TREND ANALYSIS ON AREA, PRODUCTION AND PRODUCTIVITY OF CHICKPEA IN DIFFERENT AGRO CLIMATIC REGION OF MADHYA PRADESH

ABSTRACT

In this research paper an attempt has been made to take measure the area, production and productivity of chickpea in eleven agro climaticzones of Madhya Pradesh during 1996-97 to 2015-16. The research was carried with the objective, to study trend analysis in area, production, and productivity of chickpea in eleven agro climatic zones of M.P. The secondary time series data on area, production and productivity of chickpea were collected from website of department of economics and statistics.The data pertained to the period of 20 years i.e. from 1996-97 to 2015-16. The findings of the study revealed that area of chickpea shows increasing trend in NH region of Chhattisgarh, Chhattisgarh plains, Satpura plateau, Nimar plains, Vindhya plateau, Kymore and Malwa region while Gird, Bundelkhand, Jhabua and Narmada regions show declining trend for next twenty years. Same as area, production of chickpea in all the regions of M.P. except Bundelkhand show increasing trend while Bundelkhand shows declining trend. NH region of Chhattisgarh, Chhattisgarh plains, Satpura plateau, Jhabua, Nimar plains, Vindhya plateau, Kymore and Malwa regions show increasing trend of productivity and rest of them show declining trend of productivity. The co-efficient of variation indicated that, instability in chickpea production exhibited less variation than area and productivity, at overall period.

Key words: area, chickpea, coefficient of variation, production, productivity, trend analysis.

INTRODUCTION: India is the world's largest producer and consumer of a wide variety of pulses which is dominated by tropical and sub-tropical crops such as chickpea, black gram, red gram (pigeonpea), green gram (mungbean), lentil and so on, high in protein, fiber, vitamins, and also suppliers of high quality carbohydrates, minerals and vitamins. The carbohydrates provided by pulses are released slowly as compared to cereals and so have a high value for maintaining optimal blood sugar levels and restoring energy over a long period of time after the meals. Pulses in general are one of most sustainable crop utilizing just 359 liter of water to produce one kg of pulses, as compared with 1,802 for soybeans and 3,071 for groundnut. They also contribute to soil quality by fixing nitrogen in the soil.

Presently, in India, 29.46 M ha area is under pulses, producing about 25.23 MT pulses, with the average yield of 856 kg/ha [2017-18]. Chickpea are the main pulse crop grown in the country. The important chickpea growing states are Madhya Pradesh, Karnataka, Rajasthan, Maharashtra and Andhra Pradesh which accounts for more than 85 per cent of the cultivated area and production under Chickpea in the country.

Madhya Pradesh is an important pulse growing state of India. Madhya Pradesh ranks first in India with respect to chickpea area (36 per cent) and production (45 per cent). On the basis of last twenty years, the state contributed on an average 35.31 per cent and 38.13 per cent to the total national area and production of chickpea, respectively. The average yield of the same period was 924 kg/ha which was higher than the mean national productivity [850 kg/ha]. It got momentum after the launch of NFSM-Pulses during October 01, 2007. The post

NFSM period recorded increase of 31.74 percent, 43.79 per cent and 22.15 per cent in area, production and yield respectively in the state of Madhya Pradesh. The area and production increases after NFSM implemented in the state of Madhya Pradesh. The study utilises secondary time series data with respect to area production and productivity of chickpea of the M.P.The prime objective of the study is to examine the trends in area, production and productivity of chickpea in M.P. In addition the study attempts to predict the future trend in area, production and productivity of chickpea in the state of Madhya Pradesh.

Table 1: Area, production and yield of Chickpea in India and Madhya Pradesh

Year	**Area [Lakh ha]**		**Production [Lakh tonnes]**		**Yield [kg/ha]**	
	India	M.P.	India	M.P.	India	M.P.
1996-97	68.50	25.13	55.70	22.94	813	913
1997-98	75.60	25.83	61.30	24.41	811	945
1998-99	84.70	23.95	68.00	22.24	803	929
1999-2000	61.50	23.96	51.20	22.32	833	932
2000-01	51.90	19.04	38.60	14.80	744	777
2001-02	64.20	24.55	54.70	21.75	853	886
2002-03	59.10	23.63	42.40	14.99	717	634
2003-04	70.50	25.71	57.20	22.41	811	872
2004-05	67.10	24.72	54.70	21.43	815	867
2005-06	69.30	25.41	56.00	23.78	808	936
2006-07	76.30	25.91	63.30	25.57	845	987
2007-08	**75.80**	**26.62**	**57.50**	**19.26**	**762**	**724**
2008-09	78.90	28.75	70.60	28.15	895	979
2009-10	81.70	30.86	74.80	33.04	915	1071
2010-11	91.90	31.10	82.20	26.90	894	865
2011-12	83.20	26.30	77.00	28.45	928	1082
2012-13	85.20	27.22	88.80	33.21	1036	1220
2013-14	99.30	34.82	95.30	25.55	960	734
2014-15	82.50	28.53	73.30	29.64	889	1039
2015-16	83.50	30.17	71.70	32.70	859	1084
Mean	**75.54**	**26.61**	**64.72**	**24.68**	**850**	**924**
State share	**-**	**35.31**	**-**	**38.13**		
Mean before NFSM	**68.06**	**24.35**	**54.83**	**21.51**	**805**	**880**
Mean after NFSM	**92.23**	**32.08**	**82.89**	**30.93**	**994**	**1075**
Increase [%]	35.51	31.74	51.17	43.79	23.47	22.15
CAGR [%]						

RESEARCH METHODOLOGY: The study is based on secondary data. The secondary data were collected from the website from the department of Farmer Welfare and Agriculture Development, Govt of Madhya Pradesh and department of agriculture Cooperation and farmer welfare, Govt. of India, New Delhi. The data on area, production and productivity from 1996-97 to 2015-16were used for analysis. The State Madhya Pradesh is divided in 11 Agro-climatic regions namely Chhattisgarh plains;Northern Hill Region of Chhattisgarh; Kymore Plateau; Central NarmadaValley;Vindhya Plateau; GirdRegion; Bundelkhandregion;Satpura Plateau;Malwa Plateau;Nimar Plains and Jhabua Hills.The details of 11 Agro-climatic regions and their districts are as mentioned below;

