Analysis on Rice Production in Assam during 2011-2012 to 2020-2021

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Abstract

Rice (*OryzaSativa*) farming is the way of life for majority of population in the state. The study area spans with latitude 26.244156 and the longitude 92.537842 and the GPS co-ordinates of 26°14'38.9616" N 92°16'16.2312" E with the population of 3.12 crore which is around 2.58% of India's population (as per 2011 census). The total geographical area of the state is 78438sq. km. Rice is the stable food of Assam; In this background, the paper tries to examine the growth of production of rice in Assam and to examine the significant relationship among the various factors like area of cultivation, rainfall and fertilizer used with the production of rice during the study period 2011-2021.The findings reveal that there is slight variation of rice production in the study period and there is significant relationship between 'area of farming and volume of production' as well as 'rainfall and volume of production', there is no significant relationship between 'fertiliser used and volume of production'.

Keywords: 1. Rice, 2.Production, 3.Variation, 4.Area of cultivation, 5.Rainfall, 6.Fertilizers, 7.Assam.

1. Introduction

Farming is not just an occupation but a way of life for the majority of the people of India. More than 50% of India's population are directly or indirectly related to farming. Rice is one of the most import food grains farmed in India and it is the staple food of the country. Rice is the second largest cereal produced in the world after maize (Kaur,2020). India is the second largest rice producer in the world after China. The productivity of rice in India is 3.37 tonne/hater (Reddy *et. al*, 2017). In 2018, the production on rice in India was 116.42 million tonnes covering almost 35.33% of area under crops and Assam contributes 4.41% of total rice Production in the country (Devi &Singha, 2020). Assam stood ninth position among the top ten rice producing states in India during 2015-16. According to the data published in Agricultural Statistics at a Glance 2021 by Government of India Ministry of Agriculture & Farmers Welfare Department of Agriculture & Farmers Welfare Directorate of Economics &Statistics, regarding rice production in Assam, the yield of rice kg./ hectare during 2019-20 was 2176 and it was estimated at 2224 for the year 2020-21.

Rainfall pattern has a significant effect on the production of summer rice in Nalbari district of Assam (Devi &Singha, 2020). Rice production depends on the season, fertilizer, variety, environment and geographical segmentation (Mamun, AI, Abdullah, 2021, and Nirmal, 2018). Lakshmi (2009) in her study found that the change in production of rice in the area treated with fertilizers. Moreover, with the use of excess fertilizers the returns of production becomes imbalance over the years (Jayanthi, 2012). But it is found that use of silicate fertilizer has no effect on the growth and productivity of rice namely Pandanwangi and Mentiksusu(Widjajanto*et.al*, 2021).The variations in the productivity of rice depends on the use of organic and chemical fertilizers. There is significant positive variation to the response of fertilizers used and urea being most effective in the land of Assam (Das et.al, 2020 and Saikiaet.al., 2018).

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Moreover, the application of nitrogen fertilizer significantly increased the growth and yield of rice with recommendation of 100 kg/ha of nitrogen fertilizer for optimum yield (Kalita& Sharma, 2018). HYVs and irrigation facilities are the driving factors in increasing use of fertilizers in rice production. On the other hand Subash&Gangwar (2014) and Sing (2021) in their studies it is found that there is a statistically significant relationship between rainfall and the production of rice and erratic rainfall is the cause of instability of rice production in some states of India . (Kumar *et.al*, 2022) in their study revealed that iron coated seeds results higher yield than delayed sowing of seeds. However, the study found that the traditional varieties of seed produces higher productivity than its modern varieties of seed (Ojha, 2004). Some studies reported that seed borne endophytic fungi helps in growth of rice plants. The treatment with endophytic fungi resulted higher growth in shoot and in root of the plant (Roy, *et. al,* 2021).

The total production of rice in India is 121.46 million tonnes (Ministry of Agriculture Co-operation and Farmers Welfare) while the total production of rice in Assam is5213852tonnes (Directorate of Economics and Statistics 2020, Assam) and it constitutes around 96% of total food grain production in the state. The total area of the cultivated land in the state is 2360470hacterand the productivity counts at 2209 kg/ha. (Directorate of Economics and Statistics, Assam). The agro climatic parameters like uneven rainfall in the state vary the production of rice in the state.

