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Crop Diversification In Indian Agriculture With Special Reference to Emerging Crops

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Abstract

Crop diversification, during last 20 years, has been providing large-scale boost to Indian agricultural economy in terms of income, employment and security. Obtaining required secondary data on 'area under crops', this paper attempts to explore levels and trends of crop diversification and identify major emerging crops. Results show that high crop diversification has taken place in western and south-western states, whereas crop specialization has occurred in states of West Bengal, Assam, Manipur, Mizoram etc states. Among the highly diversified states, Oilseeds, Pulses, Rice and Fruits & Vegetables have come out as 'emerging crops' (in terms of cropped area). Crop diversification continues over the time period associating most of the states. Though food crop dependency persists strongly, horticultural and commercial crops are 'emerging' significantly.

Key Words: *Crop Diversification, Gross Cropped Area, Emerging Crops, Horticultural Crops*

Introduction

Since 1990s Indian agriculture has experienced a significant change with diversification from traditional food crops (like paddy, wheat) etc to commercial crops, plantation crops and horticultural crops (Nadkarni, 1996; Joshi et. al., 2004). Though 'Green Revolution' in 1960s brought a significant change in crop production and productivity in India, but Indian agriculture traditionally burdens some associated problems. Dominance of marginal and small farmers in terms of numbers and the area cultivated, rural poverty, seasonal and pseudo-employment, non-mechanized farms, poor rural infrastructure, monsoon dependency etc always pose a big threat on the development of Indian agriculture economy. From this perspective of improving incomes, generating gainful and year-round employment, stabilizing the flow of income over the seasons and conservation and augmentation of natural resources, crop diversification i.e. shifting from less profitable crop or enterprise to more profitable crop or enterprise comes out as a major strategy (Vyas, 1996). It has been argued that crop diversification has gained momentum due to overall economic growth, rising middle class people, better market institutions, credit availability, infrastructure, urbanization, contract farming and improving rural education level.

Objectives

To assess the nature and trend of agricultural diversification at state level during the given time period (from 1990-91 to 2008-09);

To find out 'emerging crops' in states experiencing crop diversification as well as crop specialization.

Database And Methodology

This paper is mainly based on two variables, i.e. 'Area under crops' (Food crops, Commercial crops and Horticultural & Plantation crops) and Gross Cropped Area of each state. The required data has been collected from Statistical Abstract of India (1991) and official website of Ministry of Agriculture and Cooperation, Government of India.

To assess the magnitude of crop diversification, Harfindahl-Hirschman's Index (HHI) has been used, i.e.

$HHI=\sum Pi\ 2$

Where,

$Pi= [Ai/\sum Ai]$

Pi=Proportion of area under i-th crop, Ai=Actual are under i-th crop

The index is defined as a sum of squares of all 'n' proportions. This is a simple measure of concentration. For increasing diversification, HHI is decreasing and vice-versa. It is bounded by 0 (complete diversification) and 1 (complete specialization). Arc GIS 9.3 software has been used for map making.

Nature & Trend of Diversification--A Spatio-Temporal Analysis:

Changes in Percentage Shares of Gross Cropped Area-

Selected twelve crops (Rice, Jowar, Bajra, Maize, Ragi, Wheat, Pulses, Oilseeds, Cotton, Sugarcane, Coconut and Fruits & Vegetables) have been grouped into 3 categories- food crops, commercial crops and horticultural & plantation crops. In 1990-91, food crop dominated states were Manipur, Bihar, Himachal Pradesh, Nagaland, Jammu & Kashmir, Uttar Pradesh, Mizoram etc. Over two decades, almost all states (even Meghalaya, Assam, Rajasthan, Uttar Pradesh etc) have reported decline in percentage of area under food crops. Only in Bihar, Karnataka, Punjab and Tripura, percentage shares have increased mainly due to huge population pressure, increasing demand and food habit. Gujarat, Andhra Pradesh, Tamil Nadu, Maharashtra etc were commercial crop dominated states in 1990-91. Over the time period, a mixed result has come out: some of the states like Tamil Nadu, Orissa, Punjab etc have reported decrease in percentage of area under commercial crops, whereas states like Madhya Pradesh (20%), Gujarat (14%), Maharashtra (13%), Nagaland (10%) Rajasthan (8%) have experienced increase in percentage shares. During 1990-91, major players in horticultural crops were Kerala, Jammu & Kashmir, Goa, Meghalaya, Mizoram etc states. In these two decades, most of the states have reported increase in percentage shares of area under horticultural and plantation crops. Especially, Mizoram (29%), Sikkim (16%), Arunachal Pradesh (11%), West Bengal (9%) and Himachal Pradesh (8.5%) have shown higher increase in percentage shares. Only Jammu & Kashmir, Meghalaya, Tamil Nadu and Goa have experienced decline in percentage shares of area (Table-1). Such picture clearly reveals that food crops are not solely important now; rather have made Both commercial and horticultural crops important in the country, may be due to profitability and changes in people's taste and preference.

