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Changes in the Levels of Area, Production and Productivity of Major Crops in Agro-Climatic Zones of Madhya Pradesh (Period 1965-66 To 2020-21)

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Abstract - Madhya Pradesh predominantly an agrarian state. The state is divided into five crop zones which are further divided into eleven agro-climatic zone. The data for the present study where collected from published sources and a period of 1965-66 to 2020-21 where considered. The compound growth rate in area, production and yield of major crops was computed or agro- climatic regions. The result suggests that no uniform pattern has been observed in study units. The dominant crop zone has performed less significantly than non-dominant agro climatic zones. Especially the growth rate in yield have not shown dominance in crop zones. The area growth in crop zones is not very much significant in dominant zone. The production scenario was relatively better in almost all the agro- climatic zones on account of improved infrastructural facilities.
Keywords: Agro-climatic zones, annual compound growth rates, area, production, yield, agricultural crops, short-run and overall time series.

Introduction - Madhya Pradesh (MP), located at the centre of India, is often called the "Heart ofIndia". It is a landlocked state, surrounded by Uttar Pradesh, Chhattisgarh, Maharashtra,Rajasthan and Gujarat. Until 2000, it was the largest state in the country interms of geographical area; however, in November 2000, Chhattisgarh was carved outof the south-eastern part of erstwhile Madhya Pradesh. Currently, MP is the second largeststate in India after Rajasthan and it spreads over a geographical area of about308 lakh ha, which is about 9% of the total area of the country. The average rainfallreceived by MP is around 95.2 cm during the monsoon season. This accounts foraround 91% of the total rainfall in the state. In MP, the eastern parts receive relativelyhigher monsoon rainfall (105.1 cm) as compared to the western parts (87.6 cm).

According to the 2011 Census,Madhya Pradesh has a population of 72.7 million andthe estimated population for 2018 is 82.3 million, which is 6% of India's population.Madhya Pradesh had 54.6% of its workforce engaged in agriculture in 2015–16(Labour Bureau, 2015–16) while the contribution of agriculture to overall GSDPwas 40% in TE 2018–19 (CSO). The agricultural sector is largely dominated bysmall and marginal farmers. In 2015–16, 75.5% of small and marginal farmers witha holding size of less than 2 ha accounted for 48% of the total area operated. Theaverage size of landholding declined from 2.28 ha in 1995–96 to 1.78 ha in 2010–11and further to 1.57 ha in 2015–16.

In Madhya Pradesh, 50% of the reported utilised area was under cultivation. MadhyaPradesh is primarily a food grain-growing state—around 62% of its gross croppedarea (GCA) was under food grains and 32% under oilseeds in TE 2014–15. Withinfood grains, 39% of GCA was under production of cereals while 23% was underpulses. Wheat is the most important cereal grown in the state, accounting for around24% of the GCA. Among pulses, gram is the main crop grown with around 13% ofGCA dedicated to the crop (63% of pulse area), followed by *arhar*(2% of GCA and10% of area under pulses). Wheat is themajor crop grown during the *rabi* season andit is intercropped with gram while in the *kharif* season, MP mostly grows oilseeds,specifically soybean. Around 25.2% of GCA is under soybean cultivation.

Moreover, acreage under the two main crops in MP—wheat and soybean—hasincreased significantly over the years. Acreage under wheat increased from 4millionha in TE 1994–95 to 5.6 million ha in TE 2014–15. Similarly, the acreage undersoybean increased from 3.2 to 6.0 million ha in the same period. Further, the relativeimportance of wheat has also increased over the given period. In TE 1994–95, wheatcontributed around 16% of GCA; this has increased to 24% in TE 2014–15. Similarly, the share of

area under soybean as a percentage ofGCAhas increased from13 to 25%, almost doubled in the past two decades. Acreage under gram, on the otherhand, has increased onlymarginally from 2.4 million ha in TE 1994–95 to 3.0millionha in TE 2014–15. Consequently, its share in GCA has only increased from 10 to13% in the same period.

