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STATEMENT OF THE PROBLEM

OBJECTIVES

HYPOTHESES

RESEARCH METHODOLOGY

RESULTS & DISCUSSION

FINDINGS

RECOMMENDATIONS/SUGGESTIONS

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TREND OF AREA, PRODUCTION AND PRODUCTIVITY OF RICE CROP IN ASSAM

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ABSTRACT

Though there was a remarkable shift in the state's economy from primary to secondary and tertiary sector in the recent years, Assam still continues to be predominantly an agrarian economy. Agricultural sector continues to support more than 75% population of the state directly or indirectly providing employment of more than 53% of the total workforce (Economic Survey, Assam, 2011-12). Rice is the main crop of Assam. So, the growth and development of rice cultivation is very important in Assam. The total rice production in the state stands at 1.141million tonnes to 5.086million tonnes with an average rice crop yield ranging from 855 kg/ha to 1969 kg/ha during 1950-51 to 2010-11 period. This increase in yield was primarily due to increase in area under modern variety since 1980s. Rice yield thus found positively associated with the adoption of modern technology. However, the adoption needs to be further accelerated because at the current rate of increase in area under HYV, the state would take at least two decades to achieve complete adoption level. Thus the task for development of this sector is very challenging. Besides, mere enhancing production and productivity of rice, overall development of this sector is need of the hour, not only for the state alone but also for other rice consuming states in the country.

KEYWORDS

Assam, Rice, State.

INTRODUCTION

Rice is the main crop of Assam and it occupies about two third of the total cropped area in the state. Another specialty is that the rice is traditionally grown throughout the year viz., ahu or autumn rice (February/March-June/July), sali or winter rice (June/July-November/December) and boro or summer rice (November/December-May/June) with sali or winter rice is the dominant crop of the state.

The total rice production in the state stands at 1.141million tonnes to 5.086million tonnes with an average rice crop yield ranging from 855 kg/ha to 1969 kg/ha during 1950-51 to 2010-11 period. On the demand side, though the decadal population growth rate of Assam has declined from 18.92 percent to 16.93 percent in 2011, the requirement of rice in the state is still high as the population of the state has reached an all time high mark of 31 million, with a population density of 397 persons per sq.km(2011,census report). Thus, it is imperative to take in-depth study in the trend of area production and productivity of rice in Assam.

REVIEW OF LITERATURE

At present numbers of rice technologies are developed to suit the Assam condition. But those technologies are yet to adopt by farmers to a greater extent. From various studies, it is clear that Assamese farmers do not adopt rice technologies properly. In a study conducted by Hussain (1982) found that majority of Assamese farmers did not adopt recommended rice technologies. In another study, Gogoi (1989) found that overall adoption of recommended plant protection measures was low to medium in Assam. Das (1996) observed that 37.5% farmers had full gap of adoption of sali rice technologies. In case of hybrid rice varieties, Basumatary (2000) found that majority of farmers of Assam obtained low yield to very low as compared to the yield of potentials of hybrid varieties of rice. In a study, Deka (2004) determined the factors causing instability and inefficiency in rice production in Upper Brahmaputra Valley Zones (UBVZ) and Hilly Zones (HZ). Among the factors affecting instability in yield of total rice, irrigation, fertilizer and rainfall have been found to have reducing but non- significant on instability in yield in UBVZ. In HZ irrigation, fertilizer and rainfall have been found to have negative effect on instability in yield. Cropping intensity has been found to have inverse relation to farm-size, being the highest in marginal and lowest in large farms for both the zones. Drought is a major constraint affecting rice production especially in rainfed areas of Asia. Despite its importance in rice growing areas, the magnitude of economic losses arising from drought, its impact on farm household and farmer's drought coping mechanisms are poorly understood. Pandey et.al. (2006) provides insights into these aspects of drought based on a cross-country comparative analysis of rainfed rice growing areas in China, India and Thailand and found that economic cost of drought is substantially higher in eastern India than in other two countries. Higher probability and greater spatial covariance of drought and less diversified farming systems with rice accounting for a large share of household income are likely to be the main reasons for this higher cost of drought in eastern India. Farmers deploy various coping mechanisms but such mechanisms are largely unable to prevent a reduction in income and consumption, especially in eastern India. As a result, welfare consequences on poor farmers are substantial with a large number of people falling back into poverty during drought years. In a recent study conducted by Saikia (2012) found that the adoption behaviour of farmers of Assam is very poor. According to her, 79.17% farmers possessed poor adoption behavior in case of sali rice production technology, the main crop of Assam. If this trend continues then Assam will not achieve the target and will face the problems of savior food insecurity. Therefore, the state should take necessary step to increase the rate of adoption of rice technologies among farmers. Singh (2013) made an attempt to understand the status of rice cultivation and inter-district disparity within the state by using an Agricultural Development Index (ADI).The index results shows that the status of agricultural sector (rice cultivation) in Assam is much lower than the national level. Besides, the inter-district disparity in terms of overall development of this sector (rice cultivation) is also clearly visible in the state.

