Plant Archives Vol. 19 No. 1, 2019 pp. 228-230 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

FORECASTING OF YIELD VALUES BY USING GROWTH MODELS IN CHILLI OF VARIOUS DISTRICTS OF ANDHRA PRADESH

V. Sekhar and K. Umakrishna*

Department of Statistics, College of Horticulture, Dr. YSR Horticultural University, West Godavari -534101 (A.P.)

Abstract

This paper was attempted forecasting the Chillies yield of Andhra Pradesh through fitting of Growth models. The data on Chilli yield (in Kgs / Ha) was collected for a period of 25 years (1991-2015) from https://desap.cgg.gov.in. Cubic model was identified as the best model for the observed data based on the R-Square criteria and forecasted the future values for the next four years.

Key words: Growth models (Cubic, Quadratic), R^2

Introduction

Chilli is examined as one of the popular commercial spice crop and is a popular ingredient in most Indian dishes and curries. Though chillies are produced in all parts of the India, Andhra Pradesh, Karnataka, Maharashtra, Orissa, Rajasthan and Tamilnadu are the main chilli growing states in India. Andhra Pradesh is the leading state in India in respect of chilli growing area and production. Andhra Pradesh plays an important role in the chilli export of India. In Andhra Pradesh Guntur, Krishna districts are the important areas of cultivation.

Methodology for fitting of growth models

Growth models are nothing but the equations that describe the trend of a variable overtime

1. Linear equation

   $Y = a + b(t)$

   Here,

   Y is the explained variable *i.e.*, yield

   t is explanatory variable, *i.e.* time in years

   a is intercept

   b is slope

2. Quadratic equation

   $Y = a + b(t) + c(t^2)$

   Here,

   Y is the explained variable *i.e.* yield

   t is explanatory variable, *i.e.* time in years

   a is intercept

   b & c are the slopes

3. Compound equation

   $Y = ab^t$

   Here,

   Y is explained variable *i.e.*, yield

   t is explanatory variable, *i.e.* time in years

   a is intercept

   b is slope

4. Growth equation

   $Y = Exp (a + bt)$

   Here,

   Y is explained variable *i.e.*, yield

   t is explanatory, *i.e.* time in years

   a is intercept

   b is slope

5. Logarithmic function

   $Y = a + b \ln(t)$

   Here,

   Y is explained variable *i.e.*, yield

   t is time in years, *i.e.* explanatory variable

   a is intercept

   b is slope

6. Cubic equations

   $Y = a + b(t) + c(t^2) + d(t^3)$

***Author for correspondence :** E-mail : umakrishnastat@gmail.com,

Here,

Y is explained variable *i.e.*, yield

t is explanatory variable, *i.e.* time in years

a is intercept

b, c and d are slopes

7. S-curve

$Y = Exp\ (a + b/t)$

Here,

Y is explained variable *i.e.*, yield

t is explanatory variable, *i.e.* time in years

a is intercept

b is slope

8. Exponential equations

$Y = a\ Exp\ (bt)$

Here,

Y is explained variable *i.e.*, yield

t is explanatory variable, *i.e.* time in years

a is intercept

b is slope

9. Inverse equations

$Y = a + b/t$

Here,

Y is explained variable *i.e.*, yield

t is explanatory variable, *i.e.* time

a is intercept

b is slope

10. Power equations

$Y = at^b$

Here,

Y is explained variable *i.e.*, yield

t is explanatory variable, *i.e.* time in years

a is intercept

b is slope

R-square is a statistical measure of how near the data are to the fitted regression line. It is also known as the coefficient of determination.

$$R^2 = \frac{Explaines\ variation}{Total\ variation}$$

R-squared is always between 0 and 100%:

- 0% indicates that the model explains none of the variability of the explained data around its average.
- 100% indicates that the model explains all the variability of the explained data around its average.

Results and Discussions

Different (Linear, Quadratic, Compound, Growth, Logarithmic, cubic, S-curve, Exponential, inverse, Power) models used to predict trend of chilli yield over time; cubic model has highest R^2.

Table 1: Linear and Non-linear regression models to know the trend of chilli yield over years in Andhra Pradesh

S. No.	Model	R Square	Parameter Estimates			
			a	b	c	d
1	Linear	0.814	1174.850	141.424		
2	Quadratic	0.816	1048.778	169.440	-1.078	
3	Compound	0.800	1419.683	1.053		
4	Growth	0.800	7.258	.052		
5	Logarithmic	0.707	315.703	1162.711		
6	Cubic	0.822	1332.130	50.195	10.167	-.288
7	S	0.503	8.154	-1.462		
8	Exponential	0.800	1419.683	.052		
9	Inverse	0.385	3542.122	-3464.152		
10	Power	0.781	977.049	.451		

From the above table, best model is Cubic model with highest R^2 (0.822) and significant at 5 per cent Regression equation to know the trend of chilli yield over year by Cubic model $\hat{Y} = 1332.130+50.195\ t + 10.167\ t^2 - 0.288\ t^3$ where, $\hat{Y}$ = chilli yield in Kg/ha, t = year number for which yield is estimated

