

## INSTABILITY OF CROP-YIELDS AND PRODUCT PRICES IN SAURASHTRA REGION OF GUJARAT

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### ABSTRACT

The trend in area, production and productivity of crops and product price variability in Saurashtra (Gujarat) was examined. Compound growth rates of productivity were significantly positive for all the crops except maize. Instability in crop yields was the highest for sorghum and castor. There was high covariance between product prices, and the instability of product price was the highest for sugarcane and groundnut. Creation of irrigation facilities and setting up of grain reserves and fodder banks are suggested for the development of the area.

### INTRODUCTION

A striking feature of agriculture in drought prone areas is the high variability of crop yield from year to year and the low productivity of crops on account of the uncertain, erratic and scanty rainfall. The problems of instability and its implications in terms of the farmers' socio-economic conditions and improper use of money on drought relief measures in Saurashtra region of Gujarat need in depth study and analysis for proper policy formulation and hence the present study was undertaken.

### MATERIAL AND METHODS

Saurashtra region of Gujarat State, a severe drought prone tract with very high coefficient of variation of rainfall, consists of six districts viz. Amreli, Bhavnagar, Jamnagar, Junagadh, Rajkot and Surendranagar. The data on area, production, productivity and farm harvest prices of major crops in the region, and the rainfall data for 1960-61 to 1986-87 were obtained from the Directorate of Agriculture, Gujarat State, Ahmedabad.

The compound growth rates ( $r$ ) and standard errors (SEr) for the area, production and productivity were worked out and subjected to 't' test. Coefficients of variation for area, production, productivity, product prices and rainfall were also computed. The distribution of low yields and deviations from the mean were also worked out to find the nature and degree of instability. Simple correlations between product prices were also worked out.

Table 1. Compound growth rates of area, production and productivity of major crops in Saurashtra (1960-61 to 1986-87: 1960-61, 1962-63 = 100)

Crops	Area			Production			Productivity					
	r	SEr	t	R <sup>2</sup>	r	SEr	t	R <sup>2</sup>	r	SEr	t	R <sup>2</sup>
Groundnut	0.70	0.2316	3.02	0.2702	1.70	0.7221	2.35*	0.2027	1.30	0.6281	2.07	0.1557
Pearl millet	-1.51	0.4925	3.07	0.2831	3.00	0.6180	4.85	0.5126	4.50	0.7002	6.43	0.6484
Sesamum	0.50	0.5126	ns	0.0347	4.70	0.0876	53.65	0.9924	3.10	0.5980	5.18**	0.5469
Sugarcane	2.80	0.4215	6.64	0.6689	4.40	0.8978	4.90	0.5290	2.22	1.0020	2.19*	0.1758
Castor	0.90	0.9686	ns	0.0387	9.50	0.4271	22.24	0.6983	10.50	1.1603	9.05**	0.7945
Cotton	1.70	0.2237	7.60	0.7283	4.40	0.4072	10.81	0.8439	2.50	0.3895	6.42**	0.6485
Maize	3.50	0.4244	8.25	0.7597	3.30	0.6405	51.5	0.5409	-2.26	0.4588	ns	0.0130
Paddy	-5.38	0.4920	10.94	0.8325	-1.78	0.7661	2.32*	0.1879	3.70	0.6741	5.49**	0.5796
Wheat	2.30	0.6956	3.31	0.3221	6.30	0.9036	6.97	0.6926	4.30	0.2816	15.27	0.9177
Sorghum	-3.51	0.1640	21.40	0.9455	1.00	0.7676	ns	0.0792	4.80	0.9642	4.98	0.5366
Gram	6.60	1.6300	4.05	0.4349	9.80	1.7000	5.76	0.6155	2.90	0.4939	5.87	0.6054

Significance of t : \* at 5%, others at 1 % ns : non-significant

## RESULTS AND DISCUSSION

### Growth in area, production and productivity of crops

Trends in area, production and productivity of major crops from 1960-61 to 1986-87 in Saurashtra are expressed as compound growth rates in Table 1. A trend of increase in the area of all the crops existed except for pearl millet and sorghum. The rate of increase was the highest (6.60%) for gram. Total production also increased in all the crops except paddy. The growth rates of production were highly significant for all the crops except for groundnut, paddy and sorghum.

Except maize, productivity of all the crops registered increase. The rate of increase in yield was the highest for castor (10.50%), followed by sorghum (4.80%), pearl millet (4.50%), wheat (4.30%), paddy (3.70%), sesamum (3.10%), etc. Despite a decline in the area under pearl millet, paddy and sorghum, the productivity was on the increase due to the cultivation of high yielding varieties. Although there was a significant increase in the per hectare yield of paddy, yet its total production decreased due to tremendous decline in the area during the period under study.  $R^2$  values indicated continuous increase in the productivity of wheat, castor, cotton, pearl millet, gram, paddy etc. There was no congruity in increases in the yields of groundnut with very low  $R^2$  values.