Table:2 Agro Climatic Zones of Madhya Pradesh

S. No.	Name of Agro climatic zones	Name of District
1.	Vindhya Plateau	Sehore, Vidisha , Sagar, Damoh, Raisen and Bhopal
2.	Gird region	Gwalior, Morena, Bhind, Shivpuri, Guna, Ashok Nagar and Sheopur
3.	Bundelkhandregion	Chatterpur, Tikamgarh,Datiya andRewari
4.	Malwa plateau	Indore, Ujjain, Shajapur, AaagarMalwa, Dewas, Rajgarh, Mandsaur, Neemuch and Ratlam
5.	Nimarplains	Khandwa, Khargone, Badwani, Burhanpur and Harda
6.	Jhabua hill zone	Jhabua, Alirajpur and Dhar
7.	Chhattisgarh plains	Balaghat.
8.	Northern Hill Region of Chhattisgarh	Shahdol, Mandla,Dindori, Anuppur, Umaria and Singroli
9.	Kymore Plateau	Rewa,Satna,Panna,Jabalpur, Seoni, Katni and Sidhi
10.	Central Narmada Valley	Narsinghpur, Hoshangabad
11.	Satpura Plateau	Betul&Chhindwara

These zones have enormousvariations in terms of area, productivity and production of chickpea. Trend projection method was employed to estimate the trend from past data to obtain anestimate in production, productivity and area under cultivation of chickpea in different region of Madhya Pradesh. The basic idea behind this method is that the past data serves as a guide to predict future trend. The trend projection method is based on time series analysis. The basic formulas of trend projection method are given below.

$$Y_t = b_0 + b_1 t$$

where,

Y_t = trend forecast for the time t

b_0 = trend line projection for time 0

b_1 = slope of the trend line

Estimates of b_0 and b_1 were computed by maxstatlite version.

The compound growth rates were computed by fitting the exponential function as below:

$Y_t = ab^t$

where,

Y_t=dependent variable on area, production and productivity in the year 't';

a=constant;

b=regression coefficient;

t=time element which takes the value 1, 2, 3,…, n

After transforming the model into a linear form by taking logarithms, we get

$\log Y_t = \log a + t \log b$

By putting $\log Y_t = y$, $\log a = A$ and $\log b = B$, the model becomes linear between y and t, as $y = A + Bt$,.

The compound growth rate (cgr) in per cent was obtained by the following formula:

CGR=(b-1)×100= (antilog B-1)×100
The co-efficient of variation (C.V.) was used as a measure of instability as:
C.V.=(Standard deviation/Mean)×100

RESULTS AND DISCUSSION The data of chickpea from the year 1996-97 to 2015-16 has been used to understand the tendency in area, production and productivity of chickpea in eleven agro climatic zones of Madhya Pradesh. The growth in the production of chickpea depends on many factors such as area cropped, input management and yield. The cropped area and productivity are determined by the fertility of soil, monsoon behaviour, rainfall, irrigation, availability of agricultural labourers, climatic changes, chickpeas technological advancement, etc. Geography, climatic conditions, socio-economic structure is dissimilar among the two states. Table 3depicts that the chickpea scenario of different agroclimatic zones of Madhya Pradesh. Based on district wise data of twenty years [**1996-97 to 2015-16**], it is clear that more than half of the total acreage under chickpea in the state is concentrated in 15 districts of Malwa Plateau[09 districts] and vindhya plateau [6 districts] agro-climatic zones. The area and production of chickpea in Vindhya Plateau zone are higher than that of Malwa plateau but the productivity in the Malwa plateau zone is 0.21 per cent higher than the average productivity of the state. The productivity is the highest [1124 kg/ha] in the central Narmadavalley zone while its minimum [682 kg/ha]in the Northern hill region of Chhattisgarh. During the study period the state recorded 9.89 per cent higher productivity that that of national productivity [856 kg/ha].

Table:3 Area, Production and Yield of Chickpea in different Agro-climatic zones of Madhya Pradesh [Average 1996-97 to 2015-16]

S. No.	Name of Agro climatic zones	Name of Districts	Area [Th. Ha]	Production [Th t]	Yield [Kg/ha]
1.	NH Region of Chhattisgarh	Shahdol, Mandla,Dindori, Anuppur, Umaria and Singroli	41.41 [1.56]	28.22 [1.12]	682 [-28.27]
2.	Chhattisgarh plains	Balaghat.	8.80 [0.33]	7.78 [0.31]	885 [-6.94]
3.	Satpura Plateau	Betul&Chhindwara	69.04 [2.59]	76.91 [3.04]	1114 [17.26]
4.	Gird Region	Gwalior, Morena, Bhind, Shivpuri, Guna, Ashok Nagar and Sheopur	346.39 [13.01]	359.93 [14.23]	1039 [9.38]
5.	Bundelkhand	Chatterpur, Tikamgarh and Datiya	142.49 [5.35]	156.79 [6.20]	1100 [15.83]
6.	Jhabua Hills	Jhabua, Alirajpur and Dhar	87.47 [3.29]	78.63 [3.11]	899 [-5.38]
7.	Nimar Plains	Khandwa, Khargone, Badwani, Burhanpur and Harda	60.26 [2.26]	62.11 [2.45]	1031 [8.49]
8.	Central Narmada Valley	Narsinghpur, Hoshangabad	175.42 [6.59]	197.13 [7.79]	1124 [18.29]
9.	Vindhyan Plateau	Sehore, Vidisha , Sagar, Damoh, Raisen and Bhopal	740.34 [27.81]	688.53 [27.22]	930 [-2.10]
10.	Kymore Plateau	Rewa,Satna,Panna,Jabalpur, Seoni, Katni and Sidhi	383.04 [14.38[	294.93 [11.66]	770 [-18.95]
11.	Malwa Plateau	Indore, Ujjain, Shajapur, AagarMalwa, Dewas, Rajgarh, Mandsaur, Neemuch and Ratlam	607.80 [22.83]	578.61 [22.87]	952 [0.21]
	Total M.P.	**52 districts**	**2662.46**	**2529.57**	**950**
	India	National Average	7554.00	6472.00	856
	Share of MP [%]		**35.31**	**38.13**	**>9.89**

Source: DES, GOI, New Delhi

Area, production and productivity of chickpea in Madhya Pradesh

From Table 4we can observe that the area under chickpea in M.P. has been varying persistently over the last twenty years. During 1996-97 to 2015-16 maximum and minimum area of chickpea were countered in 2013-14 and 2000-01 which was3153.90hectare (5.92%) & 1971.42(3.70%) hectare respectively. We can also see that 2662.46 hectare is the average area of chickpea in M.P. and fluctuation in the area under chickpea was appeared to be as the coefficient of variation was 9.99 % in M.P. during 1996-97 to 2015-16.

