Chapter - 5

GROWTH AND VARIABILITY ANALYSIS OF CROPS IN ECONOMIC REGIONS OF UTTAR PRADESH
In this chapter growth and variability in the area, production and productivity of Paddy and Wheat have been examined for economic regions and the state level. The chapter constitutes of two parts, in the first part percent variability in area, production and output of Paddy and Wheat have been examined along with the analysis of growth rates during 1950-51 to 1964-65, 1965-66 to 1988-89 and 1989-90 to 2000-01 and in the second part relative contribution of the factors to the changes in output have been analysed using Minhas and Vaidyanathan Model (1965) in respect of the periods. The analysis is thus based on inter and intra-regional comparisons.

In economic studies area allocated to the crops define the importance accorded to the crop by the cultivators in view of its profitability, productivity in relation to competitive crops. Cultivation of crop in a particular period depends on climate and other ecological factors and economic considerations. In this parts of the chapter the variability in area, production and yield during 1965-66 to 1988-89, and 1989-90 to 2000-01, have been examined with the purpose of analysing inter and intra-regional
variabilities, the variabilities during 1950-51 to 1964-65 have also been presented.

Table - 5.1: Share of Various Countries in World Production of Paddy During 2000-2002:

(Production in 000 tonnes)

<table>
<thead>
<tr>
<th>Commodity/Country</th>
<th>2000-02 Average Production</th>
<th>% Share of the country</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>592224</td>
<td>100.0</td>
</tr>
<tr>
<td>Bangladesh</td>
<td>37344</td>
<td>6.3</td>
</tr>
<tr>
<td>Brazil</td>
<td>10592</td>
<td>1.8</td>
</tr>
<tr>
<td>China</td>
<td>181891</td>
<td>30.7</td>
</tr>
<tr>
<td>Egypt</td>
<td>5609</td>
<td>0.9</td>
</tr>
<tr>
<td>India</td>
<td>129310</td>
<td>21.8</td>
</tr>
<tr>
<td>Indonesia</td>
<td>51321</td>
<td>8.5</td>
</tr>
<tr>
<td>Japan</td>
<td>11431</td>
<td>1.9</td>
</tr>
<tr>
<td>Myanmar</td>
<td>21708</td>
<td>3.7</td>
</tr>
<tr>
<td>Pakistan</td>
<td>6457</td>
<td>1.1</td>
</tr>
<tr>
<td>Philippines</td>
<td>12872</td>
<td>2.2</td>
</tr>
<tr>
<td>Russian Federation</td>
<td>522</td>
<td>0.1</td>
</tr>
<tr>
<td>Thailand</td>
<td>26169</td>
<td>4.4</td>
</tr>
<tr>
<td>U.S.A.</td>
<td>9331</td>
<td>1.6</td>
</tr>
<tr>
<td>Vietnam</td>
<td>32855</td>
<td>5.5</td>
</tr>
</tbody>
</table>

Paddy

Paddy is one of the most important cereal crops consumed as staple food throughout Asia. During 2000-02 production of Paddy in world was 592224 thousands tonnes. Production of Paddy (Table 5.1) China was 181891 thousand tonnes, Bangladesh 37344 thousand tonnes and Indonesia 51321 thousand tonnes.
Despite covering highest area under the crop, production in India was 129310 thousand tonnes lower to China due to low productivity of the crop. Other important Paddy producing countries were Brazil 10592 thousand tonnes, Egypt 5609 thousand tonnes, Japan 11431 thousand tonnes and Thailand 26169 thousand tonnes.

Area under Paddy continuously increased during post independence period. Paddy staple food throughout the country, drew attention both in extension of area under the crop (Table 5.2) and change in production technology to raise the level of productivity. The area under the crop during T.E. 1952-53 was 30.20 million hectares has reached 41.93 million hectares in T.E. 2004-05. The production of Paddy in T.E. 1952-53 recorded 21.59 million tonnes has reached 81.80 million tonnes in T.E. 2004-05. The 3.80 times increase in production against 1.39 times increase rise in area was achieved by steep rise in productivity achieved through adoption of new techniques of production and introduction of fertilizer-irrigation responsive seeds. In India the percent-irrigated area in Paddy was 31.9 in T.E. 1952-53 reached 52.33 percent in T.E. 2002-03.

The average yield of Paddy in T.E. 1952-53 was 715 Kg. per hectare has reached 1949 Kg. yield in T.E. 2004-05. This tremendous rise in production of Paddy growers is spread over the country, located in differing ecological background the sates share of contributes to the rise in area and production of Paddy in India (Table 5.3).
Table - 5.2 All-India Area Production and Yield of Paddy from 1950-51 to 2004-05 along with percentage coverage under irrigation:

(Area-Million Hectares, Production-Million tonnes and Yield Kg/Hectare)

<table>
<thead>
<tr>
<th>Year</th>
<th>Area</th>
<th>Production</th>
<th>Yield</th>
<th>Coverage under irrigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51</td>
<td>30.81</td>
<td>20.58</td>
<td>668</td>
<td>31.7</td>
</tr>
<tr>
<td>1951-52</td>
<td>29.83</td>
<td>21.30</td>
<td>714</td>
<td>31.7</td>
</tr>
<tr>
<td>1952-53</td>
<td>29.97</td>
<td>22.90</td>
<td>764</td>
<td>32.3</td>
</tr>
<tr>
<td>1953-54</td>
<td>31.29</td>
<td>28.21</td>
<td>902</td>
<td>33.6</td>
</tr>
<tr>
<td>1954-55</td>
<td>30.77</td>
<td>25.22</td>
<td>820</td>
<td>34.4</td>
</tr>
<tr>
<td>1955-56</td>
<td>31.52</td>
<td>27.56</td>
<td>874</td>
<td>34.9</td>
</tr>
<tr>
<td>1956-57</td>
<td>32.28</td>
<td>29.04</td>
<td>900</td>
<td>35.4</td>
</tr>
<tr>
<td>1957-58</td>
<td>32.30</td>
<td>25.53</td>
<td>790</td>
<td>36.4</td>
</tr>
<tr>
<td>1958-59</td>
<td>33.17</td>
<td>30.85</td>
<td>930</td>
<td>36.3</td>
</tr>
<tr>
<td>1959-60</td>
<td>33.82</td>
<td>31.68</td>
<td>937</td>
<td>35.8</td>
</tr>
<tr>
<td>1960-61</td>
<td>34.13</td>
<td>34.58</td>
<td>1013</td>
<td>36.8</td>
</tr>
<tr>
<td>1961-62</td>
<td>34.69</td>
<td>35.66</td>
<td>1028</td>
<td>37.5</td>
</tr>
<tr>
<td>1962-63</td>
<td>35.69</td>
<td>33.21</td>
<td>931</td>
<td>37.4</td>
</tr>
<tr>
<td>1963-64</td>
<td>35.81</td>
<td>37.00</td>
<td>1033</td>
<td>37.1</td>
</tr>
<tr>
<td>1964-65</td>
<td>36.46</td>
<td>39.31</td>
<td>1078</td>
<td>37.3</td>
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<tr>
<td>1965-66</td>
<td>35.47</td>
<td>30.59</td>
<td>862</td>
<td>36.5</td>
</tr>
<tr>
<td>1966-67</td>
<td>35.25</td>
<td>30.44</td>
<td>863</td>
<td>37.9</td>
</tr>
<tr>
<td>1967-68</td>
<td>36.44</td>
<td>37.61</td>
<td>1032</td>
<td>38.6</td>
</tr>
<tr>
<td>1968-69</td>
<td>36.97</td>
<td>39.76</td>
<td>1076</td>
<td>38.4</td>
</tr>
<tr>
<td>1969-70</td>
<td>37.68</td>
<td>40.43</td>
<td>1073</td>
<td>38.2</td>
</tr>
<tr>
<td>1970-71</td>
<td>37.59</td>
<td>42.22</td>
<td>1123</td>
<td>38.4</td>
</tr>
<tr>
<td>1971-72</td>
<td>37.76</td>
<td>43.07</td>
<td>1141</td>
<td>37.2</td>
</tr>
<tr>
<td>1972-73</td>
<td>36.69</td>
<td>39.24</td>
<td>1070</td>
<td>39.1</td>
</tr>
<tr>
<td>1973-74</td>
<td>38.29</td>
<td>44.05</td>
<td>1151</td>
<td>38.4</td>
</tr>
<tr>
<td>1974-75</td>
<td>37.89</td>
<td>39.58</td>
<td>1045</td>
<td>38.8</td>
</tr>
</tbody>
</table>
Year | Area | Production | Yield | Coverage under irrigation
--- | --- | --- | --- | ---
1975-76 | 39.48 | 48.74 | 1235 | 38.7
1976-77 | 38.51 | 41.92 | 1089 | 38.4
1977-78 | 40.28 | 52.67 | 1308 | 40.2
1978-79 | 40.48 | 53.63 | 1328 | 41.6
1979-80 | 39.42 | 42.33 | 1074 | 42.8
1980-81 | 40.15 | 53.63 | 1336 | 40.7
1981-82 | 40.71 | 53.25 | 1308 | 41.5
1982-83 | 38.26 | 47.12 | 1231 | 42.0
1983-84 | 41.24 | 60.10 | 1457 | 42.7
1984-85 | 41.16 | 58.34 | 1417 | 43.7
1985-86 | 41.14 | 6.83 | 1552 | 42.9
1986-87 | 41.17 | 60.56 | 1471 | 44.1
1987-88 | 38.81 | 56.86 | 1465 | 43.6
1988-89 | 41.73 | 70.49 | 1689 | 45.8
1989-90 | 42.17 | 73.57 | 1745 | 46.1
1990-91 | 42.69 | 74.29 | 1740 | 45.5
1991-92 | 42.65 | 74.68 | 1751 | 47.3
1992-93 | 41.78 | 74.86 | 1744 | 48.0
1993-94 | 42.54 | 80.30 | 1888 | 48.5
1994-95 | 42.81 | 81.81 | 1911 | 49.8
1995-96 | 42.84 | 76.98 | 1797 | 49.9
1996-97 | 43.43 | 81.74 | 1882 | 51.0
1997-98 | 43.45 | 82.53 | 1900 | 50.8
1998-99 | 44.80 | 86.08 | 1921 | 52.3
1999-2000 | 45.16 | 89.68 | 1986 | 53.9
2000-01 | 44.71 | 84.98 | 1901 | 53.6
2001-02 | 44.90 | 93.34 | 2079 | 53.2
2002-03 | 41.18 | 71.82 | 1744 | 50.2 (P)
2003-04 | 42.50 | 88.28 | 2077 | NA
2004-05* | 42.12 | 85.31 | 2026 | NA

