*The Andhra Agric. J* 69 (2): 281-287, 2022

# Extent of Area Coverage of Rice and Saline Resistant Rice Varieties in Krishna District of Andhra Pradesh

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**ABSTRACT**

The Compound Annual Growth Rates for area (CAGR), production and productivity of rice in India, Andhra Pradesh and Krishna district were worked out from period 1990-91 to 2020-21, to get a broader view of present scenario. Later, to know the area under saline resistant rice varieties in Krishna Average Annual Growth Rates (AAGR) were calculated for each variety. The results showed that the compound annual growth rates for area, production and productivity of rice in India were found to be 0.081, 1.486 and 1.403 respectively from the period 1990-91 to 2017-2018.The compound annual growth rates for area, production and productivity of rice in A.P were found to be 0.450, 0.832 and 1.288, respectively from 1990-91 to 2020-21.The compound annual growth rates for area, production and productivity of rice in Krishna district were found to be -1.388, -0.204 and 1.201, respectively from 1990-91 to 2020-21. The negative growth rate of area and production of rice in Krishna district has been addressed by the shifting paradigm of crop cultivation to aquaculture. In Krishna district, the average annual growth rate of area under saline resistant rice varieties viz. MTU- 1061 and MCM-100 were found to be 32.70 and 60.0 respectively during the year 2020-21.

**Keywords:** *CAGR, AAGR, saline resistant rice varieties and Krishna district.*

In India, rice plays a major role in diet, economy, employment, culture and history. It is the staple food for more than 65% of Indian population contributing approximately 40% to the total food grain production, thereby, occupying a pivotal role in the food and livelihood security of people. The country has the world's largest area under rice i.e., about 430 million hectare and the second highest production i.e., about 110 million tonnes at productivity of 2.56 t $ha^{-1}$ as per 2019-20 statistics. The leading rice producing states are West Bengal, Uttar Pradesh, Punjab, Odisha, Andhra Pradesh, Bihar and Chhattisgarh. (Pathak *et al.* 2020).

Andhra Pradesh stands at fourth place in India in rice cultivation, with a production of 9.14 million tonnes and productivity of 3879 Kg/ha for the year 2019-20. West Godavari, East Godavari and Krishna are the three major rice producing districts in Andhra Pradesh, among which West Godavari is having highest area under rice cultivation (230 m ha). Krishna district is having highest production with 1250 tonnes and productivity with 5701 (kg/ha) in Andhra Pradesh with 216 m ha under cultivation (Agricultural statistics at a glance 2019-20).

In India, the available salt affected soil exists in the form of sodic and saline, covering 6.73 million hectares out of which 2.95 million hectares are saline soils. In total saline soils of India, Andhra Pradesh stands at 7$^{th}$ place with a share of 6.2%.(Arora and Sharma 2017). In Andhra Pradesh, Krishna district

stands first under saline soils with 42,796 ha. (Mandal *et al.* 2018).

Though technology for reclamation of salt affected soils is available, there is no desired achievement. It is estimated that salt effected soils reduce the yield of rice by 40-50% (Rice in Andhra Pradesh 2015). Thus, cultivation of rice is a challenging task for farmers in saline areas.

In Andhra Pradesh, A.N.G.R.A.U worked with the objective of development of high yielding rice varieties with a saline resistant characteristic suitable to coastal regions. The varieties thus released include:Chaitanya, (MTU2067), Indra ( MTU1061), Deepti (MTU4870), Somasila (NLR33358), Swarnamu khi (NLR-145). Exclusively Saline resistant varieties of rice such as MCM - 1, MCM - 2, MCM-100, MCM-101, MCM-107, MCM-108, MCM-109 have been released by ARS Machilipatnam. MCM-1, MCM-2 are not under cultivation now. MCM- 107, MCM-108, MCM-109 are under AICRIP trails. MCM-100 variety has been notified in the year 2018 and came into cultivation in saline areas of Krishna district.

