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Study of shift in cropping pattern in northern dry zone of Karnataka

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ABSTRACT: The cropping pattern plays an important role in ascertaining the extent of agricultural production and give consideration to agricultural economy of an area. Cropping pattern of any area is generally controlled by physical, socio economic and technological factors. The present study was conducted to know the changes in the cropping pattern of northern dry zone of Karnataka which includes Bagalkote, Bellari, Vijayapura, Dharwad, Gadag, part of Kalburgi and Koppal districts. The major cereal crops of these districts are Paddy, Sorghum, Finger millet, Maize and Pearl millet. Crop sown area data were collected from Agriculture Office, Government of Karnataka (Head Office, Bangalore) for the period of 2011 – 12 to 2022 – 23. Temporal changes in cropping system have been studied for selected cereal crops. The study revealed that there was negative as well as positive change in cropping pattern of the crops over the selected period of time.

Keywords: Cropping pattern, cropping system, finger millet, maize, paddy, Pearl millet, Sorghum

Agriculture is a main subdivision for economic development in India, as more than 43.51 per cent of population is involved in agriculture and its allied activities for their means of support (Ministry of Statistics and Programme Implementation, GoI), (Anonymous, 2022). Any changes in agricultural sector will influence on the food security and also on country's economy as a whole. The changes in cropping system and pattern are one such concern which may influence the expansion of an economy. The activities involved in cultivation are primarily influenced by socio – physical and politico – economic factors. These factors affect the intensity of land use, farming system and choice of crops. The adoption of technical knowledge by farmers has changed the cropping pattern in the farming community. In the present study an attempt has been made to envisage the changes in cropping pattern which will emphasis on many facts and understand numerous aspects in Northern dry zone of Karnataka. Cropping pattern is a vigorous conception because it changes over space and time. It is noticed that no cropping pattern is ideal for all times to a particular region. (Satnami and Surendra, 2019). It can be described as the division of area under various crops at a point of time. Cropping pattern is different from one locality to another depending on the terrain, topography, slope, rainfall, soil type, temperature, climate and technology. In some places it also

depends on the demand in the market. (Anamika Berman *et al*, 2022) There are various crop statistics used to denote cropping pattern which include temporal changes of crop cultivation area and crop combination. The study of cropping pattern comprises an important feature of agricultural geography as it provides a good basis for agricultural regionalization. (Joshi *et al*, 2002 and Joshi *et al*, 2003)

There has been an obvious change in the cropping pattern. This may be due to improvement in crop varieties and other productivity increasing factors of production influenced the farmers' cultivation practice which has been reflected in the cropping pattern from raising of low – value crops to high value crops in most of the regions. (Manoj *et al.*, 2023).

Considering the concept of change in cropping pattern, the present work explores the shift in cropping pattern in Northern dry zone of Karnataka for the major selected cereal crops.

MATERIALS AND METHODS

Karnataka is divided into 10 agro climatic zones. Among these zone III is the Northern dry zone which encompassing districts like Bagalkote, Bellari, Vijayapura, Dharwad, Gadag, part of Kalburgi and Koppal. The northern dry zone is one of the main

drought – prone agro – climatic zones.

The dominant cropping pattern in the study area was Sorghum (Jowar) as lead crop followed by pulses with Rabi crops like maize, pearl millet, finger millet. (Singh and Dilhon, 2005)

The present study was based on the secondary data. Agriculture crop area data have been collected from Agriculture Office, Government of Karnataka (Head office, Bangalore), (Anonymous, 2022). The selected crops include Paddy, Sorghum, Finger millet, Maize and Pearl millet. These were the major crops of Northern Dry zone of Karnataka districts like Bagalkote, Belagavi, Bellari, Vijayapura, Dharwad, Gadag, Kalburgi and Koppala. For each district and for each crop, change of cropping pattern has been studied for two time periods, 2011 – 12 and 2022 – 23. This assessment of cropping pattern includes temporal changes of individual crop cultivation for area based on the areas of selected districts.

