The Pharma Innovation Journal 2023; 12(1): 1263-1267

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(1): 1263-1267

www.thepharmajournal.com
Received: 16-10-2022
Accepted: 19-11-2022

Thejaswi Kumar J
Department of Agricultural Economics, College of Agriculture, UAS, GKVK, Bangalore, Karnataka, India

Gajanana TM
Principal Scientist, Division of Social Sciences and Training, ICAR-IIHR, Bangalore, Karnataka, India

Corresponding Author:
Thejaswi Kumar J
Department of Agricultural Economics, College of Agriculture, UAS, GKVK, Bangalore, Karnataka, India

Pattern of land allocation and crop diversification across southern agro-climatic zones of Karnataka

Thejaswi Kumar J and Gajanana TM

Abstract
The present study was carried out in southern transition and dry agro-climatic zones of Karnataka using farm level primary data. The study was majorly focused on deriving empirical evidences on micro level pattern of allocation in diverse agro-climatic zones and to assess nature and extent of crop diversification across the two zones. The study also analyzed the pattern of allocation across different farmers' category in order to understand the decision making behavior of the farm households. The data was collected from 180 farm households across two agro-climatic zones by selecting two taluks in each zone. The level of crop diversification was higher in southern transition zone (0.71) compared to southern dry zone (0.66). The crop diversification was higher among marginal and small farmers compared medium and larger farmers in southern transition zone whereas the opposite pattern was observed in southern dry zone. Commercial crops and vegetables occupied major share in allocation in southern transition whereas, vegetables and fruits were the major crop groups in southern dry zone. The shift from traditional subsistence crops to High Value Crops (HVCs) was evident from the study mainly attributed to high remunerative income from these crops compared to other regular crops. The study provide policy implications on market stabilization and improvement of secondary vertical and horizontal supply chains for sustaining the present HVCs cropping system across the study regions.

Keywords: Diversification, agro-climatic zones, high value crops, composite entropy index

1. Introduction
The proliferation of extremely small and tiny holdings on account of factors like continuing population pressure on land coupled with general lack of rural non-farm employment opportunities, liberal laws of inheritance and resultant sub-division of holdings, etc., is one of the major constraints in boosting agricultural production and productivity and raising the levels of living of a typical Indian farmer. Crop diversification a process of reallocation of resources across crops based on their comparative advantage which is generally viewed as a shift from traditional lower-value to higher-value crops plays important role in sustaining farm livelihood economically and an important pathway for agricultural development. It also enhances farmers' adaptability to external shocks and promotes self-reliance and sustainability in agriculture. Diversification serves as a sole source of combating risk against climate and weather vagaries in both dry land agriculture and regions experiencing erratic rainfall. The significance of crop diversification becomes more pronounced in the WTO-led globalized regime that restricts the scope for prices as an incentive to increase production. Farmers will remain in a disadvantageous position unless they adapt to market signals.
The term "crop diversification" is used in different contexts. While defining diversification in a purely economic term, it is treated from two analytical perspectives; first, as a process of establishing at given prices, the optimal crop mix on a production possibility frontier and second as a mechanism for incorporating risk aversion into a farmer's decision-making process in which crop specialization may lead to highly unstable income due to variance in yield, production, or price for the particular crop (World Bank, 1988) [10]. In either case, diversification is highlighted due to two purposes -increases the income and decrease the risk-both aspects of the quality and quantity of diversification. The argument is that farmers must be in a position to produce high-value crops and secondly with increase in commercialization must also be able to maintain the diversity in the cropping pattern in order to deal with the risk in this sector.

Against this background, the present paper addresses the following issues. (i) What is the pattern of land allocation in different agro-climatic zones of Karnataka? (ii) What is the extent and nature of crop diversification across agro-climatic zones of Karnataka? And (iii) what is the pattern of land allocation across different categories of farmers in the selected agro-climatic zones? (iv) What is the nature and extent of crop diversification across the two zones?