We can see from Table 4 that Vindhya Plateau has highest average area under chickpea i.e. 740.34thousand hectare followed by Malwa Plateau average area with 607.8 thousand hectare, Kymore Plateau average area with 383.04 thousand hectare, Gird Region average area with 346.40 thousand hectare, Central Narmada Valley average area with 175.42

thousand hectare, Bundelkhand average area with 142.49 thousand hectare, Jhabua hills average area with 87.47 thousand hectare, Satpura Plateau average area with 69.04 thousand hectare, Nimar plains average area with 60.26 thousand hectare, NH region of Chhattisgarh average area with 41.41 thousand hectare and Chhattisgarh plains has lowest average area with 8.795 thousand hectare.

It is also observed that theNH region of Chhattisgarh had the highest fluctuation in the area under chickpea with75.55% coefficient of variation, which was followed by 73.37 % in Chhattisgarh plains, 44.47 % in Jhabua hills, 39.25 % in Nimar plains, 34.83% in Satpura plateau, 29.18 % in Malwa plateau, 20.35 % in Bundelkhand, 18.53 % in Narmada valley, 15.33% in Vindhya plateau, 11.63 % in Gird region and fluctuation was appeared to be lowestinKymore plateau *i.e.*11.06 % during 1996-97 to 2015-16

From Table 5 it reveals that productivity of chickpea is also fluctuating consistently. Average productivity of chickpea in M.P. was 10202.1 kg/ha with 14.39% coefficient of variation.Highest average productivity was observed in Central Narmada valley which was 1119.65 kg/ha and the lowest average productivity was observed in NH region of Chhattisgarh i.e. 598.7 kg/ha.during 1996-97 to 2015-16.

From the table 5 we can also see that according to agro climatic zone highest fluctuation in productivity is observed in Satpura Plateau with 43.68 % coefficient of variation which was followed by NH region of Chhattisgarh with 38.70 % coefficient of variation, Jhabua hills with 23.54 % coefficient of variation, Bundelkhand with 22.49 % coefficient of variation, Gird region with 20.51 % coefficient of variation, Chhattisgarh plains with 20.46 % coefficient of variation, Nimar plateau with 19.50 % coefficient of variation, Vindhya Plateau with 19.30 % coefficient of variation, Malwa Plateau with 17.606 coefficient of variation, Kymore Plateau with 16.97 coefficient of variation and the lowest fluctuation in Central Narmada Valley with 13.62% coefficient of variation.

Table 6 shows that during these 20 years the average production of chickpea was 2539.6MT with 18.956% coefficient of variation. We can see that from the table6, from the year 1996-97 to 2015-16, the production of chickpea is varying continuously. We can see from Table 6 Vindhya plateau has highest average production of chickpea i.e. 688.53 MT which wasfollowed by Malwa plateau with 578.61 MT average production, Kymore plateau with 394.93 MT average production, gird region with 359.93 MT average production, Narmada valley with 197.13 MT average production, Bundelkhand with 156.79 MT average production, Jhabua hills with 78.63 MT average production, Satpura plateau with 76.91 MT average production, Nimar plains with 62.11MT average production, NH region of Chhattisgarh with 28.22 MT average production and Chhattisgarh plains has lowest average production which is 7.78 MT

As per the values of coefficient of variation, again NH region of Chhattisgarh has highest fluctuation in production of chickpea with 112.28% coefficient of variation during 1996-97- 2015-16 which was followed by Chhattisgarh plains has second highest fluctuation in production of chickpea with 98.85 % of coefficient of variation, 66.15 % coefficient of variation in Satpura plateau, 61.12 % coefficient of variation in Jhabua hills, 55.40% coefficient of variation in Nimar plains,38.44% coefficient of variation in Malwa plateau and Bundelkhand has 34.76% of C.V., and Narmada valley has 23.14 % coefficient of variation, 23.08 % coefficient of variation in Vindhya plateau, 22.57% coefficient of variation in

kymore plateauand the lowest fluctuation in production of chickpea with 20.98 % coefficient of variation in Gird region during 1996-97- 2015-16 has observed.

Projection of chickpea in area, production and productivity for the years 2020-21, 2025-26, 2030-31 and 2035-36 were prepared on the basis of linear trend analysis based on 20 years (1996-97 to 2015-16) data on these variables and are given in table 7,8 and 9. The regression coefficient (b_1 values) for area production and productivity of NH region of Chhattisgarh were 3.98, 183.16 and 3.74 whereas intercept (b_0) values for area production and productivity of NH region of Chhattisgarh were -0.42, 922.15 and -11 respectively. The regression coefficient (b_1 values) for area production and productivity of Chhattisgarh plains were 0.71, 8.97 and 0.72 whereas intercept (b_0) values for area production and productivity of NH region of Chhattisgarh plains were 1.38, 753.32 and 0.23 respectively. The regression coefficient (b_1 values) for area production and productivity of Satpura plateau were 3.24, 90.64 and 6.93 whereas intercept (b_0) values for area production and productivity of Satpura plateau were 34.99, 1099.9 and 4.17 respectively. In gird region the regression coefficient (b_1 values) for area production and productivity were -3.67, 155.2 and -0.36 whereas intercept (b_0) values for area production and productivity were 384.98, 5778.98 and 363.73 respectively. In Bundelkhand the regression coefficient (b_1 values) and intercept (b_0) for area production and productivity were -1.76, -75.49 and -4.84 and 160.96, 4130.61 and 207.59 respectively. In Jhabua hills the regression coefficient (b_1 values) and intercept (b_0) for area production and productivity were -4.10, 105.2 and 6.19 and 44.39, 746 and 13.64 respectively. The regression coefficient (b_1 values) for area production and productivity of Nimar plains were 2.56, 206.03 and 3.9 whereas intercept (b_0) values for area production and productivity of Nimar plains were 33.40, 1915.39 and 21.11 respectively. In Central Narmada valley the regression coefficient (b_1 values) and intercept (b_0) for area production and productivity were -4.24, 2.32 and -4.77 and 219.95, 2282.95 and 247.22 respectively. In Vindhya plateau the regression coefficient (b_1 values) and intercept (b_0) for area production and productivity were 8.87, 35.06 and 11.87 and 647.17, 5318.76 and 563.91 respectively. In Kymore plateau the regression coefficient (b_1 values) and intercept (b_0) for area production and productivity were 3.88, 73.14 and 6.06 and 342.29, 4424.37 and 231.31 respectively. In Malwa plateau the regression coefficient (b_1 values) and intercept (b_0) for area production and productivity were 16.26, 138.14 and 19.98 and 437.08, 5989.95 and 368.79 respectively.