A.N.G.R.A.U varieties suggested to be cultivated in saline soils of Krishna district are Chaitanya (MTU-2067), Indra (MTU-1061) and Panduranga (MCM-100). Out of these, Indra (MTU-1061) and Panduranga (MCM-100) are widely being cultivated in place of traditional varieties to overcome salinity problems in certain mandals of Krishna district like Nagalayanka, Avanigadda, Kruthivennu etc. The present study was carried out to study the extent of area under saline resistant varieties of rice in Krishna district of Andhra Pradesh.

## MATERIALS AND METHODS

Andhra Pradesh state was selected purposively for the present study as it stands in seventh place in total saline soil coverage in India. with a production of 8.64 million tonnes and productivity of 3770 Kg/ha for the year 2019-20. Krishna district was purposively selected as it has highest saline soil coverage with 42796 ha.

### Compound Growth Rate

The secondary data on area, production and productivity of rice in India, Andhra Pradesh and Krishna district were used to analyse the growth rates. The data on area, production and productivity of rice from 1991-92 to 2019-20 was used for study which was collected from Directorate of Economics and Statistics.

The compound growth rate of rice was estimated using the exponential form.

$$Y = ab^X$$

Where,

Y = Dependent variable in period (Area, Production and Productivity)

a = Intercept

b = Regression coefficient

x = Year which takes values (1, 2.....n)

It has been estimated as linear equation after taking the log for both sides. The data used for the period was 1991-92 to 2019-20 i.e. 30 years.

$$\log y = \log a + x (\log b)$$

Growth rate (%) = [Antilog (log b)-1]*100

### Average Annual Growth Rate

The Annual Average Growth Rates (AAGR) was used to estimate the growth rate of area under each saline resistant rice variety in Krishna district with the following formula:

$$\text{Annual Growth Rate (AGR)} = \frac{\text{(Current year - Previous year)}}{\text{Previous year}} \times 100$$

## RESULTS AND DISCUSSION

### Growth rates for Area, Production and Productivity of rice in India, Andhra Pradesh and Krishna district.

Trends in area, production and productivity of rice in India, Andhra Pradesh and Krishna district from period 1990-91 to 2020-21 was presented in Table 1, and Figure 1,2,3 respectively.

From Table 1, it can be inferred that there is a positive and non-significant increase in the area of rice in India. But there is a substantial and significant increase in the production and productivity of rice in India which is reflected from the growth rates of 0.081, 1.486 and 1.403 of area, production and productivity of rice in India respectively from the period 1990-91 to 2017-18. From Figure 1, it can be observed that the productivity of rice in India was lowest at 1700(Kg/ha) in the year 2003-04 and highest in 2012-13 at 2400(Kg/ha) and then gradually showed an increasing trend till 2017-18. Similar results were reported by Sekhara (2019) in which highest and lowest production and productivity years of rice in India were highlighted quoting the changes in climatic conditions.

From Table 1, it can be observed that there is a significant and positive growth rate of area, production and productivity of rice in Andhra Pradesh, reflected by 0.450, 0.832 and 1.288, respectively from 1990-91 to 2020-21. From Figure 2, it can be observed that the area of rice fell lowest in the year 2002-03 at 1.86 mha and highest in 2010-11 at 2.7 mha. Production was highest in 2020-21 at 9.1 MT. Productivity was highest in 2019-20 at 3879(Kg/ha). The increasing production and productivity of rice in the state in the recent years is the outcome of introduction of novel high yielding varieties. The results coincided with studies of Pathak *et al.* (2020).

In Krishna district, there has been a significant and negative growth rate in area of rice while a non-significant and negative growth rate in production of rice, which is observed as - 1.388 and -0.204 respectively from 1990-91 to 2020-21. The growth rate of productivity of rice was positive and significant with 1.20. From Figure 3, it can be observed that production was highest in the year 2009-10 with 1.42 MT and productivity was highest in the year 2019-20 with 4186 (Kg/ha). The area, production and productivity of rice were recorded lowest in the year 2004-05. The decreasing area under rice cultivation has been addressed by shifting offarmers from agriculture to aquaculture majorly in the district. These findings also coincide with the findings of Ramgopal and Giribabu. (2015).

