where there was a shift from food grains to non-food grains. In Kathua, this shift could also be driven by factors like changing market demands, climatic conditions, or the availability of better alternatives that offer higher returns for farmers.

Table 3: Cropping pattern of the selected study area for food crops from 2015 to 2018 (ha)

Sr. No.	Crops	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17
1.	Oilseeds	5070 (3.90)	4845 (3.70)	3705 (2.90)	3829 (3.03)	4306 (3.50)	3250 (2.60)	3556 (2.90)	3682 (3.60)	3366 (2.80)
2.	Fibres	20 (0.01)	10 (0.007)	4 (0.003)	0	0	0	0	0	0
3.	Fodder crops	6690 (5.25)	5680 (4.3)	3309 (2.64)	5893 (4.67)	6400 (5.22)	5640 (4.65)	4560 (3.78)	9989 (9.92)	5768 (4.92)
4.	Other non-food crops	0	0	7 (0.005)	143 (0.11)	20 (0.01)	35 (0.02)	20 (0.01)	0	168 (0.14)
5.	Total non-food crops	11783 (9.20)	10538 (8.15)	7028 (5.60)	9865 (7.80)	6112 (4.90)	8925 (7.37)	8136 (6.70)	13671 (13.50)	9302 (7.90)

*Figures in parentheses are percentages to total cropped area, Source= DES, 2008-09 to 2016-17

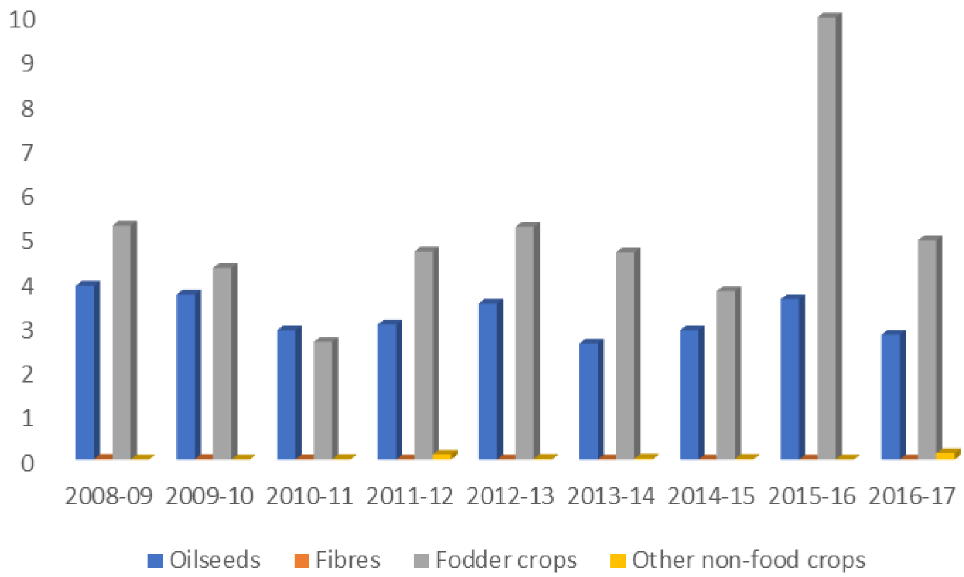

Fig 2: Cropping pattern of non-food crops

Cropping pattern of the selected study area from 2015 to 2018

Cropping pattern of the selected study area from 2015-16 to 2017-18 is presented in table 4, which reveals that in the *kharif* season, rice was the major cereal crop which occupied the maximum area and it had decreased from 142 ha to 139.415 ha during the study period. The findings are in confirmation with Akhter and Acharya (2015) [1] and Amrithalingam and Devi (2018) [2] who reported a reduction in cereal crop areas over the years, primarily due to a lack of irrigation facilities. The reason behind this decrement is due to lack of irrigation facilities. Area under maize, til, mash and vegetables had also decreased from 34.91 ha to 34.5 ha, 3 ha to 2.75 ha, 4.05 ha to 3.64 ha, 8.32 ha to 2.64 ha, respectively. Whereas, area under fodder crops like sorghum, bajra and jowar had increased from 7.77 ha to 12.52 ha, 1.35 ha to 4.8 ha, 1.35 ha to 2.41 ha, respectively. However, area under sugarcane was 4.8 ha and it does not had any variations. Total area under *kharif* crops had slightly decreased from 207.55 ha to 207.48 ha during the study period. The results are in confirmation with Kalaiselvi (2012) [10] who found negative and low growth rate for majority of cereal crops.