As per the projected results, the area under chickpea in NH region of Chhattisgarh will reach 99.08 thousand hectares in 2020-21, which is 118.98 thousand hectares in 2025-26, 138.88 thousand hectares in 2030-31 and further will increase to 158.78 thousand hectares during 2035-36. Projected production on the other hand also shows upward movement. In future the chickpea production will reach 5501.15 MT in 2020-21, 6416.95 MT in 2025-26, 7332.75 MT in 2030-31 and will increase further to 8248.55 MT during 2035-36. Like area and production, productivity also shows an increasing trend. It will increase to 861.611 kg/ha in 2020-21, 952.271 kg/ha in 2025-26, 1042.931 kg/ha in 2030-31 and 1133.591 kg/ha in 2035-36.

Again as per the projected results, the area, production and productivity under chickpea in Chhattisgarh plains will reach 19.13 thousand hectares, 977.57 MT and 975.213 kg/ha respectively in 2020-21, which are22.68 thousand hectares,1022.42 MT and 1019.183 kg/ha respectively in 2025-26, 26.23 thousand hectares,1067.27 MT and 1063.153 kg/ha

respectively in 2030-31 and further will increase to 29.78 thousand hectares,1112.12 MT and 1107.123 kg/ha respectively during 2035-36.

In Satpura plateau the area, production and productivity under chickpea show increasing trend. The area, production and productivity under chickpea will reach 115.99 thousand hectares, 3365.9 MT and 1985.53 kg/ha respectively in 2020-21, again will reach 132.19 thousand hectares, 3819.1 MT and 2292.62 kg/ha respectively in 2025-26, 148.39 thousand hectares, 4272.3 MT and 246.72 kg/ha respectively in 2030-31 and further will increase to 164.59 thousand hectares, 4725.5 MT and 2546.165 kg/ha respectively during 2035-36.

In Gird region the area, under chickpea show declining trend. The area, under chickpea will decline upto 293.23 thousand hectares, in 2020-21, 274.88 thousand hectares in 2025-26, 256.53 thousand hectares in 2030-31 and further will decrease to 238.18 thousand hectares during 2035-36. Projected production on the other hand shows upward movement. In future the chickpea production will reach 9658.98 MT in 2020-21, 10434.98 MT in 2025-26, and 11210.98 MT in 2030-31 and will increase further to 11986.98 MT during 2035-36. Like area under chickpea, Productivity also shows decline trend. It will decrease to 1197.203 kg/ha in 2020-21, 1250.153 kg/ha in 2025-26, 1303.103kg/ha in 2030-31 and 1356.053 kg/ha in 2035-36.

In Bundelkhand the area, production and productivity under chickpea show decline trend. The area, production and productivity under chickpea will fall down upto 116.96 thousand hectares, 2243.36 MT and 759.153 kg/ha respectively in 2020-21, again will decrease to 108.16 thousand hectares, 1865.91 MT and 649.033 kg/ha respectively in 2025-26, 99.36 thousand hectares, 1488.46 MT and 538.913 kg/ha respectively in 2030-31 and further will decrease to 90.56 thousand hectares, 1111.01 MT and 428.793 kg/ha respectively during 2035-36.

Again as per the projected values from table 7, 8 and 9 we can observe that in Jhabua hills area, production and productivity of chickpea show increasing trend. The area, under chickpea will reach upto 146.89 thousand hectares, in 2020-21, 167.39 thousand hectares in 2025-26, 187.89 thousand hectares in 2030-31 and further will increase to 208.39 thousand hectares during 2035-36. Projected production on the other hand also shows upward movement. In future the chickpea production will reach 3376 MT in 2020-21, 3902 MT in 2025-26, and 4428 MT in 2030-31 and again will increase to 4954 MT during 2035-36. Like area and production, productivity also shows an increasing trend. It will increase to 1233.607 kg/ha in 2020-21, 1373.162 kg/ha in 2025-26, 1512.717 kg/ha in 2030-31 and 1652.272 kg/ha in 2035-36.

In Nimar plateau, area, production and productivity of chickpea show increasing trend. The area, under chickpea in Nimar plateau will reach upto 97.40 thousand hectares, in 2020-21, 110.20 thousand hectares in 2025-26, 123 thousand hectares in 2030-31 and further will increase to 135.8 thousand hectares during 2035-36. On the other hand projected values of production under chickpea also show upward movement. In future the chickpea production will reach 7066.14 MT in 2020-21, 8096.29 MT in 2025-26, and 9126.44 MT in 2030-31 and again will increase to 10156.59 MT during 2035-36. Projected productivity also shows an increasing trend. It will reach to 1275.022 kg/ha in 2020-21, 1370.497 kg/ha in 2025-26, 1465.972 kg/ha in 2030-31 and 1561.447 kg/ha in 2035-36.

In Narmada valley, area and productivity of chickpea show downward movement while productions shows increasing trend. The area, under chickpea in Narmada valley will decline upto 113.94 thousand hectares, in 2020-21, 92.74 thousand hectares in 2025-26, 71.54 thousand hectares in 2030-31 and further will decline to 50.34 thousand hectares during 2035-36. On the other hand projected values of production under chickpea show upward movement. In future the chickpea production will reach 2340.95 MT in 2020-21, 2352.55 MT in 2025-26, and 2364.15 MT in 2030-31 and again will increase to 2375.75 MT during 2035-36. Like area under chickpea, projected productivity also shows a declined trend. It will fall down up to 1093.012 kg/ha in 2020-21, 1083.827 kg/ha in 2025-26, 1074.642 kg/ha in 2030-31 and 1065.457 kg/ha in 2035-36.

In Vindhya plateau the area, production and productivity under chickpea show upward trend. The area, production and productivity under chickpea will reach 868.91 thousand hectares, 6195.26 MT and 1007.268 kg/ha respectively in 2020-21, again will reach 913.26 thousand hectares, 6370.56 MT and 1031.568 kg/ha respectively in 2025-26, 957.62 thousand hectares, 6545.86 MT and 1055.868 kg/ha respectively in 2030-31 and further will increase to 1001.66 thousand hectares, 6721.16 MT and 1080.168 kg/ha respectively during 2035-36.