2. Methodology

2.1 Data and sampling framework

The study used primary data to provide empirical evidences on crop diversification in Southern Transition Zone (STZ) and Southern Dry Zone (SDZ). The main focus of the study was to derive empirical evidences of crop diversification and the study primarily relies upon primary data collected from randomly selected sample farmers in selected taluks of STZ and SDZ. Multi-stage random sampling design was employed for the selection of respondents across the study regions. In STZ, the taluks selected were H. D. Kote and Periyapatna and in case of SDZ the taluks selected were Mysuru and Nanjanagudu. The primary data were collected from 180 farm households, consisting of 90 farm households each from STZ and SDZ. In each zone, the data was collected from 45 farm households from each taluks.

Descriptive statistics was used to analyze the distribution of landholdings and pattern of allocation. Averages and percentages were used for better comprehension and interpretation. The study consider three categories of farmers. Since sample size of medium and large farmers was relatively lesser compared to other two categories, it was pooled and considered as one category. The categorical classification helps in deriving distinctive features and comparison between them. The classification based on land holding is as follows,

- **Marginal farmer:** Land holding of less than one hectare.
- **Small farmer:** Land holding between one hectare and two hectare.
- **Medium and large farmer:** Land holding of above two hectares.

2.2 Composite Entropy Index (CEI)

The extent of crop diversification was captured using Composite Entropy Index (CEI). The CEI has two components *viz*. distribution and number of crops, or diversity. The value of CEI increases with the decrease in concentration and rises with the number of crops. The value of C.E.I. ranges from zero to one. The index possesses all desirable properties of Modified Entropy Index and is used to compare diversification across situations having different and large number of crops since it gives due weightage to the number of crops (Pandey and Sharma, 1996; Chand, 1996) [9, 5]. The formula of C.E.I. is given by,

$$CEI = -\left(\sum_{i=1}^{N} P_i * log_N P_i\right) * \left\{1 - \left(\frac{1}{N}\right)\right\}$$

Where,

N is the number of crop groups

P is the proportion of area of a given crop group to the total gross cropped area

3. Results

The pattern of allocation provide a brief foresight into nature of diversification across the space. The pattern exhibited in different selected zones helps in understanding the existing cropping pattern and deriving implications on sustainability of agriculture in the study area.

3.1 Pattern of land allocation for different crops in southern transition zone

Presentation of the pattern of land allocation for different crops in Southern transition zone is given in table 1. The results revealed that in case of marginal farmers the maximum land was allocated under the maize crop (12.67%) followed by ginger (12.02%) and ragi (10.63%). Whereas, the lowest area was under the crops like green chilly (1.34%), brinjal (3.00%) and coconut (3.11%). It was also identified that in case of small farmers, the maximum land was allocated under the ginger crop (15.80%) followed by maize (15.46%) and tobacco (13.00%) but the lowest area was under the crops like field bean (2.02%) and brinjal (1.87%). Further in case of medium and large farmers, the maximum area was allocated under the ginger crop (20.77%) followed by maize (11.03%) and tobacco (9.72%) but the lowest area was under the crops like field bean (2.39%) and sugarcane (2.39%). It was interesting to note that maximum area of land holdings was allotted to ginger, maize and tobacco by all the category of farmers since ginger and tobacco were the major commercial crops grown in the study area and these crops fetches higher returns to farmers.

3.2 Pattern of land allocation for different crops in southern dry zone

The pattern of land allocation for different crops in southern dry zone is tabulated in table 2. Results revealed that in case of marginal farmers, the maximum land was allocated under the crop field bean (12.63%) followed by tomato (11.43%) and banana (11.27%). Whereas the lowest area was allocated under the crops like green pumpkin (0.20%), groundnut (0.40%) and sunflower (0.80%). It was also identified that in case of small farmers the maximum land was allocated under the crop tomato (11.08%) followed by sunflower (7.82%) and paddy (7.35%) but the lowest area was under the crops like sericulture (3.03%), pumpkin (1.87%) and green chilly (1.63%). Further in case of medium and large farmers, the maximum area was allocated under the crop banana (8.70%) followed by tomato (8.70%) and paddy (7.43%) but the lowest area was under the crops like green chilly (1.49%), pumpkin (2.97%) and ragi (3.18%).