* Advance Estimates as on 06.07.2005. P - Provisional.

Note: The yield rates given have worked out on the basis of production & area figures taken in 000 unit.
West Bengal contributes 16.61 percent in production followed by Uttar Pradesh 14.75 percent, Punjab 10.94 percent, Andhra Pradesh 10.14 percent.

**Table – 5.3**  
Area, Production and Yield of Paddy during 2003-04 in respect of Major Paddy Producing States:

<table>
<thead>
<tr>
<th>States</th>
<th>Area</th>
<th>% of Total Area</th>
<th>Production</th>
<th>% of Total Prod.</th>
<th>Cumulative % of Total Production</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>West Bengal</td>
<td>5.86</td>
<td>13.79</td>
<td>14.66</td>
<td>16.61</td>
<td>16.61</td>
<td>2504</td>
</tr>
<tr>
<td>Uttar Pradesh</td>
<td>5.95</td>
<td>14.00</td>
<td>13.02</td>
<td>14.75</td>
<td>31.35</td>
<td>2187</td>
</tr>
<tr>
<td>Punjab</td>
<td>2.61</td>
<td>6.14</td>
<td>9.66</td>
<td>10.94</td>
<td>42.30</td>
<td>3694</td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>2.98</td>
<td>7.01</td>
<td>8.95</td>
<td>10.14</td>
<td>52.44</td>
<td>3009</td>
</tr>
<tr>
<td>Orissa</td>
<td>4.50</td>
<td>10.59</td>
<td>6.80</td>
<td>7.70</td>
<td>60.14</td>
<td>1511</td>
</tr>
<tr>
<td>Chhattishgarh</td>
<td>3.72</td>
<td>8.75</td>
<td>5.41</td>
<td>6.13</td>
<td>66.27</td>
<td>1455</td>
</tr>
<tr>
<td>Bihar</td>
<td>3.56</td>
<td>8.38</td>
<td>5.39</td>
<td>6.11</td>
<td>72.37</td>
<td>1516</td>
</tr>
<tr>
<td>Assam</td>
<td>2.53</td>
<td>5.95</td>
<td>3.88</td>
<td>4.40</td>
<td>76.77</td>
<td>1534</td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>1.40</td>
<td>3.29</td>
<td>3.22</td>
<td>3.65</td>
<td>80.41</td>
<td>2308</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>1.54</td>
<td>3.62</td>
<td>2.84</td>
<td>3.22</td>
<td>83.63</td>
<td>1850</td>
</tr>
<tr>
<td>Haryana</td>
<td>1.02</td>
<td>2.40</td>
<td>2.79</td>
<td>3.16</td>
<td>86.79</td>
<td>2749</td>
</tr>
<tr>
<td>Karnataka</td>
<td>1.15</td>
<td>2.71</td>
<td>2.52</td>
<td>2.85</td>
<td>89.65</td>
<td>2190</td>
</tr>
<tr>
<td>Jharkhand</td>
<td>1.36</td>
<td>3.20</td>
<td>2.31</td>
<td>2.62</td>
<td>92.26</td>
<td>1695</td>
</tr>
<tr>
<td>Madhya Pradesh</td>
<td>1.67</td>
<td>3.93</td>
<td>1.68</td>
<td>1.90</td>
<td>94.17</td>
<td>1003</td>
</tr>
<tr>
<td>Gujarat</td>
<td>0.68</td>
<td>1.60</td>
<td>1.28</td>
<td>1.45</td>
<td>95.62</td>
<td>1891</td>
</tr>
<tr>
<td>Kerala</td>
<td>0.29</td>
<td>0.68</td>
<td>0.62</td>
<td>0.70</td>
<td>96.32</td>
<td>2141</td>
</tr>
<tr>
<td>Others</td>
<td>1.68</td>
<td>3.95</td>
<td>3.25</td>
<td>3.68</td>
<td>100.00</td>
<td>2077</td>
</tr>
<tr>
<td>All India</td>
<td>42.50</td>
<td>100.00</td>
<td>88.28</td>
<td>100.00</td>
<td>@</td>
<td>2077</td>
</tr>
</tbody>
</table>

@ - since area/production is low in individual states, yield rate is not worked out.

Note: States have been arranged in descending order of percentage share of production during 2002-03.
The area under crops in West Bengal is 18.79 percent followed by Uttar Pradesh 14.00 percent and Orissa 10.59 percent. Both in view of area and production of Paddy West Bengal followed by Uttar Pradesh are leading Paddy producing states in India.

The state of Uttar Pradesh comprises four economic regions. There exist regional diversities in ecological conditions. The focus of this study is on change in area, production and yield of Paddy analysed on the basis estimates for two time spans of 1965-66 to 1988-89 and 1989-90 to 2000-01. The objectives of the study cover these periods. However, inclusion of pre green revolution period 1950-64 shall provide better understanding of the dimensions and directions of change in area, production and yield of Paddy in economic regions of Uttar Pradesh.

Table – 5.4  Area under Paddy:

<table>
<thead>
<tr>
<th>Year</th>
<th>Western</th>
<th>Central</th>
<th>Bundelkhand</th>
<th>Eastern</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51</td>
<td>666734</td>
<td>646657</td>
<td>82378</td>
<td>2237463</td>
<td>3633232</td>
</tr>
<tr>
<td>1960-61</td>
<td>763693</td>
<td>744765</td>
<td>114703</td>
<td>2319094</td>
<td>3942255</td>
</tr>
<tr>
<td>1970-71</td>
<td>877126</td>
<td>741645</td>
<td>120162</td>
<td>2413560</td>
<td>4152493</td>
</tr>
<tr>
<td>1980-81</td>
<td>1119086</td>
<td>949830</td>
<td>106124</td>
<td>2839639</td>
<td>5014679</td>
</tr>
<tr>
<td>1990-91</td>
<td>1126111</td>
<td>1028648</td>
<td>95306</td>
<td>3097445</td>
<td>5347510</td>
</tr>
<tr>
<td>2000-01</td>
<td>1567505</td>
<td>1090799</td>
<td>98100</td>
<td>3147724</td>
<td>5904128</td>
</tr>
</tbody>
</table>

Area under Paddy in 1950-51 was 3633232 hectares, which inclined to 5904128 hectares in 2000-01 (Table 5.4). This incline was on account of incline in the crop in Western region from 666734 hectares in 1950-51 to 15667505 hectares in 2000-01, in Central region from 646657 hectares in 1950-51 to 1090799

Production of Paddy in Uttar Pradesh in 1950-51 was 1755822 quintal, which inclined to 11672250 quintal in 2000-01.