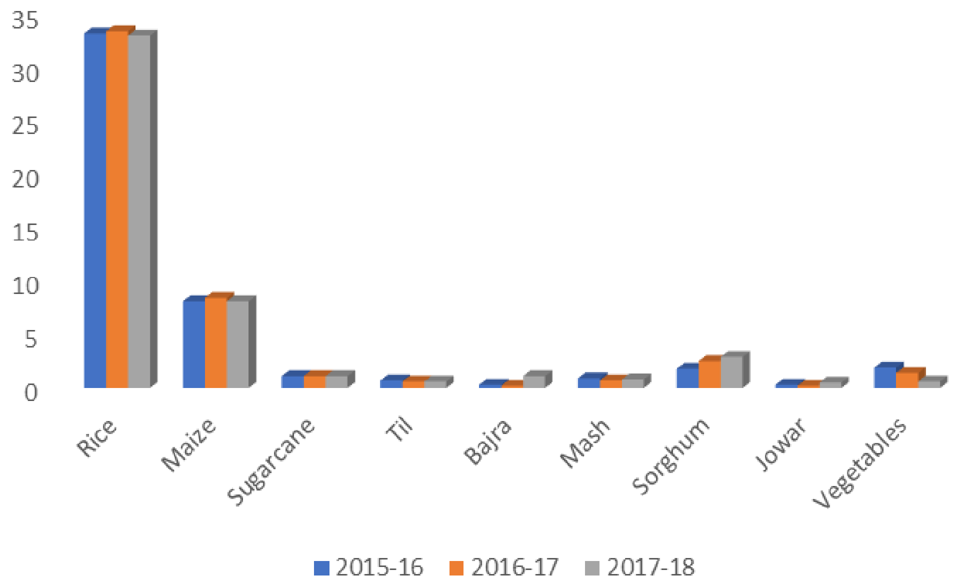

Fig 3: Cropping pattern of *kharif* season

Table 4: Cropping pattern of the selected study area from 2015 to 2018 (ha)

***Kharif* Season**				
Sr. No.	**Crops**	**2015-16**	**2016-17**	**2017-18**
1.	Rice	142 (33.10)	141.35 (33.30)	139.415 (32.90)
2.	Maize	34.91 (8.10)	36 (8.40)	34.5 (8.10)
3.	Sugarcane	4.8 (1.10)	4.8 (1.10)	4.8 (1.10)
4.	Til	3 (0.70)	2.8 (0.60)	2.75 (0.60)
5.	Bajra	1.35 (0.30)	1.2 (0.20)	4.8 (1.10)
6.	Mash	4.05 (0.90)	3.15 (0.70)	3.64 (0.80)
7.	Sorghum	7.77 (1.80)	10.8 (2.50)	12.52 (2.90)
8.	Jowar	1.35 (0.30)	1.2 (0.20)	2.41 (0.50)
9.	Vegetables	8.32 (1.90)	6.28 (1.40)	2.645 (0.60)
10.	Total area	207.555 (48.41)	207.58 (48.9)	207.48 (49.0)
***Rabi* Season**				
1.	Wheat	171.77 (40.07)	172 (40.50)	171.16 (40.40)
2.	Barseem	15.95 (3.70)	19.7 (4.60)	23.13 (5.50)
3.	Mustard	5.05 (1.10)	4.55 (1.00)	4.5 (1.00)
4.	Vegetables	14.785 (3.40)	11.33 (2.60)	8.69 (2.10)
5.	Total area	207.55 (48.41)	207.58 (48.90)	207.48 (49.00)
***Summer* Season**				
1.	Vegetables	6.55 (1.60)	2.2 (0.50)	1.3 (0.30)

Figures in parentheses are percentages to total cropped area

In *rabi* season, wheat was the major cereal crop and area under wheat was slightly decreased from 171.77 ha to 171.16 ha whereas, area under mustard and vegetables had decreased from 5.05 ha to 4.5 ha and 14.78 ha to 8.69 ha. However, area under barseem had increased from 15.95 ha to 23.13 ha during the study period. Total area under *rabi* crops had slightly decreased from 207.55 ha to 207.48 ha during the study period. The results are in confirmation with Sangral (2015) [22] who also found the trend of shift from food grains to non-food grains in the Jammu and Kashmir.