Table-1: Percentage Change in Area under Crop Categories

State	1990-91			2008-09		
	% FOOD CROPS	% Commercial Crops	% Horticultural & Plantation Crops	% FOOD CROPS	% Commercial Crops	% Horticultural & Plantation Crops
Andhra Pradesh	66.42	30.78	4.45	53.59	30.33	9.85
Arunachal Pradesh	75.62	6.72	18.56	65.76	12.46	29.49
Assam	69.87	10.78	8.33	66.65	7.11	9.11
Bihar+ Jharkhand	90.20	2.91	10.64	99.33	4.13	15.30
Goa	44.62	1.54	26.15	36.27	2.89	25.96
Gujarat	42.99	33.62	1.86	34.49	48.03	6.25
Haryana	72.94	16.76	1.32	70.27	17.91	5.18
Himachal Pradesh	84.38	2.39	19.93	81.54	1.70	28.42
Jammu & Kashmir	83.63	6.34	29.18	79.60	5.74	23.38
Karnataka	58.99	20.28	6.60	60.06	22.92	9.45
Kerala	21.17	1.29	45.45	9.09	0.24	48.36
Madhya Pradesh+ Chhattisgarh	74.34	9.18	1.09	61.97	28.82	3.03
Maharashtra	71.69	22.42	2.55	50.52	34.98	8.47
Manipur	91.53	3.44	16.72	78.64	0.64	25.00
Meghalaya	66.50	7.52	24.32	38.61	5.28	22.91
Mizoram	77.46	5.63	21.55	68.33	4.69	50.52
Nagaland	80.63	6.81	7.02	67.66	16.64	7.34
Orissa	72.37	10.02	9.42	59.64	3.97	11.13
Punjab	74.45	14.59	2.18	81.41	9.45	3.07
Rajasthan	70.62	13.99	0.49	56.67	21.98	0.69
Sikkim	65.67	5.97	11.42	63.73	8.22	27.12
Tamil Nadu	59.70	26.04	19.05	54.26	17.08	16.97
Tripura	71.08	3.19	19.90	85.19	1.93	23.02
Uttar Pradesh+ Uttarakhand	79.38	14.41	3.49	76.87	13.38	5.95
West Bengal	76.72	6.11	7.15	66.62	7.42	15.87

Source: Statistical Abstract of India, 1991 and Department of Agriculture and Cooperation, Govt. of India, 2008-09

Changes in Levels of Crop Diversification-

In 1990-91, Karnataka, Gujarat, Madhya Pradesh and Sikkim were the most diversified states. Besides, Kerala, Haryana, Rajasthan, Maharashtra and Tamil Nadu showed higher levels of diversification. On the other hand, levels of crop diversification were on lower side in states of Manipur, Mizoram, Tripura and West Bengal. During 2008-09, Karnataka, Maharashtra, Goa, Kerala, Rajasthan and Gujarat are most diversified states. Tamil, Nadu, Meghalaya, Andhra Pradesh, Madhya Pradesh also display higher levels of crop diversification. Again, states like West Bengal, Assam, Mizoram, Manipur and Tripura show lower levels of crop diversification (Table-2). Regionally speaking, Western and South-Western regions have shown higher levels of crop diversification as compared to Eastern and North-Eastern region (Fig. A and B). The case of North-Eastern region is a bit interesting, where only Meghalaya and Nagaland show moderate level of crop diversification over the time period. In two decades, Meghalaya's percentage area under rice has declined by 21% and Nagaland's percentage area under oilseeds has increased by almost 11%. Higher levels of crop diversification have occurred in western and south-western region due to dominant shares of commercial and horticultural crop areas. If one takes Maharashtra's case into account, considerable increase in shares of oilseeds (10%) and fruits & vegetables (6%) as well as sharp decline in shares of Jowar (13%) have pushed the state to emerge as second most diversified state over two decades. On the downside, experience of three North-Eastern states (Manipur, Mizoram and Tripura) show that huge dominance of rice and fruits & vegetables in GCA has resulted into low diversification status in two decades.

