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Agric. Econ. Res. Rev., Vol. 5(1), 1992

Research Note

SHIFTS IN CROPPING PATTERN—SOME MEASUREMENT PROBLEMS

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Introduction

Cropping pattern is commonly defined as the proportionate or percentage share of various crops in the gross cropped area of a region. Cropping pattern in any region is a function of the interplay of climatic and soil conditions, agricultural infrastructure, agricultural practices and traditions of farmers, their level of education and exposure to external influences, the relative structure and level of farm prices, etc. Each of these factors has a unique influence on the crop mix in a region and it is only natural that cropping pattern changes in tune with changes in one or all of these factors. Since cropping pattern can affect not only the agricultural output but the entire agrarian structure of a region, studies on cropping pattern assume importance.

The Problem

Spearman's rank correlation coefficient and Kendall's coefficient of concordance are the most commonly used statistical tools for measuring changes in cropping pattern (Rama Subban, 1963 and Suyambulingom, 1990). These techniques were used in studies on cropping pattern of Kerala by Lakshmi and Pal (1988) and Thomas *et al.* (1990) to prove that no significant changes had occurred in Kerala over the past two decades. Analysis of variance has also been used, though less frequently, to assess cropping pattern changes (Swaminathan, 1989).

A cursory look at the data on acreage under major cultivated crops of Kerala, for the past two decades, reveal changes which cannot be treated as insignificant. It is the objective of this paper to prove that a better statistical tool is needed for measuring shifts in cropping pattern.

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Data and Methodology

Data on area under 10 major crops (which together occupy more than 80 per cent of the gross cropped area) in the State for the period 1975 to 1990 were collected from the statistical reports published by the Department of Economics and Statistics, Government of Kerala. The percentage share of individual crops in the gross cropped area were computed and on this basis ranks were assigned to the crops in various years. Spearman's rank correlation coefficients and Kendall's coefficient of concordance were then worked out and tested for significance.

Analysis of variance was conducted for the periods 1975, 1980 and 1990, considering the percentage share of each crop in gross cropped area during the respective years.

Compound growth rates in acreages of the crops were worked out by fitting an exponential function to the time series data.

Results of the above were then compared with the results of simple percentage analysis of changes in crop acreages between the years 1975-1990 and 1980-1990.

Results and Discussion

Rank correlation coefficients worked out for each pair of years from 1975-1990 are given in Table 1. All the correlation coefficients were significant, indicating that there was no major shift in cropping pattern during the period under study.

Kendall's coefficient of concordance worked out to 0.6837 with a X^2 value of 102.56. Significance of the coefficient again revealed uniformity in cropping pattern during the entire period.

Results of the analysis of variance conducted for the periods 1975, 1980 and 1990 are presented in Table 2. Non-significance of the F value indicates that the cropping patterns in the three periods are similar.

Compound growth rates of crop acreages for the period 1980-1990 are given in Table 3. The results show significant negative growth rates in area of paddy, tapioca, tea and cashew. The positive growth rates recorded in the case of pepper, coconut, coffee and rubber were also significant. These significant growth rates in area suggest the possibility of a shift in cropping pattern, thus questioning the validity of the results obtained earlier.

The percentage share of major crops in gross cropped area are given in Table 4. The figures by themselves are eloquent. Paddy, which occu-

Table 1. Rank correlation coefficients (1975-76 to 1988-89)

Period	Correlation coefficient	't' value
1975-76	0.9794	18.1417
1976-77	0.9912	28.0331
1977-78	0.9914	34.2507
1978-79	0.9971	48.8189
1979-80	1.0000	0
1980-81	1.0000	0
1981-82	0.9765	16.9627
1982-83	0.9941	34.2507
1983-84	0.9765	16.9627
1984-85	1.0000	0
1985-86	0.9971	49.0314
1986-87	1.0000	0
1987-88	1.0000	0
1988-89	1.0000	0

Table 2. Analysis of variance (1975, 1980 and 1990)

Source	Sum of squares	Degrees of freedom	Mean square	F*
Between	10.454	2	5.227	0.0441^{NS}
Within	3201.21	27	118.55	
Total	3211.664	29		$F_{2,27}=3.37$