Although MP is one of India's major food grain-producing regions, there hasbeen an increasing trend towards the cultivation of horticultural crops as a cash crop.There has been a significant expansion of area under vegetables inMPafter 2010–11.Acreage under vegetables increased from 284,000 ha in 2010–11 to 930,000 ha in2017–18. This has almost tripled the share of area under vegetables in GCA from1.3% in 2010–11 to 3.9% in 2017–18. While the expansion of area under vegetableswas sudden and took place after 2010–11, in the case of fruits, the expansion beganas early as 2008–09. The area under fruit cultivation increased from 47,000 ha in2007–08 to 92,000 ha in 2008–09 and further to 355,000 ha in 2017–18.

The present paper is divided into four sections. The first section belongs to introduction, followed by review of past literature in second section, the third section is dedicated for methodology adopted in the present paper, finally, section four belongs to results and discussions.

Review of Past Literature

In India, agriculture and other allied activities contribute significantly to the Gross Domestic Product (GDP), accounting for nearly 16 per cent of the total GDP. It provides employment to around 64 per cent of the total work force while contributing 18 per cent of the total export. India, with only 2.3 per cent of world's total land area supports 18 per cent of human and 15 per cent of livestock population in the world. The country has made an impressive progress on the food front, which has resulted in increased production of food grains (**Anonymous, 2010**). In Karnataka, maize production was increasing at 8.29 per cent per annum during the study period. Similar trend was reported by **Singh and Singh (1991)** and **Sinha and Thakur (1993)** who observed an increasing trend in yield level in their study.

Sustaining growth in agriculture assumes priority to the government, policymakers and academicians due to high dependency of population on agriculture (**Chand and Parappurathu, 2012; Ravallion and Datt, 1996; Datt and Ravallion, 1998; Virmani, 2008**).The results imply that main factors contributing to the agricultural growth in Madhya Pradesh are, (i) expanded irrigated area coverage; (ii) improvement in credit; (iii) assured and remunerative price for wheat by strengthening wheat procurement system (**Krishnamurthy 2012**) and (iv) diversification towards high value crops. Assured and remunerative price for wheat by strengthening wheat procurement system also helped farmers in realizing fair prices for their produce (**Gulati et. al. 2017**).

Sahu and Mishra (2013) studied trend analysis using different parametric model and forecasting the production, import - export (both in quantity and value) and trade balance of total spices in India and China along with world using different parametric trend models using time series data covering the period of 1961-2009. **Niranjan et al., (2015)** studied the sustainability of yield of major food grains in Madhya Pradesh.

One of the major reasons for low productivity in Madhya Pradesh it is that the pulses are largely grown in rain fed situations. **Pant and Kukreti (1976)** found the production changes over initial years were quite on marginal land which is incapable of supporting high yield. Poor crop management is another most important factor contributing towards poor production with almost no fertilizer application. Also, in view of the problem situation discussed **George and Nampoori (1966)** in Kerala state to found variations in agricultural productivity due to soils and climate.

In recent years, many researchers have been using compound annual growth rate to predict area, production and productivity of agricultural crops. **Surendar and Satinder (2014)** predicted area, production and productivity of sugarcane in Haryana. They found that the area's growth rate was declined in all states of Haryana, and the growth rate of production was positive in only two districts, Bhiwani and Karnal. The productivity growth was increasing in all sections of Haryana except Gurgoan, Rewari, and Sirsa. **Shabana and Madhulika (2018)** investigated growth and instability analysis in Indian agriculture. They revealed that rice and maize's area has increased, the production of pulse and wheat has increased, and the productivity of wheat and pulses has increased in the period. **Nethravathi and Yeledhalli (2016)** forecasted growth and instability in area, production and productivity of different agricultural crops in Bengaluru. **Neethu et al. (2017)** investigated growth and instability in area, production and productivity of Cassava in Kerala. **Abid et al. (2014)** forecasted area and production of Maize in Khyber Pakhtunkhwa, Pakistan. Production and consumption of minor millets in India investigated by **Balaji et al. (2017)**. **Kumari et al. (2017)** investigated forecasting models for predicting pod damage of pigeon pea in Varanasi region. Kumari et al. (2016) forecasted yield of pigeon pea in Varanasi region by using different statistical models. **Kumari Prity and Sathish Kumar (2021)** forecasted area, production and productivity of citrus in Gujarat by using different artificial neural network models. **Sathish Kumar M and Kumari Prity (2021)** forecasted area, production and productivity of sapota in Gujarat. **Gayathri (2018)** investigated trend analysis of area, production and yield of ground nut in India. **Prajneshu and Chandran (2005)** computed compound growth rate of different agriculture crops in India. **Saikia and Gosh (2021)** found growth rate of area and production of silk in different areas of Assam. **Kumari et al., (2018)** investigated trend analysis of area, production and productivity of Jute crop in India.**Unjia et al. (2021)** investigated trend analysis of area, production