Table-2: Harfindahl-Hirschman's Index (HHI) Values of Crop Diversification

RANK	STATE	1990	STATE	2008-09
1	Karnataka	0.094	Karnataka	0.106
2	Gujarat	0.099	Maharashtra	0.119
3	Madhya Pradesh+ Chhattisgarh	0.139	Goa	0.130
4	Sikkim	0.142	Kerala	0.132
5	Kerala	0.155	Rajasthan	0.133
6	Haryana	0.162	Gujarat	0.135
7	Rajasthan	0.163	Tamil Nadu	0.152
8	Maharashtra	0.168	Meghalaya	0.160
9	Tamil Nadu	0.178	Andhra Pradesh	0.175
10	Uttar Pradesh+ Uttarakhand	0.198	Madhya Pradesh+ Chhattisgarh	0.177
11	Goa	0.212	Haryana	0.205
12	Andhra Pradesh	0.218	Sikkim	0.213
13	Punjab	0.266	Uttar Pradesh+ Uttarakhand	0.217
14	Orissa	0.275	Nagaland	0.247

15	Jammu & Kashmir	0.294	Jammu & Kashmir	0.247
16	Himachal Pradesh	0.300	Orissa	0.261
17	Bihar+ Jharkhand	0.332	Punjab	0.325
18	Meghalaya	0.356	Himachal Pradesh	0.334
19	Arunachal Pradesh	0.395	Arunachal Pradesh	0.337
20	Assam	0.417	West Bengal	0.398
21	Nagaland	0.445	Assam	0.398
22	West Bengal	0.480	Bihar+ Jharkhand	0.408
23	Tripura	0.500	Mizoram	0.562
24	Mizoram	0.532	Manipur	0.575
25	Manipur	0.810	Tripura	0.721

Source: calculated from data available in Statistical Abstract of India, 1991 and Department of Agriculture and Cooperation, Govt. of India, 2008-09

Note: <0.150 = Highly Diversified; 0.150-0.300 = Moderately diversified, 0.301-0.450 =Less Diversified and >0.450 = Specialized

