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SPATIO-TEMPORAL ANALYSIS OF FOOD IMPORTS IN JAMMU AND KASHMIR, INDIA

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Abstract: **The present paper attempted to assess the cropping land use change in Jammu and Kashmir and its impact on the food imports of the state. Cropping land use is a dynamic process and it keeps on changing with the change in economic returns of the crops, agro-climatic conditions, farm programmes, conservation strategies and management, and environmental regulations. The cropping land use in India underwent large-scale changes after green revolution and major shift occurred from cereals to non-cereals. The state of Jammu and Kashmir also experienced a change in the cropping land use though with varying degree of intensity across its spatial units (*districts*). The analysis of the data reveals that area under paddy, maize and wheat have registered a negative growth during the last thirty years. The area under orchards has increased in all the districts of the state. The food deficit of the state increased from 33.9 percent in 1980 to 43.2 percent in 2008 and thus the food imports increased steadily over the period of time. The import of wheat increased from 0.77 lac metric tons in 1980 to 1.82 lac metric tons in 2008 and rice imports increased from 1.50 lac metric tons in 1980 to 4.81 lac metric tons in the same time period. The urban areas reflect more imports than rural areas. Moreover, Jammu division of the state have low food import level than Kashmir valley and Ladakh regions of the state.**

Keywords: **Cropping land use, spatial, food import, dynamics, orchard.**

1. INTRODUCTION

The food budget of any region may be defined as the balance between the food production and food requirement. The gap between these two aspects reflects the food deficit level in any geographical area. To ensure food security in a food deficit area, the food imports become inevitable. The food production of any spatial unit is directly related with the cropping pattern of that region. Cropping pattern refers to the proportion of the area under different crops at a point of time. It also reveals the rotation of crops and the area under double cropping etc. in any state or country [1]. Cropping land-use is a highly dynamic process and the farmer's choice of cropping pattern is determined by various factors, viz; *physical factors* such as soil, climate, *technological factors* like irrigation, improved varieties of seeds, availability of fertilizers and plant protection chemicals; *Institutional factors* like land reform, consolidation of holdings, credit facilities, price structure, procurement policies and storage facilities and other factors like the rate of return, agro-climatic conditions, farm programmes, conservation programmes, and environmental regulations [2], [3], [4], [5]. This cropping land use shift is a direct result of the increase in relative price of labor and changes in domestic and global agricultural policies [6], [7] and was spurred by dramatic improvements in agricultural productivity, and a shift from more labor-intensive agriculture to more capital and technology-intensive agricultural practices that employed new varieties, synthetic inputs, and irrigation [8], [9], [10], [11], [12], [13], [14], [15]. The cropping system of any locality is the cumulative results of the past and present decisions by individuals, communities or governments and it keeps on changing in consonance with change in prices of goods, Govt. policies and other related factors [16]. The interacting driving forces of population increase, income growth, urbanization and globalization on food production, markets and consumption have changed food and agricultural system worldwide [17]. The relative importance of crops, crop yields and farm size leads to change in cropping pattern of an area [18]. Agriculture is the main occupation for the people of Jammu and Kashmir. About two-

third population of the state is directly or indirectly dependent on agriculture and allied activities for their livelihood. Agriculture and its allied activities are the predominant sector of the economy of Jammu and Kashmir and this sector contributed more than 31.29 per cent of Gross Domestic Production (GDP) in 2007 [19]. The cropping land use in the state also underwent drastic changes which led to the decrease in area under food crops and increase in area under cash crops/plantation agriculture. This phenomenon of shift from food crops to cash crops has led to widening the gap between food production and requirement and thus increased the food imports in the state. The study of this shifting land use was necessary for the sustainable agriculture of the state. Knowledge of cropping land use helps in maximization of productivity and conservation of land [20].

2. STUDY AREA

The state of Jammu and Kashmir constitutes northern most extremity of India and is situated between $32^{o}\,17'$ to $36^{o}\,58'$ N latitude and $73^{o}\,26'$ to $80^{o}\,30'$ E longitude. It falls in the great northwestern complex of the Himalayan Ranges with marked relief variation, snow-capped summits, antecedent drainage, complex geological structure and rich flora and fauna [21]. The total area of the State is 2, 22, 236 km^2 comprising 6.93 per cent of the total area of the Indian territory including 78,114 km^2 under the occupation of Pakistan and 42,685 km^2 under China [22].

