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Letters to the Editor

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SOUTHWEST MONSOON RAINS AND KHARIF PRODUCTION

Weather and climate play dominating role in the crop production. Advance information on farm output, particularly foodgrains, is vital for economic planning for a country having agricultural oriented economy. Such an information, if available, in advance of crop harvest, provide enough lead time for initiating policy decisions like import/export/distribution in the country and thus has immense economic value. Mathematical models for estimating crop yield from specific meteorological factors have been in vogue in India Meteorological Department since the '70 decade (Das 1971, Chowdhury and Sarwade 1985, etc.). The techniques used for development are mostly statistical in nature since crop development does not readily lend itself to mechanical type modelling. Forecasts based on IMD models were for kharif rice and wheat are issued on meteorological sub-divisionwise basis. These forecasts do not provide estimate of total food production in an agircultural season and have thus a limited utility.

TABLE 1

Percentage change in foodgrains production in years of monsoon failures and that in following year

Year	% departure	Year	% departure
1965	−1.9	1967	24.3
1966	−12.6	1973	15.7
1972	−7.0	1975	25.0
1974	−12.8	1980	22.7
1979	−18.9	1983	27.7
1982	−12.0	1988	29.2
1986	−6.7		
1987	−7.0		

Thapliyal (1990) has computed seasonal (June-September) rainfall for the country as a whole from 1875 onwards. As reliable kharif foodgrain data were available from 1965 onwards and since the country has witnessed large-scale droughts with increased frequency from 1965, it was thought appropriate to develop model for forecasting total foodgrain production in the country using seasonal rainfall as an input.

TABLE 2

Analysis of variance

	SS	DF	MS	F
Regression	4372.36	2	2186.18	*121.21
Residual	414.85	23	18.04	
Total	4787.21	25	2204.22	

$r=0.96$. *Significant at 0.1% level.

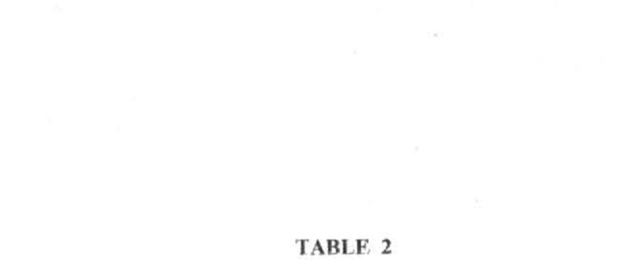

Fig. 1. Rainfall and food production variations

Production figures for this purpose were collected from the publication entitled *"Agricultural situations in India"* brought out by Ministry of Agriculture, Government of India, New Delhi.

Percentage variations in kharif food production in well known years of droughts, from the previous years, is shown in Table 1 alongwith changes in production in succeeding years. The fall in production ranged from nearly 2 to 19% and an average fall of about 9%, with lowest of 18.9% observed in 1979. On the other hand, years following drought have invariably registered rise with mean rise as 24.1% and the highest of 29% being in 1988.

Having established that drastic fall in foodgrain output occurs in years of poor rainfall an attempt was made to translate it into mathematical forms. Initially the mean yearly monsoon rainfall for the country was plotted against total food production during kharif season (Fig. 1). The trends in the two curves show remarkable similarity. A rise in production seems generally in tune with corresponding rise in the rainfall and *vice versa*. Thus, one may be tempted to conclude that food production is highly correlated with seasonal rainfall. However, correlation between the two was found as $r=0.45$, which though significant statistically at 5% level, was not large enough to be a potential forecasting tool by itself. Log or square root transformation also did not improve the correlation significantly.

As we are well aware, the country has benefitted greatly by the Green Revolution of the mid 60's. Scientific methods of farming, involving high dozes of technology, better water and farm managements etc have caused production to increase in a stepwise manner through time. In order to perceive and capture the effect of technology in a regression model, Thompson (1966) advocated use of some type of time variable. In this study dummy variable, linearly increasing to represent technological variable, has been employed. This variable from 1965 onwards was introduced as one of the independent parameters (x_1) alongwith mean seasonal rainfall (x_2). The multiple correlation $r^2 = 0.96$ accounting for 91% of the variability, were seen. Both the independent variables were statistically significant even at 1% level. The analysis for variance is given in Table 2.

The resulting equation was as below :

$$P = 1.53\ x_1 + 0.05\ x_2 + 11.41$$

where, P — kharif foodgrain production (million tons)

x_1 — Time variable with 1965=1, 1966=2........

x_2 — Mean seasonal rainfall (mm).

It was seen that the F-value was significant even at 0.1% level. Since yield series showed remarkable increase through time, the trend variable explained a significant proportion of yield variability.

As forecast of seasonal rainfall in India are available in May/June, it seems possible to have a reasonable estimate of kharif foodgrains output nearly 4 months, ahead of harvest.

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