RESULTS AND DISCUSSION

Cropping pattern of major crops that are grown in the dry zone of Karnataka has been selected for the time periods 2011 – 12 and 2022 – 23. The selected cereal crops were Paddy, Sorghum, Finger millet, Maize and Pearl millet. The data was collected from Agriculture office, Bangalore. Then the data was classified into a suitable format required for comparing temporal changes and analysed. For the selected cereal crops the entire northern dry zone of Karnataka covered 27, 46,411 hectares in the year 2011 – 12 which decreased to 24,02,305 hectares in the year 2022 – 23 (Table 1).

Paddy (*Oryza sativa*)

Paddy was significant crop in the study area. Cultivation of paddy crop contributed considerably to the local economy and provided income for

farming community.

The study of temporal changes of paddy cultivation in the year 2011-12 and 2022-23 in Northern dry zone (Bagalkote, Belagavi, Bellari, Vijayapura, Dharwad, Gadag, Kalburgi and Koppal districts) of Karnataka (Table 2) revealed that the district Bellari recorded maximum positive change (5.34%), indicating that the gross cultivated area for paddy increased by 5.34 per cent during the time period 2022-23 as compared to 2011-12. This was followed by the district Koppal, which recorded a percentage increase of 5.19 in gross cultivated areas in the time period 2022-23 as compared to 2011-12. In Kalburgi and Gadag districts there was positive change of 1.83% and 1.70% respectively, in the change in the crop sown area from 2011 – 12 to 2022 – 23. These results were close to Satnami and Surendra (2019) study of a geographical analysis of changes in cropping pattern in Karnataka. In Belagavi district there was maximum negative change (7.85%), indicating that the gross sown area for paddy decreased by 7.85% during the time period 2022 – 23 as compared to 2011 – 12. This was followed by Dharwad district which recorded percentage decrease of 6.19% in gross cultivated area in the time period 2022 – 23 as compared to 2011 – 12. There was a very negligible negative change in Bagalkote district (0.02%). In Vijayapura district there was no change during the time period 2011 – 12 and 2022 – 23.

The reason behind decrement in paddy cultivation was scarcity of water or less rainfall in the northern part of Karnataka.

Sorghum (*Sorghum bicolor*)

Sorghum was a predominant crop and staple food in the districts of North Karnataka especially during Rabi season. In some districts like Dharwad and Gadag sorghum was grown during both Kharif and Rabi seasons. Cultivation of sorghum played a crucial role in supporting sustainable agriculture practices in the study area. (Hariprasanna and Rakshit, 2016)

The analysis of temporal changes of Sorghum cultivation in the crop year 2011-12 and 2022-23 in Northern dry zone (Bagalkote, Belagavi, Bellari,

Table 1: Cereals crop area in Northern dry zone of Karnataka

Northern Dry Zone	2011 – 12 (Area in ha)	2022 – 23 (Area in ha)
	27,46,411	24,02,305

Source: Agriculture office, Bangalore

Table 2: Comparison of temporal changes of Paddy Cultivation in 2011 – 12 and 2022 – 23 in Northern Dry zone of Karnataka

District	2011-12		2022-23		Percent Changes
	Area (ha)	Area %	Area (ha)	Area %	
Bagalkote	85	0.03	24	0.01	-0.02
Belagavi	68307	23.38	53142	15.53	-7.85
Ballari	116169	39.75	154333	45.09	5.34
Vijayapura	88	0.03	108	0.03	0.00
Dharwad	25829	8.84	9075	2.65	-6.19
Gadag	1707	0.58	7826	2.29	1.70
Kalburgi	3963	1.36	10908	3.19	1.83
Koppal	76073	26.03	106868	31.22	5.19
Total	292221	-	342284	-	17

Source: Agriculture Office, Bangalore

Table 3: Temporal changes of Sorghum cultivation in 2011-12 and 2022-23 in Northern Dry zone of Karnataka