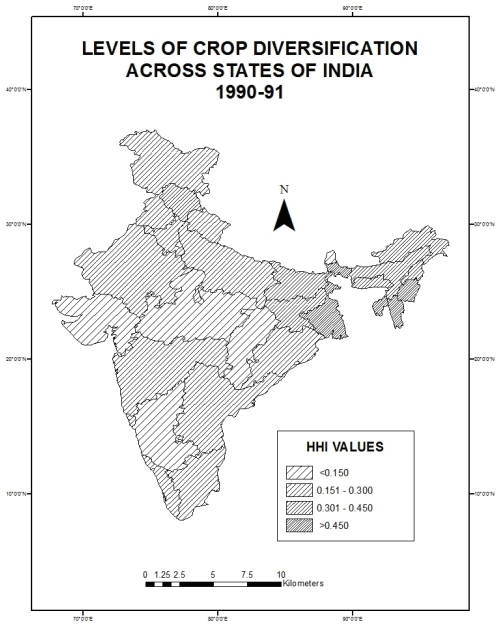

Fig. A

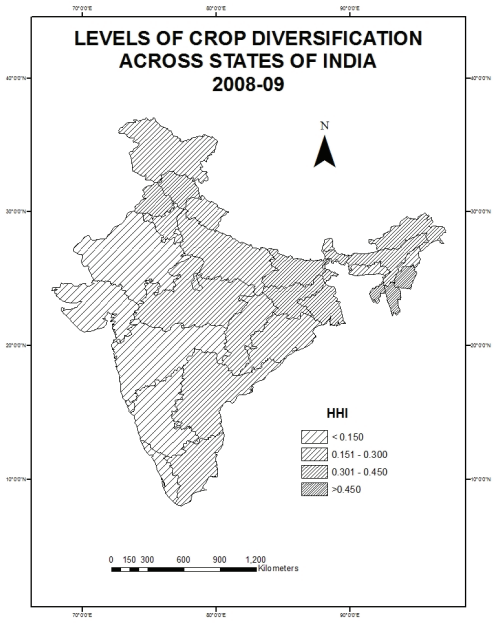

Fig. B

Based on the changes in rank, we can identify states which are moving towards crop diversification vis-à-vis crop specialization. Over two decades, Meghalaya, Goa, Nagaland, Maharashtra, Andhra Pradesh etc states have moved towards crop diversification. On the downside, few states like Sikkim, Madhya Pradesh, Haryana, Bihar, Punjab, Gujarat etc have proceeded towards crop specialization. However crops, in which these states are moving towards specialization, are quite different. Sikkim is getting specialized in fruits & vegetables, Madhya Pradesh in oilseeds, Bihar in food crops and so on. Only three states, namely Karnataka, Jammu & Kashmir and Arunachal Pradesh have reported no change in their ranks.

Identification of Major Emerging Crops-

Based on descending order of percentage shares of area, 5 crops can be identified easily. For each of the highly diversified and first five moderately diversified states, 5 major crops have been put together. For spatio-temporal comparison, major three of them have been taken into account. Frequency distribution based Histogram (Fig-C) reveals some results:

- Due to dietary habit, huge domestic demand and traditional food crop farming, suitable geographical conditions and Government procurement system, Rice comes up as a major emerging crop.
- Oilseeds come out as one of major emerging crops. Western and South-western states exhibit high % share area under oilseeds. Joshi et. al (2004) has argued that high tariff barrier on imported edible oil indirectly propelled higher cultivation of oilseeds. On policy front, Government's Technology Mission on Oilseeds (1986) initiated augmentation of oilseed production.
- Fruits and Vegetables, with growing level of and affordability health consciousness as well as tireless promotion by National Horticultural Board, also appear as important emerging crop. Percentage area under 'fruits & vegetables' are considerably higher in hilly states and few others like Kerala, Bihar and West Bengal.
- Pulses come out as a major emerging crop in Western and SW states as well as in Madhya Pradesh. Its majority has reduced a bit in 2008-09 compared to 1990.
- In the wake of diversification towards high-value crops, coarse cereals like Jowar and Bajra are losing importance.