We can also observe in both Kymore and Malwa plateau the area, production and productivity under chickpea show upward trend. The area, production and productivity under chickpea will reach 439.29 thousand hectares, 6252.87 MT and 878.839 kg/ha respectively in Kymore plateau and in Malwa plateau 843.58 thousand hectares, 9443.45 MT and 1059.533 kg/ha respectively in 2020-21, again it will reach 458.69 thousand hectares, 6618.57 MT and 917.249 kg/ha respectively in Kymore plateau and in Malwa plateau 924.88 thousand hectares, 10134.15 MT and 1103.388 kg/ha respectively in 2025-26, and again in Kymore plateau it will reach to 478.09 thousand hectares, 6984.27 MT and 955.659 kg/ha respectively in 2030-31 and further will increase to 1001.67 thousand hectares, 10824.85 MT and 1147.243 kg/ha respectively in 2030-31 in Malwa plateau and in Kymore plateau 497.49 thousand hectares, 7349.97 MT and 994.069 kg/ha respectively and in Malwa plateau 1087.48 thousand hectares, 11515.55 MT and 1191.098 kg/ha respectively during 2035-36.

CONCLUSION:

We can conclude that with the help of trend analysis, policy makers can suggest appropriate cropping pattern, land use pattern and designing of agricultural policy for all agro climatic zones of Madhya Pradesh. Area of chickpea shows increasing trend in NH region of Chhattisgarh, Chhattisgarh plains, Satpura plateau, Nimar plains, Vindhya plateau, Kymore and Malwa region. And Gird, Bundelkhand,Jhabua and Narmada regions show declining trend for next twenty years. Same as area, production of chickpea in all the regions of M.P. except Bundelkhand show increasing trend whileBundelkhand shows declining trend. NH region of Chhattisgarh, Chhattisgarh plains, Satpura plateau, Jhabua, Nimar plains, Vindhya plateau, Kymore and Malwa regions show increasing trend of productivity and rest of them show declining trend of productivity.

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Table 4; Area of Chickpea (000'ha) during 1996-2016

Year/ Agro-climatic zones	NH Region of Chhattisgarh	Chhattisgarh plains	Satpura Plateau	Gird Region	Bundelkhand	Jhabua Hills	Nimar Plains	Central Narmada Valley	Vindhya Plateau	Kymore Plateau	Malwa Plateau	M.P.
1996-97	27.90	6.70	54.80	346.30	125.20	98.90	31.10	222.80	553.30	320.30	537.20	2324.50
1997-98	26.40	4.70	56.50	356.40	121.40	100.60	34.20	190.30	547.70	314.80	656.70	2409.70
1998-99	25.40	5.10	60.20	380.70	146.00	100.50	67.40	175.30	593.60	316.90	705.60	2576.70
1999-2000	24.33	5.70	57.15	371.01	145.31	82.55	66.09	182.75	617.52	330.16	689.39	2571.96
2000-01	17.00	4.80	31.78	406.22	147.95	10.95	38.92	189.50	612.33	336.46	175.51	1971.42
2001-02	20.31	5.40	46.67	447.81	176.80	51.46	54.44	205.90	717.65	379.56	441.74	2547.74
2002-03	20.53	6.00	51.53	372.60	194.34	24.98	58.16	217.94	852.27	418.63	247.40	2464.38
2003-04	22.73	6.40	58.08	373.99	192.72	44.44	57.10	214.09	850.10	419.03	546.44	2785.12
2004-05	23.15	5.80	62.05	349.93	185.44	50.81	47.46	196.12	820.60	423.61	521.28	2686.25
2005-06	25.30	7.50	59.70	321.10	168.90	54.10	45.00	189.20	812.10	427.00	424.60	2534.50
2006-07	24.50	7.10	66.40	312.60	122.90	64.30	47.90	184.10	818.50	408.30	528.10	2584.70
2007-08	25.30	7.10	67.30	300.20	82.10	71.00	43.70	176.90	863.50	419.30	599.30	2655.70
2008-09	40.90	7.00	54.80	304.00	137.30	103.10	60.30	177.20	877.50	409.30	697.60	2869.00
2009-10	42.40	12.40	62.90	337.20	148.30	112.90	70.50	185.80	879.30	414.00	813.70	3079.40
2010-11	53.16	6.80	83.58	312.52	141.38	102.70	54.32	136.20	769.25	367.00	853.30	2880.21
2011-12	44.90	7.40	82.70	286.40	126.50	114.90	48.60	126.70	678.50	365.40	741.70	2623.70
2012-13	48.20	7.90	82.94	313.30	134.54	121.80	61.34	131.24	727.32	376.30	711.34	2716.22
2013-14	78.70	11.10	99.70	351.60	139.70	145.40	82.60	154.40	858.80	434.80	797.10	3153.90
2014-15	94.00	17.00	95.00	384.00	100.00	154.00	138.00	93.00	608.00	341.00	772.00	2796.00
2015-16	143.00	34.00	147.00	300.00	113.00	140.00	98.00	159.00	749.00	439.00	696.00	3018.00
Average	**41.41**	**8.795**	**69.04**	**346.40**	**142.49**	**87.47**	**60.26**	**175.42**	**740.34**	**383.04**	**607.8**	**2662.46**
C.V.	**75.55**	**73.37**	**34.83**	**11.63**	**20.35**	**44.47**	**39.25**	**18.53**	**15.33**	**11.06**	**29.18**	**9.99**