3.3 Pattern of land allocation for different crop groups across the study regions (per cent)

Pattern of land allocation for different crop groups across the study regions revealed that in southern transition zone, marginal farmers devoted the maximum land to vegetables and fruits (22.95%), followed by pulses (22.34%) and cereals (19.23%) whereas the lowest area was allocated for plantation crops (3.11%). However, small, medium and large farmers allocated maximum land to commercial crops followed by vegetables and fruits and cereals, whereas the lowest area was allocated for pulses and millets (Table 3). This implied that the farmers were willingness to take risk since these crops yield higher returns as compared to pulses and millets.

Table 1: Pattern of land allocation for different crops in southern transition zone

Particulars	Southern transition zone (N=90)					
	Marginal (n=32)		Small (n= 36)		Medium and Large (n=22)	
	Area (ha)	Per cent	Area (ha)	Per cent	Area (ha)	Per cent
Total GCA	37.34		89.67		119.48	
Paddy	2.45	6.56	4.32	4.82	5.34	4.47
Maize	4.73	12.67	13.86	15.46	13.18	11.03
Ginger	4.49	12.02	14.17	15.80	24.82	20.77
Tobacco	2.64	7.07	11.66	13.00	11.61	9.72
Cotton	1.21	3.24	2.14	2.39	4.10	3.43
Tomato	3.20	8.57	7.58	8.45	10.14	8.49
Beans	1.70	4.55	3.74	4.17	4.30	3.60
Brinjal	1.12	3.00	1.68	1.87	4.99	4.18
Green chilli	0.50	1.34	2.10	2.34	4.22	3.53
Banana	3.17	8.49	4.70	5.24	8.76	7.33
Sugar cane	0.00	0.00	1.97	2.20	2.85	2.39
Coconut	1.16	3.11	3.64	4.06	5.37	4.49
Arecanut	0.00	0.00	3.05	3.40	5.34	4.47
Ragi	3.97	10.63	7.67	8.55	3.92	3.28
Horse gram	3.65	9.78	3.96	4.42	4.16	3.48
Field bean	2.23	5.97	1.81	2.02	2.86	2.39
Other crops	1.12	3.00	1.62	1.81	3.52	2.95

Table 2: Pattern of land allocation for different crops in southern dry zone

Particulars	Southern dry zone (N=90)					
	Marginal (n=30)		Small (n=42)		Medium and Large (n=18)	
	Area (ha)	Per cent	Area (ha)	Per cent	Area (ha)	Per cent
Total GCA	32.47		85.73		94.22	
Paddy	1.61	4.96	6.30	7.35	7.00	7.43
Maize	0.00	0.00	3.80	4.43	4.90	5.20
Ragi	1.46	4.50	3.00	3.50	3.00	3.18
Banana	3.66	11.27	6.03	7.03	8.20	8.70
Mango	1.95	6.01	3.00	3.50	4.40	4.67
Tomato	3.71	11.43	9.50	11.08	8.20	8.70
Sunflower	0.80	2.46	6.70	7.82	6.20	6.58
Groundnut	0.40	1.23	3.50	4.08	4.00	4.25
Beans	2.82	8.68	4.80	5.60	4.90	5.20
Green chilli	0.00	0.00	1.40	1.63	1.40	1.49
Cabbage	2.24	6.90	3.80	4.43	3.10	3.29
Pumpkin	0.20	0.62	1.60	1.87	2.80	2.97
Cauliflower	3.06	9.42	5.60	6.53	3.60	3.82
Cotton	0.00	0.00	4.40	5.13	6.90	7.32
Sugar cane	0.40	1.23	2.61	3.04	5.00	5.31
Coconut	1.40	4.31	4.10	4.78	4.10	4.35
Sericulture	0.00	0.00	2.60	3.03	3.80	4.03
Horse gram	2.25	6.93	4.90	5.72	3.80	4.03
Field bean	4.10	12.63	4.80	5.60	4.90	5.20
Other	2.41	7.42	3.29	3.84	4.02	4.27