and productivity of maize in India. In another study, **Nida and Rahman (2020)** applied compound annual growth rate to find out growth rate of area, production and productivity of Sugarcane crop in India.

Section III: Material and methods

i. Area of the Study: The entire state of Madhya Pradesh has been the area of the study. The state level aggregates constitute the study area.

ii. Period of the Study: Statistical information from 1965-66 to 2020-21 constitute the period of the study. This period is considered as long run or overall time series. Thus, overall time series covers a span of 55 years. For providing better understanding this overall time series is divided into three short run time series as under:

a. Short run Period I: 1965-66 to 1982-83
b. Short run Period II: 1983-84 to 2000-01
c. Short run Period III: 2001-02 to 2020-21
d. Overall or long run Period 1965-66 to 2020-21

iii. Data Sources: The statistical information pertaining to the study was mainly gathered from the various volumes of Agricultural Statistics of Madhya Pradesh. Data on some other aspects were collected with the help of various web sites of governmental and non-governmental agencies.

iv. Objectives of the Study: The objective of the present study is to investigate into the growth in area, production and yield of various crops agro-climatic zones of the state of Madhya Pradesh.

v. Hypotheses of the Study: The hypotheses are as under:

There is no growth in area, production and yield of various crops.

vi. Variable specification:

a. Cereals: Rice, Wheat, Jowar, Bazra, Maize
b. Pulses: Tur, Urad, Moong, Gram, Masur, Matar
c. Oilseeds: Til, Sarson, Alsi, Soya bean
d. Commercial crop: Sugarcane and cotton
e. Variables: Area, Production and Yield of crops

vii. Tools and Techniques:

a. Growth rate analysis: Regression analysis is used to analyse the behaviour of crop over the period of time. The area, production and yield of the crops is dependent variable and time is independent variable. The parameters are obtained with the help of ordinary least square technique. Following two regression line are as under:

$\Sigma Y = N a + n \Sigma X$ ..... (1)

$\Sigma XY = N \Sigma X + B \Sigma X^2$

Y = dependent variable (area, production and yield of the crops)

X = independent variable (time)

'a' = Intercept

'b' = regression coefficient (slope)

Equation (1) is solved as under:

$$b = \frac{N \Sigma xy - \Sigma x \Sigma y}{(N \Sigma y^2) - \Sigma x^2} \quad \text{..... (2)}$$

$$a = \bar{Y} - b \bar{X} \quad \text{..... (3)}$$

Log-linear form is as under

$Y = ab^x$ ..... (4)

$\text{Log } Y = \text{Log } a + x \text{ log } b$

viii. Test of significance: t-test is used to adjudicate the parameters of simple and multiple regression coefficients.

ix. Limitations of the Study: The present study is based on secondary data. Thus, the validity and reliability of results will depend upon the validity and reliability of the secondary data.