Table – 5.5 Production of Paddy:

<table>
<thead>
<tr>
<th>Year</th>
<th>Western</th>
<th>Central</th>
<th>Bundelkhand</th>
<th>Eastern</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51</td>
<td>380817</td>
<td>337404</td>
<td>42069</td>
<td>995532</td>
<td>1755822</td>
</tr>
<tr>
<td>1960-61</td>
<td>685927</td>
<td>547960</td>
<td>107658</td>
<td>1525080</td>
<td>2866631</td>
</tr>
<tr>
<td>1970-71</td>
<td>791610</td>
<td>557798</td>
<td>88920</td>
<td>1828405</td>
<td>3266733</td>
</tr>
<tr>
<td>1980-81</td>
<td>1575313</td>
<td>906771</td>
<td>58303</td>
<td>2586290</td>
<td>5126677</td>
</tr>
<tr>
<td>1990-91</td>
<td>25116589</td>
<td>1903844</td>
<td>93400</td>
<td>5204746</td>
<td>9718579</td>
</tr>
<tr>
<td>2000-01</td>
<td>3382620</td>
<td>1893258</td>
<td>96040</td>
<td>6300332</td>
<td>11672250</td>
</tr>
</tbody>
</table>

The sharp rise in production resulted from increase in Paddy production in Western region from 380817 quintals in 1950-51 to 3382620 quintals in 2000-01, in Central region from 3374404 in 1950-51 to 18893258 in 2000-01, in Bundelkhand region from 42069 quintals in 1950-51 to 96040 quintals in 2000-01 and Eastern region from 995532 quintals in 1950-51 to 6300332 quintals in 2000-01. Consequent to technological changes emerging as the result of green revolution the yield of Paddy recorded sharp incline. At the state level the yield of Paddy increased from 483 Kg. per hectare in 1950-51 to 1977 Kg. per hectare. It was caused by rise in Western region from 571 Kg/hectare in 1950-51 to 2158 Kg. in 2000-01 in central region from 522 Kg. per hectare in 1950-51 to 1736 Kg. per hectare in 2000-01, in Bundelkhand region from 511 Kg. per hectare in
1950-51 to 979 Kg. per hectare in 2000-01 and in eastern region from 445 Kg. per hectare in 1950-51 to 2002 Kg. per hectare in 2000-01.

Table - 5.6   Yield of Paddy in Uttar Pradesh:  

<table>
<thead>
<tr>
<th>Year</th>
<th>Western</th>
<th>Central</th>
<th>Bundelkhand</th>
<th>Eastern</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51</td>
<td>571</td>
<td>522</td>
<td>.511</td>
<td>445</td>
<td>483</td>
</tr>
<tr>
<td>1960-61</td>
<td>898</td>
<td>736</td>
<td>939</td>
<td>658</td>
<td>727*</td>
</tr>
<tr>
<td>1970-71</td>
<td>903</td>
<td>752</td>
<td>740</td>
<td>758</td>
<td>787</td>
</tr>
<tr>
<td>1980-81</td>
<td>1408</td>
<td>955</td>
<td>549</td>
<td>911</td>
<td>1022</td>
</tr>
<tr>
<td>1990-91</td>
<td>2235</td>
<td>1851</td>
<td>980</td>
<td>1680</td>
<td>1817</td>
</tr>
<tr>
<td>2000-01</td>
<td>2158</td>
<td>1736</td>
<td>979</td>
<td>2002</td>
<td>1977</td>
</tr>
</tbody>
</table>

Variability in area under Paddy in different economic regions:

In economic analysis variability is measured and compared with help of estimation of coefficient of variation. Coefficient of variation (C.V.) is derived by dividing standard deviation by mean and multi physical the same by 100. In short C.V. denotes percent coefficient between standard deviation and mean. It shows that in the period under reference the variable deviated from the mean between plus and minus of derived C.V. from the mean. Presentation of mean along with C.V. reflects on the nature of series.

Variability in area under Paddy Uttar Pradesh and the economic regions therein are presented in table 5.7. It shows that though the mean area under Paddy cultivation during 1950-51 to 1964-65, 1965-66 to 1988-89 and 1989-90 to 2000-01 increased
constantly over times respectively being 3749489.67 ± 8.40 c.v., 4574757.42 ± 9.77 c.v. and 5388363.42 ± 4.83 c.v. the state level variability was higher during 1965-66 to 1988-89.

Table — 5.7 Variability in Area under Paddy in Economic Regions of Uttar Pradesh:

<table>
<thead>
<tr>
<th>Year</th>
<th>Western (Hectare)</th>
<th>Central (Hectare)</th>
<th>Bundelkhand (Hectare)</th>
<th>Eastern (Hectare)</th>
<th>State (Hectare)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51 to 1964-65</td>
<td>687702.47</td>
<td>698762.53</td>
<td>95370.40</td>
<td>2267654.27</td>
<td>3749489.67</td>
</tr>
<tr>
<td>1989-90 to 2000-01</td>
<td>1283738.92</td>
<td>1023142.83</td>
<td>88117.33</td>
<td>2993264.33</td>
<td>5388263.42</td>
</tr>
</tbody>
</table>

(Figures under parenthesis are estimates of C.V.)

Closer scrutiny shows that during 1950-51 to 1964-65 coefficient of variation (c.v.) ranged between ± 4.63 percent in Eastern region and ± 23.62 percent in Western region. During 1965-66 to 1988-89 the c.v. ranged between ± 8.60 percent in eastern region and ± 14.42 percent in Bundelkhand region. During 1989-90 to 2000-01 the coefficient of variation ranged between ± 2.90 in Eastern Uttar Pradesh region and 13.00 in Western region. Coefficient of variation was in reference to mean area under the crop.
Variability in Production of Paddy in Uttar Pradesh and Economic regions therein:

The estimates of variability in production of Paddy in economic regions of Uttar Pradesh and the state in has been presented in Table 5.8.

Table – 5.8 Variability in Production of Paddy in Economic Region of Uttar Pradesh:

<table>
<thead>
<tr>
<th>Year</th>
<th>Western</th>
<th>Central</th>
<th>Bundelkhand</th>
<th>Eastern</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51 to 1964-65</td>
<td>498980.0</td>
<td>472337.93</td>
<td>62513.8</td>
<td>1326494.27</td>
<td>2360326.0</td>
</tr>
<tr>
<td></td>
<td>(34.53)</td>
<td>(23.91)</td>
<td>(43.18)</td>
<td>(23.67)</td>
<td>(25.42)</td>
</tr>
<tr>
<td>1965-66 to 1988-89</td>
<td>1254345.25</td>
<td>853456.58</td>
<td>95666.13</td>
<td>2323384.29</td>
<td>4526852.25</td>
</tr>
<tr>
<td></td>
<td>(44.77)</td>
<td>(45.87)</td>
<td>(119.18)</td>
<td>(42.07)</td>
<td>(41.85)</td>
</tr>
<tr>
<td>1989-90 to 2000-01</td>
<td>2897633.75</td>
<td>1691794.0</td>
<td>87361.67</td>
<td>5483315.08</td>
<td>10360104.50</td>
</tr>
</tbody>
</table>

(Figures under parenthesis are estimates of C.V.)

It reveals that the coefficient of variation in production of Paddy was ± 25.42 percent during 1950-51 to 1964-65, It reveals that the coefficient of variation in production of Paddy was ± 41.85 percent 1965-66 to 1988-89 and ± 11.97 percent during 1989-90. It shows that the Paddy production was relatively more stable against periodic average during 1989-90 to 2000-01. 1950-51 to 1964-65 variability in production indifferent regions was fairly high and ranged between ± 23.67 percent in eastern region and ± 43.18 percent in Bundelkhand during 1965-66 to 1988-89 the variability in production of Paddy ranged between ± 42.07 percent in Eastern region and ± 11.98 percent in Bundelkhand.

**Variability in Yield of Paddy in Uttar Pradesh and Economic regions:**

Production is function of area and yield. The production of crops is raised by increasing area under the crop or increasing its productivity. Table 5.9 presents variability of Paddy yield.

**Table – 5.9 Variability in Yield of Paddy in Economic Region of Uttar Pradesh:**

<table>
<thead>
<tr>
<th>Year</th>
<th>Western (Kg/Hectare)</th>
<th>Central (Kg/Hectare)</th>
<th>Bundelkhand (Kg/Hectare)</th>
<th>Eastern (Kg/Hectare)</th>
<th>State (Kg/Hectare)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51 to 1964-65</td>
<td>706.10</td>
<td>667.51</td>
<td>632.65</td>
<td>581.48</td>
<td>622.09</td>
</tr>
<tr>
<td>1989-90 to 2000-01</td>
<td>1267.24</td>
<td>984.22</td>
<td>905.88</td>
<td>875.56</td>
<td>982.05</td>
</tr>
<tr>
<td>1988-89 to 2000-01</td>
<td>(33.89)</td>
<td>(32.47)</td>
<td>(125.52)</td>
<td>(34.05)</td>
<td>(32.49)</td>
</tr>
</tbody>
</table>

(Figures under parenthesis are estimates of C.V.)

The table reveals that coefficient of variation of the Paddy yield during 1950-51 to 1964-65 was ± 18.43 percent, during 1965-66 to 1988-89 ± 32.49 percent and during 1989-90 and 2000-01 ± 11.18 percent indicating that the production paddy remained fairly stable during the period. The variability in yield
during 1950-51 to 1964-65 ranged between ± 14.10 percent in Central region and ± 22.37 percent in Bundelkhand region. During 1965-66 to 1988-89 the yield variability in Paddy ranged between ± 32.47 percent in central region and ± 125.52 percent in Bundelkhand region. During 1989-90 to 2000-01, the variability in yield ranged between ± 5.11 percent in Western region and ± 22.99 percent in Bundelkhand region.

**Growth in Area under Paddy:**

Estimates of compound growth rate in area under Paddy in Uttar Pradesh and regions therein are presented in Table 5.11. Perusal of the table reveals that the growth rate in area under paddy has remained positive during the periods under reference, however at the state level the percent per annum increase in area in state was 0.646 percent per annum during 1950-51 to 1964-65 followed by 0.446 percent per annum in 1965-66 and was only 0.184 percent per annum during 1989-90 to 2000-01.