**Table 1. Growth rates in area, production and productivity of rice in India, Andhra Pradesh and Krishna district.**

| S.No. | Particular | Compound growth rate | | |
|---|---|---|---|---|
| | | India (1990-2018) | Andhra Pradesh(1990- 2020) | Krishna(1990-2020) |
| 1 | Area | 0.081$^{NS}$ | 0.450** | -1.388** |
| 2 | Production | 1.486** | 0.832** | -0.204 $^{NS}$ |
| 3 | Productivity | 1.403** | 1.288** | 1.201** |

Note: **= 5% level of significance, $^{NS}$ = Non significant

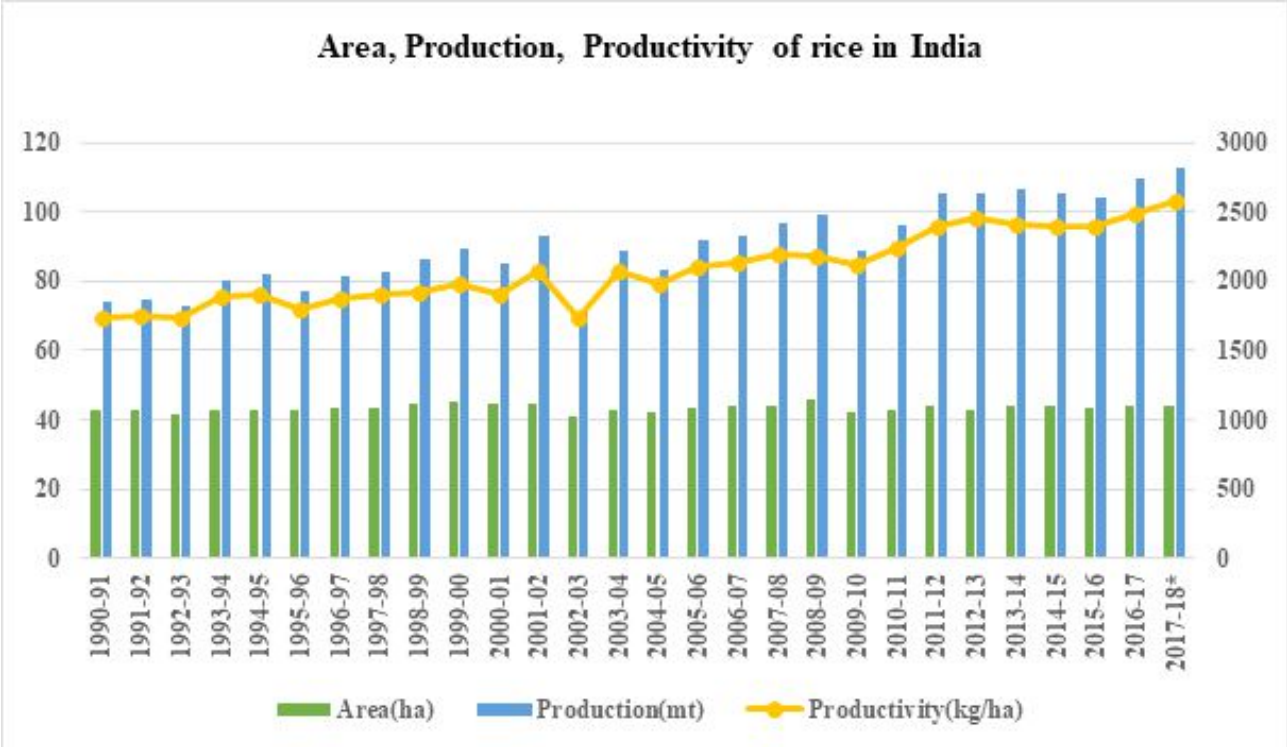


**Fig 1. Area, Production, Productivity of rice in India**

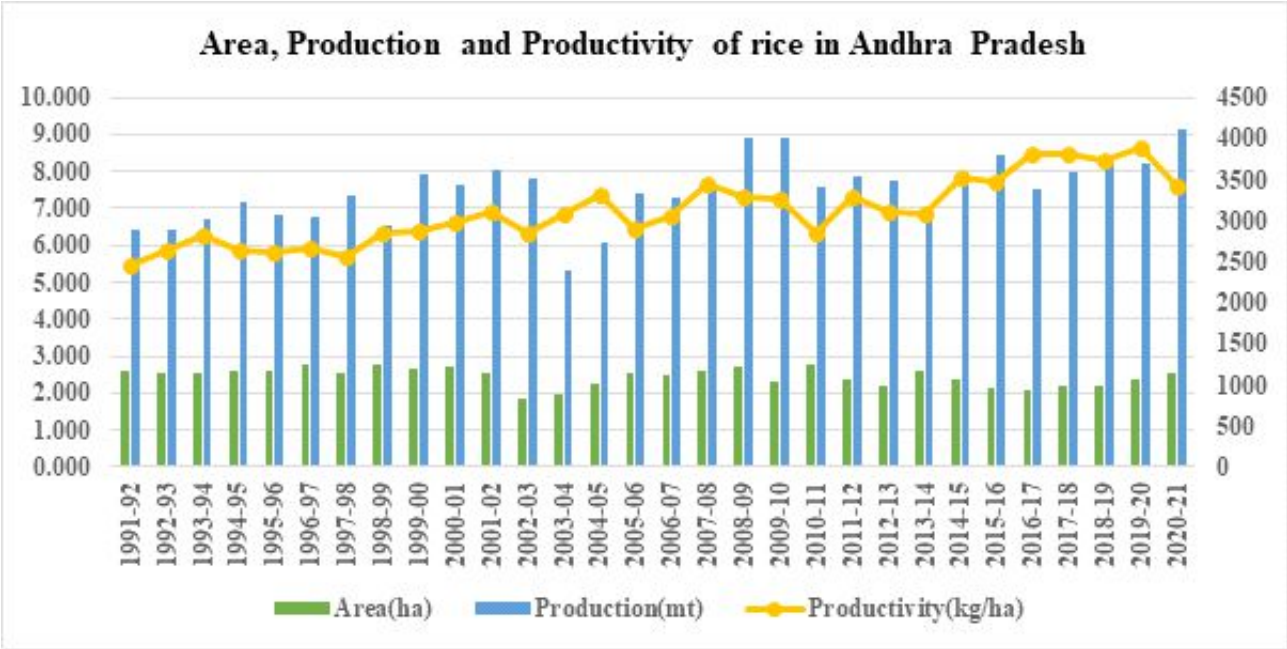


**Fig 2. Area, Production, Productivity of rice in Andhra Pradesh**

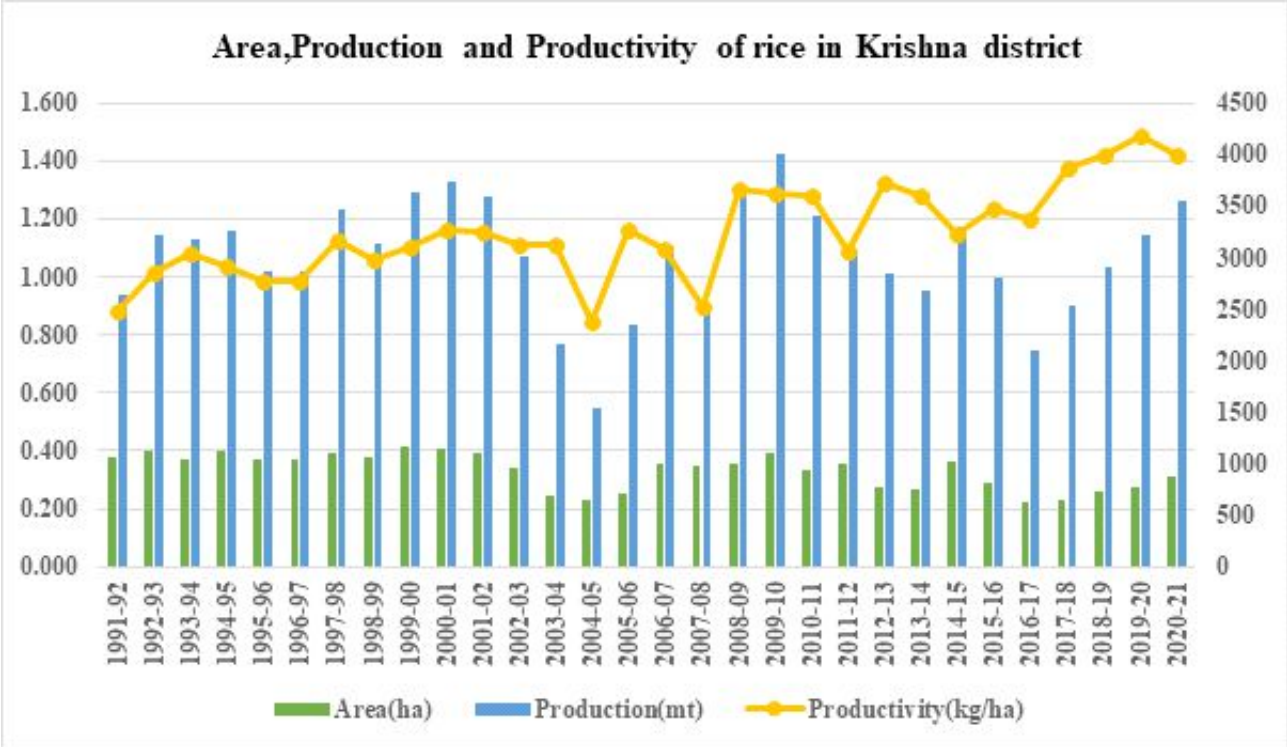


