PREDICTION MODELS FOR THE AREA, PRODUCTION AND PRODUCTIVITY OF THE URD OF SARGUJA DISTRICT OF CHHATTISGARH

A. Sahu, M.L. Lakhera and K.K. Pandey*

Department of Agril. Statistics, Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh

Received-20.11.2015, Revised-27.11.2015

Abstract: Three models have been used for the study of trend analysis of the Urd for the Sarguja district. Linear Quadratic and Exponential Models has been used for Sarguja district. Present study period was 1979-80 to 2012-13, which divided into three group i.e. period-I, period-II and period-III. The value of R² indicates the efficiency of the models and the forecasted value indicates the accuracy of the models. CGR (%), CV (%) and Instability Index have been calculated for the respective periods and all three models. The studies are very necessary not only for understanding the growth trends and magnitude of fluctuations in crop production, but are also useful for scientific planning and effective implementation of agricultural developmental at different levels.

Keywords: CGR, CV, Exponential, Linear and Quadratic Models and Instability Index, etc.

INTRODUCTION

Chhattisgarh is a state in Central India. It is the 10th largest state in India, with an area of 13.5 million hectare. It is the 16th most-populated state of the nation having a total population of 25.5 million. The State has three agroclimatic zones, i.e. Chhattisgarh plains, Bastar plateau and Northern Hill Region spreading over a total geographical area of 13.60 million hectares. Forest occupies 1.85 million hectares in the State. The net area sown is 4.82 million hectares, which is 35.44 per cent of the geographical area. The cropping intensity is 117.0 per cent. Chhattisgarh is an important State as it contributes about 5.72 per cent of the total annual pulses area. Production and productivity in Chhattisgarh during 2010-11 were 0.81 (Mha), 0.49 million ton and 605 kg/ha (State of Indian Agriculture, 2012-13) respectively. About 90 percent of the total global area under pigeonpea, 65 percent under chickpea and 37 percent under lentil is contributed by India, with a corresponding share of production of 93 percent, 68 percent and 32 percent, respectively (Reddy, 2004). Pulses occupy an important place in Indian agricultural economy as they are rich sources of proteins and constitute 10 to 15 per cent of India’s food grain diet. They are relatively the richest, cheapest and easiest source of best quality proteins and fats, have a vast multiplicity of uses as food and industrial products. India is the largest producer and consumer of pulses in the world accounting for 33 per cent of the world area and 22 per cent of world production and about 30 per cent of consumption. Pulses complement cereals in both production and consumption (Joshi and Saxena, 2002). The important states engaged in growing pulses are Madhya Pradesh (22.90 %), Uttar Pradesh (18.12 %), Maharashtra (14.25 %), Rajasthan (10.84 %), Andhra Pradesh (8.64 %), Karnataka (5.76 %) and others (19.49 %), (Shailendra, 2011).

The total area, production and productivity was 22.46 (Mha), 10.63 million ton and 473 kg/ha respectively during 1980-81, which increased to 24.66 million hectares, 14.26 million ton and 578 kg/ha during 1990-91. During 2000-01, 20.35 (Mha), 11.08 million tons and 544 kg/ha. During 2000-01 the country imported about 4.73Mt of pulses export earnings were a little less crores which increased to 23.50 million hectares, 14.60 million ton and 689 kg/ha during 2010-11. Production of pulses during 2011-12 was 14.60 million tonnes which was slightly less than the 32.48 million tonnes recorded in 2010-11, (GoI, 2012).

MATERIAL AND METHOD

The study was confined to the Northern Hills of Chhattisgarh state and its district. There was only one district in Northern Hill zone is Sarguja. In the present study we have investigated only two districts as mentioned above. Urd (Vigna mungo) were considered for the study, because most of the districts of Northern Hill of Chhattisgarh had some appreciable area under these crops.

The present study mainly hinges on secondary sources of data for analysis, drawing inferences and arriving at relevant conclusions. Blackgram and Greengram other pulses and total pulses for the three districts were collected for the period from 1979-80 to 2012-13 from various issues of publication such as 'Agricultural Statistics' published by Directorate of Agriculture, Government of Madhya Pradesh, Bhopal (1979-80 to 1997-1998) and 'Basic Agricultural Statistics' (1979-80 to 1997-1998) published by Commissioner of Land Records and Settlement Gwalior, Government of
Madhya Pradesh and from the website www.agridept.cg.gov.in/agriculture/ kharif.htm (1998-99 to 2011-12) and “Table of Agriculture Statistics” (2012-13) published by Commissioner, Land Records and Settlement, Raipur, Chhattisgarh. The data on area, production and productivity for pulses in Chhattisgarh for the period of 1979-80 to 2012-13 formed the basis of the present study.

However, the entire period has been divided into three periods to assess the trend analysis (linear, quadratic and exponential trends) as shown below:

1. Pre-establishment of IGKV, Raipur: 1979-80 to 1986-87 (period- I).

The main consideration underlying the choice of these sub-periods was based on the fact that ‘Indira Gandhi Krishi Vishwavidyalaya’ and newly formed State Chhattisgarh started functioning from the year 1987-88 and 1998-99 respectively and number of districts is different in different study period.

In order to quantify the growth of area, production and productivity of cereal crops, district wise trend in area, production and productivity were worked out for the cereal crops of Northern Hills of Chhattisgarh, for the three separate periods viz., (1) Pre-establishment of IGKV, Raipur: 1979-80 to 1986-87 (period- I); (2) Post-establishment of IGKV, Raipur and pre-period of M.P. and C.G. partition: 1987-88 to 1997-98 (period-II); (3) Post-period of M.P. and C.G. partition: 1998-99 to 2012-13. To analyse the trend in area, production and productivity of different cereal crops, the following different functional forms were fitted.