### Instability of crop yields

Low and highly unstable yields, characteristic of the crops raised under the unfavourable soil and rainfall conditions, were obvious from the levels and variability of yields in the region (Table 2). Instability of yield was the highest in case of sorghum, followed by castor, paddy, sesamum, pearl millet and groundnut, etc., the lowest being in respect of cotton. The fluctuation in product prices was the highest in case of sugarcane, the lowest in case of sorghum. Thus, instability in product prices was relatively less in cereal crops as compared to other crops.

The severity of the yield instability can be further elucidated through the frequency of below - average yield observations, the maximum (74.07%) in gram and lowest (18.52%) in respect of sugarcane (Table 3). The results presented also reveal that number of observations with cluster of 4 and above for below average yield were more for all the crops under study, Poor yields successively for four or more years severely affect the economy of the farmers of Saurashtra region.

### Incidence of crop yield instability

Temporal and spatial incidences tend to reduce the effectiveness of the measures adopted by the drought prone farmers to minimise the hardship of instability in arid and semi-arid agriculture and constitute other feature of crop instability.

Table 2. Per cent area of the crops, average crop yield and the frequency distribution of coefficient of variations in Saurashtra region for 1960-61 to 1986-87

Area of crop (%)	Av yield (kg/ha)	CV (%)			Total product
		Crop yield	Product price	Area	
40.72 (Groundnut)	704	72.44 (Sorghum)	99.73 (Sugarcane)	110.54 (Gram)	142.92 (Gram)
14.90 (Cotton)	166	59.41 (Castor)	68.79 (Groundnut)	57.83 (Castor)	94.05 (Castor)
14.42 (Pearl millet)	697	44.56 (Paddy)	66.56 (Gram)	52.20 (Paddy)	68.10 (Wheat)
11.26 (Sorghum)	194	41.71 (Sesamum)	62.67 (Sesamum)	48.43 (Maize)	51.66 (Maize)
3.79 (Wheat)	1813	40.47 Pearl millet)	54.37 (Castor)	39.96 (Wheat)	51.33 (Paddy)
1.52 (Sesamum)	228	37.64 (Groundnut)	47.59 (Maize)	30.97 (Sugarcane)	51.30 (Sugarcane)
0.82 (Sugarcane)	4794	37.31 (Gram)	47.33 (Wheat)	26.94 (Sorghum)	46.93 (Sorghum)
0.43 (Gram)	719	36.91 (Maize)	46.19 (Paddy)	23.26 (Sesamum)	45.50 (Sesamum)
0.30 (Paddy)	875	35.58 (Sugarcane)	45.59 (Cotton)	18.97 (Pearl millet)	40.31 (Groundnut)
0.10 (Maize)	986	32.81 (Wheat)	45.28 (Pearl millet)	17.70 (Cotton)	38.76 (Cotton)
0.09 (Castor)	649	26.82 (Cotton)	44.16 (Sorghum)	10.85 (Groundnut)	37.20 (Pearl millet)

Table 3. Distribution of low crop-yield observations in the Saurashtra region of Gujarat

Crops	Total number of observations	No. of observations with yield		Frequency of clusters of below-average yield observations				
		< average	> average	No cluster	Cluster of two	Cluster of three	Cluster of four and above	
Groundnut	27	13 (48.15)	14 (51.85)	3 (11.11)	3 (22.22)	—	1 (14.82)	
Pearl millet	27	13 (48.15)	14 (51.85)	1 (3.70)	—	1 (11.11)	1 (33.34)	
Sesamum	27	14 (51.85)	13 (48.15)	2 (7.41)	1 (7.41)	—	1 (37.03)	
Sugarcane	27	5 (18.52)	22 (81.48)	1 (3.70)	—	—	1 (14.82)	
Castor	27	11 (40.74)	16 (59.26)	1 (3.70)	—	—	1 (37.04)	
Cotton	27	14 (51.85)	13 (48.15)	1 (3.70)	1 (7.41)	—	1 (40.74)	
Maize	27	15 (55.56)	12 (44.44)	2 (7.41)	5 (37.04)	1 (11.11)	—	
Paddy	27	12 (44.44)	15 (55.56)	4 (14.81)	—	1 (11.11)	1 (18.52)	
Wheat	27	17 (62.96)	10 (37.04)	—	—	—	(62.96)	
Sorghum	27	14 (51.85)	13 (48.15)	1 (3.70)	1	1 (37.04)	1	
Gram	27	20 (74.07)	7 (25.93)	—	2 (14.81)	—	2 (59.26)	

Figures in parentheses indicate percentage

The time incidence of poor years (below-average yield years), besides the amplitude of yield fluctuations, create serious economic problem. Table 4 presents distribution of total observations with low (below average) yield according to the yield position (average, above average and below average) in the years which followed them. The results revealed that in most crops, deviations in yield upto 60 per cent existed; however, in some cases, the deviations moved beyond 60 per cent also.