3. MATERIALS AND METHODS

A. Materials:

- The Survey of India toposheets (1971) on scale 1:50,000 were used to generate a base map of the study area.
- Food import data has been obtained from directorate of Consumer Affairs and Public Distribution Department (CAPD), Jammu and Srinagar.

B. Methods:

(i) Determination of cropping land use shift:

For depicting the spatio-temporal change in the cropping land use, the data sets generated were analysed. The temporal change has been calculated by using the following formula;

$$\textit{Change } (V_1) = \frac{St1 - St2}{St1} \times 100 \quad [23]$$

Where, V_1 = Change in any variable, St_1= Status at time t_1, St_2 = Status at time t_2

(ii) Determination of food requirement:

The formula used to calculate food requirement is;

$$\mathbf{FR_y = Tp \times I \times 365 \ldots\ldots\ldots\ldots (i)}$$

Where, FR_y = Food requirement in a year; Tp= Total Population and I= intake needed per person per day (standard norm)

(iii) Determination of levels of food import:

For the determination of levels of food import across the districts of the state, standardized score (z- score) has been employed.

4. RESULTS AND DISCUSSION

In order to understand the effect of the changing cropping land use on food imports of the state, the dynamics in population growth and food requirement in a spatio-temporal manner need to be analyzed. These factors or dimensions are discussed in detail below;

A. Population dynamics:

The population in absolute values in the state has increased from 5808929 persons in 1980 to 11704596 in 2008 (102.46 percent increase) with an overall growth rate of 102.46 percent. The population increased at a faster rate from 1980 to 2000; however it started dwindling after 2000. The highest growth is observed in Kupwara district (148.94 percent) followed by Anantnag (116.36 percent) and Srinagar (109.84 percent), while as lowest growth is observed in Kathua

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(61.67 percent). The districts with growth rate less than state average are Udhampur (87.35 percent), Rajouri (97.35 percent), Jammu (92.05 percent), Pulwama (97.26 percent) and Budgam (96.87 percent) [24].

B. Spatial variation in the cropping land use dynamics:

The cropping land use has not changed uniformly in the state but exhibit greater variations. In order to quantify the spatial variation in the cropping land use, four variables have been taken for analysis, *viz*, area under paddy, wheat, rice and orchards. Since wheat occupies miniscule area in Kashmir valley and orchards do not occupy substantial area in districts of Jammu division, therefore for the respective divisions, they have not been taken into account for analysis. The percent change in different crops grown in the state has been calculated (table 1). The percent change in different crops grown in the state has been subjected to ranking method. The first rank was given to the district which showed highest decrease or increase in the cropping land use under any crop taken for the study and last rank or highest value was assigned to the district with lowest change in area under different crops.

TABLE 1: Percent change in area under different crops from 1980-2008 CE

	Change in area under crops (in percent)				Ranking				C.I
District	**Rice**	**Maize**	**Wheat**	**Orchards**	**Rice**	**Maize**	**Wheat**	**Orchards**	
Srinagar	-48.95	-4.59	-	106.82	1	11	-	2	**14**
Budgam	-41.6	16.3	-	54.68	4	3	-	4	**11**
Baramulla	-29.67	10.83	-	17.22	5	7	-	7	**19**
Kupwara	-23.69	7.83	-	49	9	9	-	5	**23**
Pulwama	-44.88	-9.44	-	1533.21	3	8	-	1	**12**
Anantnag	-26.27	-6.52	-	64.62	7	10	-	3	**20**
Jammu	-13.3	-14	-15.5	24.53	12	5	6	6	**29**
Kathua	-22.59	-25.5	-29.28	-	10	2	2	-	**14**
Doda	-15.35	-15.48	-23.66	-	11	4	4	-	**19**
Poonch	-27.67	-13.41	-16.4	-	6	6	5	-	**17**
Rajouri	-24.23	-28.78	24.26	-	8	1	3	-	**12**
Udhampur	-46.64	-28.78	-43.46	-	2	1	1	-	**4**
Leh	-	-	-	-	-	-	-	-	-
Kargil	-	-	-	-	-	-	-	-	-

Source: *Compiled by using data obtained from Financial Commissioner's Office Srinagar, 2011.* ***C. I*** *means* ***'Composite Index'***

The ranks of all the crops have been added to get composite index and finally a choropleth map has been prepared to highlight the spatial variation in the cropping land use of the state (Fig 2).