Table 3: Pattern of land allocation for different crop groups across the study regions (per cent)

Crop group	Southern transition zone (N=90)			Southern dry zone (N=90)		
	Marginal (n=32)	Small (n= 36)	Medium and Large (n=22)	Marginal (n=30)	Small (n=42)	Medium and Large (n=18)
Cereals	19.23	20.27	15.50	4.96	11.78	12.63
Pulses	15.75	6.43	5.88	19.56	11.31	9.23
Vegetables and fruits	25.95	22.08	27.13	54.33	41.68	38.85
Commercial crops	22.34	33.39	36.31	1.23	11.21	16.66
Plantation crops	3.11	7.46	8.96	4.31	4.78	4.35
Millets	10.63	8.55	3.28	4.50	3.50	3.18
Oilseeds	-	-	-	3.70	11.90	10.83
Others	3.00	1.81	2.95	7.42	3.84	4.27
	100	100	100	100	100	100

It was also identified that in southern dry zone, marginal farmers allocated major share of the land to vegetables and fruits (54.33%) followed by pulses (19.56%) and others (7.42%), whereas the lowest area is allocated under the commercial crops (3.11%). Further in case of small farmers, the maximum land was allocated under the vegetables and

fruits (41.68%) followed by oilseeds (11.90%) and cereals (11.78%), whereas the lowest area was allocated under the commercial crops (3.11%). In the same zone the medium and large farmers allocated highest area under vegetable and fruits (38.85%) followed by commercial crops (16.66%) and cereals (12.63%) but the lowest area was found under plantation crops (4.35%).

3.4 Distribution of sample farms according to composite entropy index

The distribution of sample farmers according to Composite Entropy Index (CEI) of crop diversification across the study regions is given in Table 4. In Southern transition zone, marginal farmers (0.75) had highest CEI followed by small farmers (0.71) and medium and large farmers (0.67) however medium and large farmers (0.7) in southern dry zone had highest CEI compared to small farmers (0.65) and marginal farmers (0.63). The mean CEI of southern transition zone was 0.71 and it was 0.66 in southern dry zone. The distribution clearly depicts regional variation in crop diversification since the crop combination in two zones was different.

Table 4: Distribution of sample farms according to composite entropy indices of crop diversification across the study regions

Sl. No.	Composite Entropy Index	Southern transition zone (N=90)			Southern dry zone (N=90)		
		Marginal (n=32)	Small (n= 36)	Medium and Large (n=22)	Marginal (n=30)	Small (n=42)	Medium and Large (n=18)
1	Average of farmers group	0.75	0.71	0.67	0.63	0.65	0.7
2	Zone average	0.71			0.66		

4. Discussion

From the results it was evident that crops like, maize, ginger, tobacco, tomato, ragi and horsegram dominated the allocation across southern transition zone. The farmers had fairly good distribution of diverse crops in the cropping pattern. In case of southern dry zone crops like, paddy, banana, tomato, mango, field bean and horse gram dominated the allocation.

When the allocation was analyzed by crop group wise it was found that commercial crops and vegetable crops dominated the allocation in southern transition zone. Among different farmer categories, medium and larger farmers' allocated higher proportion of land towards these crops whereas, marginal and small farmers had fairly good distribution of cereals, pulses and millets along with commercial and vegetable crops in the allocation. Similarly in case of southern dry zone, vegetable crops dominated the allocation implying the high income oriented cropping pattern the zone. Among the farmers category, marginal and small farmers allocated higher proportion towards HVCs like vegetables and fruits compared to medium and large farmers. Hence, it was evident that the farmers were moving towards high value crops which provide higher returns compared to subsistence crops. Diversification towards high value crops (HVCs), including vegetables, fruits and commercial crops, is claimed to be an important means of securing agriculture-based livelihoods, accelerating growth and reducing rural poverty (Bigsten and Tengstam, 2011; Birthal *et al*., 2015; Michler and Josephson, 2017) [1, 3, 8]. Compared to the widely-grown cereal crops, HVCs are more remunerative (Joshi *et al*., 2004; Birthal *et al*., 2015) [7, 3] and also labor-intensive (Joshi *et al*., 2006) [6]. Thus, the farm households who have a larger endowment of labour in relation to land are likely to benefit more from diversification into HVCs.