**Fig 3. Area, Production, Productivity of rice in Krishna district**

**Area under selected A.N.G.R.A.U released saline resistant rice variety, (MTU-1061) in Andhra Pradesh.**

**Table 2. Area and AAGR of MTU-1061 rice variety in Andhra Pradesh**

| S.No. | Year | Area (L ha) | Average annual growth rate |
|---|---|---|---|
| 1 | 2015-16 | 5.003 | |
| 2 | 2016-17 | 2.773 | -44.6 |
| 3 | 2017-18 | 3.343 | 20.56 |
| 4 | 2018-19 | 2.852 | -14.7 |
| 5 | 2019-20 | 3.602 | 26.3 |
| 6 | 2020-21 | 3.77 | 4.664 |
| 7 | 2021-22 | 5.003 | 32.7 |

Source: Department of Agriculture, Andhra Pradesh

**Table 3. Area and AAGR of MCM-100 rice variety in Andhra Pradesh**

| S.No. | Year | Area (ha) | Average annual growth rate |
|---|---|---|---|
| 1 | 2018-19 | 890 | |
| 2 | 2019-20 | 1790 | 68.54 |
| 3 | 2020-21 | 2400 | 60 |

Source: Department of Agriculture, Andhra Pradesh

Table 2 shows the area under MTU-1061 rice variety in A.P from 2015 to 2022, for which average annual growth rates were computed. The lowest growth rate was recorded in the year 2016-17 with 2.77 L ha where growth rate fell to - 44.6 per year. While the highest was recorded in the year 2021-22 with 5.003 L ha with a growth rate of 32.70. Since the variety is high yielding suitable to normal soils and also an additional saline resistant character, it's cultivation has showed a wide spread increase in all over the state in the recent years.