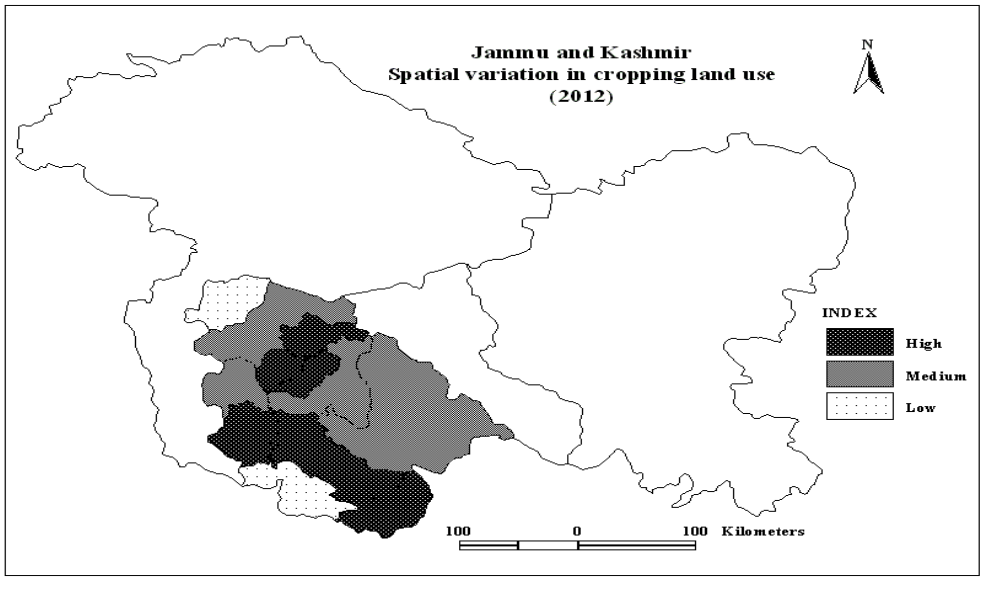

Fig 2

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C. Domestic production:

The domestic production in the study area has been calculated by addition of production of the three main crops (Paddy, Maize and wheat) taken for the study in the state. The overall domestic production has increased from 581803 metric tonnes in 1980 to 953118 metric tonnes in 2008, thus recorded an absolute increase of 371315 metric tonnes [25]. The overall trend of domestic production is increasing in the state on account of increasing productivity, but it does not increase in consonance with increasing population.

D. Food requirement:

Food requirement means the total food needed to support the population for ensuring food security. The food requirement has been calculated by using the standard consumption intake of rice, wheat or maize per capita/head (400grams/head/day) fixed by food and agricultural organization [26]. and world health organization [27]. The significant increase in population (36.59% per decade) has increased the food demand in the state. The formula used to calculate food requirement is;

$$\mathbf{FR_y = Tp \times I \times 365 \ldots\ldots\ldots\ldots (1)}$$

Where, FR_y = Food requirement in a year; Tp= Total Population and I= intake needed per person per day (standard norm)

The food requirement has increased by 860768 metric tonnes during these twenty eight years, *i.e.*, more than what was needed in 1980. The average rate of increase per annum is 3.62 percent. The food requirements in the different districts of the study area have increased in consonance with the rate of population growth in the respective districts. The highest requirement in absolute values is in Jammu district (256880 metric tonnes) followed by Srinagar (211194 metric tonnes) and Anantnag (201778 metric tonnes), while as lowest requirement is in Kargil (19730 metric tonnes).