In southern transition zone, marginal and small farmers were found to be more diversified than medium and large farms indicating better risk management by including less volatile crops like cereals (Chand and Raju, 2008) [5] and volatile crops like vegetables and commercial crops. Whereas, in southern dry zone, medium and large farmers were more diversified than marginal and small farmers indicating income oriented farming among small farmers to generate higher income and cereals crops were found to be non-remunerative to these farmers. Further, there is an evidence of an inverse relationship between farm size and productivity of HVCs, but not in case of other crops (Birthal *et al*., 2014) [7]. Overall, southern transition zone had better diversification index compared to southern dry zone. Since, crop combination and allocation was relatively better compared to southern dry zone which had higher proportion of vegetables and fruits. Since HVCs come with high amount of volatility which indirectly induce high risk will lead to extensive losses in contingent situations (Chand and Raju, 2008) [5]. Hence, well designed cropping pattern along with better vertical and horizontal supply linkages have to be developed in order to make viable and sustainable production of HVCs.

5. Conclusion

The selected zones have shown reasonable level of diversification and evidence of shift from traditional subsistence crops to HVCs was visible from the pattern of allocation. The marginal and small farmers have high allocation towards HVCs which shows commercial intent and transformation towards more remunerative crops which provide better livelihood compared to regular low income crops. Hence, it is necessary to improve secondary linkages to provide better market ecosystem and stabilize the production system of HVCs. Integration of vertical and horizontal supply chains and price stabilization in horticulture and commercial crops is need of the hour to reduce the volatility in supply and price of these crops. Careful and judicious agro-ecological based designing of cropping system is necessary to derive sustainable farm livelihood which is economical as well as resilient to climate change.

6. References

1. Bigsten A, Tengstam S. Smallholder diversification and income growth in Zambia. J Afr. Econ. 2011;20(5):781-822.
2. Birthal PS, Negi DS, Jha AK, Singh D. Income sources of farm households in India: Determinants, distributional consequences and policy implications. Agricultural Economics Research Review. 2014;27(1):37-48.
3. Birthal PS, Roy D, Negi DS. Assessing the impact of crop diversification on farm poverty in India. World Dev. 2015;72:70-92.
4. Chand R, Raju SS. Instability in Indian agriculture during different phases of technology and policy. National Centre for Agricultural Economics and Policy Research,

Discussion Paper: NPP; c2008.
5. Chand R. Diversification through high-value crops in Western Himalayan region: Evidence from Himachal Pradesh. Indian Journal of Agricultural Economics. 1996;41(4):652-63.
6. Joshi PK, Birthal PS, Minot N. Sources of agricultural growth in India: Role of diversification towards high value crops. Discussion Paper 98, Markets, Trade and Institutions Division, International Food Policy Research Institute, Washington, DC; c2006.
7. Joshi PK, Gulati A, Birthal PS, Tewari L. Agricultural diversification in South Asia: patterns, determinants and policy implications. Econ. Polit. Weekly. 2004;39(24):2457-2468.
8. Michler JD, Josephson AL. To specialize or diversify: agricultural diversity and poverty dynamics in Ethiopia. World Dev. 2017;89:214-226.
9. Pandey VK, Sharma KC. Crop diversification and self-sufficiency in food grains. Indian J Agric. Econ. 1996;51(4):644-651.
10. World Bank. Diversification in Rural Asia, Working Paper Series, No. 98, Agriculture and Rural Development Department, The World Bank, Washington DC, Agricultural Diversification Policies and Issues from East Asian Experiences, Policy and Research Series 11, Agricultural and Rural Development Department; c1988.