**Area under selected A.N.G.R.A.U released saline resistant rice variety, (MCM-100) in Andhra Pradesh.**

Table 3 shows the area under MCM-100 rice variety in A.P from 2018 to 2019, for which average annual growth rates were computed. The growth rate of area for the year 2019-20 was found to 68.54 and 60.00 for the year 2020-21. The substantial increase in the area under MCM-100 variety is due to adoption of the variety by the rice growers as a result of spreading awareness about the variety by the extension agents.

**Area under different A.N.G.R.A.U released rice varieties and their production estimates for Kharif 2021 in Krishna district of Andhra Pradesh.**

From Table 4, it can be observed that BPT-5204 has highest area coverage and production with 1,64961 ha with a share of 64.18 per cent. MTU-1318 variety stands in second place with an area coverage of 14984 ha having 5.83 per cent share. MTU-1061 variety accounts with an area coverage of 14676 ha, sharing 5.71 per cent which is a high yielding variety suitable to normal soils and also holding the saline resistant ability. MTU-7029 variety stands fourth with an area coverage of 13475 ha, having 5.24 per cent share. This is followed by MTU-1262 variety with an area coverage of 11613 ha . MTU-2231 variety holds an area coverage of 10999, which shares 4.27 per cent. MTU-1224 and MTU-1121 varieties share 5254 ha and 4811ha respectively out of the total 256994 ha of area under rice cultivation in Krishna district. MCM-100 shares 0.42 per cent of all rice varieties, covering 1082 hecatres.MCM-100 variety is the saline resistant rice variety being cultivated by the farmers. The percentage share of other rice varieties in Krishna district account for 6.31.

**Table 4. Area under different rice varieties for Kharif 2021 in Krishna district of Andhra Pradesh**

| S.No. | Variety | Area(ha) | Production (MT) |
|---|---|---|---|
| 1 | Samba Mahsuri (BPT-5204) | 164961 (64.18) | 774063 (54.83) |
| 2 | Indra (MTU-1061)* | 14676 (5.71) | 86458 (6.12) |
| 3 | Swarna (MTU-7029) | 13475 (5.24) | 96009 (6.80) |
| 4 | Sri Druthi (MTU-1121) | 4811 (1.87) | 36083 (2.55) |
| 5 | Akshaya (BPT-2231) | 10999 (4.27) | 82493 (5.84) |
| 6 | MTU-1318 | 14984 (5.83) | 106761 (7.56) |
| 7 | Maruteru Samba (MTU-1224) | 5254 (2.04) | 37435 (2.65) |
| 8 | Maruteru Mahsuri (MTU-1262) | 11613 (4.51) | 82743 (5.86) |
| 9 | Panduranga (MCM-100)* | 1082 (0.42) | 5626 (0.39) |
| 10 | Others | 15139 (6.31) | 109492 (7.75) |
| | Total | 256994 | 1411536 |

Source: Department of agriculture, Andhra Pradesh. Note: * indicate saline resistant rice varieties

## CONCLUSION

Growth rates of 0.081, 1.486 and 1.403 of area, production and productivity of rice in India were observed respectively from the period 1990-91 to 2017-18. Significant and positive growth rate of area, production and productivity of rice in Andhra Pradesh was reflected by 0.450, 0.832 and 1.288, from 1990-91 to 2020-21. In Krishna district, the growth rates were found to be -1.388, -0.204 and 1.201 for area, production and productivity respectively. Average annual growth rates for extent of area coverage under MTU-1061 and MCM-100 in Andhra Pradesh were computed. For MTU-1061, highest was recorded in the year 2021-22 with 5.003 L ha with a growth rate of 52.86. For MCM-100, The growth rate of area for the year 2019-20 was found to 68.54 and 60 for the year 2020-21.

The negative growth rate of area and production of rice in Krishna district has been addressed by the shifting paradigm of crop cultivation to aquaculture especially in the saline areas of the district in recent years. Introducing saline resistant rice varieties and spreading awareness about them would be a proper solution to overcome this scenario.

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