E. Food import analysis:

Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life [28]. Since food deficit exists in the study area, therefore in order to ensure food security, the import of food grains becomes an indispensable process. The government supplies the food through public distribution system at the outlets of consumer affairs and public distribution department (commonly known as *'ration ghats'*) established in every locality of the state. Since the food deficit increased in the state over the period of time, therefore naturally the food imports increased over time. The people meet the food requirements by purchasing food from private dealers as well in addition to the food received per month from ration outlets. The food imports in the state consist mainly of wheat and rice shown in the table 2 and 3 below;

TABLE 2: Food imports in Jammu and Kashmir (1980-81 to 2008-09)

District	Food imports-wheat in '000 metric tonnes							
	1980-81	**1985-86**	**1990-91**	**1995-96**	**2000-01**	**2005-06**	**2008-09**	**Change (%)**
Srinagar	15.46	16.36	16.86	18.00	19.14	11.26	18.51	**19.76**
Budgam	1.43	2.29	3.04	3.58	4.38	4.44	3.25	**126.27**
Baramulla	3.13	3.45	3.96	5.24	6.26	7.41	7.23	**130.82**
Kupwara	3.51	4.09	4.41	5.24	5.28	5.64	5.87	**67.08**
Pulwama	1.78	1.93	2.24	2.02	1.65	1.76	2.29	**28.94**
Anantnag	2.17	2.10	2.25	1.95	2.92	3.35	3.64	**67.42**
Jammu	16.65	21.65	28.28	31.50	35.92	38.73	43.31	**160.22**
Kathua	5.43	7.13	7.44	7.65	7.73	7.15	6.28	**15.66**
Doda	13.68	17.49	19.46	26.88	31.02	32.62	36.67	**168.06**
Poonch	1.87	3.15	4.45	4.17	4.25	4.83	7.50	**300.78**
Rajouri	1.27	1.96	2.97	4.19	5.22	6.46	10.73	**744.57**
Udhampur	8.23	15.87	19.44	19.98	23.77	26.87	31.94	**288.09**
Leh	1.21	1.41	1.52	1.80	2.02	2.49	2.24	**86.09**
Kargil	1.27	1.48	1.60	1.89	2.12	2.62	2.43	**91.60**
Total	**77.09**	**100.35**	**117.88**	**134.07**	**151.67**	**155.60**	**181.89**	**135.95**

Source: *Consumer affairs and Public distribution department (CAPD), Srinagar/Jammu, 2008-09*

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The wheat imports in the study area have increased from 77086 metric tonnes in 1980 to 181885 metric tonnes in 2008, thus an absolute increase of 104799 metric tonnes with the percentage increase of 135.95 percent. Since wheat is staple food of Jammu province, therefore the imports have increased much in Jammu district (26669 metric tonnes) followed by Udhampur (23710 metric tonnes) and Doda (22991 metric tonnes), while as the imports are recorded least in Kathua (851 metric tonnes) and Pulwama (514 metric tonnes). The import of rice is more than wheat in the study area because being staple food of more people with less domestic production. It has more demand than wheat and like wheat it has increased from 150262 metric tonnes in 1980 to 481038 metric tonnes in 2008, thus an absolute increase of 330776 metric tonnes (table 3) with the percentage increase of 220.13 percent.

TABLE 3: Food imports in Jammu and Kashmir (1980-81 to 2008-09)

District	Food imports (Rice)-in '000 metric tonnes							
	1980-81	**1985-86**	**1990-91**	**1995-96**	**2000-01**	**2005-06**	**2008-09**	**Change (%)**
Srinagar	41.36	48.27	55.80	73.70	82.43	92.40	109.36	**164.41**
Budgam	6.20	10.46	15.43	20.54	25.17	28.72	32.64	**426.26**
Baramulla	20.15	28.74	38.35	41.67	55.31	66.08	70.24	**248.63**
Kupwara	11.04	11.97	17.71	25.26	30.30	33.26	40.16	**263.71**
Pulwama	11.53	18.18	21.60	26.29	35.13	43.02	51.65	**347.96**
Anantnag	22.82	25.40	34.24	40.92	51.07	62.81	75.13	**229.18**
Jammu	9.23	11.17	13.23	14.89	18.81	20.02	21.71	**135.14**
Kathua	1.35	2.28	2.37	2.06	1.97	2.26	1.78	**31.57**
Doda	9.46	9.68	11.78	13.79	14.99	21.35	28.79	**204.47**
Poonch	3.13	3.45	4.31	3.96	4.30	4.48	6.06	**93.38**
Rajouri	0.46	1.32	2.46	3.98	4.14	5.81	7.42	**1506.50**
Udhampur	5.24	6.23	8.23	8.48	9.26	10.88	11.63	**122.02**
Leh	4.04	4.88	5.67	6.98	9.18	11.29	12.03	**198.02**
Kargil	4.25	5.14	5.97	7.34	9.66	11.89	12.45	**192.97**
Total	**150.26**	**187.17**	**237.15**	**289.85**	**351.70**	**414.25**	**481.04**	**220.13**