Table.5: Productivity of Chickpea (kg/ha) during 1996-2016

Year/ Agro-climatic zones	NH Region of Chhattisgarh	Chhattisgarh plains	Satpura Plateau	Gird Region	Bundelkhand	Jhabua Hills	Nimar Plains	Central Narmada Valley	Vindhya Plateau	Kymore Plateau	Malwa Plateau	M.P.
1996-97	631	940	819	936	1232	757	791	1168	934	760	942	9910
1997-98	322	426	504	1346	1165	745	737	1002	968	690	1016	8921
1998-99	657	824	756	1032	1267	689	984	1154	1026	792	951	10132
1999-2000	564	895	839	1014	1290	572	856	1146	1023	804	1007	10010
2000-01	404	750	625	866	1113	388	850	1156	793	580	757	8282
2001-02	551	833	634	1072	1331	657	989	1318	953	761	708	9807
2002-03	505	867	620	658	1157	635	1033	861	546	661	757	8300
2003-04	575	828	978	1025	1238	714	999	1097	884	815	857	10010
2004-05	590	810	886	909	1152	753	1063	1032	933	752	941	9821
2005-06	510	787	948	982	1161	771	1107	1077	961	774	899	9977
2006-07	502	887	941	998	873	891	1111	1218	1032	696	1117	10266
2007-08	415	761	869	635	747	856	897	1118	697	606	738	**8339**
2008-09	477	829	1575	1110	1110	900	682	1243	1021	811	900	10658
2009-10	531	1032	1436	1170	1094	1035	695	1312	1141	832	1058	11336
2010-11	412	1044	859	1003	895	951	1007	1161	743	684	688	9447
2011-12	532	1054	1932	1285	1397	926	1146	1266	1129	908	924	12499
2012-13	1384	949	2066	1578	1240	1094	1421	1239	1232	999	1063	14265
2013-14	731	820	1786	962	438	1105	1104	826	618	642	902	9934
2014-15	723	471	789	1135	670	1110	1246	785	944	666	1382	9921
2015-16	958	1147	1143	1157	1000	1029	1245	1214	1158	1116	1040	12207
Average	**598.7**	**847.7**	**1050.25**	**1043.65**	**1078.5**	**828.9**	**998.15**	**1119.65**	**936.8**	**767.45**	**932.35**	**10202.1**
C.V.	**38.70**	**20.46**	**43.68**	**20.51**	**22.49**	**23.54**	**19.50**	**13.62**	**19.30**	**16.97**	**17.606**	**14.391**

Table 6:Production of Chickpea (000'tonnes) during 1996-2016

Year / Agro-climatic Zones	NH Region of Chhattisgarh	Chhattisgarh plains	Satpura Plateau	Gird Region	Bundelkhand	Jhabua Hills	Nimar Plains	Central Narmada Valley	Vindhya Plateau	Kymore Plateau	Malwa Plateau	M.P.
1996-97	17.60	6.30	44.90	324.20	154.30	74.90	24.60	260.30	516.80	243.50	506.20	2173.60
1997-98	8.50	2.00	28.50	479.60	141.40	74.90	25.20	190.70	530.30	217.30	667.30	2365.70
1998-99	16.70	4.20	45.50	392.70	185.00	69.20	66.30	202.30	609.20	251.00	671.30	2513.40
1999-2000	13.73	5.10	47.95	376.31	187.42	47.20	56.58	209.37	631.49	265.37	694.32	2534.84
2000-01	6.86	3.60	19.85	351.97	164.65	4.25	33.10	219.07	485.68	195.05	132.84	1616.92
2001-02	11.19	4.50	29.58	480.00	235.31	33.79	53.82	271.31	684.02	288.83	312.72	2405.07
2002-03	10.36	5.20	31.93	245.24	224.79	15.87	60.06	187.62	465.01	276.68	187.36	1710.12
2003-04	13.06	5.30	56.81	383.34	238.56	31.74	57.03	234.80	751.50	341.51	468.20	2581.85
2004-05	13.65	4.70	54.96	318.09	213.65	38.24	50.44	202.41	766.02	318.73	490.35	2471.24
2005-06	12.90	5.90	56.60	315.40	196.10	41.70	49.80	203.80	780.30	330.70	381.60	2374.80
2006-07	12.30	6.30	62.50	312.00	107.30	57.30	53.20	224.30	844.30	284.30	589.80	2553.60
2007-08	10.50	5.40	58.50	190.50	61.30	60.80	39.20	197.80	601.90	254.30	442.50	1922.70
2008-09	19.50	5.80	86.30	337.50	152.40	92.80	41.10	220.20	895.80	332.10	628.10	2811.60
2009-10	22.50	12.80	90.30	394.60	162.30	116.90	49.00	243.80	1003.30	344.30	861.20	3301.00
2010-11	21.92	7.10	71.79	313.58	126.55	97.70	54.69	158.11	571.93	251.16	587.03	2261.56
2011-12	23.90	7.80	159.80	368.00	176.70	106.40	55.70	160.40	765.80	331.80	685.20	2841.50
2012-13	66.70	7.50	171.34	494.43	166.84	133.30	87.14	162.65	895.73	375.90	756.44	3317.97
2013-14	57.50	9.10	178.10	338.20	61.20	160.70	91.20	127.60	530.50	279.10	718.70	2551.90
2014-15	68.00	8.00	75.00	436.00	67.00	171.00	172.00	73.00	574.00	227.00	1067.00	2938.00
2015-16	137.00	39.00	168.00	347.00	113.00	144.00	122.00	193.00	867.00	490.00	724.00	3344.00
Average	**28.22**	**7.78**	**76.91**	**359.93**	**156.79**	**78.63**	**62.11**	**197.13**	**688.53**	**294.93**	**578.61**	**2539.6**
C.V. (%)	**112.28**	**98.85**	**66.15**	**20.98**	**34.76**	**61.12**	**55.40**	**23.14**	**23.08**	**22.57**	**38.44**	**18.956**

Table 7: Projected area of chickpea

Name of Agro-climatic Zones/ Years	2020-21	2025-26	2030-31	2035-36
NH Region of Chhattisgarh	99.08	118.98	138.88	158.78
Chhattisgarh plain	19.13	22.68	26.23	29.78
Satpura Plateau	115.99	132.19	148.39	164.59
Gird Region	293.23	274.88	256.53	238.18
Bundelkhand	116.96	108.16	99.36	90.56
Jhabua Hills	146.89	167.39	187.89	208.39
Nimar Plains	97.40	110.20	123.00	135.80
Central Narmada Valley	113.94	92.74	71.54	50.34
Vindhya Plateau	868.91	913.26	957.61	1001.96
Kymore Plateau	439.29	458.69	478.09	497.49
Malwa Plateau	843.57	924.87	1006.17	1087.47