As per 1991 Census, about 89 percent of the population in Assam lives in rural areas and 75 percent of the state's population is directly or indirectly depend on agriculture and out of the total workforce of the state 69 percent engaged in agricultural activities. From the several studies with reference to the production of rice in India it is found that there is a wide variation of rice production during the study period and it has the significant relationship with area of cultivation, rainfall and fertilizer used in the study area. Moreover, Assam being one of major rice growing state iscrucial for the overall improvement of rice production in India.Rice production in Assam and other regions of India can differ in terms of yield, quality, and profitability. Research can help identify the reasons behind these disparities and develop strategies to address them. Improving rice production in Assam can have a significant impact on the economy and food security of the state and the country. Climate change is also affecting rice production globally, and research can help understand its impact on rice production in Assam and identify adaptation strategies to mitigate its effects.

2. Materials and Methods

The study is descriptive as well as the analytical in nature and based on secondary data. In order to conduct the study the records of area of production, average rainfalls and fertilizer used are collected from Statistical Handbook of Assam and Director of Agriculture, Government of Assam for the period 2011-2012 to 2020-2021. Apart from this, information have also been collected from published books, article published in different journals, periodicals, conference paper and websites. The data collected from the secondary sources have been processed and analysed with statistical toolssuch as Pearson's correlation coefficient and regression analysis. The Microsoft Excel is used to analyse data.To examine the significant relationship among the various factors like area of cultivation, rainfall and fertilizer used with the production of rice during the study period 2011-2021, the researcher have been formulated three hypothesises: Ho1: There is no significant relationship between area of cultivation and rice production in Assam during 2011-2012 to 2020-2021; Ho2: There is no significant relationship between average rainfall and rice production in Assam during 2011-2012 to 2020-2021 and Ho3: There is no significant relationship between fertilizer used and rice production in Assam during 2011-2012 to 2020-2021.

3. Results and Discussion

(A) The growth of rice production in Assam during 2011-2012 to 2020-2021:

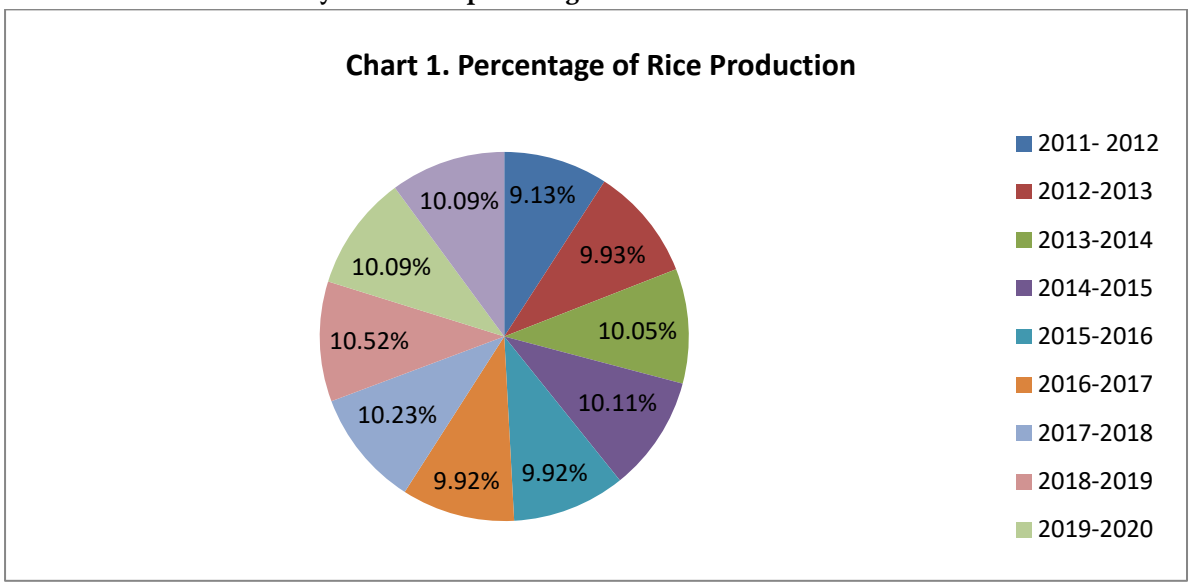
Table 1 (a) shows the year wise rice production in Assam during 2011-12 to 2020-21. It is revealed that out of the total production of rice (51662435 tonnes for ten years) the percentage of rice production in Assam for the period 2011-2012 is observed as 9.13 percent and it is increased to 9.93 percent in 2012-2013. A slight increase during the 2013-2014, 2014-2015, 2015-2016, 2016-2017, 2017-2018, 2018-2019, 2019-2020 and 2020-2021 is observed; the percentage of rice production to the total production which is observed during these years are 10.05 percent in 2013-2014; 10.11 percent in 2014-2015; 9.92 percent in 2015-2016; 9.92 percent in 2016-2017, 10.23 percent in 2017-2018; 10.52 percent in 2018-2019; 10.09 percent in 2019-2020 and 10.09 percent in 2020-2021 respectively. During the period 2018-2019 the highest rice production is found during 2018-2019 and lowest production is observed during the period 2011-2012. The Year-wise percentage of Rice Production in Assam to the total production during the study period 2011-2012 to 2020-21 is shown in Pei Chart.1.