Table 2: Original and trend yield of chilli in Andhra Pradesh State

S. No.	Year	Original Yield(Kg/ha)	Predicted Yield (kg/ha) based on cubic model	Error (kg/ha)
1	**1991**	1107	1392	-285
2	**1992**	1946	1471	475
3	**1993**	1467	1566	-99
4	**1994**	1784	1677	107
5	**1995**	1386	1801	-415
6	**1996**	2268	1937	331
7	**1997**	2227	2083	144
8	**1998**	2546	2237	309
9	**1999**	1782	2397	-615
10	**2000**	2364	2562	-198
11	**2001**	2870	2731	139
12	**2002**	1863	2900	-1037
13	**2003**	3723	3069	654
14	**2004**	3561	3236	325
15	**2005**	3469	3399	70
16	**2006**	3979	3557	422
17	**2007**	3866	3707	159
18	**2008**	3994	3848	146
19	**2009**	4337	3978	359
20	**2010**	3370	4096	-726
21	**2011**	3594	4200	-606
22	**2012**	3804	4287	-483
23	**2013**	4584	4357	227
24	**2014**	5480	4407	1073
25	**2015**	3963	4436	-473

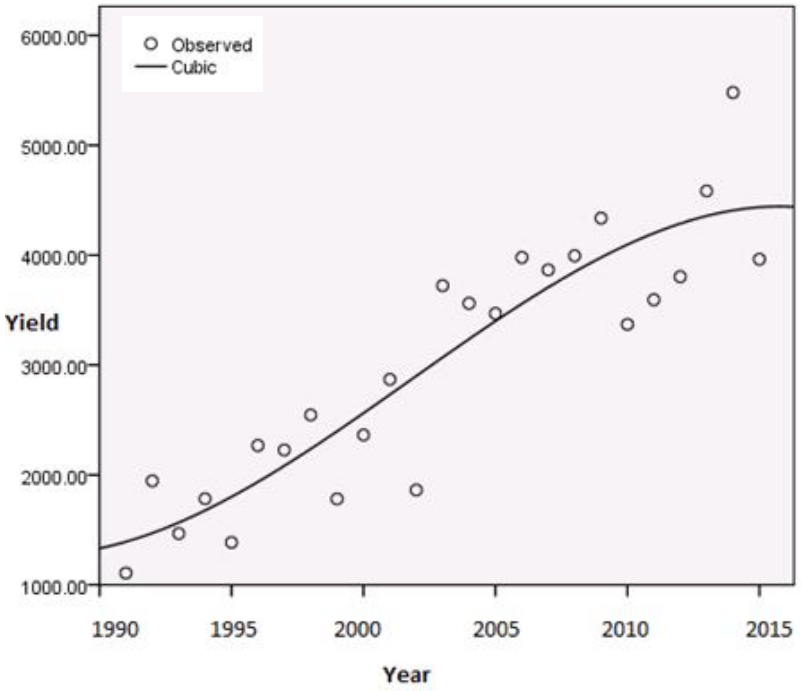
Table 3: Output of Runs Test for error values of the above table

	Error
Test Value[a]	139.00
Cases < Test Value	12
Cases >= Test Value	13
Total Cases	25
Number of Runs	13
Z	.000
Asymp. Sig. (2-tailed)	1.000

a. Median

From the above table Asymp. Sig. (2-tailed) is 1.000. That is greater than 0.05, so, we accept the Null hypothesis. *i.e.* sample(error) values come from a random sequence

Graph belongs to Year Vs Yield in Andhra Pradesh



The main objective of this article is to know the trend of chilli yield over years, by knowing that farmers can plan for marketing and processing of chilli

References

Directorate of Economics and Statistics, Andhra Pradesh. https://desap.cgg.gov.in/ YieldStatistics.do

Himanshu Shekhar (2042). "Estimation of potato yield in relation to weather parameters" M.Sc. Thesis, University of Agricultural Sciences, Dharward, Karnataka, 2014.

Karthik Sudha, Ch. (2012). "Comparative performance of different trend models in relation to crops of Guntur District". M.Sc. Thesis, Agricultural College, Bapatla, Acharya NG Ranga Agricultural University, Hyderabad, .

Raju, K.V. and C.K. Lucrose (1991). "Trends in Area, Production and export of Chillies from India" *Agricultural Situation in India,* **XLV(11)**: 771.

Sathish, G., K. Supriya, M.H.V. Bhave and P. Venkatesh (2015). An Analysis of Growth Trends and Instability of Chilli in Andhra Pradesh. *Research Journal of Agricultural Sciences,* 6(December), 1753–1756.

Velayutham, L.K. and K. Damodaran (2015). Growth Rate of Chilli Production in Guntur District of Andhra Pradesh. *International Journal of Research in Humanities and Social Studies,* **2(11)**: 1–5.

Table 4: Forecasting of yield values by using Cubic model in chillies of various districts of Andhra Pradesh

Year (forecasting period)	Srikakulam	Vizianagaram	Visakhapatnam	East Godavari	West Godavari	Krishna	Guntur	Prakasham	Nellore	Kadapa	Kurnool	Ananthapuram	Chittor	Andhra Pradesh
2016	4010	2386	2334	4081	3952	6445	4528	4454	7676	5222	3863	2388	1681	4442
2017	3686	2639	2131	4021	4431	7244	4300	4555	8638	5664	4063	2106	1244	4424
2018	3274	2937	1885	3930	4969	8164	4015	4639	9718	6139	4267	1775	723	4379
2019	2769	3285	1591	3808	5571	9212	3670	4702	10920	6648	4477	1389	112	4306
Model Criterion														
R^2	0.843	0.318	0.457	0.650	0.724	0.806	0.576	0.907	0.774	0.873	0.736	0.470	0.418	0.822
Adjusted R^2	0.821	0.221	0.380	0.600	0.685	0.779	0.516	0.894	0.741	0.855	0.698	0.394	0.334	0.797