Source: *Consumer affairs and public distribution department (CAPD), Srinagar/Jammu, 2008-09*

Since rice is a staple food of Kashmir province, therefore the imports have increased much in Srinagar district (67997 metric tonnes) followed by Anantnag (52304 metric tonnes) and Baramulla (50089 metric tonnes), while as the imports are recorded least in Kupwara (29117 metric tonnes) and Budgam (26440 metric tonnes). Kashmir province imports more followed by Jammu province. Ladakh province has minimum food imports because it has only two districts with the total population of 287492 (Census of India, 2011). The food imports increased at a higher rate in Kashmir province because its food deficit widened more than other two provinces of the state.

F. Levels of food import:

In order to determine the levels of food import across the districts of the state, Z-score has been computed for both rice and wheat imports for the year 1980 and 2008 (Table 4). Then composite z-score has been calculated and three groups have been identified, *viz*, high, medium and low (Fig 3 and 4).

TABLE 4: Standardized scores of food imports in Jammu and Kashmir, 2011

District	Z-Score (1980)		Composite Score (1980)	Z-Score (2008)		Composite Score (2008)
	Rice	**Wheat**		**Rice**	**Wheat**	
Srinagar	2.79	1.76	**4.55**	0.39	2.36	**2.75**
Budgam	-0.41	-0.72	**-1.13**	-0.69	-0.05	**-0.75**
Baramulla	0.86	-0.42	**0.44**	-0.41	1.13	**0.72**
Kupwara	0.03	-0.35	**-0.32**	-0.51	0.18	**-0.33**
Pulwama	0.07	-0.66	**-0.59**	-0.76	0.54	**-0.22**
Anantnag	1.10	-0.59	**0.51**	-0.67	1.28	**0.61**
Jammu	-0.14	1.97	**1.83**	2.16	-0.40	**1.76**
Kathua	-0.85	-0.01	**-0.87**	-0.48	-1.02	**-1.50**
Doda	-0.12	1.44	**1.33**	1.69	-0.17	**1.51**
Poonch	-0.69	-0.64	**-1.34**	-0.39	-0.89	**-1.28**

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Rajouri	-0.94	-0.75	**-1.68**	-0.16	-0.85	**-1.01**
Udhampur	-0.50	0.48	**-0.02**	1.35	-0.71	**0.64**
Leh	-0.61	-0.76	**-1.37**	-0.77	-0.70	**-1.47**
Kargil	-0.59	-0.75	**-1.34**	-0.75	-0.69	**-1.44**

Source: *Compiled by using table 2 & 3*

From the figure 3, it is clear that three districts namely Srinagar, Jammu, and Doda have high levels of food imports; while as five districts (Leh, Kargil, Rajouri, Poonch and Budgam) have low food imports and six districts of the state (Kupwara, Baramulla, Anantnag, Pulwama, Udhampur and Kathua) fall in the medium level of food imports. The figure 4 shows that the three districts namely Srinagar, Jammu, and Doda have again high levels of food imports; while as five districts (Leh, Kargil, Rajouri, Poonch and Kathua) have low food imports and six districts of the state (Kupwara, Baramulla, Anantnag, Pulwama, Budgam and Udhampur) fall in the medium level of food imports. Form these two figures, district Kathua has improved in its domestic food production, thus it changed from medium to low food importer; while as Budgam district moved from low to moderate level in food imports.