1. Linear function \[ Y = a + bx \]
2. Quadratic function \[ Y = a + bx + cx^2 \]
3. Exponential function \[ Y = a b^x \]

Where, \( Y \) = Area, production and productivity of different food grain crops
\( x \) = Time variable

The functional form having the highest co-efficient of determination (\( R^2 \)) is selected for fitting the trend. Similarly, the growth rate of area, production and productivity of different cereal crops were also computed. Compound Growth Rate was also computed for area, production and productivity of different cereal crops based on the exponential function for the period. The Compound Growth Rate was computed as follows:

\[
\text{Compound Growth percentage (CGR %)} = (b-1) \times 100
\]

To measure the magnitude of variability in area, production and productivity the co-efficient of variation (%) was computed. Further the instability index was also calculated to examine the instability area, production and productivity of different cereal crops in different districts of Chhattisgarh plain over the time period by using the formula:

\[
\text{Instability Index (I)} = (1-R^2) \times CV^2
\]

## RESULT AND DISCUSSION

### Linear Trend Analysis

#### Performance of Urd

It was observed from the Table 1 that a positive linear trend of area (\( R^2 = 93.86\% \)) and production (\( R^2 = 63.62\% \)) were found to be significant at 1% level of significance, while productivity (\( R^2 = 33.53\% \)) was found to be non-significant of period- I. A positively linear trend in area (\( R^2 = 89.60 \% \)) and productivity (\( R^2 = 20.33\% \)) were found to be negatively significant at 1% level of significance while negatively linear trend production (\( R^2 = 66.31\% \)) was found to be non-significance during period-II. and linear trend in area (\( R^2 = 83.02 \% \)) production (\( R^2 = 0.11 \% \)) and productivity (\( R^2 = 42.83\% \)) of crop during period –III.

#### Growth trend analysis

It was observed form the Table 1 that a positive growth trend in area (\( R^2 = 93.81\% \)) and production (\( R^2 = 57.42\% \)) was found to be statistically highly significant at 1% and 5% level of significance, while productivity (\( R^2 = 33.96 \% \)) was found to be non-significant study period- I. A positive growth trend in area (\( R^2 = 89.57\% \)) and productivity (\( R^2 = 65.30 \% \)) was found to be statistically highly significant at 1% level of significance, while production (\( R^2 = 22.32 \% \)) was found to be non-significant study period- II.

#### Quadratic trend analysis

Table 1 Relevance that the the linear and quadratic regression coefficient were found to be non-significant for area, production productivity of crop during study period-I. It was observed form the Table 1 that linear and quadratic regression coefficient were found to be positive and negative significant respectively for production (\( R^2 = 69.39 \)) under study period- II.

It was observed form the Table 1 that linear and quadratic regression coefficient were found to be positive and negative significant respectively for productivity (\( R^2 = 87.12 \)) under study period- III.

### Instability analysis

Table 2 revealed that the coefficient of variation for area is very low indicates that grown in all over the area in all period. All districts in period III showed negative significant growth rate, which indicate that the urd crop is grown in all over the Northern hills of Chhattisgarh with varying area in all period. Though the area exhibits negative significantly growth rate in all of the districts of Northern hills of Chhattisgarh.
Table 1. $R^2$ value of linear, quadratic and exponential and Forecast for Urd crop

<table>
<thead>
<tr>
<th>District</th>
<th>Aspects</th>
<th>Linear</th>
<th>Quadratic</th>
<th>Exponential</th>
<th>Years</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>$R^2$ (in %)</td>
<td></td>
<td></td>
<td>2013-14</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$Y= a+bx$</td>
<td>$Y= a+bx+cx^2$</td>
<td>$Y= a.b^x$</td>
<td></td>
</tr>
<tr>
<td>Sarguja</td>
<td>Area</td>
<td>15.47</td>
<td>26.25</td>
<td>18.08</td>
<td>0.12</td>
</tr>
<tr>
<td></td>
<td>Production</td>
<td>10.10</td>
<td>6.22</td>
<td>10.10</td>
<td>0.020</td>
</tr>
<tr>
<td>Jashpur</td>
<td>Area</td>
<td>16.04</td>
<td>8.91</td>
<td>21.14</td>
<td>0.036</td>
</tr>
<tr>
<td></td>
<td>Production</td>
<td>17.58</td>
<td>18.12</td>
<td>20.94</td>
<td>0.008</td>
</tr>
</tbody>
</table>

Table 2. CGR (%), CV (%) and II of area, production and productivity of Urd crop

<table>
<thead>
<tr>
<th>Aspects</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
</tr>
<tr>
<td>A</td>
<td>2.77***</td>
</tr>
<tr>
<td></td>
<td>6.47</td>
</tr>
<tr>
<td></td>
<td>0.0259</td>
</tr>
<tr>
<td>P</td>
<td>7.27**</td>
</tr>
<tr>
<td></td>
<td>17.63</td>
</tr>
<tr>
<td></td>
<td>0.123</td>
</tr>
<tr>
<td>Y</td>
<td>4.53**</td>
</tr>
<tr>
<td></td>
<td>14.55</td>
</tr>
<tr>
<td></td>
<td>1.398</td>
</tr>
</tbody>
</table>

Note: ***, **, * & NS: Significant at 1per cent, 5 per cent, 10 per cent probability level and Non Significant respectively A= Area, P= Production, Y=Yield/Productivity

REFERENCES


