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INSTABILITY IN DRYLAND AGRICULTURE-A STUDY OF A DROUGHT-PRONE DISTRICT IN KARNATAKA*

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ABSTRACT

Realising that an understanding of the pattern of instability in farming in dryland areas becomes all the more important in formulating policies for the development of such areas which produce the bulk of foodgrains, pulses and oilseeds, an attempt was made in this study to examine the nature and extent of instability in farming in one of the drought-prone districts namely. Tumkur of Karnataka. Instability was examined with the help of coefficient of variation around the trend (CVt) of crop and livestock yields, prices and returns. Probability of failure and distribution of crop yields were also attempted.

The results indicated that instability was very high in crop farming as compared to livestock rearing. Further, yield variability was found to be higher than price variability. Below average yields of one crop were accompanied by other crops in 3-4 years. Prices were found to be moving in the same direction.

It is suggested to follow livestock rearing and sericulture on the farms. Besides, adoption of dry farming practices and re-introduction of crop insurance in the area were suggested for the development of the district.

INTRODUCTION

Rainfed and drought-prone areas predominate the Indian agricultural scenario. Development of such areas assumes crucial significance since these lands contribute nearly 42 per cent to the nation's food basket. Besides, major portion of production of oil seeds and pulses comes from these areas. Owing to the recurrent droughts such arcas are generally believed to be exposed to risk of crop failure and death of animals resulting in low and uncertain pay-offs from farming. An understanding of the pattern of instability in farming would help formulate policies for the development of such arcas. Keeping this in view, a study was undertaken in one of the drought-prone districts namely, Tumkur in Karnataka to examine the nature and extent of instability in farming and to suggest policy options for the development of the district.

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MATERIAL AND METHODS

Data on crop yields, rainfall and farm harvest prices for the period from 1968-69 to 1985-86 were collected from Bureau of Economics and statistics, Bangalore. Data on silk cocoon yields and prices were obtained from Department of Sericulture, Bangalore. Required data on dairy enterprises were collected from Department of Animal Husbandry, Bangalore and Tumkur Milk Union Ltd., Tumkur.

Coefficient of variation (CV) is usually used as an index of instability. However since the time series data often contains the trend component, it is suggested to use coefficient of variation around the trend (CVt) instead of simple coefficient of variation. The appropriateness of CVt over CV was suggested by Nadakarni (1971) and Cuddy and Della (1978) developed an index of instability to take care of the trend component in time series data. This index was made use of in the study. A trend of the form, $y=a+bt$ was fitted to the time series data on yield/price/returns and whenever the trend was significant, the coefficient of variation (CV) was multiplied by the square root of the unexplained portion of the variation in the trend equation. The index was developed as follows.

$$\text{Index of instability (CVt)} = CV\sqrt{1-R^2}$$

where,

$$CV = \frac{\text{Standard Deviation}}{\text{Mean}} \times 100$$

In addition to this index, probability of crop failure (PF) was also used to study the extent of instability in crop yields. Crop yields were tested for normality with the help of Shapiro-wilk's 'W' (Shapiro and Wilk 1965) and Geary's 'a' (Geary 1936). It was observed that the crop yields followed normal distribution. Then, probability of crop yields below 10 per cent of the normal (mean) yield was treated as probability of failure (PF). Further, distribution of low yield observations was also assessed.

RESULTS AND DISCUSSION

Instability in yields

Barring dairy (cow and buffalo) all the enterprises had very high index of instability thereby indicating that farming in Tumkur district is exposed to risk of very high magnitude (Table 1). Among all the enterprises, haraka (kodo millet) was found to be the most risky crop followed by redgram (pigeonpea), navane (Fox tail millet) and bajra (pearl millet) which are grown mainly for subsistence. Frequent attack of pests (Heliothis podborer) has made the cultivation of redgram in the area a

risky proposition. Interestingly, it may be seen that paddy, predominantly an irrigated crop (irrigated mainly by tanks which in turn depend on rain fall), had a CVt of 25 per cent which is much higher than that for ragi (finger millet) and groundnut which are essentially rainfed. This suggests that cultivation of an irrigated crop in the study area is also risky. This may be because of the reason that failure of rains affects paddy more than ragi since the water requirement of paddy is more than that of ragi.

Probability of failure (PF) is yet another index of instability in yields. As a measure of instability, PF further suggested the results of CVt analysis. More or less the same pattern of instability was noticed among the crops, the ranking being almost the same. As can be seen from the table PF ranged from 0.22 (ragi) to 0.44 (haraka). The analysis of time series data on rain fall and crop yields indicated that the below normal rain fall was not necessarily followed by below normal crop yields, which suggests that rain fall alone was not responsible for crop yield variability. This finding is in line with Nadakarni and Ghosh (1978). An analysis of cropping pattern changes in the study area suggested that the area under the crops like haraka, navane and bajra was encroached upon by groundnut over the years. Being subsistence crops, their cultivation was found to have been extended to marginal lands also which has made these crops risky, Gajanana (1990).