**Table – 5.10 Growth in Area under Paddy:**

(Percent/Annum)

<table>
<thead>
<tr>
<th>Period</th>
<th>Western</th>
<th>Central</th>
<th>Bundelkhand</th>
<th>Eastern</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51 to</td>
<td>1.192</td>
<td>1.024</td>
<td>1.729</td>
<td>0.332</td>
<td>0.646</td>
</tr>
<tr>
<td>1964-65</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1965-66 to</td>
<td>0.479</td>
<td>0.601</td>
<td>(-) 0.231</td>
<td>0.405</td>
<td>0.446</td>
</tr>
<tr>
<td>1988-89</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1989-90 to</td>
<td>1.244</td>
<td>0.369</td>
<td>0.324</td>
<td>2.018</td>
<td>0.184</td>
</tr>
<tr>
<td>2000-01</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(Figures under parenthesis are estimates of C.V.)
In western region the growth rate remained positive all along and was highest 1.224 percent per annum during 1989-90 to 2000-01. In central region the growth rate remained positive during the thrice time spans and was highest 1.024 percent per annum during 1950-51 to 1964-65. In Bundelkhand region the growth rate in area was negative (-) 0.231 percent per annum during 1965-66 to 1989-90. In East Uttar Pradesh the growth rate in area under Paddy remained positive throughout and was highest 2.018 percent per annum during 1989-90 to 2000-01.

Growth in Production of Paddy:


<table>
<thead>
<tr>
<th>Year</th>
<th>Western</th>
<th>Central</th>
<th>Bundelkhand</th>
<th>Eastern</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51 to 1964-65</td>
<td>2.782</td>
<td>1.995</td>
<td>2.692</td>
<td>1.752</td>
<td>0.025</td>
</tr>
<tr>
<td>1965-66 to 1988-89</td>
<td>2.183</td>
<td>2.070</td>
<td>1.370</td>
<td>2.167</td>
<td>1.965</td>
</tr>
<tr>
<td>1989-90 to 2000-01</td>
<td>1.404</td>
<td>0.779</td>
<td>1.871</td>
<td>1.009</td>
<td>1.084</td>
</tr>
</tbody>
</table>

(Figures under parenthesis are estimates of C.V.)

Perusal of the table reveals that the growth rate of Paddy production remaining positive all along and recorded highest 1.512 percent per annum during 1965-66 to 1988-89. The
compound growth rate of paddy production in Western region recorded highest 2.782 percent per annum during 1950-51 to 1964-65. In central region the growth rate in production of paddy recorded highest 2.070 percent per annum during 1965-66 to 1988-89. In Bundelkhand region the compound growth rate of production of recorded highest 2.692 percent per annum during 1950-51 to 1964-65. The compound growth rate in Paddy production remained positive in Eastern region throughout and recorded highest 2.167 percent per annum during 1965-66 to 1988-89. It shows that there has been continuous rising trend in production of Paddy.

Table - 5.12 Growth in Yield of Paddy:

<table>
<thead>
<tr>
<th>Year</th>
<th>Western</th>
<th>Central</th>
<th>Bundelkhand</th>
<th>Eastern</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51 to 1964-65</td>
<td>1.572</td>
<td>0.965</td>
<td>1.132</td>
<td>1.415</td>
<td>1.370</td>
</tr>
<tr>
<td>1965-66 to 1988-89</td>
<td>1.699</td>
<td>1.460</td>
<td>0.369</td>
<td>1.546</td>
<td>1.512</td>
</tr>
<tr>
<td>1989-90 to 2000-01</td>
<td>0.158</td>
<td>0.409</td>
<td>1.546</td>
<td>3.047</td>
<td>1.270</td>
</tr>
</tbody>
</table>

(Figures under parenthesis are estimates of C.V.)

**Compound growth in Paddy Productivity:**

The growth in productivity of Paddy in Uttar Pradesh and economic regions there in is presented in table 5.12. It is evident from the table that the compound growth rate in yield of paddy has remained positive throughout.
Perusal of the table reveals that compound growth rate of yield in Paddy in Uttar Pradesh recorded highest 1.512 percent per annum during 1965-66 to 1988-89. In Western region the compound growth rate in yield of Paddy recorded highest 1.699 percent per annum during 1965-66 to 1988-89. In Central region the growth in Paddy yield recorded highest 1.460 percent per annum during 1965-66. In Bundelkhand region growth rate in yield of Paddy recorded highest 1.546 percent per annum during 1989-90. In eastern region there seems that there has been a very high growth in yield, which recorded 3.047 percent per annum. The compound growth rates in Paddy yield in all the regions and state recorded positive.

**Wheat:**

Wheat is the most important cereal crop. It is cultivated all through world. It is said that Wheat is sown every day and harvested every day in one part of world or other. During 2000-02 the world production of Paddy was 583105 thousand metric tonnes. China, India and Russian Federation are the major wheat producing countries in world (Table 5.13). China contributes 16.3 percent, India 12.5 percent and Russian Federation 7.5 percent of the Worlds production.

Area under wheat is continuously increasing in India (Table 5.14). The wheat area was 9.55 million hectares in T.E. 1952-53 and it increased to 25.09 million hectares in T.E. 2004-05. The production of wheat has also increased from 6.71 million tonnes in T.E. 1952-53 to 69.95 million tonnes in T.E. 2004-05. Wheat,
has been unanimously acknowledged by economists was flagship of green revolution in country. The revolutionary increase in production of wheat was achieved through substantial rise in yield of the crop, which increased from 693 kg. per hectare in T.E. 1952-53 to 2680.3 kg. per hectare in T.E. 2005.

Table – 5.13: Share of Various Countries in World Production of Wheat during 2000-2002:

<table>
<thead>
<tr>
<th>(Production in 000 tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commodity/Country</td>
</tr>
<tr>
<td>--------------------------</td>
</tr>
<tr>
<td>World</td>
</tr>
<tr>
<td>Argentina</td>
</tr>
<tr>
<td>Bangladesh</td>
</tr>
<tr>
<td>Canada</td>
</tr>
<tr>
<td>China</td>
</tr>
<tr>
<td>Egypt</td>
</tr>
<tr>
<td>France</td>
</tr>
<tr>
<td>India</td>
</tr>
<tr>
<td>Iran</td>
</tr>
<tr>
<td>Italy</td>
</tr>
<tr>
<td>Pakistan</td>
</tr>
<tr>
<td>Romania</td>
</tr>
<tr>
<td>Russian Federation</td>
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<tr>
<td>Spain</td>
</tr>
<tr>
<td>Syria</td>
</tr>
<tr>
<td>Turkey</td>
</tr>
<tr>
<td>U.K.</td>
</tr>
<tr>
<td>U.S.A.</td>
</tr>
<tr>
<td>Ukraine</td>
</tr>
<tr>
<td>Australia</td>
</tr>
</tbody>
</table>
Table 5.14 All-India Area Production and Yield of Wheat from 1950-51 to 2004-05 along with percentage coverage under irrigation:

<table>
<thead>
<tr>
<th>Year</th>
<th>Area</th>
<th>Production</th>
<th>Yield</th>
<th>% Coverage under irrigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51</td>
<td>9.75</td>
<td>6.46</td>
<td>663</td>
<td>34.0</td>
</tr>
<tr>
<td>1951-52</td>
<td>9.47</td>
<td>6.18</td>
<td>653</td>
<td>35.8</td>
</tr>
<tr>
<td>1952-53</td>
<td>9.83</td>
<td>7.50</td>
<td>763</td>
<td>37.2</td>
</tr>
<tr>
<td>1953-54</td>
<td>10.68</td>
<td>8.02</td>
<td>750</td>
<td>36.2</td>
</tr>
<tr>
<td>1954-55</td>
<td>11.26</td>
<td>9.04</td>
<td>803</td>
<td>35.0</td>
</tr>
<tr>
<td>1955-56</td>
<td>12.37</td>
<td>8.76</td>
<td>708</td>
<td>32.7</td>
</tr>
<tr>
<td>1956-57</td>
<td>13.52</td>
<td>9.40</td>
<td>695</td>
<td>29.4</td>
</tr>
<tr>
<td>1957-58</td>
<td>11.73</td>
<td>7.99</td>
<td>682</td>
<td>33.3</td>
</tr>
<tr>
<td>1958-59</td>
<td>12.62</td>
<td>9.96</td>
<td>789</td>
<td>31.8</td>
</tr>
<tr>
<td>1959-60</td>
<td>13.38</td>
<td>10.32</td>
<td>772</td>
<td>31.8</td>
</tr>
<tr>
<td>1960-61</td>
<td>12.93</td>
<td>11.00</td>
<td>851</td>
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</tr>
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<td>1961-62</td>
<td>13.57</td>
<td>12.07</td>
<td>890</td>
<td>31.9</td>
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<tr>
<td>1962-63</td>
<td>13.59</td>
<td>10.78</td>
<td>793</td>
<td>33.8</td>
</tr>
<tr>
<td>1963-64</td>
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<td>9.85</td>
<td>730</td>
<td>34.9</td>
</tr>
<tr>
<td>1964-65</td>
<td>13.42</td>
<td>12.26</td>
<td>913</td>
<td>36.8</td>
</tr>
<tr>
<td>1965-66</td>
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<td>10.40</td>
<td>827</td>
<td>43.1</td>
</tr>
<tr>
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<td>11.39</td>
<td>887</td>
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<td>1967-68</td>
<td>14.99</td>
<td>16.54</td>
<td>1103</td>
<td>43.4</td>
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<tr>
<td>1968-69</td>
<td>15.96</td>
<td>18.65</td>
<td>1169</td>
<td>49.8</td>
</tr>
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<td>1969-70</td>
<td>16.63</td>
<td>20.09</td>
<td>1208</td>
<td>51.1</td>
</tr>
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<td>1970-71</td>
<td>18.24</td>
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<td>1971-72</td>
<td>19.14</td>
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<td>1380</td>
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<td>1973-74</td>
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<td>1975-76</td>
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<td>1410</td>
<td>61.8</td>
</tr>
<tr>
<td>Year</td>
<td>Area</td>
<td>Production</td>
<td>Yield</td>
<td>Coverage under irrigation</td>
</tr>
<tr>
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<td>-------</td>
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<td>-------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>1976-77</td>
<td>20.92</td>
<td>29.01</td>
<td>1387</td>
<td>65.1</td>
</tr>
<tr>
<td>1977-78</td>
<td>21.46</td>
<td>31.75</td>
<td>1480</td>
<td>64.6</td>
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<td>1985-86</td>
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<td>2046</td>
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<td>1986-87</td>
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<td>80.3</td>
</tr>
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<td>2281</td>
<td>81.1</td>
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<td>57.21</td>
<td>2327</td>
<td>84.2</td>
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<td>1993-94</td>
<td>25.15</td>
<td>59.84</td>
<td>2380</td>
<td>84.8</td>
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<tr>
<td>2000-01</td>
<td>25.73</td>
<td>69.68</td>
<td>2708</td>
<td>88.1</td>
</tr>
<tr>
<td>2001-02</td>
<td>26.34</td>
<td>72.77</td>
<td>2762</td>
<td>87.4</td>
</tr>
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<td>25.20</td>
<td>65.76</td>
<td>2610</td>
<td>88.0 (P)</td>
</tr>
<tr>
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<td>26.58</td>
<td>72.11</td>
<td>2713</td>
<td>NA</td>
</tr>
<tr>
<td>2004-05*</td>
<td>26.49</td>
<td>72.00</td>
<td>2718</td>
<td>NA</td>
</tr>
</tbody>
</table>

* Advance Estimates as on 06.07.2005. P - Provisional

Note: The yield rates given have worked out on the basis of production & area figures taken in 000 unit.
The green revolution was achieved by adoption of fertilizer irrigation responsive crop strains. The average irrigated area

Table – 5.15 Area, Production and Yield of Wheat during 2003-04 in respect of Major Wheat Producing States along-with coverage under Irrigation:

(Area-Million Hectares, Production-Million tonnes and Yield Kg/Hectare)

<table>
<thead>
<tr>
<th>States</th>
<th>Area</th>
<th>% of Total Area</th>
<th>Production</th>
<th>% of Total Prod.</th>
<th>Cumulative % of Total Production</th>
<th>Yield</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uttar Pradesh</td>
<td>9.15</td>
<td>34.42</td>
<td>25.57</td>
<td>35.46</td>
<td>35.46</td>
<td>2794</td>
</tr>
<tr>
<td>Punjab</td>
<td>3.44</td>
<td>12.94</td>
<td>14.49</td>
<td>20.09</td>
<td>55.55</td>
<td>4207</td>
</tr>
<tr>
<td>Haryana</td>
<td>2.30</td>
<td>8.65</td>
<td>9.13</td>
<td>12.66</td>
<td>68.22</td>
<td>3966</td>
</tr>
<tr>
<td>Madhya Pradesh</td>
<td>4.05</td>
<td>15.24</td>
<td>7.24</td>
<td>10.04</td>
<td>78.26</td>
<td>1789</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>2.10</td>
<td>7.90</td>
<td>5.88</td>
<td>8.15</td>
<td>86.41</td>
<td>2794</td>
</tr>
<tr>
<td>Bihar</td>
<td>2.12</td>
<td>7.98</td>
<td>3.78</td>
<td>5.24</td>
<td>91.65</td>
<td>1783</td>
</tr>
<tr>
<td>Gujarat</td>
<td>0.76</td>
<td>2.86</td>
<td>2.04</td>
<td>2.83</td>
<td>94.48</td>
<td>2681</td>
</tr>
<tr>
<td>West Bengal</td>
<td>0.43</td>
<td>1.62</td>
<td>0.99</td>
<td>1.37</td>
<td>95.85</td>
<td>2315</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>0.67</td>
<td>2.52</td>
<td>0.89</td>
<td>1.23</td>
<td>97.09</td>
<td>1335</td>
</tr>
<tr>
<td>Uttaranchal</td>
<td>0.40</td>
<td>1.50</td>
<td>0.75</td>
<td>1.04</td>
<td>98.13</td>
<td>1877</td>
</tr>
<tr>
<td>Himachal Pradesh</td>
<td>0.36</td>
<td>1.35</td>
<td>0.50</td>
<td>0.69</td>
<td>98.82</td>
<td>1380</td>
</tr>
<tr>
<td>Jammu &amp; Kashmir</td>
<td>0.26</td>
<td>0.98</td>
<td>0.31</td>
<td>0.43</td>
<td>99.25</td>
<td>1179</td>
</tr>
<tr>
<td>Jharkhand</td>
<td>0.08</td>
<td>0.30</td>
<td>0.12</td>
<td>0.17</td>
<td>99.42</td>
<td>1573</td>
</tr>
<tr>
<td>Karnataka</td>
<td>0.23</td>
<td>0.87</td>
<td>0.11</td>
<td>0.15</td>
<td>99.57</td>
<td>481</td>
</tr>
<tr>
<td>Assam</td>
<td>0.07</td>
<td>0.26</td>
<td>0.07</td>
<td>0.10</td>
<td>99.67</td>
<td>1046</td>
</tr>
<tr>
<td>Others</td>
<td>0.16</td>
<td>0.60</td>
<td>0.24</td>
<td>0.33</td>
<td>100.00</td>
<td>@</td>
</tr>
<tr>
<td>All India</td>
<td>25.58</td>
<td>100.00</td>
<td>72.11</td>
<td>100.00</td>
<td>--</td>
<td>2713</td>
</tr>
</tbody>
</table>

@ - since area/production is low in individual states, yield rate is not worked out.

Note: States have been arranged in descending order of percentage share of production during 2002-03.
under wheat was 35.66 percent in T.E. 1952-53 increased to 87.83 percent in T.E. 2004-05. Uttar Pradesh, Punjab, Haryana and Madhya Pradesh are major wheat producing states in India. Table 5.15 presents Area, Production and yield of Wheat during 2003-04 in respect of major wheat producing states. It shows that in Uttar Pradesh wheat is cultivated in 34.42 percent of the total area under crop in India, in Punjab 12.94 percent, in Haryana 8.65 percent and in Madhya Pradesh 15.24 percent. Uttar Pradesh produces 35.46 percent of the nations wheat production, Punjab produces 20.09 percent, Haryana produces 12.66 percent and Madhya Pradesh produces 10.04 percent.

Area under wheat in Uttar Pradesh was 3088761 hectare in 1950-51, which inclined to 9239311 in 2000-01.

**Table – 5.16  Area under Wheat:**

<table>
<thead>
<tr>
<th>Year</th>
<th>Western</th>
<th>Central</th>
<th>Bundelkhand</th>
<th>Eastern</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51</td>
<td>1491120</td>
<td>537159</td>
<td>317248</td>
<td>743234</td>
<td>3088761</td>
</tr>
<tr>
<td>1960-61</td>
<td>1693461</td>
<td>660945</td>
<td>464038</td>
<td>869512</td>
<td>3687956</td>
</tr>
<tr>
<td>1970-71</td>
<td>2636915</td>
<td>913071</td>
<td>541073</td>
<td>1399114</td>
<td>5490173</td>
</tr>
<tr>
<td>1980-81</td>
<td>3113018</td>
<td>1696230</td>
<td>629351</td>
<td>2598842</td>
<td>8037441</td>
</tr>
<tr>
<td>1990-91</td>
<td>3126969</td>
<td>1442043</td>
<td>591297</td>
<td>3048352</td>
<td>8208661</td>
</tr>
<tr>
<td>2000-01</td>
<td>3584091</td>
<td>1666235</td>
<td>672634</td>
<td>3316351</td>
<td>9239311</td>
</tr>
</tbody>
</table>

This rise in the area under crop was due to increase of western region from 1491120 in 1950-51 to 3584091 in 2000-01, in central region from 537159 hectares in 1950-51 to 1666235 in 2000-01, in bundelkhand region from 317248 hectares in 1950-51 to 676634 hectare in 2000-01 and in eastern region from 743234 in 1950-51 to 3316351 hectare in 2000-01.
Production of Wheat in Uttar Pradesh during 1950-51 was 2527308 quintals, which increased to 25168332 quintals in 2000-01. The sharp rise in production of wheat was caused on account similar increase in different regions of Uttar Pradesh. In western region the wheat production in 1950-51 was 1278735 quintals, which increased to 1159489 quintals in 2000-01.