This shift could be driven by factors like increased profitability of non-food crops and the rising importance of livestock farming in the region. In *summer* season, area under vegetables had decreased from 6.55 ha to 1.3 ha during the study period.

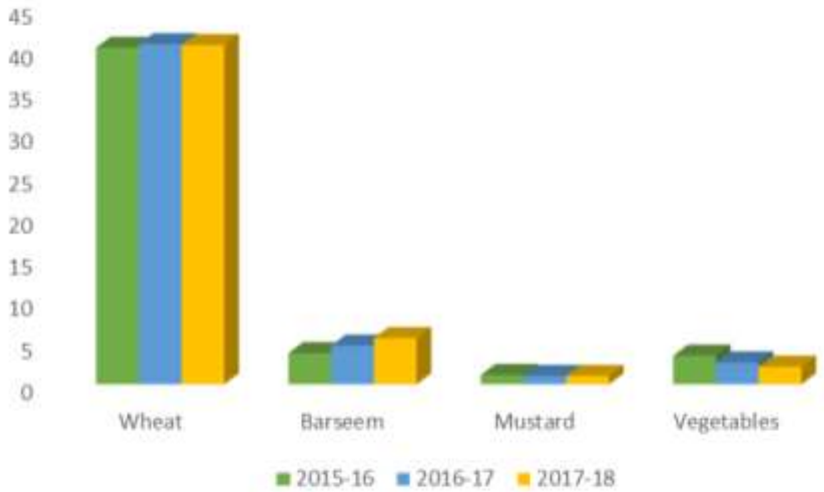

Fig 4: Cropping pattern of *rabi* season

Table 5 shows that vegetables had the largest area (29.605 ha) in 2015-16, with brinjal leading in the *kharif* season, and potato dominating the *rabi* season. In the *summer*, coriander had the most area. By 2016-17, the vegetable area decreased to 19.81 ha, with okra leading in *kharif*, potato in *rabi*, and cucumber in *summer*. In 2017-18, the area further reduced to 12.635 ha, with brinjal having the highest area in *kharif*, potato in *rabi*, and carrot in the *summer*. This trend shows a gradual decline in vegetable cultivation over the years.

Table 5: Vegetables of the selected study area from 2015 to 2018 (ha)

Parameter	Total (n= 120)		
	2015-16	2016-17	2017-18
***Kharif* season (Total area in ha)**	8.32	6.28	2.645
Okra (*Abelmoschus esculentus*)	2.7	2.0	0.7
Brinjal (*Solanum melongena*)	3.6	1.5	1.05
Bottle gourd (*Lagenaria siceraria*)	1.02	1.03	0.3
Cauliflower (*Brassica oleracea var. botrytis*)	0.25	1.2	0.2
Capsicum (*Capscicum annuum*)	0	0.25	0.395
Knol khol (*Brassica oleracea L.*)	0	0.30	0
Bitter gourd (*Momordica charantia*)	0.35	0	0
Pumpkin (*Cucurbita moschata*)	0.4	0	0
***Rabi* season (Total area in ha)**	14.785	11.33	8.69
Potato (*Solanum tuberosum*)	4.60	3.75	2.45
Brinjal (*Solanum melongena*)	0.10	0.1	0.2
Onion (*Allium cepa*)	3.0	2	1.25
Knol khol (*Brassica oleracea L.*)	0.02	0.82	0.47
Cauliflower (*Brassica oleracea var. botrytis*)	1.7	0.75	0.75
Spinach (*Spinacia oleracea*)	0	3.12	0.46
Beans (*Phaseolus vulgaris*)	0	0.2	0.55
Radish (*Raphanus sativus*)	1.6	0.12	1
Bottle gourd (*Lagenaria siceraria*)	0	0	0.84
Bitter gourd (*Momordica charantia*)	1.4	0	0
Cucumber (*Cucumis sativus*)	1.765	0.02	0.02
Okra (*Abelmoschus esculentus*)	0.15	0	0
Water melon (*Citrullus lanatus*)	0.20	0.20	0.25
Pumpkin (*Cucurbita moschata*)	0.10	0.10	0.15
Pea (*Pisum sativum*)	0.15	0.15	0.10
***Summer* season (Total area in ha)**	6.5	2.2	1.3
Cucumber (*Cucumis sativus*)	0.8	0.95	0.20
Coriander (Coriandrum sativum)	4.1	0.20	0.05
Beans (*Phaseolus vulgaris*)	0.4	0.40	0.45
Radish (*Raphanus sativus*)	0.25	0.05	0.05
Carrot (*Daucus carota*)	0.95	0.60	0.55
Total	29.605	19.81	12.635