Instability in yields can also be studied in terms of distribution of low yield observations. It may be seen that low yield in a year was rarely restricted to one crop. Below normal yields of a crop were followed by 3-6 crops having below normal yields in 2-4 years (Table 2.). Jodha and Purohit (1971) and Mruthyunjaya and Sirohi (1979) also observed that the crop yields in dry regions were in the same directions. However, such a situation limits the scope for diversification through adoption of more crop enterprises to be an effective method of insulation against crop uncertainty.

Instability in product prices and enterprise returns

All crop enterprises ranked higher than sericulture and dairy in respect of price variability. Crop price variability as measured by CVt was found 20 per cent which is less compared to yield variability (Table 1). However, as can be seen from Table 3, prices of crops are moving in the same direction. Further, prices of ragi are correlated with all the dryland crops. Prices of another important crop, groundnut, were also correlated with prices of important crops like ragi, horsegram and jowar. In such situations, price stabilisation becomes difficult. Stabilisation of prices of ragi and groundnut appear to stabilise the prices of other dryland crops in the area. As regards dairy and sericulture, price variability was significantly low which might be the result of institutional intervention in the marketing of the products of the respective enterprises. It is to be noted that there exists a well established regulated

Table 1. Ranking of enterprises based on coefficient of variation ($CV/CV_{t.}$) in yields, prices, gross returns and on probability of failure (PF)

CV/CV_t of yields (%)	Enterprises	CV_t of price (%)	Enterprises	CV_t of gross returns (%)	Enterprises	PF*	Crops
39.53	Haraka	20.65	Horsegram	45.55	Redgram	0.44	Haraka
35.29	Redgram	20.30	Paddy	45.32	Bajra	0.44	Redgram
34.82	Navane	18.97	Bajra	39.53	Haraka+	0.39	Jowar
30.53	Bajra	18.54	Ragi	34.82	Navane+	0.33	Horsegram
30.36	Horsegram	18.06	Jowar	30.48	Paddy	0.28	Navane
29.20	Jowar	17.31	Groundnut	29.68	Groundnut	0.28	Paddy
24.58	Paddy	17.07	Redgram	25.26	Horsegram	0.28	Groundnut
21.81	Korle	8.41	Sericulture	21.35	Ragi	0.22	Ragi
20.11	Sericulture	4.34	Dairy (Cow)	18.74	Korle		
19.38	Groundnut	3.41	Dairy (Buffalo)	15.59	Sericulture		
19.22	Ragi			10.37	Dairy (Buffalo)		
10.12	Dairy (Buffalo)			8.44	Dairy (Cow)		
6.16	Dairy (Cow)						

*Normality of yields enables mean yield to be the normal yield, yields less than 10 per cent below the normal yield are treated as failures.

+Due to the non-availability of farm harvest prices variability was not considered in calculating variability in returns.

Tab'e 2. Distribution of yearly crop yields according to number of crops simultaneously having below normal yields

Crops	Total number of observations	Number of years of below average yleld	Number of years having low yield for one crop accompanied by low yields of remaining crops							
			One crop	Two crops	Three crops	Four crops	Five crops	Six crops	Seven crops	Eight crops
Ragi	18 (30.67)	9	1	2	2	3	—	1	—	—
Horsegram	18 (14.64)	8	1	—	2	2	—	3	—	—
Groundnut	18 (12.19)	7	—	—	1	2	—	3	1	—
Paddy	18 (8.47)	7	—	1	3	2	—	—	1	—
Haraka	18 (5.24)	10	—	1	2	3	1	3	—	—
Jowar	18 (4.33)	12	—	1	4	2	—	1	2	2
Navane	18 (1.86)	8	—	—	1	3	—	3	1	—
Redgram	18 (1.60)	8	—	1	—	3	—	3	1	—
Korle	18 (0.95)	14	1	3	2	4	—	3	1	—
Bajra	18 (0.64)	10	1	—	2	2	1	1	2	1

Note : Figures in the parentheses are area under respective crop as percentage of gross cropped area.

market for silk cocoons which ensures stable and remunerative prices. Tumkur Milk Union Ltd., with its network of milk cooperatives in the villages, collects milk from the farmers and offers remunerative prices to them.

As regards returns, coefficient of variation (CVt) ranged from a minimum of 8 per cent for dairy (cow) to a maximum of 46 per cent in case of redgram. Here again, crop enterprises were found to be risky compared to sericulture and dairy enterprises (Table 1). This leaves some scope for stabilising the farm returns by combining these relatively stable enterprises with crop cultivation.

Table 3. Zero-Order Correlation matrix of detrended prices of crops in Tumkur district (1968-69 to 1985-86)

Crop	Ragi	Horsegram	Groundnut	Paddy	Jowar	Redgram	Bajra
Ragi	1.0000	0.6767[a]	0.5768[b]	0.4443[c]	0.8837[a]	0.4727[c]	0.7518[a]
Horsegram		1.0000	0.7449[a]	0.2279	0.6042[a]	0.2703	0.5377[b]
Groundnut			1.0000	–0.0047	0.4903[b]	0.3028	0.3455
Paddy				1.0000	0.4086[c]	0.4665[c]	0.2766
Jowar					1.0000	0.4879[c]	0.7576[a]
Redgram						1.0000	0.2235
Bajra							1.0000

Note : a, b and c indicate statistical significance at 1, 5 and 10 per cent level of probability, respectively.

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