District	2011-12		2022-23		Percent Changes
	Area (ha)	Area %	Area (ha)	Area %	
Bagalkote	111391	10.16	40108	7.83	-2.32
Belagavi	154736	14.11	109496	21.39	7.28
Ballari	42185	3.85	22123	4.32	0.48
Vijayapura	167299	15.25	49551	9.68	-5.57
Dharwad	44092	4.02	28483	5.56	1.54
Gadag	53545	4.88	26165	5.11	0.23
Kalburgi	207898	18.95	58609	11.45	-7.51
Koppal	31563	2.88	16675	3.26	0.38
Total	1096846		511984		-53.32

Source: Agriculture Office, Bangalore

Vijayapura, Dharwad, Gadag, Kalburgi and Koppal districts) of Karnataka illustrated highest positive change in Belagavi district (7.28%), indicating that gross cropped area for Sorghum increased by 7.28% during time period 2022 – 23 as compared to 2011 – 12. The districts Dharwad, Bellari, Koppal and Gadag showed percentage increase of 1.54, 0.48, 0.38 and 0.23 respectively in the gross cultivated area of Jowar crop. In the district Kalburgi, there was maximum negative change (7.51%), indicating that gross cultivated area under Sorghum has decreased in the time period 2022 – 23 as compared to gross sown area in the time period 2011 – 12. The decrease in sorghum farming was due to farmers' shifting to other crops like pigeonpea, because of its high cultivation cost and lower price in the market. (kisandeals.com) In Vijayapura district also

there was negative change of about 5.57% which revealed that gross cropped area of Jowar decreased during time period 2022 – 23 as compared to 2011 – 12. In Bagalkote district there was negative change (2.32%) in gross cropped area from time period 2011 – 12 to 2022 – 23. Sorghum cultivation requires good drenching soil condition areas but due to urbanization, lack of irrigation facilities the cultivation is hampered which showed negative results. Most of the farmers in study area shifted their cultivation of sorghum to Bengal gram. (Indian Newspaper, Deccan Herald).

Finger millet (*Eleusine coracana*)

Finger millet commonly known as Ragi was widely cultivated in the Northern dry zone especially in areas with semi – arid conditions. It was a staple

food for weaker sections of society in many regions of study area. (Maharajan *et al.*, 2021)

The examination of temporal changes of Finger millet cultivation in the crop year 2011 – 12 and 2022 – 23 in Northern dry zone (Bagalkote, Belagavi, Bellari, Vijayapura, Dharwad, Gadag, Kalburgi and Koppal districts) of Karnataka (Table 4) revealed that maximum positive changes occurred in the district Belagavi followed by Vijayapura and Kalburgi, indicating that gross cultivated area of Ragi crop increased (0.19%, 0.16% and 0.13% respectively) during time period 2022 – 23 as compared to 2011 – 12. The districts Koppal, Gadag and Bagalkote recorded a percentage increase of 0.06, 0.04 and 0.02 respectively in the gross cultivated area of Finger millet crop during time period 2022 – 23 as compared to time period 2011 – 12. The table also showed that maximum negative change occurred in Bellari district (2.84%) followed by Dharwad (0.05%), indicating decrease in gross

cultivated area of Finger millet during time period 2022 – 23 as compared to time period 2011 – 12. (Satnami and Surendra, 2019)

Maize (*Zea mays*)

Maize was the most versatile crop among cereals in study area with respect to its adaptability, types and uses. It played an important role in agricultural economy both as staple food for population and feed for animals. (Singh, and Morris, 1997)

The study of temporal changes of Maize cultivation in the crop year 2011 – 12 and 2022 – 23 in Northern dry zone (Bagalkote, Belagavi, Bellari, Vijayapura, Dharwad, Gadag, Kalburgi and Koppal districts) of Karnataka (Table 5) indicated that district Koppal recorded maximum positive change (5.30%) implied that the gross cultivated area for maize increased by 5.30% during the time period 2022 – 23 as compared to its level in time period 2011 – 12. This was followed by Gadag district which recorded

Table 4: Temporal changes of Finger millet Cultivation in 2011 – 12 and 2022 – 23 in Northern Dry zone of Karnataka