Among horticultural crops, mango had the maximum area which was 2.775 ha as findings are supported by Biswas and Kumar (2011) [5] and area under other horticultural crops like banana, litchi, guava, orange, pear, jamun and kinnow was 3.725 ha as shown in table 4.22. Maximum respondents of Kandi area have mango orchards as there is no irrigation facility for cultivation of field crops.

Table 6: Area under horticulture crops (ha)

Area under horticultural crops	
Parameter	**Total (n= 120)**
	Area (ha)
Mango	2.775
Others (banana, litchi, guava, orange, pear, jamun and kinnow)	3.725

Compound annual growth rate (CAGR) for cropping pattern

Compound annual growth rate (CAGR) for cropping pattern of food crops

CAGR for cropping pattern of food crops of Kathua district from 2008 to 2017 is presented in table 7, which shows that highest and positive growth trend was observed for other fruit crops of 69.82 per cent, followed 69 by sugarcane (4.71%), fruit and vegetables (2.32%) and rice (1.85%), respectively. Whereas, wheat, millets/gram, pulses and total food crops had shown significant negative growth trend of -2.27 per cent, -74.88 per cent, -14.88 per cent and -2.27 per cent, respectively. The findings are in line with the findings of Thakre *et al*. (2024) [27] and Dey *et al*. (2020) [6] who also showed negative absolute and relative change in area for rice and wheat. Barley, maize and condiments and spices had also shown negative growth rate of -46.29 per cent, -6.67 per cent and -2.27 per cent, respectively.

Further, CAGR for the cropping pattern of food crops in the selected study area from 2015 to 2018 reveals a concerning trend. Table 7 shows that fruits and vegetables experienced a significant negative growth rate of -49.88%, indicating a sharp decline in their cultivation. Other major food crops like wheat, maize, pulses, and total food crops also demonstrated a negative growth trend, with CAGRs of -0.06%, -1.14%, -10.8%, and -4.5%, respectively. This negative growth could be attributed to several factors, including changes in market demand, fluctuating prices, and climatic challenges that may have discouraged farmers from cultivating these crops at previous levels. The sharp decline in fruits and vegetables, in particular, might also suggest a shift towards other more profitable or less risky crops, or a reflection of issues related to perishability and market volatility (Kumar & Singh, 2020; Sharma, 2021) [29, 30]. These trends highlight the need for targeted interventions to reverse the negative growth and promote sustainable agricultural practices in the region.

Table 7: Compound annual growth rate (CAGR) for cropping pattern of food crops

Sr. No.	Parameter	CAGR (2008 to 2017)	CAGR (2015 to 2018)
1.	Rice	1.82	-2.05
2.	Wheat	-2.27*	-0.06
3.	Maize	-6.67	-1.14
4.	Barley	-46.29	0
5.	Millets/gram	-74.88*	0
6.	Pulses	-14.88*	-10.8
7.	Sugarcane	4.71	0
8.	Condiments & spices	-2.27	0
9.	Fruits & vegetables	2.32	-49.88*
10.	Other fruit crops	69.82	0
11.	Total food crops	-2.27*	-4.5

*Figures depict percentages, CAGR of 2008 to 2017 as per digest of 2008-09 to 2016-17 and
*Significant at $p \leq 0.05$