Table 4. Number of observed deviations of crop yields from the mean (+ toward positive; toward negative) in Saurashtra region (1960-61 to 1986-87)

Crops	Deviation <30%		Deviation 30 to 60%		Deviation >60%	
	(+)	(-)	( )	(-)	(+)	(-)
Groundnut	8	6	5	4	1	3
Pearl millet	5	5	7	8	2	-
Sesamum	5	6	3	7	5	1
Sugarcane	13	3	6	-	3	2
Castor	3	2	7	3	6	6
Cotton	10	9	3	5	-	-
Maize	8	9	2	5	2	1
Paddy	6	7	5	3	4	2
Wheat	6	9	4	8	-	-
Sorghum	4	5	4	8	5	1
Gram	5	10	2	9	1	-

Flexibility in farm production organisation through diversification is an age old practice for adaptability to instability. To assess the scope for such a strategy, the phenomenon of yields of different crops in a given year was studied. In most of the cases, low yield of a crop was accompanied by a low yield of one or more of the other crops as well (Table 5). Thus, in an unfavourable year, most of the principal crops get adversely in the area and diversification may not necessarily insure stability in farm production in such situations.

#### Instability of product price

Product prices, as signals of efficient resource allocation, are not much effective. Still, some degree of stability in product price is important since drought prone farmers face a phenomenon of distress sales and procurement deficits. During the harvest period, they are forced to sell their produce to meet their urgent needs. Similarly, during severe drought years, falling short of their food reserves they have to purchase grains at higher prices.

Table 5. Number of years of below-average crop yields, crop-wise and corresponding with average low yields of other crops

Crop	Below-average yield years for the crop & (no.)	Number of years of simultaneous below-average yield observations for										
		1 crop	2 crops	3 crops	4 crops	5 crops	6 crops	7 crops	8 crops	9 crops	10 crops	All crops
Groundnut	13	—	1	—	2	—	2	—	1	2	6	1
Pearl millet	13	—	—	—	—	2	1	2	2	2	5	6
Sesamum	14	—	—	—	—	2	1	2	2	2	6	1
Sugarcane	05	—	—	1	—	1	—	—	—	—	2	1
Castor	14	—	—	—	—	1	1	2	2	2	4	1
Cotton	14	—	1	—	—	2	1	2	2	2	5	1
Maize	15	1	1	4	—	—	2	—	—	—	6	1
Paddy	12	—	—	2	—	—	—	—	1	2	6	4
Wheat	17	—	2	2	—	1	1	2	2	2	6	1
Sorghum	14	—	—	—	—	2	1	2	2	2	6	1
Gram	20	1	1	4	—	2	1	2	2	2	6	1

Table 6. Simple correlation matrix of crop prices in Saurashtra region, 1960-61 to 1986-87

Crop	Groundnut	Pearl millet	Sesamum	Castor	Cotton	Maize	Paddy	Wheat	Sorghum	Gram	Sugarcane
Groundnut	1.00	0.9137*	0.9918*	0.9518*	0.9233*	0.9310*	0.8063*	0.9595*	0.9362*	0.9503*	0.6138*
Pearl millet	—	1.00	0.9169*	0.9022*	0.8532*	0.9420*	0.8903*	0.9837*	0.9758*	0.9321*	0.6031*
Sesamum	—	—	1.00	0.9639*	0.9483\$	0.9347*	0.8039*	0.9584*	0.9421*	0.9439*	0.6314*
Castor	—	—	—	1.00	0.9268*	0.9250*	0.8464*	0.9464*	0.9374*	0.9063*	0.5484*
Cotton	—	—	—	—	1.00	0.8873*	0.7376*	0.8982*	0.9054*	0.8572*	0.5989*
Maize	—	—	—	—	—	1.00	0.8972*	0.9583*	0.9719*	0.9027*	0.5667*
Paddy	—	—	—	—	—	—	1.00	0.8758*	0.8744*	0.8292*	0.4616*
Wheat	—	—	—	—	—	—	—	1.00	0.9806*	0.9403*	0.5872*
Sorghum	—	—	—	—	—	—	—	—	1.00	0.9198*	0.6013*
Gram	—	—	—	—	—	—	—	—	—	1.00	0.6510*
Sugarcane	—	—	—	—	—	—	—	—	—	—	1.00

Significance : \* at P= 0.01, \$ at P= .05

Simple correlations among the product prices of different crops were positive and significant (Table 6) indicating that the product prices of different crops moved in the same direction. Under severe unstable crop raising conditions, provisions of irrigation facilities may elevate as well as favourably stabilise the crop yields. To reduce seasonal fluctuations, storage facilities should be created at appropriate places and money advance should be given to farmers on the pledge of the produce. It is also required to open and operate grain reserves and fodder banks in the region. These can mobilise grain and fodder during surplus years and distribute them in drought years.