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Study of paddy scenario in the west central table land and mid central table land climatic zones of Odisha

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Abstract
Agriculture is the largest employer in our country, besides being an important contributor to the country's GDP. Rice is grown as a principal cereal crop in our state Odisha and here it is regarded as the staple food. To feed the exponentially growing population of our state the quantity of rice production is to be enhanced. But it has been seen that the rice area is retarding day by day due to industrialization, urbanization, construction of roads etc. The production and yield are also fluctuating over the years. In this endeavor, it has been tried to give a picture of rice on area, production and productivity of seven districts of west central table land and mid central table land of the state season wise. Besides, the similarity with respect to yield of rice has been studied among these seven districts along with their growth rates. Further, some univariate models have been fitted to rice area, production and yield of these districts season wise to forecast their near future values. This study will immensely help the policymakers for policy formulation and implementation to enhance the food security and sustainability of the people of Odisha.

The study was based on the secondary data (2000-01 to 2009-10) on rice area, production and productivity of the study area. The data were collected from the records of Bureau of Economics & Statistics and Agriculture department of Odisha government. By the application of advanced statistical tools and techniques with the help of computer the analysis was carried out.

The analysis revealed that area under rice cultivation was almost stagnant from 2005-06 to 2009-10 in both Autumn and Summer seasons in comparison to Winter and total rice. Variability in area, production and yield based on the 10 years observations showed more than 50 per cent fluctuation in the seasons except Winter season, where the fluctuation was less.

Taking the average rice yield into consideration, the districts were found to be clustered into four groups in Autumn (maximum of Sambalpur of 1040.60kg/ha and minimum of Angul, Bolangir and Deogarh with average of 831.10kg/ha) and Winter (maximum of Bargarh, Sambalpur and Sonepur of 1753.90kg/ha and minimum of Angul and Deogarh of 1205.60kg/ha). In Summer season the districts were into six (maximum of Bargarh of 3065.10kg/ha and minimum of Deogarh of 1576.20kg/ha). Deogarh was placed in the last cluster for all seasons.

The annual percentage growth rate on area was decreasing in almost all the districts in Autumn but the production was increasing in small pace in Summer season.

For forecasting the area, production and productivity the fitted models were found to be different for the districts season wise. The models best fitted and screened showed a forecast error from 0.16 to 14.69 per cent.

Keywords: paddy scenario, central table, climatic, Odisha

Introduction
Out of different kinds of crops being grown all over the world, rice is the most important cereal crop. It is the second largest produced cereal in the world. It is predominantly a crop of Asia with India having the largest area under cultivation of about 44.5 million hectare. It is the principal cereal crop of our state with the coverage of 55% of gross cropped area and it is the staple food of Odisha. It is grown in almost all the districts of Odisha.

Status of rice in world
Rice cultivation is the principal activity and source of income for millions of households around the globe. Several countries of Asia and Africa are highly dependent on rice as a source of foreign exchange earnings and government revenue.

Rice is the second largest produced cereal in the world. At the beginning of the 1990s, annual production was around 350 million tons which is now 410 million tons. Production is geographically concentrated in Western and Eastern Asia. Asia is the biggest rice producer, accounting for 90% of the world's production and consumption of rice. China and India, which account for more than one-third of global population,

supply over half of the world's rice. Brazil is the most important non-Asian producer. The world's major rice-producing countries, including the two most populous nations, China and India, have emphasized the importance of continuing to develop new rice varieties to guarantee Asia's food security and support the region's economic development. Today, rice is grown and harvested on every continent except Antarctica, where conditions make its growth impossible. The majority of all rice produced comes from India, China, Japan, Indonesia, Thailand, Burma, and Bangladesh. Asian farmers still account for 92-percent of the world's total rice production. More than 550 million tons of rice is produced annually around the globe. In the United States, farmers have been successfully harvesting rice for more than 300 years. There are thousands of strains of rice today, including those grown in the wild and those which are cultivated as a crop.