Compound annual growth rate (CAGR) for cropping pattern of non-food crops

CAGR for cropping pattern of non-food crops Kathua district from 2008 to 2017 is presented in table 8, which shows that highest and positive growth trend for other non-food crops of 123.8 per cent. Whereas, oilseeds, fibres, fodder crops and total non-food crops had showed negative growth trend of 8.79 per cent 63.6 per cent from, 4.71 per cent and 0.09 per cent, respectively. Further, CAGR for cropping pattern of non-food crops in selected study area from 2015 to 2018 is presented in table 8, which shows that highest significant and positive growth trend was observed for fodder crops of 54.99 per cent, followed by total non-food crops of 34.89 per cent. Whereas, oilseeds had shown negative growth trend of -10.8 per cent from 2015 to 2018.

Table 8: Compound annual growth rate (CAGR) for cropping pattern of non-food crops

Sr. No.	Parameter	CAGR (2008 to 2017)	CAGR (2015 to 2018)
1.	Oilseeds	-8.79*	-10.8
2.	Fibres	-63.6*	0
3.	Fodder crops	-4.71	54.99*
4.	Other non-food crops	123.8	0
5.	Total non- food crops	-0.09	34.89*

*Figures depict percentages, CAGR of 2008 to 2017 as per digest of 2008-09 to 2016-17 and
*Significant at $p \leq 0.05$

Instability index for cropping pattern

Instability index for cropping pattern of food crops

Instability index for cropping pattern of food crops of Kathua district from 2008 to 2017 is presented in table 9, which shows that barley and millets/gram had shown the high range of instability index of 98.28 and 34.96. Pulses had shown medium range of instability index of 16.39. Whereas, maize, condiment and spices, fruits and vegetables, rice, wheat, other food crops and total food crops had shown the low range of instability index of 11.11, 9.38, 8.65, 5.71, 2.29, 1.73 and 1.66, respectively. Further, table 9 shows instability index for cropping pattern of food crops in selected study area from 2015 to 2018 that, pulses had shown the medium range of instability index of 15.23. However, fruits and vegetables, maize, wheat, and rice displayed even lower instability, with indices ranging between 0.35 and 4.45, suggesting improved consistency in production. These findings highlight the relative stability of staple crops such as rice and wheat, while variability in minor crops like barley and millets may be attributed to changing market conditions or climatic factors (Sharma and Verma, 2019; Kumar, 2021) [26, 14].

Table 9: Comparison of instability index for cropping pattern of food crops

Sr. No.	Parameter	Instability index (2008 to 2017)	Instability index (2015 to 2018)
1.	Rice	5.71	0.40
2.	Wheat	2.29	0.41
3.	Maize	11.11	3.0
4.	Barley	98.28	0
5.	Millets/gram	34.96	0
6.	Pulses	16.39	15.23
7.	Condiments & spices	9.38	0
8.	Fruits & vegetables	8.65	4.45
9.	Other fruit crops	1.73	0
10.	Total food crops	1.66	0.35

* Instability index of 2008 to 2017 as per digest of 2008-09 to 2016-17

Instability index for cropping pattern of non-food crops

Instability index for cropping pattern of non-food crops of Kathua district from 2008 to 2017 is presented in table 10, which shows that the highest range of instability index had observed for other non-food crops and fodder crops of 105.23 and 30.77. Such high instability could be attributed to various factors, including market demand fluctuations, changing climatic conditions, and shifting farmer preferences due to profitability considerations (Sharma & Gupta, 2019) [24]. Medium range of instability index had observed for total non-food crops of 26.29. Conversely, oilseeds demonstrated a much lower instability index of 10.66, reflecting more stable cultivation and potentially better adaptive practices or market stability for these crops (Kumar, 2020) [11]. Further, table 10 shows instability index for cropping pattern of non-food crops in selected study area from 2015 to 2018 that, all the non-food crops like as oilseeds, fodder crops and total non-food crops had shown the low range of instability index of 3.27, 1.90 and 1.33, respectively. This decrease suggests improved stability in cropping patterns, possibly due to advancements in agricultural practices, policy interventions, or consistent market conditions during these years (FAO, 2022) [8]. Lower instability in this period could also imply better risk management strategies adopted by farmers, such as diversification and the adoption of resilient crops (Sarkar *et al*., 2021) [23].