District	2011-12		2022-23		Per cent Changes
	Area (ha)	Area %	Area (ha)	Area %	
Bagalkote	0	0.00	12	0.02	0.02
Belagavi	525	0.87	762	1.05	0.19
Ballari	3742	6.19	2420	3.35	-2.84
Vijayapura	0	0.00	115	0.16	0.16
Dharwad	50	0.08	21	0.03	-0.05
Gadag	11	0.02	40	0.06	0.04
Kalburgi	0	0.00	97	0.13	0.13
Koppal	0	0.00	43	0.06	0.06
Total	60483		72303		19.54

Source: Agriculture Office, Bangalore

Table 5: Temporal changes of Maize Cultivation in 2011 – 12 and 2022 – 23 in Northern Dry zone of Karnataka

District	2011-12		2022-23		Per cent Changes
	Area (ha)	Area %	Area (ha)	Area %	
Bagalkote	82297	8.13	79903	5.91	-2.23
Belagavi	147998	14.63	188737	13.95	-0.67
Ballari	103650	10.24	29716	2.20	-8.05
Vijayapura	81890	8.09	105488	7.80	-0.29
Dharwad	45272	4.47	60101	4.44	-0.03
Gadag	63860	6.31	124872	9.23	2.92
Kalburgi	6959	0.69	1952	0.14	-0.54
Koppal	53116	5.25	142679	10.55	5.30
Total	1011812		1352474		33.67

Source: Agriculture Office, Bangalore

Table 6: Temporal changes of Bajra Cultivation 2011 – 12 and 2022 – 23 in Northern Dry zone of Karnataka

District	2011-12		2022-23		Per cent changes
	Area (ha)	Area %	Area (ha)	Area %	
Bagalkote	33222	11.65	14759	11.97	0.32
Belagavi	12459	4.37	6598	5.35	0.98
Ballari	16348	5.74	3476	2.82	-2.92
Vijayapura	60052	21.07	19476	15.80	-5.27
Dharwad	0	0.00	15	0.01	0.01
Gadag	2159	0.76	669	0.54	-0.21
Kalburgi	20942	7.35	333	0.27	-7.08
Koppal	65874	23.11	39927	32.39	9.28
Total	285049		123260		- 56.76

Source: Source: Agriculture Office, Bangalore

percentage increase of 2.92 in gross cultivated areas in the time period 2022 – 23 as compared to 2011 – 12. The district Bellari recorded maximum negative change (8.05%) indicating that the gross cultivated area for Maize decreased by 8.05%, during the time period 2022 – 23 as compared to its level in time period 2011 – 12. The districts Bagalkote, Belagavi, Vijayapura, Kalburgi and Dharwad recorded negative change of 2.23%, 0.67%, 0.29%, 0.54% and 0.03% respectively, indicating decrease in the gross cropped area of Maize during time period 2022 – 23 as compared to time period 2011 – 12. (Rubeenah and Rekha, 2015)

Pearl millet (*Cenchrus americanus*)

Pearl millet commonly known as Bajra was a significant crop in Northern dry zone of Karnataka particularly in semi-arid regions. It was drought tolerant crop in the study area. (Ravi *et al.*, 2015) The analysis of temporal changes of Pearl millet cultivation in the crop year 2011 – 12 and 2022 – 23 in Northern dry zone (Bagalkote, Belagavi, Bellari, Vijayapura, Dharwad, Gadag, Kalburgi and Koppal districts) of Karnataka (Table 6) indicated that the district Koppal recorded maximum positive change (9.28%), indicating that the gross cultivated area for Bajra increased by 9.28% during the time period 2022 – 23 as compared to its level in 2011 – 12. This was followed by districts Belagavi and Dharwad which recorded a percentage increase of 0.98 and 0.01 respectively in gross cultivated area in the time period 2022 – 23 as compared to 2011 – 12. The district Kalburgi recorded maximum

negative change (7.08%) indicating that the gross cultivated area for Bajra decreased by 7.08% during the time period 2022 – 23 as compared to time period 2011 – 12. This was followed by districts Vijayapura, Bellari and Gadag which recorded negative change of 5.27%, 2.92% and 0.21% respectively, indicating that the total crop sown area for Bajra decreased during the time period 2022 – 23 as compared to time period 2011 – 12.