Status of rice in India

Rice is the most important crop of India and it occupies 23.3 per cent of gross cropped area of the country. Rice contributes 43 per cent of total food grain production and 46 per cent of total cereal production. It continues to play vital role in the national food grain supply. It is the staple food of nearly half of the world population. It ranks third after wheat and maize in terms of worldwide production. Asia accounts for 90 per cent and 92 per cent of world's rice area and production respectively. Thus, rice production, consumption and trade are concentrated in Asia. One third of Asia's rice production is consumed in China and one fifth in India. Among the rice growing countries in the world, India has the largest area under rice crop (about 45 million ha.) and ranks second in production next to China. India and China together accounts for 56 per cent of the total production and about 50 per cent of world's area under rice during 1997-98. From production point of view, China ranks first in the world and accounts for 34.6 per cent of total production of world during 1997-98. India accounts for 21.5 per cent of total rice production of world during 1997-98.

The productivity of rice in India is higher than Thailand, Pakistan, Bangladesh, Nepal and Brazil but much below than the yield in Japan, China, Korea, U.S.A. and Indonesia.

In India the statistics shows that, around 44 million hectare of area was under rice cultivation with a production of 96.43 million tones and yield of 2203 kg/ha in the year 2007-08. But in the year 2008-09 the area under its cultivation increased to 45.54 million hectare with an increased production of 99.18 million tones and reduced yield of 2178 kg/ha. In India the rice growing states are Uttar Pradesh, Punjab, West Bengal, Odisha, Bihar, Madhya Pradesh, Maharashtra, Assam and Andhra Pradesh.

Status of rice in Odisha

Agriculture sector contributes to the state's economy of about 26.4% of Net State Domestic Product in 2004-05. The state's income as well as larger percentage of people depend on this sector for food, fodder, fuel, fiber, shelter etc. In the year 2007-08, the area under rice cultivation was 4452 thousand hectare with a production of 7655 thousand metric tons and yield of 1720 kg/ha. During 2008-09, the area under its cultivation became 4455 thousand hectare with a total production of 6916 thousand metric tons and yield of 1553 kg/ha. (Agricultural Statistics report of Odisha, 2007-08 & 2008-09 respectively).

Despite these, the production and yield of rice is not satisfactory due to various factors like land degradation, rainfall, price of rice, diverse agro-ecological situation, insect attack, pest and disease attack etc. (*Usman, 1991; Samal and Kumar, 2002*)

Rice is cultivated all over the state in the districts like Sambalpur, Bargarh, Bolangir, Cuttack, Balasore, Mayurbhanj, Ganjam and Puri.

Geographical location and political aspects of Odisha

The state of Odisha lies in the sub-tropical belt in the eastern region of India between 17.52° and 22.45° North latitude and 81.45° and 7.5° East longitude. It covers an area of about 15571 thousand hectares which is about 4.74% of total area of our country. The state is bounded by states of Jharkhand, West Bengal, Chhattisgarh and Andhra Pradesh in north, north-east, north-west and south-west respectively. The Bay of Bengal has a long coast of 480 km to the east of the state. The state has 30 administrative districts and 314 developmental blocks.

Materials and Methods

Sources of data

Secondary data of rice area, production and yield of the districts coming under West Central table land and Mid Central table land zones of Odisha were collected from different sources in accordance with the objectives delineated in the problem under study. The annual data (season wise) pertaining to area ('000ha), production ('000MTs), and productivity (kg/ha.) on rice of the seven districts (Angul, Bargarh, Bolangir, Deogarh, Dhenkanal, Sambalpur and Sonepur) of Odisha for 10 years (2000-01 to 2009-10) were collected from the Agriculture Statistics of Odisha, Directorate of Agriculture and Food Production and Bureau of Economics and Statistics, Govt. of Odisha, Bhubaneswar.