Table 10: Comparison of instability index for cropping pattern of non-food crops

Sr. No.	Parameter	Instability index (2008 to 2017)	Instability index (2015 to 2018)
1.	Oilseeds	10.66	3.27
2.	Fodder crops	30.77	1.90
3.	Other non-food crops	105.23	0
4.	Total non- food crops	26.29	1.33

* Instability index of 2008 to 2017 as per digest of 2008-09 to 2016-17

Production and yield of major crops

The results indicate that rice and maize were the major cereal crops during the *kharif* season, while wheat was dominant in the *rabi* season in the study area from 2015-16 to 2017-18. In 2015-16, rice occupied 142 ha with an average yield of 33.5 q/ha and a selling price of Rs 2502.11/q, showing a stable pattern over the next two years with slight fluctuations in area and production. Maize, covering around 35 ha, had an average yield of 25.56 q/ha and steadily increased its selling price, reaching Rs 1511.45/q in 2017-18. Wheat, as the major *rabi* crop, showed consistent production levels with yields around 27 q/ha, but the selling price increased significantly to Rs 1696.20/q by 2017-18. These findings suggest that while yields remained fairly stable for these cereals, price fluctuations could have been influenced by market dynamics or input costs. The stability in area under cultivation reflects the farmers' reliance on these staple crops, but the variations in production indicate room for improvements in yield management and price stability (Sharma & Singh, 2020; Kumar *et al*., 2019) [25, 12].

Table 11: Production and yield of major cereal crops from 2015 to 2018 (q/ha)

Parameter		Total (n=120)	
	2015-16	2016-17	2017-18
Rice			
Total area (ha)	142	141.35	139.41
Average area under rice (ha)	1.31±0.93	1.29±0.75	1.32±0.95
Average production (q)	37.65±25.72	34.08±25.80	35.91±26.88
Average yield (q/ha)	33.5q/ha	32.90±5.93	32.52±5.66
Average quantity sold (q)	38.7±32.6	38.61±31.89	37.93±32.45
Average selling price (/q)	2502±594.82	3008.64±52.83	3044±487.33
Maize			
Total area (ha)	34.91	36.0	34.5
Average area under rice (ha)	0.88±0.61	0.90±0.59	0.86±0.54
Average production (q)	47.05±30.35	44.70±30.14	53.22±32.15
Average yield (q/ha)	25.6±4.67	27.70±4.08	28.14±3.39
Average quantity sold (q)	21.5±19.9	23.45±18.74	24.60±18.72
Average selling price (/q)	1376.54±75.39	1426.21±333.52	1511±137.94
Wheat			
Total area (ha)	171.77	172	171.16
Average area under rice (ha)	1.43±1.16	1.47±1.23	1.43±1.16
Average production (q)	28.92±20.86	30.61±22.80	26.77±22.51
Average yield (q/ha)	27.63±10.96	26.60±6.94	26.85±6.57
Average quantity sold (q)	32.06±27.88	32.06±27.88	32.95±30.32
Average selling price (/q)	1554.41±147.12	1554.41±147.12	1696±217.41

Cost of cultivation of major cereal crops

Result reveals that the in 2015-16, average total cost of cultivation of rice was Rs 17095.33/ha (±2952.08), followed by average total cost of cultivation of wheat was Rs 13849.57/ha (±2674.90) and average total cost of cultivation of maize was Rs 13158/ha (±2536.33). In 2016-17, average total cost of cultivation of rice was Rs 20018.27/ha (±4228.83), followed by average cost of cultivation of wheat which was Rs 16627.78/ha (±3553.60) and average cost of cultivation of maize was Rs 16440/ha (±3700.09). In 2017 18, average total cost of cultivation of rice was Rs 24234.58/ha (±6473.05), followed by average cost of cultivation of wheat which was Rs 19542.74/ha (±3480.66) and average cost of cultivation of maize which was Rs 7190.76/ha (±5557.14) (Table 12).