<table>
<thead>
<tr>
<th>Year</th>
<th>Western</th>
<th>Central</th>
<th>Bundelkhand</th>
<th>Eastern</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51</td>
<td>1278735</td>
<td>433109</td>
<td>255324</td>
<td>560140</td>
<td>2527308</td>
</tr>
<tr>
<td>1960-61</td>
<td>1861430</td>
<td>643382</td>
<td>525667</td>
<td>690811</td>
<td>3721290</td>
</tr>
<tr>
<td>1970-71</td>
<td>4057109</td>
<td>119863</td>
<td>594753</td>
<td>1529791</td>
<td>7301516</td>
</tr>
<tr>
<td>1980-81</td>
<td>3039160</td>
<td>2317213</td>
<td>722350</td>
<td>3800070</td>
<td>9878793</td>
</tr>
<tr>
<td>1990-91</td>
<td>819408</td>
<td>3068300</td>
<td>935701</td>
<td>5844567</td>
<td>18007976</td>
</tr>
<tr>
<td>2000-01</td>
<td>11589489</td>
<td>4254912</td>
<td>1309873</td>
<td>8014058</td>
<td>25168332</td>
</tr>
</tbody>
</table>

In central region the production of wheat in 1950-51 was 433109 quintals, which inclined to 4254912 quintals in 2000-01. In Bundelkhand region wheat production in 1950-51 was 255324 quintals it recorded 1309873 quintals in 2000-01. In eastern region the wheat production during 1950-51 was 560140 quintals, which increased to 8014058 quintals in the year 2000-01. As discussed earlier the sharp rise in wheat production resulted in green revolution.

Green revolution, which is termed by several economists as wheat revolution was caused by introduction and adoption of High Yielding Varities. These were termed as dwarf wheat varieties inview of their height. These were fertilizer irrigation responsive. Adoption of these varieties enhanced yield of wheat. During 1950-
the average yield of wheat in Uttar Pradesh was 818 kilogram per hectare resulted in very sharp rise as the average yield in 2000-01 recorded 2724 kg. per hectare. This sharp rise recorded in productivity was combined impact of rise in yield in the economic regions of Uttar Pradesh. In western region the yield per hectare was 858 kg in 1950-51 and it inclined to 3234 kg per hectare in 2000-01. In central region the 806 kg per hectare yield in 1950-51 inclined to 2554 kg per hectare in 2000-01. In Bundelkhand region the 1950-51 yield was 805 kg per hectare, which inclined to 1947 kg per hectare in 2000-01. In eastern region the per hectare yield was 754 kg and it inclined to 2417 kg in 2000-01.

**Variability in Area under Wheat:**

Variability in economic analysis is examined in reference to the mean of the time series. Variability in area under wheat is discussed for the periods 1950-51 to 1964-65, 1965-66 to 1988-89 and 1989-90 to 2000-01. It is expressed as coefficient of

---

**Table - 5.18 Yield of Wheat:**

(Kg/Hectare)

<table>
<thead>
<tr>
<th>Year</th>
<th>Western</th>
<th>Central</th>
<th>Bundelkhand</th>
<th>Eastern</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51</td>
<td>858</td>
<td>806</td>
<td>805</td>
<td>754</td>
<td>818</td>
</tr>
<tr>
<td>1960-61</td>
<td>1099</td>
<td>973</td>
<td>1133</td>
<td>794</td>
<td>1009</td>
</tr>
<tr>
<td>1970-71</td>
<td>1539</td>
<td>1226</td>
<td>1099</td>
<td>1093</td>
<td>1330</td>
</tr>
<tr>
<td>1980-81</td>
<td>976</td>
<td>1366</td>
<td>1148</td>
<td>1462</td>
<td>1229</td>
</tr>
<tr>
<td>1990-91</td>
<td>2609</td>
<td>2128</td>
<td>1582</td>
<td>1917</td>
<td>2194</td>
</tr>
<tr>
<td>2000-01</td>
<td>3234</td>
<td>2554</td>
<td>1947</td>
<td>2417</td>
<td>2724</td>
</tr>
</tbody>
</table>
variation or percent variability. Estimates of variability in area under wheat are presented in table 5.19.

The table shows that the variability at state level in area under wheat was ± 7.13 percent during 1950-51 to 1964-65, ± 22.02 percent during 1965-66 to 1988-89 and ± 3.89 percent during 1989-90 to 2000-01.

Table – 5.19 Variability in Area under Wheat:

<table>
<thead>
<tr>
<th>Year</th>
<th>Western</th>
<th>Central</th>
<th>Bundelkhand</th>
<th>Eastern</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51 to 1964-65</td>
<td>1667066.40</td>
<td>632258.93</td>
<td>399800.80</td>
<td>856824.13</td>
<td>3555950.27</td>
</tr>
<tr>
<td>1965-66 to 1988-89</td>
<td>2764870.46</td>
<td>1136172.92</td>
<td>557066.46</td>
<td>2017069.63</td>
<td>6475179.46</td>
</tr>
<tr>
<td>1989-90 to 2000-01</td>
<td>3344560.58</td>
<td>1553760.67</td>
<td>636716.83</td>
<td>3139753.25</td>
<td>8674791.33</td>
</tr>
</tbody>
</table>

(Figures under parenthesis are estimates of C.V.)

In western region variability during 1950-51 was ± 5.72 percent followed by ± 15.37 and ± 4.27 percent during 1965-66 to 1988-89 and 1989-90 to 2000-01. Central region recorded highest variability ± 24.91 during 1965-66 to 1988-89. In Bundelkhand region highest variability recorded was ± 15.00 percent during 1950-51 to 1964-65. In eastern region recorded highest variability ± 34.54 percent during 1965-66 to 1988-89. During 1950-51 highest variability recorded was ± 15.00 percent in Bundelkhand in 1965-66 to 1988-89 the highest variability recorded was in eastern region ± 34.54. In the highest variability was ± 6.94 percent in 1989-90 to 2000-01 in area may arrive.
**Variability in Production of Wheat:**

Estimates of variability in production of wheat in Uttar Pradesh and economic regions there in are presented in table 5.20. Perusal of the table reveals that during 1950-51 to 1964-65 variability in production of wheat was ± 16.35 in Uttar Pradesh in comparison to which it recorded ± 45.01 percent in 1965-66 to 1988-89 and 12.46 percent in 1989-90 to 2000-01.

**Table – 5.20 Variability in Production of Wheat:**

<table>
<thead>
<tr>
<th>Year</th>
<th>Western (Quintal)</th>
<th>Central (Quintal)</th>
<th>Bundelkhand (Quintal)</th>
<th>Eastern (Quintal)</th>
<th>State (Quintal)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51 to</td>
<td>1508629.73</td>
<td>513878.33</td>
<td>345091.47</td>
<td>638727.93</td>
<td>3006327.47</td>
</tr>
<tr>
<td>1964-65</td>
<td>(14.54)</td>
<td>(17.57)</td>
<td>(30.58)</td>
<td>(17.65)</td>
<td>(16.35)</td>
</tr>
<tr>
<td>1965-66 to</td>
<td>4855810.13</td>
<td>1652704.75</td>
<td>604332.46</td>
<td>2859228.08</td>
<td>9972075.42</td>
</tr>
<tr>
<td>1988-89</td>
<td>(41.13)</td>
<td>(47.98)</td>
<td>(30.36)</td>
<td>(57.21)</td>
<td>(45.01)</td>
</tr>
<tr>
<td>1989-90 to</td>
<td>9658723.25</td>
<td>3643524.50</td>
<td>1167075.25</td>
<td>6890222.33</td>
<td>21359545.33</td>
</tr>
</tbody>
</table>

(Figures under parenthesis are estimates of C.V.)

It further reveals that in 1950-51 to 1964-65 variability ranged between ± 14.54 percent in western region to ± 30.58 percent in Bundelkhand region, in 1965-66 to 1988-89 it ranged between ± 30.36 in Bundelkhand region and ± 57.21 percent in eastern region and during 1989-90 to 2000-01 the variability in production ranged between It further reveals that in 1950-51 to 1964-65 variability ranged between ± 14.54 percent in western region to ± 30.58 percent in Bundelkhand region, in 1965-66 to 1988-89 it ranged between ± 30.36 in Bundelkhand region and ± 57.21 percent ± 12.11 percent in western region to ± 19.49 in
Bundelkhand region. The sharp rise in production of wheat in the state and the economic regions are expressed by the estimates of coefficient of variation.

**Variability in yield of Wheat:**

The rise in production of wheat in Uttar Pradesh and the regions therein were caused by introduction of fertilizer-irrigation responsive wheat varieties, which registered sharp rise in yield. The variability in yield of wheat is presented in table 5.21. The table shows that across regions and periods for comparison there has been positive change in yield of wheat. In Uttar Pradesh variability in yield of wheat recorded ± 12.76 percent during 1950-51 to 1964-65, ± 25.8 percent in 1965-66 to 1988-89 and ± 8.94 in 1989-90 to 2000-01.