Section IV: Results and Discussion

The growth rate in area, production and yield of major crops namely- Paddy, Wheat, Jowar, Bazra, Maize, Tur, Urad, Moong, Gram, Masur, Matar, Til, Sarson, Alsi, Soya bean, Sugarcane and Cotton were computed for three short-run time series Short run Period I: 1965-66 to 1982-83; Short run Period II: 1983-84 to 2000-01; Short run Period III: 2001-02 to 2020-21 and Overall or long run Period 1965-66 to 2020-21 for agro-climatic zones of the State of Madhya Pradesh.

The results of Short run Period I: 1965-66 to 1982-83 for area growth suggests that the maximum growth rate in area was observed in Kymore Plateau & Satpura Hills as 4.976 per cent per annum in case of Paddy; Kymore Plateau & Satpura Hills as 14.150 per cent per annum in case of wheat; Malwa Plateau as 2.539 per cent per annum in case of jowar; Vindhya Pleateau 0.006 per cent per annum in case of bazra; Malwa Plateau as 8.546 per cent per annum in case of maize;Vindhya Pleateau 1.318 per cent per annum in case of tur; Kymore Plateau & Satpura Hills as 0.429 per cent per annum in case of urd; Gird Region as 0.036 per cent per annum in case of moong; Malwa Plateau as 12.231 per cent per annum in case of gram; Kymore Plateau & Satpura Hills as 1.049 per cent per annum in case of matar; Vindhya Pleateau3.977 per cent per annum in case of masur;Chhattisgarh plains as 0.008 per cent per annum in case of til; Gird Region as 1.333 per cent per annum in case of sarson; Malwa Plateau as 1.685 per cent per annum in case of alsi; Vindhya Pleateau 7.317 per cent per annum in case of soya bean; Malwa Plateau as 0.598 per cent per annum in case of ganna; and Nimar Plains 2.406 per cent per annum in case of kapas.

The results of Short run Period II: 1983-84 to 2000-01 for area growth suggests that the maximum growth rate in area was observed in Northern Hill Region of Chhattisgarh as 7.184 per cent per annum in case of Paddy; Malwa Plateau as 19.569 per cent per annum in case of wheat; Northern Hill Region of Chhattisgarh as 0.053 per cent per annum in case of jowar; Jhabua Hills 0.259 per cent per annum in case of bazra; Satpura Plateauas 2.976 per cent per annum in case of maize; Bundelkhand Region0.261 per cent per annum in case of tur; Northern Hill Region of Chhattisgarh as 0.476 per cent per annum in case of urd; Gird Region as 0.174per cent per annum in case of moong; Malwa Plateau as 15.482 per cent per annum in case of gram; Bundelkhand Region as 1.233 per cent per annum

in case of matar; Vindhya Pleateau5.695 per cent per annum in case of masur; Bundelkhand Region as 1.513 per cent per annum in case of til; Malwa Plateau as 25.379 per cent per annum in case of sarson; Northern Hill Region of Chhattisgarh as 0.900 per cent per annum in case of alsi; Malwa Plateau100.328 per cent per annum in case of soya bean; Central Narmada Valley as 0.343 per cent per annum in case of ganna; and Satpura Plateau1.045 per cent per annum in case of kapas.

The results of Short run Period III: 2001-02 to 2020-21 for area growth suggests that the maximum growth rate in area was observed in Vindhya Pleateau as 12.292 per cent per annum in case of Paddy; Malwa Plateau as 44.258 per cent per annum in case of wheat; Northern Hill Region of Chhattisgarh as 0.326 per cent per annum in case of jowar; Gird Region5.103 per cent per annum in case of bazra; Satpura Plateau as 9.943 per cent per annum in case of maize; Kymore Plateau & Satpura Hills7.506 per cent per annum in case of tur; Vindhya Pleateau as 10.092 per cent per annum in case of urd; Kymore Plateau & Satpura Hills as 1.283 per cent per annum in case of moong; Malwa Plateau as 22.162 per cent per annum in case of gram; Kymore Plateau & Satpura Hills as 4.163 per cent per annum in case of matar; Northern Hill Region of Chhattisgarh4.054 per cent per annum in case of masur; Bundelkhand Region as 5.633 per cent per annum in case of til; Malwa Plateau as 12.220 per cent per annum in case of sarson; Malwa Plateau as 0.586 per cent per annum in case of alsi; Malwa Plateau 17.146 per cent per annum in case of soya bean; Central Narmada Valley as 2.636 per cent per annum in case of ganna; and Nimar Plains2.278 per cent per annum in case of kapas.