Table 1(a): Growth of Rice Production in Assam.

Year (as on 31st March)	Production (in tonnes)	Growth rate	% to the total production
2011-2012	4715678	--	9.13
2012-2013	5128508	0.087544	9.93
2013-2014	5193379	0.012649	10.05
2014-2015	5222645	0.005635	10.11
2015-2016	5125104	-0.01868	9.92
2016-2017	5127435	0.000455	9.92
2017-2018	5283713	0.030479	10.23
2018-2019	5437372	0.029082	10.52
2019-2020	5214749	-0.04094	10.09
2020-2021	5213852	-0.00017	10.09
Total	51662435		100.00

Source: Director of Agriculture, Assam (from 2011-12 to 2020-21)

Chart1: Production of rice year wise in percentage



Source: Compiled from the Table 1(a)

Table 1(a), also clearly indicates the growth rate of rice production in Assam. The highest growth rate is found during 2012-2013 and lowest rate is observed during the period 2016-2017 and 2020-2021. There is negative growth rate during 2015-2016, 2019-2020, whereas, slight positive growth rate is found in 2013-2014, 2014-2015, 2017-2018 and 2018-2019. It is revealed that there is slight variation in the growth of rice production in Assam.

Table1 (b), reveals the information about the area of cultivation, average rainfall and fertilizer used in the production of rice during 2011-2012 to 2020-2021 in Assam.

Table: 1 (b) : Area of Cultivation, Average Rainfall and Fertilizer used in Rice Production of Assam

Year (as on 31st March)	Area (in hect)	Average Rainfall(in mm)	Fertilizers Used N+P+K(in MT)
2011-12	2545707	1566.6	117670
2012-13	2488228	2151.8	105957
2013-14	2503201	1706.8	120189.04
2014-15	2495297	1861.6	135328.04
2015-16	2484987	2077.8	111322.7
2016-17	2467136	2042.2	95856.74
2017-18	2433711	2338.8	111176.03
2018-19	2425178	2937.4	136098.06
2019-20	2400949	2251.7	128983.03
2020-21	2360470	2652.8	136159

Source: Director of Agriculture, Assam (from 2011-12 to 2020-21), N-Nitrogen; P-Phosphorous; K-Murate of Potash

(B) Relationship between 'area of cultivation, average rain fall , fertilizer consumption' and rice production in Assam:

The Pearson Co-efficient of correlation is calculated in order to find out the nature of relationship between 'area of cultivation, average rain fall , fertilizer consumption' and 'volume of rice production' in Assam; and it is found that in case of 'area of plantation and 'volume of rice production', value is -

0.63761. It indicates that there is an inverse relationship between 'area of rice cultivation' and 'rice production in Assam' during the study period. Regarding relationship between 'average rain fall' and 'volume of rice production' Pearson Co-efficient of correlation value is found to be 0.736899; it indicates that there is high positive relationship between average rainfall and rice production in Assam during the study period. However, in case of 'fertilizer consumption' and 'volume of rice production', the Pearson Co-efficient of correlation value is 0.3566533447, it indicates that though there is positive relationship between fertilizer used and rice production in Assam during the study period, there is weak relationship between these two variables during the study period.

Table 2.a clearly shows how strong the liner relationship between the 'area of cultivation and rice production', 'rainfall and rice production' and 'fertilizer used and rice production'. The Multiple R value of 'area of cultivation and rice production', 'rainfall and rice production' are found to be 0.64 and 0.74 respectively whereas Multiple R value of 'fertilizer used and rice production' is found to be 0.36. It clearly indicates that while the strength of relationship is found to be 'moderate' in case of area of cultivation and rice production', 'rainfall and rice production', in case of 'fertilizer used and rice production', the strength of relationship is found to be 'weak'. The R square result clearly shows how much influence the land area of cultivation, rainfall and fertiliser utilisation has on volume of rice production. While the R square values of 'land area of cultivation and volume of rice production' and 'rainfall and volume of rice production' are found to be 0.4 & 0.5 respectively, the R square values of 'fertiliser utilisation and volume of rice production' is found to be 0.1. it clearly reveals that while land area of cultivation and rainfall have moderate influence of volume of rice production, fertiliser utilisation has very weak influence on volume of rice production in Assam during the study period.