Results and Discussion

Rice area

The rice area of the seven districts during Summer season showed more than 100 per cent variability as revealed from Table 1. It indicated during the study period among the districts the rice area was very highly fluctuating (Dutta, J. and Das, R. K. 2005). There may be a number of reasons like lack of timely irrigation, labor, non availability of inputs, little or no rainfall etc. Winter was the main season of rice growing, but the total of rice area of the districts revealed consistent variability. The average rice area of all the districts over the 10 years was (14.71 to 99.47 thousand hectare). In Summer due to lack of irrigation facilities, the average rice area was 14.71 thousand hectare but in Winter season it was 99.47 thousand hectare.

Table 1: Mean rice area ('000 ha) over 10 years (2000-01 to 2009-10) of the districts season wise

Districts	Autumn	Winter	Summer	Overall
Angul	21.77	85.35	2.01	36.38
Bargarh	61.00	180.19	57.04	99.41
Bolangir	81.38	133.82	3.16	72.79
Deogarh	20.21	26.62	2.03	16.29
Dhenkanal	14.09	102.10	2.02	39.40

Sambalpur	45.07	85.85	12.99	47.97
Sonepur	14.93	82.34	23.72	40.33
Overall	36.92	99.47	14.71	50.37
S.D	24.69	44.69	20.62	47.71
CV (%)	66.87	44.93	140.22	94.73

From the summary analysis by means of graph (fig.1), the share of the mean rice area of Bolangir district was the highest followed by Bargarh and Sambalpur during Autumn season. But in Summer, Bargarh district occupied the highest rice area followed by Sonepur district. And in Winter, Bargarh occupied the top position followed by Bolangir. Coverage of area in Bolangir in Summer was very small. Deogarh occupied the last position in almost all the seasons.

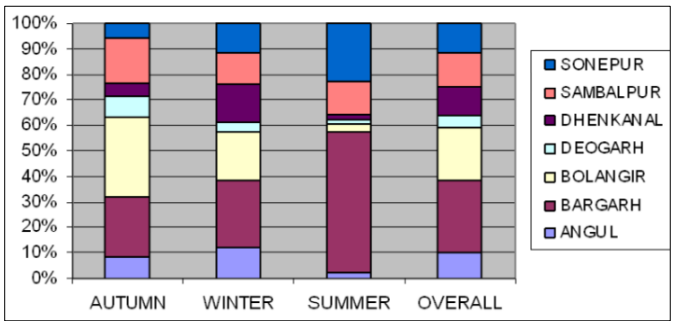

Fig.1: Plot of mean rice area (‘000 ha) over 10 years (2000-01 to 2009-10) of the districts season wise

As revealed from the pie chart (fig.2) out of the total area under study over the 10 years (2000-01 to 2009-10) in Winter season (66 percent) maximum area was covered followed by autumn season (24 percent) and Summer season (10 percent).

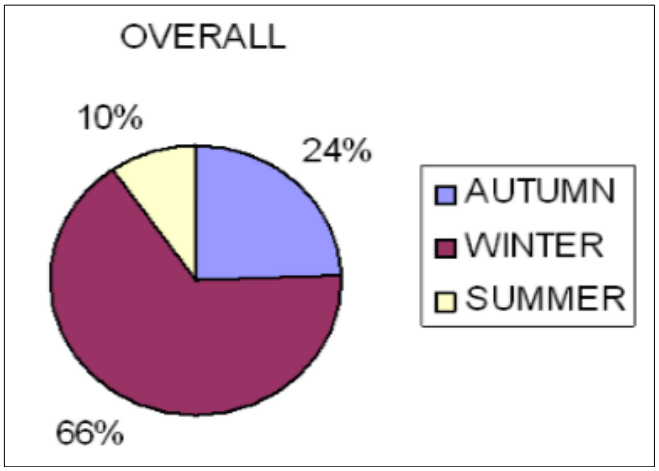

Fig 2: Pie chart of rice area (‘000ha) in the seasons over 10 years(2000-01 to 2009-10)

Rice production

The mean rice production of the districts over the years (Table 2) revealed that, there was high variability in production of rice during Summer season as compared to that in Winter. Bolangir ranked first in production of rice (‘000MTs) in Autumn season followed by Bargarh. In Winter and Summer seasons, Bargarh produced highest amount of rice followed by Bolangir in Winter season and Sonepur in Summer season.