The results of Overall or long run Period 1965-66 to 2020-21 for area growth suggests that the maximum growth rate in area was observed in Northern Hill Region of Chhattisgarh as 4.591 per cent per annum in case of Paddy; Malwa Plateau as 16.262 per cent per annum in case of wheat; Northern Hill Region of Chhattisgarh as 0.064 per cent per annum in case of jowar; Gird Region1.579 per cent per annum in case of bazra; Satpura Plateau as 4.092 per cent per annum in case of maize; Kymore Plateau & Satpura Hills1.383 per cent per annum in case of tur; Bundelkhand Region as 3.228 per cent per annum in case of urd; Kymore Plateau & Satpura Hills as 0.247 per cent per annum in case of moong; Vindhya Pleateau as 11.367 per cent per annum in case of gram; Kymore Plateau & Satpura Hills as 1.351 per cent per annum in case of matar; Kymore Plateau & Satpura Hills3.017 per cent per annum in case of masur; Bundelkhand Region as 2.403 per cent per annum in case of til; Malwa Plateau as 11.026 per cent per annum in case of sarson; Northern Hill Region of Chhattisgarh as 0.123 per cent per annum in case of alsi; Malwa Plateau51.177 per cent per annum in case of soya bean; Central Narmada Valley as 0.957 per cent per annum in case of ganna; and Nimar Plains2.542 per cent per annum in case of kapas.

The results of Short run Period I: 1965-66 to 1982-83 for production growth suggests that the maximum growth rate in production was observed in Northern Hill Region of Chhattisgarh as 7.105 per cent per annum in case of Paddy; Vindhya Pleateau as 28.293 per cent per annum in case of wheat; Jhabua Hills as 58.758 per cent per annum in case of jowar; Gird Region 0.866 per cent per annum in case of bazra; Malwa Plateau as 14.251 per cent per annum in case of maize; Vindhya Pleateau 0.575 per cent per annum in case of tur; Malwa Plateau as 1.315 per cent per annum in case of urd; Kymore Plateau & Satpura Hills as 0.024 per cent per annum in case of moong; Malwa Plateau as 8.349 per cent per annum in case of gram; Kymore Plateau & Satpura Hills as 1.097 per cent per annum in case of matar; Vindhya Pleateau1.550 per cent per annum in case of masur; Malwa Plateau as 0.350 per cent per annum in case of til; Gird Region as 0.811 per cent per annum in case of sarson; Malwa Plateau as 0.728 per cent per annum in case of alsi; Vindhya Pleateau6.818 per cent per annum in case of soya bean; Malwa Plateau as 1.418 per cent per annum in case of ganna; and Nimar Plains0.176 per cent per annum in case of kapas.

The results of Short run Period II: 1983-84 to 2000-01 for production growth suggests that the maximum growth rate in production was observed in Kymore Plateau & Satpura Hills as 10.438 per cent per annum in case of Paddy; Malwa Plateau as 63.309 per cent per annum in case of wheat; Central Narmada Valley as 67.713 per cent per annum in case of jowar; Gird Region3.341 per cent per annum in case of bazra; Malwa Plateau as 6.140 per cent per annum in case of maize; Central Narmada Valley 0.259 per cent per annum in case of tur; Jhabua Hills as 1.337 per cent per annum in case of urd; Bundelkhand Region as 0.067 per cent per annum in case of moong; Malwa Plateau as 25.278 per cent per annum in case of gram; Kymore Plateau & Satpura Hills as 0.646 per cent per annum in case of matar; Vindhya Pleateau3.662 per cent per annum in case of masur; Malwa Plateau as 0.840 per cent per annum in case of til; Gird Region as 25.257 per cent per annum in case of sarson; Northern Hill Region of Chhattisgarh as 0.242 per cent per annum in case of alsi; Vindhya Pleateau32.279 per cent per annum in case of soya bean; Central Narmada Valley as 1.849 per cent per annum in case of ganna; and Nimar Plains0.909 per cent per annum in case of kapas.