Table 12: Cost of cultivation of major cereal crops from 2015 to 2018 (Rs/ha)

Particulars	Cost of land preparation	Cost of sowing	Cost of Intercultural operations	Cost of harvesting	Cost of threshing	Cost of post-harvesting activities	Total cost
2015-16 (Mean ± SD)							
Rice	3994.38±	3346.72±	4261.68±	2949.53±	1635.92±	1686.91±	17095.33±
	566.56	751.309	996.09	1098.65	426.99	750.80	2952.08
Maize	4043.48±	3025.64±	3448.71±	1235.89±	1305.55±	1628.20±	13158.97±
	325.44	255.17	523.08	319.11	451.62	482.83	2536.33
Wheat	4042.42±	1611.11±	2904.27±	2880.34±	1598.24±	1633.21±	13849.57±
	665.94	443.10	773.86	2328.28	438.61	783.96	2674.90
2016-17 (Mean ± SD)							
Rice	4948.64±	3858.49±	4952.83±	3495.28±	1995.09±	2055.66±	20018.27±
	562.42	827.37	909.02	1391.29	548.87	921.80	4228.83
Maize	4965.51±	3762.5±	4087.5±	1835±	1700±	2107.5±	16440±
	421.11	339.44	517.48	834.98	320.5	489.57	3700.09
Wheat	5030.33±	2323.07±	3512.82±	3084.62±	1907.96±	1975.21±	16627.78±
	684.44	1635.82	807.99	1104.03	541.68	1282.23	3553.60
2017-18 (Mean ± SD)							
Rice	5919.10±	4537.38±	5570.09±	4196.26±	2378.64±	2398.13±	24234.58±
	672.99	933.39	836.79	1418.80	477.25	911.76	6473.05
Maize	6051.72±	4287.5±	4825±	2225±	2138.88±	2425±	7190.76±
	469.51	517.48	1157.75	587.80	370.54	549.47	5557.14
Wheat	6040.40±	2467.52±	3970.28±	3611.11±	2216.81±	2269.23±	19542.74±
	709.54	664.99	866.74	1291.73	481.23	937.94	3480.66

Conclusion

Over the period of years, Kathua district saw an increase in the area under rice, sugarcane, fruits, and vegetables, while barley, condiments, spices, millets, gram, pulses, and total food crops declined. For non-food crops, the area under fodder crops, oilseeds, and total non-food crops decreased, although other non-food crops increased. From 2015 to 2018, *kharif* crops like rice, maize, til, mash, and vegetables saw a reduction, whereas fodder crops increased. In the *rabi* season, wheat showed stability, but mustard and vegetables declined, while barseem fodder increased. Overall, instability was low for most crops, with pulses exhibiting medium-range instability.

Limitations and future studies

The study focuses primarily on the period from 2008 to 2017 and 2015 to 2018, which may not fully capture long-term trends or more recent developments in cropping patterns influenced by emerging technologies, policies, or climate variations. Data collection was limited to 120 respondents using a multistage random sampling technique, which may not represent the broader agricultural diversity of the district comprehensively.

Expanding the study to include data from a longer timeframe and additional regions within Jammu and Kashmir can provide a more comprehensive understanding of cropping pattern changes. Future research should analyze the impacts of climate variability, water availability, and market trends on cropping decisions, which emphasize the role of external drivers in agricultural productivity. Incorporating qualitative methods such as focus group discussions or interviews with farmers, extension agents, and policymakers could uncover underlying motivations and constraints influencing crop choices. Investigating the impact of existing government interventions and schemes on cropping patterns can help design more targeted and effective policy measures, complementing existing findings on land-use trends. Future studies should focus on integrating sustainable agricultural practices, such as drought-resilient crops and conservation techniques, to address the challenges posed by declining food crop areas. By addressing these limitations and incorporating the suggestions, future research can provide more actionable insights to guide agricultural development and policymaking in Kathua district and similar regions.