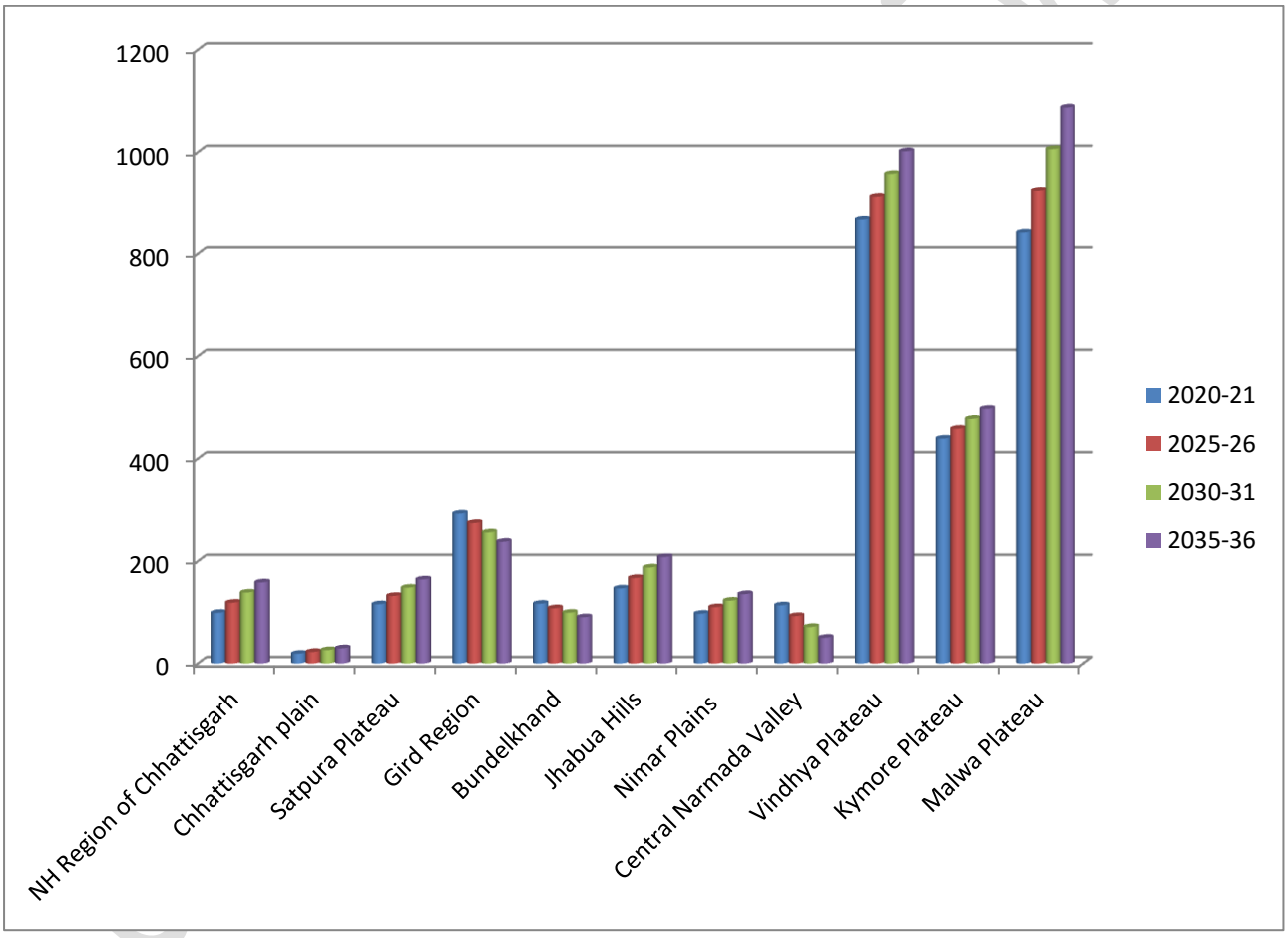

Figure1: Projected area of chickpea

Table 8 Projected value of productivity of chickpea in Madhya Pradesh

Name of Agro-climatic Zones/ Years	2020-21	2025-26	2030-31	2035-36
NH Region of Chhattisgarh	861.61	952.27	1042.93	1133.59
Chhattisgarh plain	975.21	1019.18	1063.15	1107.12
Satpura Plateau	1785.53	2039.07	2292.6	2546.16
Gird Region	1197.20	1250.15	1303.10	1356.05
Bundelkhand	759.15	649.03	538.91	428.79
Jhabua Hills	1233.61	1373.16	1512.72	1652.27
Nimar Plains	1275.02	1370.49	1465.97	1561.45
Central Narmada Valley	1093.01	1083.83	1074.64	1065.46
Vindhya Plateau	1007.26	1031.57	1055.87	1080.17
Kymore Plateau	878.84	917.25	955.66	994.07
Malwa Plateau	1059.53	1103.39	1147.24	1191.09