The results of Short run Period III: 2001-02 for production growth suggests that the maximum growth rate in production was observed in Kymore Plateau & Satpura Hills as 79.268 per cent per annum in case of Paddy; Malwa Plateau as 234.539 per cent per annum in case of wheat; Kymore Plateau & Satpura Hills as 138.224 per cent per annum in case of jowar; Gird Region25.804 per cent per annum in case of bazra; Satpura Plateau as 65.353 per cent per annum in case of maize; Kymore Plateau & Satpura

Hills9.539 per cent per annum in case of tur; Bundelkhand Region as 6.073 per cent per annum in case of urd; Kymore Plateau & Satpura Hills as 0.579 per cent per annum in case of moong; Malwa Plateau as 31.471 per cent per annum in case of gram; Kymore Plateau & Satpura Hills as 4.945 per cent per annum in case of matar; Kymore Plateau & Satpura Hills 5.758 per cent per annum in case of masur; Bundelkhand Region as 2.375 per cent per annum in case of til; Gird Region as 8.640 per cent per annum in case of sarson; Northern Hill Region of Chhattisgarh as 0.531 per cent per annum in case of alsi; Gird Region 13.326 per cent per annum in case of soya bean; Central Narmada Valley as 12.025 per cent per annum in case of ganna; and Nimar Plains3.857 per cent per annum in case of kapas.

The results of Overall or long run Period 1965-66 to 2020-21 for production growth suggests that the maximum growth rate in production was observed in Kymore Plateau & Satpura Hills as 20.560 per cent per annum in case of Paddy; Malwa Plateau as 77.600 per cent per annum in case of wheat; Central Narmada Valley as 72.426 per cent per annum in case of jowar; Gird Region 7.579 per cent per annum in case of bazra; Satpura Plateau as 17.687 per cent per annum in case of maize; Kymore Plateau & Satpura Hills 1.539 per cent per annum in case of tur; Bundelkhand Region as 1.399 per cent per annum in case of urd; Kymore Plateau & Satpura Hills as 0.093 per cent per annum in case of moong; Vindhya Pleateau as 14.257 per cent per annum in case of gram; Kymore Plateau & Satpura Hills as 0.850 per cent per annum in case of matar; Kymore Plateau & Satpura Hills 1.728 per cent per annum in case of masur; Bundelkhand Region as 1.218 per cent per annum in case of til; Gird Region as 12.707 per cent per annum in case of sarson; Northern Hill Region of Chhattisgarh as 0.228 per cent per annum in case of alsi; Vindhya Pleateau 24.741 per cent per annum in case of soya bean; Central Narmada Valley as 4.316 per cent per annum in case of ganna; and Nimar Plains1.934 per cent per annum in case of kapas.

The results of Short run Period I: 1965-66 to 1982-83 for yield growth suggests that the maximum growth rate in yield was observed in Bundelkhand Region as 15.800 per cent per annum in case of Paddy; Jhabua Hills as 58.758 per cent per annum in case of wheat; Vindhya Pleateau as 3.823 per cent per annum in case of jowar; Nimar Plains as 33.951 per cent per annum in case of maize; Central Narmada Valley as 30.664 per cent per annum in case of urd; Satpura Plateau as 3.420 per cent per annum in case of moong; Bundelkhand Region as 11.135 per cent per annum in case of gram; Jhabua Hills as 13.354 per cent per annum in case of matar; Chhattisgarh plains10.390 per cent per annum in case of masur; Jhabua Hills as 6.996 per cent per annum in case of til; Chhattisgarh plains as 17.424 per cent per annum in case of sarson; Vindhya Pleateau as 8.259 per cent per annum in case of alsi; Chhattisgarh plains17.716 per cent per annum in case of soya bean; Nimar Plains as 102.721 per cent per annum in case of ganna; and Satpura Plateau2.818 per cent per annum in case of kapas.