Several reasons were cited by farmers for decreasing cultivation area of pearl millet in the study area. Some of the constraints were unachievable minimum support price, lack of demand by consumers, lack of marketing facilities, lack of technical information and machineries (Verma, 2020).

CONCLUSION

Present study of temporal changes in the crop year 2011 – 12 and 2022 – 23 showed both positive and negative changes in the cropping system of selected cereal crops in Northern dry zone of Karnataka. Paddy (17%), Maize (33.67%) and Finger millet (19.54%) showed positive changes in total. The reason behind increase of cultivation area of these crops may be sufficiency in irrigation facilities, knowledge of nutritional values, and demand from the consumers and other factors. Whereas, Sorghum (-53.32%) and Pearl millet (-56.76%) showed negative changes in total. The decrement in area of these crops were due to lack of facilities like minimum support price by government, irrigation and markets, higher cost of cultivation, lack of

technologies, availability of resources etc. The shift in cropping pattern in particular span of time clearly displays the changes that have taken place in the agricultural sector. (Kumar and Gupta, 2015)

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REFERENCES

- Anamika Barman, Priyanka Saha, Shashank Patel and Anurag Bera (2022). Crop Diversification an Effective Strategy for Sustainable Agriculture Development, Sustainable Crop Production – Recent Advances, Intech_Openpp., Pp 1 – 18.
- Anonymous (2022). Agriculture Office (Head office), Bangalore, Government of Karnataka.
- Anonymous (2022). Ministry of Statistics and Programme Implementation, Government of India. mspi.gov.in
- Hariprasanna, K. and Rakshit, S. (2016). Economic Importance of Sorghum. In: Rakshit, S., Wang, YH. (eds) The Sorghum Genome. Compendium of Plant Genomes. Springer, Cham.
- Joshi P.K. Ashok Gulati, Pratap S Birlthal and Laxmi Tewari (2003). Agricultural Diversification in South Asia: Patterns, Determinants and Policy implications, Economic and Political weekly, 39(24): 52 – 53
- Joshi, P K., Ashok Gulati, P.S. Birlthal and L. Tewari (2002). Agricultural Diversification in India, Agricultural Diversification and Smallholders in South Asia, Pp 219 – 242.
- Kumar S. and Gupta S., (2015). Crop diversification towards High – value crops in India: A state level empirical analysis. *Agricultural Economics Research Review*, 28(2): 339 – 350.
- Maharajan T., Antony Ceasar S., Ajeesh Krishna T.P. and Ignacimuthu S. (2021) Finger Millet [*Eleusine coracana* (L.) Gaertn]: An Orphan Crop with a Potential to Alleviate the Calcium Deficiency in the Semi-arid Tropics of Asia and Africa. *Front. Sustain.*
- Manoj B.G., Vasantha Kumari J., Ashalatha K.V., Sumesh K.G., Pradeep Mishra, Roshan Kumar Bhardwaj & Lakshmi Narsimhaiah (2023). Study of Shift in Cropping Pattern in Selected Districts of Karnataka, 3(1): 41-46.
- Ravi S.C., Rashmi K.S., Satishkumar M. and Mahadeva Reddy B.V. (2015). Millets Cultivation in Karnataka: A Profitability Analysis, *Trends in Biosciences*, 8(6): 1428-1430.
- Akhtar Rubeenah and Acharya Rekha (2015). Changes in Cropping Pattern in Jammu and Kashmir. *Int. J. Advanced Research*, 2 (4): 88-91.
- Satnami D. and Surendra P., (2019), Changes in cropping pattern of Karnataka state: A geographical analysis. *Geographical Analysis*, 8(1):43 – 49
- Verma Shivani, April 5, 2020, Bajra – A Dying Crop in North Karnataka's Muddebihal, Indian Institute of Journalism & New Media article.
- Singh, J. and Dillion, S. S. (2005). Agricultural Geography, New Delhi: Tata McGraw Hill Pub.
- Singh, R. P. and Morris, M. L. (1997). Adoption, management, and impact of hybrid maize seed in India. CIMMYT, Economics working paper, Mexico, Pp 2-3.
- www.deccanherald.com
- www.kisandeals.com

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