Table 2: Mean rice production (‘000MTs) over 10 years (2000-01 to 2009-10) of the districts season wise

Districts	Autumn	Winter	Summer	Overall
Angul	17.60	103.17	3.77	41.51
Bargarh	55.64	318.67	172.62	182.31
Bolangir	68.40	196.58	5.43	90.14
Deogarh	16.72	33.45	23.11	24.43
Dhenkanal	11.89	163.60	4.20	59.89
Sambalpur	46.97	151.17	38.25	78.79
Sonepur	13.91	145.23	62.13	73.76
Overall	33.02	158.84	44.21	78.69
SD	26.61	99.66	64.36	90.16
CV (%)	80.60	62.75	145.55	114.58

From analyzing the graph (fig.3), Bolangir produced highest rice in Autumn season followed by Bargarh and Sambalpur. Both in Summer and Winter seasons, Bargarh produced highest amount of rice followed by Bolangir in Winter season and Sonepur in Summer season.

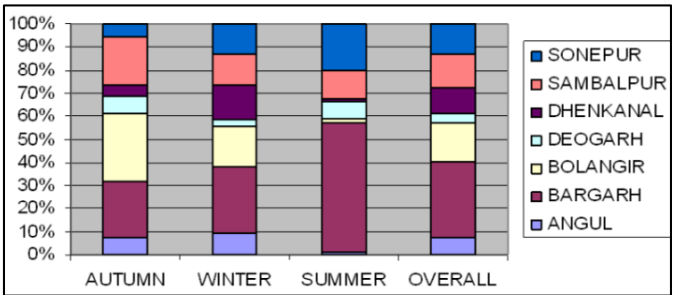

Fig 3: Plot of mean rice production (‘000MTs) over 10 years (2000-01 to 2009-10) of the districts season wise

The pie chart (fig.4) revealed that, in Winter season maximum rice was produced (62 percent) over the 10 years in the study area as compared to 21 percent in Autumn season and 17 percent in summer.

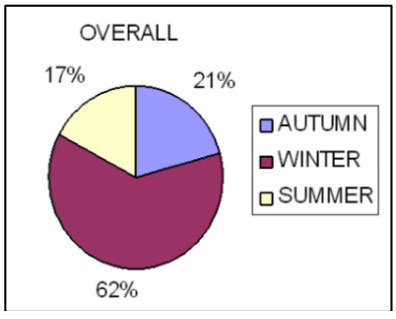

Fig 4: Pie chart of rice production (‘000MTs) in the seasons over 10 years (2000-01 to 2009-10)

Rice yield

The mean rice yield of the districts was more consistent to the tune of 31 to 49 percent (Table.3). It was not fluctuating like rice area and production over the years in the study area in all the seasons. In almost all the districts the average rice yield was same in all the seasons over the 10 years (2000-01 to 2009-10).

Table 3: Mean rice yield (kg/ha) over 10 years (2000-01 to 2009-10) of the districts season wise

Districts	Autumn	Winter	Summer	Overall
Angul	855.30	1205.60	1786.40	1282.43
Bargarh	909.70	1795.30	3065.10	1923.37
Bolangir	845.10	1463.00	1764.10	1357.40
Deogarh	831.10	1234.10	1576.20	1213.80
Dhenkanal	887.40	1540.80	2025.30	1484.50
Sambalpur	1040.60	1753.90	2784.30	1859.60
Sonepur	937.30	1754.60	2464.50	1718.80
Overall	900.93	1535.33	2209.41	1548.56
S.D	329.70	544.27	705.23	764.65
CV (%)	36.60	35.45	31.92	49.38

From the graph (fig.5) it was more clear that the average yield among the districts in the three seasons as well as overall average was highest in Bargarh district(1795.30kg/ha to 3065.10kg/ha) except in Autumn season where Sambalpur district was at the top(1040.60kg/ha).