The results of Short run Period II: 1983-84 to 2000-01 for yield growth suggests that the maximum growth rate in yield was observed in Gird Region as 49.896 per cent per annum in case of Paddy; Central Narmada Valley as 67.713 per cent per annum in case of wheat; Northern Hill Region of Chhattisgarh as 0.053 per cent per annum in case of jowar; Jhabua Hills 0.259 per cent per annum in case of bazra; Gird Region as 51.726 per cent per annum in case of maize; Chhattisgarh plains 23.567 per cent per annum in case of tur; Jhabua Hills as 45.647 per cent per annum in case of urd; Chhattisgarh plains as 4.016 per cent per annum in case of moong; Gird Region as 26.833 per cent per annum in case of gram; Central Narmada Valley as 6.554 per cent per annum in case of matar; Northern Hill Region of Chhattisgarh16.290 per cent per annum in case of masur; Jhabua Hills as 19.204 per cent per annum in case of til; Gird Region as 32.004 per cent per annum in case of sarson; Malwa Plateau as 14.938 per cent per annum in case of alsi; Central Narmada Valley29.928 per cent per annum in case of soya bean; Central Narmada Valley as 109.135 per cent per annum in case of ganna; and Satpura Plateau4.676 per cent per annum in case of kapas.

The results of Short run Period III: 2001-02 for yield growth suggests that the maximum growth rate in yield was observed in Kymore Plateau & Satpura Hills as 112.076 per cent per annum in case of Paddy; Kymore Plateau & Satpura Hills as 138.224 per cent per annum in case of wheat; Vindhya Pleateau as 33.775 per cent per annum in case of jowar;Gird Region5.103 per cent per annum in case of bazra; Satpura Plateau as 155.146 per cent per annum in case of maize; Kymore Plateau & Satpura Hills21.051 per cent per annum in case of tur; Chhattisgarh plains as 24.289 per cent per annum in case of urd; Malwa Plateau as 10.791 per cent per annum in case of moong; Satpura Plateau as 39.307 per cent per annum in case of gram; Bundelkhand Region as 39.541 per cent per annum in case of matar; Malwa Plateau26.352 per cent per annum in case of masur; Central Narmada Valley as 18.338 per cent per annum in case of til; Bundelkhand Region as 31.428 per cent per annum in case of sarson; Satpura Plateau as 28.176 per cent per annum in case of alsi; Jhabua Hills51.160 per cent per annum in case of soya bean; Northern Hill Region of Chhattisgarh as 119.280 per cent per annum in case of ganna; and Nimar Plains9.196 per cent per annum in case of kapas.

The results of Overall or long run Period 1965-66 to 2020-21 for yield growth suggests that the maximum growth rate in yield was observed in Kymore Plateau & Satpura Hills as 28.009 per cent per annum in case of Paddy; Central Narmada Valley as 72.426 per cent per annum in case of wheat; Vindhya Pleateau as 21.048 per cent per annum in

case of jowar; Vindhya Pleateau 8.574 per cent per annum in case of bazra; Satpura Plateau as 71.708 per cent per annum in case of maize; Chhattisgarh plains 20.870 per cent per annum in case of tur; Jhabua Hills as 5.029 per cent per annum in case of urd; Jhabua Hills as 1.182 per cent per annum in case of moong; Satpura Plateau as 15.319 per cent per annum in case of gram; Satpura Plateau as 4.411 per cent per annum in case of matar; Gird Region5.980 per cent per annum in case of masur; Chhattisgarh plains as 13.932 per cent per annum in case of til; Gird Region as 21.560 per cent per annum in case of sarson; Satpura Plateau as 14.229 per cent per annum in case of alsi; Satpura Plateau17.602 per cent per annum in case of soya bean;Central Narmada Valley as 53.042 per cent per annum in case of ganna; and Satpura Plateau6.819 per cent per annum in case of kapas.

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