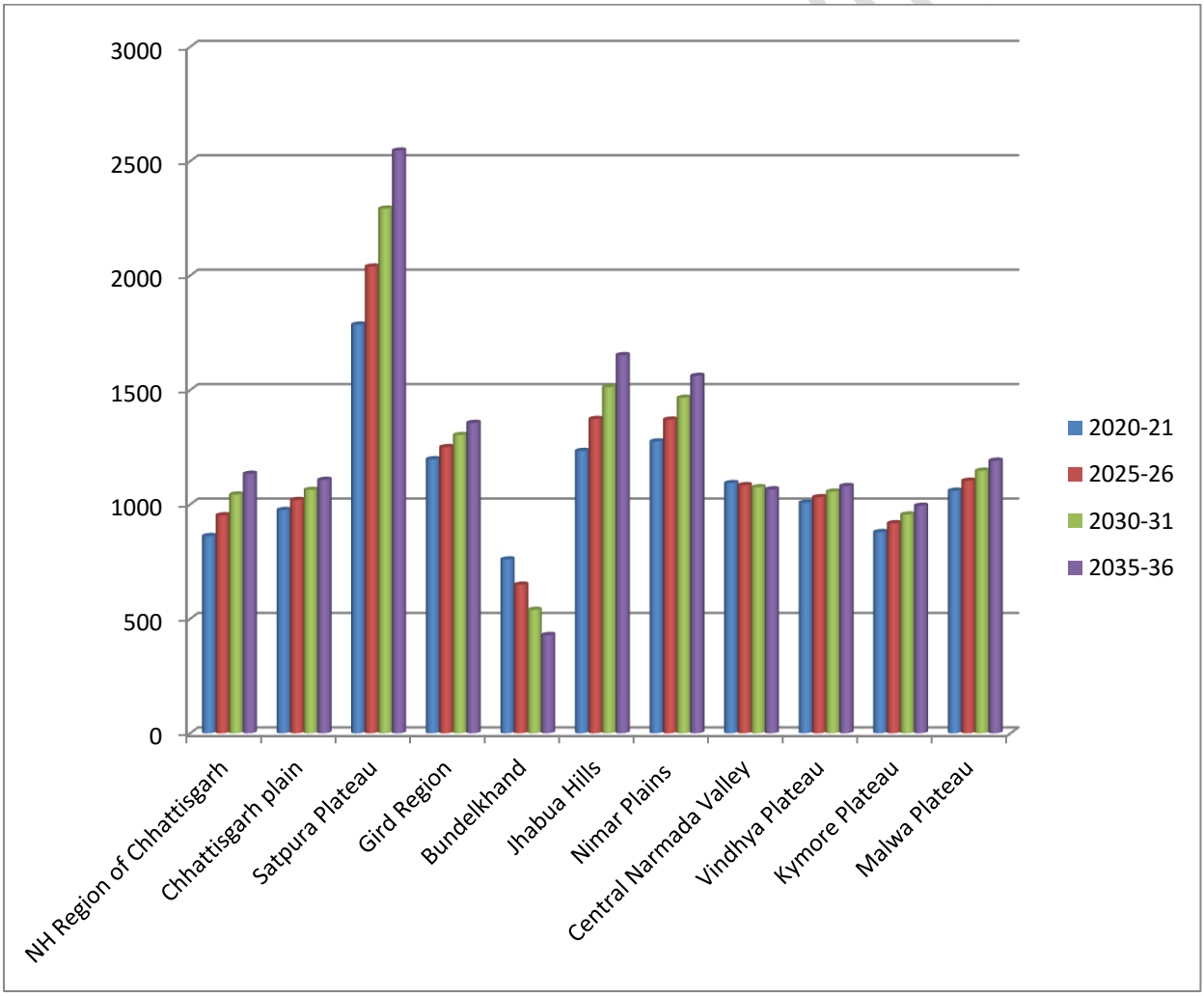

Figure:2 Projected value of productivity of chickpea in Madhya Pradesh

Table 9: Projected values of production of chickpea in Madhya Pradesh

Name of Agro-climatic Zones/ Years	2020-21	2025-26	2030-31	2035-36
NH Region of Chhattisgarh	5501.15	6416.95	7332.75	8248.55
Chhattisgarh plain	977.57	1022.42	1067.27	1112.12
Satpura Plateau	3365.90	3819.10	4272.30	4725.50
Gird Region	9658.98	10434.98	11210.98	11986.98
Bundelkhand	2243.36	1865.91	1488.46	1111.01
Jhabua Hills	3376.00	3902.00	4428.00	4954.00
Nimar Plains	7066.14	8096.29	9126.44	10156.59
Central Narmada Valley	2340.95	2352.55	2364.15	2375.75
Vindhya Plateau	6195.26	6370.56	6545.86	6721.16
Kymore Plateau	6252.87	6618.57	6984.27	7349.97
Malwa Plateau	9443.45	10134.15	10824.85	11515.55

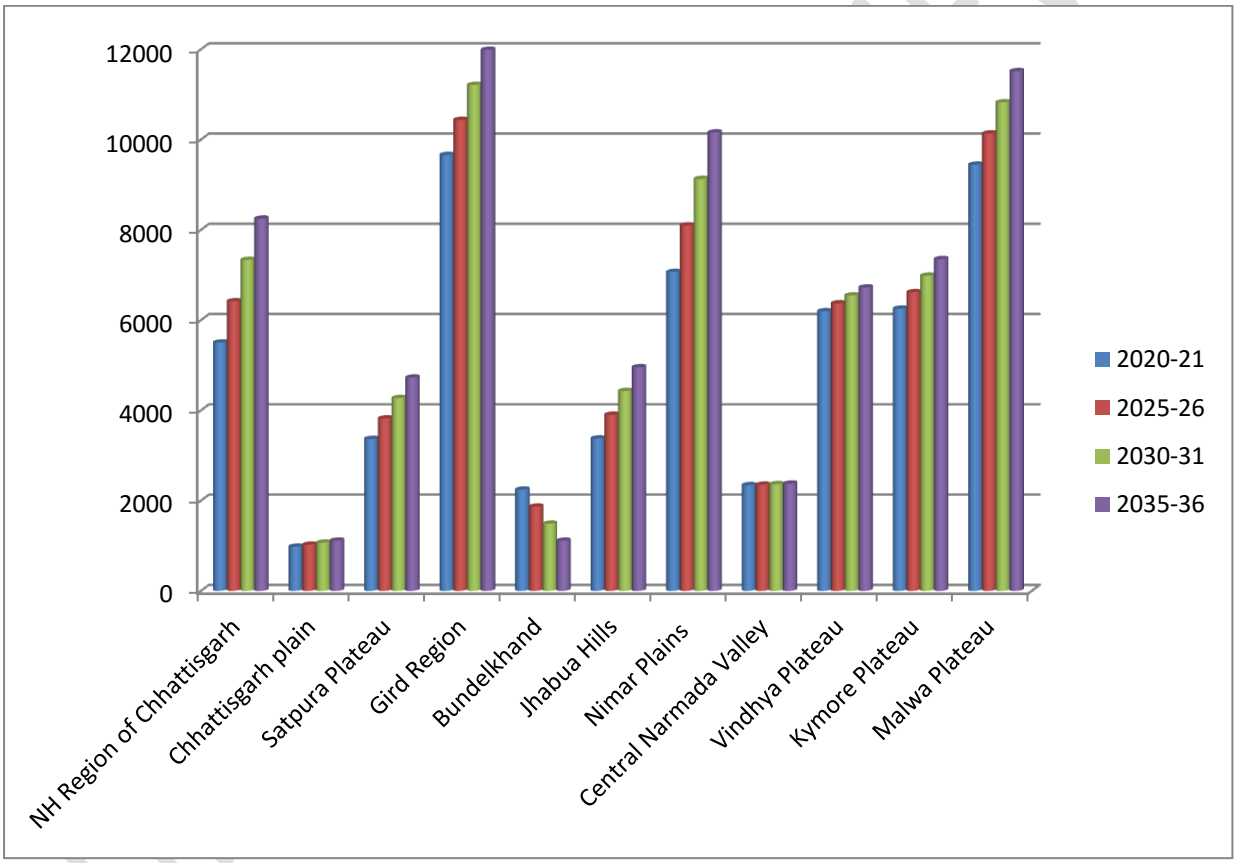

Figure:3: Projected values of production of chickpea in Madhya Pradesh