References

1. Akhtar R, Acharya R. Changes in cropping pattern in Jammu and Kashmir. Int J Adv Res Educ Technol. 2015;2(4):88-91.
2. Amrithalingam N, Devi S. An economic analysis of changes in the cropping pattern in Cuddalore district, Tamil Nadu. Int J Curr Res. 2018;10(8):72131-6.
3. Anjum S. Growth and instability analysis in Indian agriculture. Int J Multidiscip Res Dev. 2018;5(11):119-25.
4. Bisht A, Kumar A. Growth and instability analysis of pulses production in India. Int J Agric Sci. 2018;10(14):0975-3710.
5. Biswas BC, Kumar L. Revolution in mango production: Success stories of some farmers. Fertil Mark News. 2011:1-24.
6. Dey A, Dinesh, Rashmi. Rice and wheat production in India: An overtime study on growth and instability. J Pharmacogn Phytochem. 2020;9(2):158-61.
7. Dobariya JB, Thesiya NM, Zinzala VJ. Cropping pattern in tribal areas of Dang district. J Krishi Vigyan. 2016;5(1):19-22.
8. Food and Agriculture Organization. State of Food and Agriculture Report [Internet]. 2022 [cited 2025 Apr 12]. Available from: https://www.fao.org
9. Ghosh BK. Determinants of the changes in cropping pattern in India: 1970-71 to 2006-07. Bangladesh Dev Stud. 2011;34(2):109-20.
10. Kalaiselvi V. An economic analysis of crop diversification in Tamil Nadu. Int J Curr Res Rev. 2012;4(8):147-54.
11. Kumar A. Agricultural production and stability in India. Indian J Agric Econ. 2020;75(4):564-78.
12. Kumar A, Singh P, Verma S. Cereal crop production trends in India. Indian J Agric Econ. 2019;74(3):345-58.
13. Kumar P, Singh R, Sharma R. Agricultural diversification and sustainability in India: Current trends and future prospects. J Agric Econ. 2023;75(4):602-618.
14. Kumar R. Instability and cropping patterns in Northern India: An analytical study. Agric Econ Rev. 2021;82(4):455-470.
15. Majumder K. Nature and pattern of crop diversification in West Bengal. Int J Res Manag Pharm. 2014;3(2):33-41.
16. Nair R, Deshmukh S, Rao K. Monsoon variability and its impact on Indian agriculture. Clim Res Lett. 2023;19(3):245-59.
17. Nayak D. Changing cropping pattern, agricultural diversification and productivity in Odisha: A district-wise study. Agric Econ Res Rev. 2015;29(1):93-104.
18. Nirpal RS, Suryawanshi RR, Shelke RA, Londe SM. Structural changes in land use and cropping pattern of Kolhapur district of Maharashtra. J Pharmacogn Phytochem. 2019;8(5):191-5.
19. Pattanaik F, Mohanty S. Changes in cropping pattern in Odisha agriculture in the neo-liberal period. J Rural Dev. 2017;36(1):121-54.
20. Pawar KS, More. Landholding and cropping pattern of the Maharashtra state. Aayushi Int Interdiscip Res J. 2018;5(1):238-241.
21. Sandhu H, Sohal KS. Regional imbalances in agricultural transformation in Punjab-Haryana plains.
22. Sangral C. Changes in cropping pattern and crop diversification in Jammu and Kashmir. J Humanit Soc Sci. 2015;20(4):7-9.
23. Sarkar R, Singh P, Verma S. Crop diversification and stability: Insights from Northern India. Agric Syst. 2021;189:103-16.
24. Sharma P, Verma A. Food crop production variability in India: A case study of Kathua district. J Agric Res. 2019;30(2):112-25.
25. Sharma R, Singh M. Agricultural output and price trends in Northern India. J Rural Dev. 2020;39(1):215-30.
26. Sharma V, Gupta R. Agricultural instability in Kathua district: A cropping pattern analysis. J Rural Stud. 2019;35(2):245-58.
27. Thakare AB, Shende NV, Tingre AS, Dangore UT. Changes in cropping pattern in Maharashtra. Int J Stat Appl Math. 2024;9(2):177-82.
28. Venkatesh S, Sen C. Decomposition analysis and sustainability of cropping pattern in Andhra Pradesh, India. Pharma Innov J. 2018;7(10):408-10.
29. Kumar S, Singh A. Growth trends in agricultural production: A regional analysis. Indian J Agric Econ. 2020;79(2):321-30.
30. Sharma P. Declining crop growth rates in Northern India: Causes and implications. J Rural Dev. 2021;35(1):144-58.