Table 2. a

Summary output, *Regression Statistics*

SUMMARY OUTPUT					
Regression Statistics					
Area and production		**Rainfall and production**		**Fertilizer and production**	
Multiple R	0.637606	Multiple R	0.736899	Multiple R	0.356653
R Square	0.406542	R Square	0.54302	R Square	0.127202
Adjusted R Square	0.33236	Adjusted R Square	0.485898	Adjusted R Square	0.018102
Standard Error	150042.4	Standard Error	131664.1	Standard Error	181960
Observations	10	Observations	10	Observations	10

Source: computed based on data collected by the researchers

Hypothesis Testing Results

Relationship between 'Rice production In Assam' and 'area of cultivation, rainfall and fertilizer used' is shown in Table, 2.a; 2.b, and 2.c.

Table 2.b: ANOVA result

Area and production					
ANOVA					
	Df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.23E+11	1.23E+11	5.480309	***0.047341***
Residual	8	1.8E+11	2.25E+10		
Total	9	3.03E+11			
Rainfall and production					

ANOVA					
	Df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1.65E+11	1.65E+11	9.506249	***0.015043***
Residual	8	1.39E+11	1.73E+10		
Total	9	3.03E+11			
Fertilizer and production					
ANOVA					
	Df	*SS*	*MS*	*F*	*Significance F*
Regression	1	3.86E+10	3.86E+10	1.16592	***0.311716***
Residual	8	2.65E+11	3.31E+10		
Total	9	3.03E+11			

Source: computed based on data collected by the researchers

Table, 2.c: Standard Error, t and P - Value

Area and production								
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	10404142	2237959	4.648942	0.001647	5243399	15564886.17	5243398.778	15564886.17
X Variable 1	-2.12881	0.909355	-2.34101	***0.047341***	-4.22578	-0.031829182	-4.22578344	-0.031829182
Rainfall and production								
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	4463440	231715.9	19.26255	5.47E-08	3929102	4997778	3929102	4997778
X Variable 1	325.5603	105.591	3.08322	***0.015043***	82.06705	569.0536	82.06705	569.0536
Fertilizer and production								
	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	4607129	520992.3	8.842989	2.11E-05	3405719	5808539	3405719	5808539
X Variable 1	4.664186	4.319578	1.079778	***0.311716***	-5.29678	14.62515	-5.29678	14.62515

Source: computed based on table 1 (a) and table 1 (b).

With regard to Null Hypothesis Ho1

The test result shows that at 95 percent confidence level at 9 degree of freedom the P- value is 0.047341 which is less than or almost equal to 0.05, hence , the hypothesis is rejected. It means there is statistically significant relationship between 'area of cultivation and volume of rice production' in Assam during the study period.

With regard to Null Hypothesis Ho2

The test result shows that at 95 percent confidence level at 9 degree of freedom the P- value is 0.015043 which is less than or 0.05 , hence , the hypothesis is rejected. It means there is significant relationship between average rainfall and rice production in Assam during the study period.

With regard to Null Hypothesis Ho3

The test result shows that at 95 percent confidence level at 9 degree of freedom the P- value is 0.311716 which is higher than or 0.05, hence, the hypothesis is accepted. It means there is no significant relationship between fertiliser used and rice production in Assam during the study period.

4. Conclusion

The study revealed that the growth rate of rice production in Assam is not satisfactory during the study period. There is slight increase in growth rate is found during the period 2012-13, 2013-14,2017-18 and 2018-2019 respectively. However, negative growth rate is found during the period 2015-2016 and 2019-2020. The test results shows that there is a significant relationship between average rainfall and rice production and there is no significant relationship between fertilizer used and rice production in Assam during the study period. The findings clearly indicate that the rice production in Assam is highly depends on monsoon and the erratic rainfall and lack of fertilizer management system are the main cause of low growth rate of rice production in Assam. Therefore, there is a scope of further study on the effectiveness of irrigation policy, fertilizer management system and its level of awareness among the farmers to increase the rice production in Assam. Moreover, the Government should also give more emphasis on irrigation policy; in addition to this, other policies like fertilizer subsidy, minimum support price policy, and agricultural credit policy are to be framed and implemented in good sprit in order to enhance the production of rice in Assam.

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