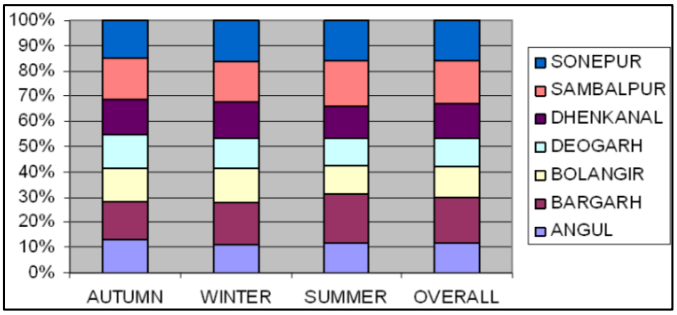

Fig 5: Plot of mean rice yield (kg/ha) over 10 years (2000-01 to 2009-10) of the districts Season wise

The pie chart (fig.6) concluded that, the average rice yield (kg/ha) was maximum in Summer season (48 percent) followed by Winter season (33 percent) and Autumn season (19 percent).

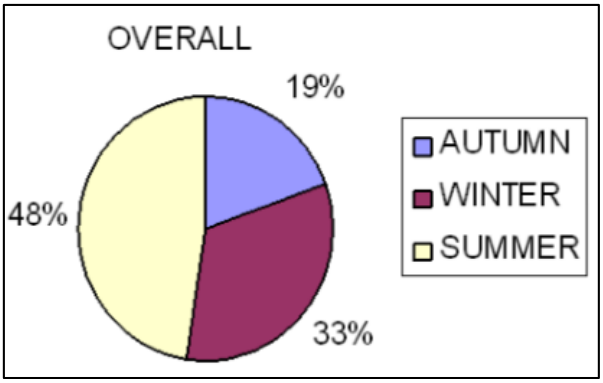

Fig 6: Pie chart of rice yield (kg/ha) in the seasons over 10 years (2000-01 to 2009-10)

Conclusions

Secondary data were collected on area, production and yield of the seven districts coming under West Central table land and Mid Central table zones of Odisha for the 10 years (2000-01 to 2009-10) and their analysis in Autumn, Winter and Summer seasons were done. The analysis revealed that the area under rice cultivation was almost stagnant in all the seasons. Similarly rice production was almost stagnant from 2005-06 to 2009-10 in both Autumn and Summer seasons but increasing in a slow pace in Winter season. Again rice yield (kg/ha) had showed a remarkable decreasing trend over the years since 2006-07. In comparison to the rice yield of Odisha, the yield of rice is not at par with the districts within the seasons for the 10 years with 50 percent fluctuations.

Taking average rice yield into consideration clustering were done for the seven districts and they were clustered or grouped for their similarity in productivity into groups i.e. four groups in Autumn and Winter, six groups in Summer season and five groups in average rice yield. Bargarh district was placed in the top cluster as regards to rice yield in Autumn, Winter and Summer seasons as well as the average yield figures. Deogarh district was placed in the last cluster group for all the seasons.

Based on the results and discussion, it was found that the scenario on rice area, production and yield of the districts in the three seasons as well as on the total was not blooming. The area under rice cultivation was decreasing day by day due to industrialization, urbanizations, construction of roads, change of cropping pattern, scarcity of rainfall, drought, flood etc. The rice area as well as production was found to be decreasing in its absolute value as well as in the growth rate. The yield of rice was also found to be stagnant. Based on the rice yield the districts were grouped into four clusters in Autumn and Winter seasons and into six groups in Summer season. But they were not having similar yields even in the nearby districts. All the seven districts covered and their seasons didn't follow any particular model. Under these scenario and findings there is need of more emphasis on cultivation of rice in these districts to boost production as well as yield in the prevailing and diminishing availability of land under rice cultivation. More and more area should be covered under rice cultivation. Sufficient inputs should be provided to the farmers and they are to be encouraged to go for rice cultivation. Awareness is needed for them not to go for non-food crops and cash crops cultivation. Government subsidies, fertilizers, good quality planting materials are to be made available easily along with pesticides, insecticides etc. to boost their production. Which will let our state's and country's economy to grow.

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