Letters to the Editor

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 agricultural season and have thus a limited utility.

<table>
<thead>
<tr>
<th>TABLE 1</th>
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<td>Percentage change in foodgrains production in years of monsoon failures and that in following year</td>
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</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>% departure</th>
<th>Year</th>
<th>% departure</th>
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<tbody>
<tr>
<td>1965</td>
<td>1.9</td>
<td>1967</td>
<td>24.3</td>
</tr>
<tr>
<td>1966</td>
<td>12.6</td>
<td>1973</td>
<td>15.7</td>
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<tr>
<td>1972</td>
<td>7.0</td>
<td>1975</td>
<td>25.0</td>
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<tr>
<td>1974</td>
<td>12.8</td>
<td>1980</td>
<td>22.7</td>
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<tr>
<td>1979</td>
<td>18.9</td>
<td>1983</td>
<td>27.7</td>
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<tr>
<td>1982</td>
<td>12.0</td>
<td>1988</td>
<td>29.2</td>
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<tr>
<td>1986</td>
<td>6.7</td>
<td>1987</td>
<td>7.0</td>
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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.

![Figure 1: Rainfall and Food Production Variations](image)

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 along with 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 benefited greatly by the Green Revolution of the mid 60's. Scientific methods of farming, involving high doses 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 ($x_1$) along with mean seasonal rainfall ($x_2$). The multiple correlation $r^2 = 0.96$ accounting for 91.6% 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:

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

where, $P$ — kharif feedgrain 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.

References


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6 August 1992

RESPONSE OF BIOMASS PRODUCTION TO WEATHER PARAMETERS IN SORGHUM

1. There has been a continuous interest in grain sorghum (*Sorghum bicolor* L. Moench) throughout the world. In northern India, sorghum has been widely adopted by the farmers as a fodder crop. However, the seed setting in this crop is very shy being the forage cultivars. The time of sowing is the most important factor which decides the available period for vegetative and reproductive phases and ultimately the yield.

The biomass production depends upon agricultural practices and meteorological parameters during the growing season. Various relationships have attempted for expressing biomass production in terms of the parameters, like growing degree days (GDD) and pan evaporation (EP).

2. Materials and method—Field experiments were conducted at research farm of Department of Agricultural Meteorology, Haryana Agricultural University, Hisar (Lat. 29° 10' N, Long. 75° 46' E, height 215.2 m) during kharif seasons of 1986 and 1987. The experiment comprised of three dates of sowing (5, 20 June — D1, D2 and 5 July — D3) and two cultivars (HC-260, CV1 and HC-171, CV2). All the treatments were replicated thrice in a randomised block design. The crop was raised as per the recommended package of practices. The soil of the experimental field was sandy loam. The biomass observations were taken first as soon as the plants were established (which is affected generally about twenty days after the date of sowing) and then subsequently at every 15 days intervals up to the maturity stage of the crop. Thus six biomass observations were taken for each year. The biomass samples were taken randomly from each field. Then dry weight was determined after oven drying. Maximum and minimum temperatures (in degree celsius) and open pan evaporation (in mm) by U.S.A. class A-type open pan evaporimeter were recorded at observatory located about 100 m away from the field. Taking a base temperature as 10°C for sorghum, a growing degree day (GDD) was calculated by $(T_{max} + T_{min}/2) - 10$. The number of degree days was then computed from the date of sowing to each day of observation for each experiment. Similarly accumulated evaporation was computed corresponding to each biomass observation from the date of sowing for each sowing date and variety for both years. Then the data of both years were pooled to develop the response functions between the accumulated dry biomass with growing degree days and pan evaporation of the form of:

$$v = a + bx$$

$$v = a + b \log x$$