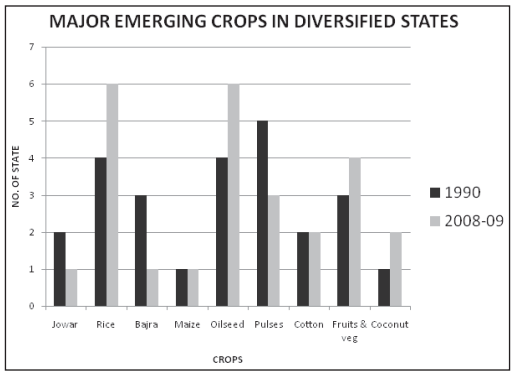

Fig. C

Table-3: Emerging Crops in Prominently Diversified States

1990	STATE	EMERGING CROPS
Highly Diversified	Karnataka	Jowar,Pulses, Oilseeds, Rice, Ragi
	Gujarat	Oilseeds, Bajra, Cotton, Jowar, Pulses
	Madhya Pradesh+ Chhattisgarh	Rice, Pulses, Wheat, Jowar, Oilseeds
	Sikkim	Maize, Rice, Fruits & Vegetables, Wheat, Pulses
Moderately Diversified	Kerala	Coconut, Rice, Fruits & Vegetables, Pulses, Oilseeds
	Haryana	Wheat, Bajra, Pulses, Rice, Cotton
	Rajasthan	Bajra, Pulses, Oilseeds, Wheat, Jowar
	Maharashtra	Jowar, Pulses, Cotton, Bajra, Rice
	Tamil Nadu	Rice, Oilseeds, Fruits & Vegetables, Pulses, Bajra
2008-09		
Highly Diversified	Karnataka	Oilseeds, Pulses, Rice, Jowar, Maize
	Maharashtra	Jowar, Oilseeds, Cotton, Pulses, Fruits & Vegetables
	Goa	Rice, Coconut, Fruits & Vegetables, Pulses, Oilseeds
	Kerala	Coconut, Fruits & Vegetables, Rice, Pulses, Jowar/Oilseeds
Moderately Diversified	Rajasthan	Bajra, Oilseeds, Pulses, Wheat, Maize
	Gujarat	Oilseeds, Cotton, Wheat, Pulses, Rice
	Tamil Nadu	Rice, Fruits & Vegetables, Oilseeds, Pulses, Coconut
	Meghalaya	Rice, Fruits & Vegetables, Maize, Oilseeds, Cotton
	Andhra Pradesh	Rice, Oilseeds, Pulses, Cotton, Fruits & Vegetables

Source: calculated from calculated from data available in Statistical Abstract of India, 1991 and Department of Agriculture and Cooperation, Govt. of India, 2008-09

Development-Diversification Interlinkages-

Crop diversification, which is supposed to have more remuneration and certain benefits for farmers, is found to be at higher level in southern and western part of India. One can find some spatial similarity as most socio-economically more developed states also belong to these regions. It is also true that less developed states like Meghalaya, Rajasthan etc are moving progressively towards diversification. Studies (for example, Nadkarni, 2004; Rao et. al, 2006) have argued that high value crop diversification is considerably associated with urbanization and economic and infrastructural development. Urban centres not only create market demand of these crops, but also provide good road network based transport and well-equipped storage and processing system. But one should also remember the ecological conditions under which crops grow. Low water requirement of some crops (Bajra, Oilseeds, and Pulses) has gained importance in Rajasthan, whereas local geographical conditions

best suit fruits & vegetable cultivation in Meghalaya. Besides, in a country like India, strengthening of crop diversification depends on market and production risks through technological support, quality input supply, insurance cover and establishment of modern storage-processing centres.

Conclusion

Crop diversification is found to be continuing over the time period and most of the states are associated with this process. Though food crop dependency persists strongly, but commercial and horticultural crops are emerging significantly. In this respect, leading states like Rajasthan, Gujarat, Maharashtra and Karnataka are showing the way through which both diversity and self-sufficiency can be achieved in crop sector. Of late, with boiling of multi-brand retail FDI debate, policy makers must take note of crop diversification in a more pragmatic way, so as to deliver real benefits to small and marginal farmers who can provide high value non-food grains directly to these proposed private retail chains.

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References

Bhal S. K, R. S Prasher and P Mehta (1997): 'Diversification of Indian Agriculture, Issues and Perspectives', Indian Journal of Agricultural Economics, 78(308) pp. 101-11;

Jha, D (1997): 'Diversification of Agriculture and Food Security in context of New Economic Policy', Indian Journal of Agricultural Economics, 52(1), pp. 52-54;

Joshi P.K, Ashok Gulati, Pratap S. Birthal, Laxmi Tewari (2004): 'Agriculture Diversification in South Asia: Patterns, Determinants and Policy Implications', Economic and Political Weekly, Vol. 39, No. 24, pp. 2457-2467;

Nadkarni M.V (1996): 'Accelerating Commercialization of Agriculture: Dynamic Agriculture and Stagnating Peasants, June 29, pp. A-63 – A-73;

Rao Parthasarathy P, P. S. Birthal and P. K. Joshi (2006): 'Diversification towards High Value Agriculture: Role of Urbanisation and Infrastructure', Economic and Political Weekly, Vol. 41, No. 26, pp. 2747-2753;

Vyas, V.S (1996): 'Diversification in Agriculture: Concept, Rationale and Approaches', Indian Journal of Agricultural Economics, 51(4) pp. 636-46;

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