**Table – 5.21  Variability in Yield of Wheat:**

(Kilogram)

<table>
<thead>
<tr>
<th>Year</th>
<th>Western</th>
<th>Central</th>
<th>Bundelkhand</th>
<th>Eastern</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51 to 1964-65</td>
<td>904.81</td>
<td>812.48</td>
<td>848.47</td>
<td>744.88</td>
<td>843.73</td>
</tr>
<tr>
<td>1965-66 to 1988-89</td>
<td>1702.50</td>
<td>1380.44</td>
<td>1068.28</td>
<td>1311.25</td>
<td>1471.31</td>
</tr>
<tr>
<td>(29.27)</td>
<td>(27.01)</td>
<td>(22.82)</td>
<td>(26.45)</td>
<td>(25.81)</td>
<td></td>
</tr>
<tr>
<td>1989-90 to 2000-01</td>
<td>2881.37</td>
<td>2337.98</td>
<td>1819.34</td>
<td>2189.30</td>
<td>245.45</td>
</tr>
<tr>
<td>(8.80)</td>
<td>(8.76)</td>
<td>(13.35)</td>
<td>(9.33)</td>
<td>(8.94)</td>
<td></td>
</tr>
</tbody>
</table>

(Figures under parenthesis are estimates of C.V.)

During 1950-51 to 1964-65 the variability in yield of wheat recorded ± 13.26 percent in western region. During the period the maximum variability was recorded in ± 19.21 percent during
1965-66 to 1988-89 the variability in wheat yield ranged between ± 22.82 percent in Bundelkhand and 29.27 percent in western region. During 1989-90 to 2000-01 the variability in wheat ranged between ± 8.80 percent in western region and 13.35 percent in Bundelkhand region.

The examination of variability in area, production and yield leads to the conclusion that 1965-66 to 1988-89 was the most important period, which changed facet of agriculture in India...

**Growth in area of wheat:**

The estimates of compound growth rates in area of wheat across regions and time periods are presented in table 5.22. Perusal of the table reveals that the area under crop in Uttar Pradesh grew by 0.476 percent per annum during 1950-51 to 1964-65, 1.184 percent per annum during 1965-66 to 1988-89 and 0.380 percent per annum during 1989-90 to 2000-01.

**Table – 5.22 Growth in Area of Wheat:**

(Percent/Annum)

<table>
<thead>
<tr>
<th>Year</th>
<th>Western</th>
<th>Central</th>
<th>Bundelkhand</th>
<th>Eastern</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51 to 1964-65</td>
<td>0.180</td>
<td>0.542</td>
<td>1.180</td>
<td>0.675</td>
<td>0.476</td>
</tr>
<tr>
<td>1965-66 to 1988-89</td>
<td>0.783</td>
<td>1.270</td>
<td>0.498</td>
<td>1.920</td>
<td>1.184</td>
</tr>
<tr>
<td>1989-90 to 2000-01</td>
<td>0.346</td>
<td>0.446</td>
<td>0.642</td>
<td>0.335</td>
<td>0.380</td>
</tr>
</tbody>
</table>

(Figures under parenthesis are estimates of C.V.)
Among regions the percent per annum growth in area of wheat ranged between 0.180 percent per annum in western region and 1.180 per annum in Bundelkhand region. During 1965-66 to 1988-89 the variability in area under wheat ranged between 0.498 percent per annum in Bundelkhand region and 1.920 percent per annum in eastern region, during 1989-90 the growth in area under wheat ranged between 0.335 percent per annum in eastern region and 0.642 percent per annum in Bundelkhand region. Compound growth rate estimates throughout the period were positive showing positive change across periods and regions throughout the entire time span.

**Growth in Production of Wheat:**

Estimates of compound growth rate in production of in Uttar Pradesh and across economic regions are presented in table 5.23. Uttar Pradesh recorded 0.761 percent per annum growth during 1950-51 to 1964-65, 2.41 percent per annum during 1965-66 to 1988-89, and 1.244 percent per annum from 1989-90 to 2000-01.

<table>
<thead>
<tr>
<th>Year</th>
<th>Western</th>
<th>Central</th>
<th>Bundelkhand</th>
<th>Eastern</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51 to 1964-65</td>
<td>0.572</td>
<td>0.624</td>
<td>1.928</td>
<td>0.753</td>
<td>0.761</td>
</tr>
<tr>
<td>1965-66 to 1988-89</td>
<td>2.048</td>
<td>2.597</td>
<td>1.236</td>
<td>3.237</td>
<td>2.401</td>
</tr>
<tr>
<td>1989-90 to 2000-01</td>
<td>1.207</td>
<td>1.210</td>
<td>1.898</td>
<td>1.214</td>
<td>1.244</td>
</tr>
</tbody>
</table>

(Figures under parenthesis are estimates of C.V.)
1988-89 and 1.244 percent per annum during 1989-90 to 2000-01. Across the region the growth in production of wheat recorded during 1950-51 to 1964-65 ranged between 0.572 percent per annum in Western region and 1.928 percent per annum growth in Bundelkhand region. During 1965-66 to 1988-89 the growth in production ranged between 1.236 percent per annum in Bundelkhand and 3.237 percent per annum in eastern region. During 1989-90 to 2000-01 the compound growth rate in area of wheat ranged between 1.207 percent per annum in western region and 1.898 percent per annum growth in Bundelkhand region. On the basis of compound growth rate estimates highest growth rate in production of wheat was recorded during 1965-66 to 1988-89.

**Growth in Yield of Wheat:**

Estimates of compound growth rate in yield in Uttar Pradesh and across economic regions of Uttar Pradesh are presented in table 5.24.

**Table – 5.24 Growth in Yield of Wheat:**

<table>
<thead>
<tr>
<th>Year</th>
<th>Western</th>
<th>Central</th>
<th>Bundelkhand</th>
<th>Eastern</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950-51 to 1964-65</td>
<td>0.391</td>
<td>0.081</td>
<td>0.783</td>
<td>0.077</td>
<td>0.280</td>
</tr>
<tr>
<td>1965-66 to 1988-89</td>
<td>1.251</td>
<td>1.315</td>
<td>0.735</td>
<td>1.288</td>
<td>1.203</td>
</tr>
<tr>
<td>1989-90 to 2000-01</td>
<td>0.857</td>
<td>0.761</td>
<td>1.247</td>
<td>0.876</td>
<td>0.861</td>
</tr>
</tbody>
</table>

(Figures under parenthesis are estimates of C.V.)
Perusal of the table reveals that compound growth rate in yield of wheat was 0.280 percent per annum during 1950-51 to 1964-65, 1.203 percent per annum during 1965-66 to 1988-89 and 0.861 percent per annum during 1989-90 to 2000-01.

It leads to conclusion that high degree of quantitative growth in wheat yield was recorded in Uttar Pradesh during 1965-66 to 1988-89. Across regions, during 1950-51 to 1964-65 the compound growth rate in yield of wheat ranged between 0.077 percent per annum in eastern region. During 1965-66 to 1988-89 the compound growth rate in yield of wheat ranged between 0.735 percent per annum in bundelkhand and 1.288 percent per annum in eastern regions. During 1989-90 to 2000-01 the compound growth rate in yield of wheat ranged between 0.761 percent per annum in central and 1.247 percent per annum in bundelkhand regions.

On the basis of the overtime and across the region comparisons of the estimates of compound growth rates the broad observation is that the period of rapid growth in area, production and productivity of Paddy and Wheat in Uttar Pradesh and regions therein.

II

In this part of the chapter contribution of area, yield and their interaction for change in output of Paddy and Wheat during the periods 1950-51 to 1964-65, 1965-66 to 1988-89 and 1989-90 to 2000-01 have been analysed applying Minhas and Vaidyanathan model (1965), which is widely accepted for decomposition analysis.
The model:
\[ P_t - P_0 = (A_t - A_0) Y_0 + (Y_t - Y_0) A_0 + (A_t - A_0) (Y_t - Y_0) \]
where:
- \( A_t - A_0 \) = Area of reference and Base Periods.
- \( P_t - P_0 \) = Production of reference and Base Periods.
- \( Y_t - Y_0 \) = Yield of reference and Base Periods.

In economic analysis, output is considered as function of area and production. It has been observed in the first part of this chapter that has been positive as well as negative change in different time span. In view of the ecological and inter state divergence it is important to a certain reason of output changes for formulation of suitable regional development strategy. To explain the reason of change in output decomposition model developed by Minhas and Vaidyanathan has been applied. This model decomposes the contribution of area, productivity and their interaction to the change in output thereby illustrating the relative contribution of these variables to the output changes. Decomposition of the cause of change in output of Paddy and Wheat are presented hereinafter.

**Paddy:**

Importance of Paddy and its share in the total cropping pattern has already being discussed earlier. The model applied for decomposition of contribution of changes in area and yield in the changes in production in Uttar Pradesh and economic region therein are presented in table.