Table 3. Compound growth rates of acreage under crops (1980-1990)

Crops	C.G.R. (%)	Standard error
Paddy	—4.0780*	0.6575
Tapioca	—5.2769*	0.9801
Banana and other plantations	2.1448^{NS}	1.8634
Pepper	5.7010**	2.1966
Coconut	3.0190**	1.1273
Arecanut	0.2329^{NS}	0.9271
Cashew	—1 9161**	0.9002
Tea	—0.4961*	0.1569
Coffee	2.4573**	0.8872
Rubber	6.2307*	1.0670

*—Significant at 1% level
**—Significeant at 5% level
NS—Not significant

Table 4. Percentage share of major crops in GCA

Crops	1974-75	1980-81	1984-85	1989-90
Paddy	29.10 (1)	27.79 (1)	25.43 (1)	19.32 (2)
Tapioca	10.49 (3)	8.49 (3)	7.54 (4)	5.30 (5)
Banana	1.56 (8)	1.70 (9)	1.79 (9)	2.01 (9)
Pepper	3.91 (5)	3.75 (6)	3.68 (6)	5.53 (4)
Coconut	24.71 (2)	22.58 (2)	23.92 (2)	27.56 (1)
Arecanut	3.07 (7)	2.12 (7)	2.98 (7)	2.09 (8)
Cashew	3.46 (6)	4.90 (5)	4.76 (5)	4.09 (6)
Tea	1.24 (9)	1.25 (10)	1.22 (10)	1.15 (10)
Coffee	1.20 (10)	2.01 (8)	2.22 (8)	2.48 (7)
Rubber	6.68 (4)	8.24 (4)	10.85 (3)	13.13 (3)

Figures in parentheses are ranks of each crop

Table 5. Percentage change in acreage of major crops in Kerala

Crops	1975-90	1980-90
Paddy	—34.08	—27.23
Tapioca	—51.01	—34.63
Banana	16.23	23.35
Pepper	54.37	54.62
Coconut	20.09	27.76
Arecanut	—17.54	3.16
Cashew	13.39	—12.64
Tea	—8.21	—4.31
Coffee	79.66	29.52
Rubber	91.82	66.75

pied the first rank in acreage with 29 per cent of GCA in 1974-75, came to second place in 1989-90 with only 19 per cent of GCA under it. Meanwhile, coconut ascended to the first place with 27.5 per cent of GCA. Tapioca, which was a major food crop of the State, occupied 10.5 per cent of the area in 1974-75. As the cropping pattern shifted in favour of perennial cash crops, its area declined by over 50 per cent to 53 per cent of GCA. Among plantation crops, all except tea recorded increase in their percentage share in GCA. The above analysis clearly indicates that there had been changes in the proportion of the area under cultivation of different crops. It might be interesting to see the nature and magnitude of these changes. Table 5 gives the percentage change in crop acreage over the periods 1975-90 and 1980-90. Over the period 1975-90, four crops, viz., tapioca, pepper, coffee and rubber, recorded more than 50 per cent change in acreage. Whereas the shift was positive in the three perennial

crops, tapioca registered a decline of 51 per cent. The major foodgrain of the State, paddy, recorded an area decline of 34 per cent. Similarly during the period 1980-1990 also there was considerable change in acreages of the crops.

While it is beyond the scope of this paper to identify the causes as well as implications of these changes, it seems reasonable to argue that a definite shift is taking place in Kerala's agricultural scenario in favour of the cash crops, at the expense of the seasonal and annual crops. Rank correlation coefficient and coefficient of concordance fail to capture these changes since these analyses are based on the ranks of crops and the changes of acreages do not reach magnitudes at which ranks of all or majority of the crops change.

Conclusion

Though statistically disproved, there is a definite shift in the cropping pattern of Kerala in favour of perennial plantation crops. As it is, this change is irreversible in the short run and will have its impact on agricultural production, income and employment opportunities, consumption habits of the people and even on the fragile ecological balance. The results of rank correlation and Kendall's coefficient of concordance tend to be misleading and may lead to complacency on the part of planners and policy makers when there is room for none. Hence, till a better statistical tool for measuring shifts in cropping pattern is arrived at, simple percentage analysis seems to be the best bet.

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