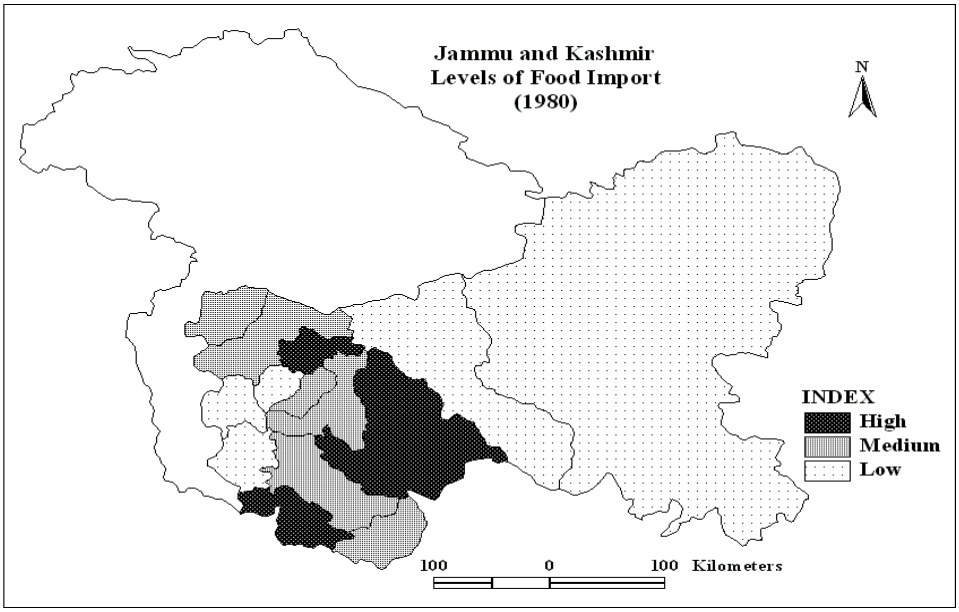

Fig. 3

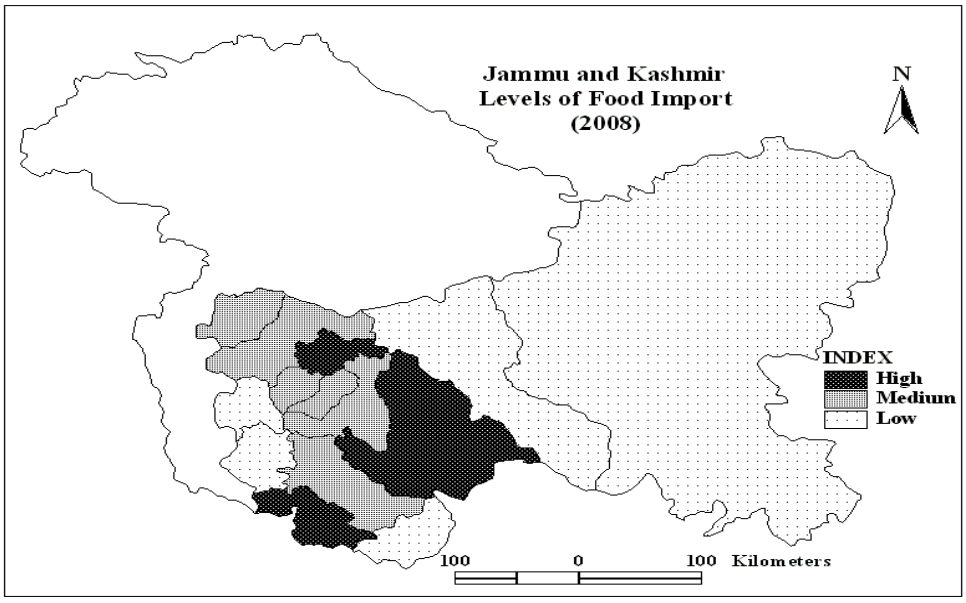

Fig. 4

4. CONCLUSION

The analysis and interpretation of the data revealed that on an average, the area under the three major food crops grown in the state (*Paddy, Maize and wheat*) has decreased at state level and the area under orchards has registered a high positive growth in all the districts. This increase is largely explained by the shifting of cropping land use from food crops to plantation agriculture (orchard cultivation). This cropping land use shift over the period of time increased the food deficit in the state and hence for ensuring food security the food imports of the state are on rise. Therefore, the need of the hour is to evolve a comprehensive agricultural policy for the state to prevent further cropping land shift for the sustainable agricultural development and food security of the state.

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