Perusal of the table reveals that the production of Paddy in 1964-65 increased by 1416554 metric tonnes over 1950-51 in
Uttar Pradesh this increase was contributed to the extent of 22.23 percent by change in area under the crop and 65.95 percent by change in yield due to technological improvement. The increase of 337025 metric tonnes in western region was contributed 32.07 percent by increase in area, 52.91 percent by improvement in yield and 15.02 percent by area-yield-interaction.

Table – 5.25 Components of Changes in Output of Paddy:

<table>
<thead>
<tr>
<th>Region/State</th>
<th>Changes in Output 1964-65 over 1950-51</th>
<th>Contribution of</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Area</td>
</tr>
<tr>
<td>Western</td>
<td>337025</td>
<td>32.07</td>
</tr>
<tr>
<td>Central</td>
<td>27801</td>
<td>34.99</td>
</tr>
<tr>
<td>Bundelkhand</td>
<td>42850</td>
<td>51.76</td>
</tr>
<tr>
<td>Eastern</td>
<td>758678</td>
<td>13.66</td>
</tr>
<tr>
<td>State</td>
<td>1416554</td>
<td>22.23</td>
</tr>
</tbody>
</table>

In central region in output by 27801 metric tonnes were contributed 34.99 percent by change in area, 50.46 percent by improvement in yield and 14.55 percent by interaction. The increase in production of 42850 tonnes in Bundelkhand was contributed 51.70 percent by increase in area and 32.12 percent by improvement in yield and 16.12 percent by area-yield-interaction. The increase in production of 758678 tonnes was contributed 13.66 percent by increase in area and 78.20 percent by improvement in yield.

Between 1988-89 and 1965-66 the production of Paddy in Uttar Pradesh increased by 6682498 metric tonnes. 8.85 percent of the addition to overtime production was contributed by increase in area and 71.93 percent by increase in yield. In
western region 2027857 metric tonnes of additional production was contributed 9.49 percent by area and 84.31 percent by improvement in yield. In central region addition to production by 1488644 metric tonnes was contributed 22.31 percent by change

Table – 5.26 Components of Changes in Output of Paddy:
(Percent/Annum)

<table>
<thead>
<tr>
<th>Region/State</th>
<th>Changes in Output 1988-89 over 1965-66</th>
<th>Contribution of</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Area</td>
</tr>
<tr>
<td>Western</td>
<td>2027857</td>
<td>9.49</td>
</tr>
<tr>
<td>Central</td>
<td>1488644</td>
<td>22.31</td>
</tr>
<tr>
<td>Bundelkhand</td>
<td>52962</td>
<td>(-) 4.98</td>
</tr>
<tr>
<td>Eastern</td>
<td>3113035</td>
<td>18.99</td>
</tr>
<tr>
<td>State</td>
<td>6682498</td>
<td>8.85</td>
</tr>
</tbody>
</table>

in are and 70.23 percent by improvement in yield. In Bundelkhand region the increase in production by 52962 metric tonnes was contributed (-) 4.98 percent by increase in yield. In eastern region the addition to the production of 3113035 metric tonnes was shared 18.99 percent by improvement in yield.

Between 2000-01 and 1966-67 production of paddy recorded 2727914 metric tonnes increase in production in Uttar Pradesh.

Table – 5.27 Components of Changes in Output of Paddy:
(Percent/Annum)

<table>
<thead>
<tr>
<th>Region/State</th>
<th>Changes in Output 2000-01 over 1966-67</th>
<th>Contribution of</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Area</td>
</tr>
<tr>
<td>Western</td>
<td>1005818</td>
<td>102.27</td>
</tr>
<tr>
<td>Central</td>
<td>250140</td>
<td>97.61</td>
</tr>
<tr>
<td>Bundelkhand</td>
<td>40238</td>
<td>27.34</td>
</tr>
<tr>
<td>Eastern</td>
<td>1431718</td>
<td>14.65</td>
</tr>
<tr>
<td>State</td>
<td>2727914</td>
<td>48.50</td>
</tr>
</tbody>
</table>
Decomposition analysis revealed that the increase attributed to area to area and 44.86 percent rise in productivity. In western region additional production of Paddy by 1005818 metric tonnes is attributed 102.27 percent area, (-) 1.588 percent to yield and remaining area yield interaction. The 250140 metric tonnes increase in production in central region is attributed 96.61 percent to area and 2.08 percent to improvement in yield. In Bundelkhand region the addition to production by 40238 metric tonnes was attributed 14.65 percent to increase in production and 60.68 percent to yield. In eastern region the additional production of 1431718 metric tonnes was attributed 14.65 percent to area and 81.81 percent to production.

Wheat:

Wheat is crop of such prominence in Post Green Revolution period that a group of economists term Green Revolution as Wheat Revolution indicating that cultivation of Wheat has revolutionised, in the recent past, Indian agriculture.

<table>
<thead>
<tr>
<th>Region/State</th>
<th>Changes in Output 1964-65 over 1950-51</th>
<th>Contribution of</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Area Yield</td>
<td>Interaction</td>
</tr>
<tr>
<td>Western</td>
<td>609218</td>
<td>18.35 75.07</td>
<td>6.57</td>
</tr>
<tr>
<td>Central</td>
<td>243668</td>
<td>37.43 51.68</td>
<td>10.89</td>
</tr>
<tr>
<td>Bundelkhand</td>
<td>200404</td>
<td>57.33 29.43</td>
<td>13.24</td>
</tr>
<tr>
<td>Eastern</td>
<td>307867</td>
<td>58.04 31.81</td>
<td>10.15</td>
</tr>
<tr>
<td>State</td>
<td>1361157</td>
<td>37.47 52.03</td>
<td>10.50</td>
</tr>
</tbody>
</table>

Table – 5.28 Components of Changes in Output of Wheat: (Percent/Annum)
The share of Wheat in the pattern of cropping is always increasing at national as well as state level. Between 1965-65 and 1950-51 the production of wheat Uttar Pradesh increased by 1361157 metric tonnes.

Application of Minhas-Vaidyanathan decomposition model lead to the finding that 37.47 percent of increase was due to increase in area under wheat and 52.03 percent due to improvement in yield. In western region the production increased by 609218 metric tonnes of which 18.36 percent was on account of area and 75.07 percent on account of yield. In central region the production increased by 243668 metric tonnes of which 37.43 percent was due to area and 51.68 percent due to yield. In Bundelkhand region there was increase of 200409 metric tonnes 57.33 of it was attributed to area and 29.43 percent to yield. The increase of 307867 metric tonnes in eastern region in attributed 58.04 percent to area and 31.81 percent to yield.

Between 1965-66 and 1988-89 Uttar Pradesh recorded increase of 15381699 metric tonnes of production which was contributed 27.07 percent to area, 33.84 percent to yield and 39.09 percent to area-yield-interaction. In western region the addition to production by 6900910 metric tonnes was attributed 23.36 percent to area and 40.60 percent to yield. The central region increase in production of 2718000 metric tonnes was attributed 23.68 percent to area and 36.62 percent to yield. The increase of 458960 metric tonnes recorded in Bundelkhand region was attributed 31.84 percent due to area and 20.01 percent to yield. In eastern region there was increase of 5303829 metric tonnes in production. It was attributed 31.63 percent to area and 22.90 percent to yield.
Between 1989-90 and 2000-01 the production of what in the state of Uttar Pradesh recorded additional production of 8056646 metric tonnes. The analysis reveals that this increase is 25.57 percent due to area and 66.43 percent due to yield. The western region recorded additional production of 3642896 metric tonnes, which was attributed 23.09 percent to area and 69.52 percent to yield.

**Table – 5.29 Components of Changes in Output of Wheat:**

(Percent/Annum)

<table>
<thead>
<tr>
<th>Region/State</th>
<th>Changes in Output 2000-01 over 1989-90</th>
<th>Contribution of Area</th>
<th>Yield</th>
<th>Interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Western</td>
<td>3642896</td>
<td>23.09</td>
<td>69.52</td>
<td>7.39</td>
</tr>
<tr>
<td>Central</td>
<td>1296416</td>
<td>34.41</td>
<td>56.99</td>
<td>8.60</td>
</tr>
<tr>
<td>Bundelkhand</td>
<td>554867</td>
<td>31.78</td>
<td>55.30</td>
<td>12.92</td>
</tr>
<tr>
<td>Eastern</td>
<td>2562467</td>
<td>21.47</td>
<td>71.32</td>
<td>7.21</td>
</tr>
<tr>
<td>State</td>
<td>8056646</td>
<td>25.57</td>
<td>66.43</td>
<td>8.00</td>
</tr>
</tbody>
</table>

The central region recorded increase of 1296416 metric tonnes production, which was attributed 34.41 percent to area and 56.99 percent to yield. The Bundelkhand region recorded increase of 554867 metric tonnes attributed 31.78 percent to area and 55.30 percent to yield. The eastern region recorded additional production of 2562467 metric tonnes attributed 21.47 percent to area and 71.32 percent to yield.

It can be observed on the basis of above discussion that generally in the early phase increase in production was attributed more to increase in area but later on yield started emerging as the main factor for addition in production.