STATEMENT OF THE PROBLEM

In Assam, rice has been the major food in the consumption basket. But the state has by and large fallen in a situation of 'food -trap' in the post independent period where the growth in consumption demand for rice persistently exceeds the production growth for a longer period. The result once a surplus state become a net importer of rice from the early 1970's. Though there have been some achievements in the 1980's, the process again weakened in the later period (Barah, Betne and Bhowmick, 2001). Insufficient irrigation facilities, lack of technical knowhow, and damage caused by natural calamities coupled with inconsistent weather like flood stands as impediment in the production of rice in Assam.

OBJECTIVES

TO NARROW DOWN THE AREA OF STUDY, SOME SPECIFIC OBJECTIVES OF THE PRESENT STUDY ARE LISTED BELOW:-

1. To study the trend and growth of area, production and yield of rice in Assam in comparison with India.
2. To analyze the area and production status of rice in Assam.

RESEARCH METHODOLOGY

The study is based upon secondary data. The data were collected from the various publications and websites of Director of Economics and Statistics government of India and Department of Agriculture, Assam state. The other requisite data were collected from the various published and unpublished sources. The basic statistics viz. arithmetic mean(X) standard deviation (SD) and co-efficient of variation (CV) were estimated to know the average position and variability in the

area and production of rice in Assam in comparison with India. Karl Pearson's coefficient of correlation method is also used to analyse the area and production status of rice in Assam.

DURATION OF PERIOD

The data have been collected for the period 1950-51 to 2010-11.

RESULTS AND DISCUSSION

TREND AND GROWTH OF AREA, PRODUCTION AND YIELD OF RICE IN ASSAM IN COMPARISON WITH INDIA

During sixty years since independence, the area under rice has increased by about 70.26 percent, while the production has more than doubled registering about 345.74 percent growth, mainly on account of area expansion. The linear growth rate of productivity is barely 130.29 percent during (1950-51 to 2010-11) period, which is quite low. Thus, the state agriculture department has prioritized optimum and efficient use of available resources to enhance the production and productivity of the rice. In Assam, the soil, topography, rainfall and climate in general are congenial for agricultural activities mainly for paddy cultivation. The paddy cultivation occupies 91.5% of the net cropped area and 62.6% of the gross cropped area in the state during the year 2010-11 (Economic Survey, 2011-2012).

TABLE 1: TREND AND GROWTH OF AREA, PRODUCTION AND YIELD OF RICE IN ASSAM (1950-51-2010-2011)

Year	Area (million hectares)	Production (million tonnes)	Yield (kg/ha)
1950-51	1.510	1.141	855
1960-61	1.716	1.633	968
1970-71	1.974	1.986	1022
1980-81	2.228	2.459	1120
1990-91	2.526	3.270	1313
2000-01	2.652	4.170	1470
2010-11	2.571	5.086	1983

Source: - Directorate of Economics and Statistics, Department of Agriculture, Assam state

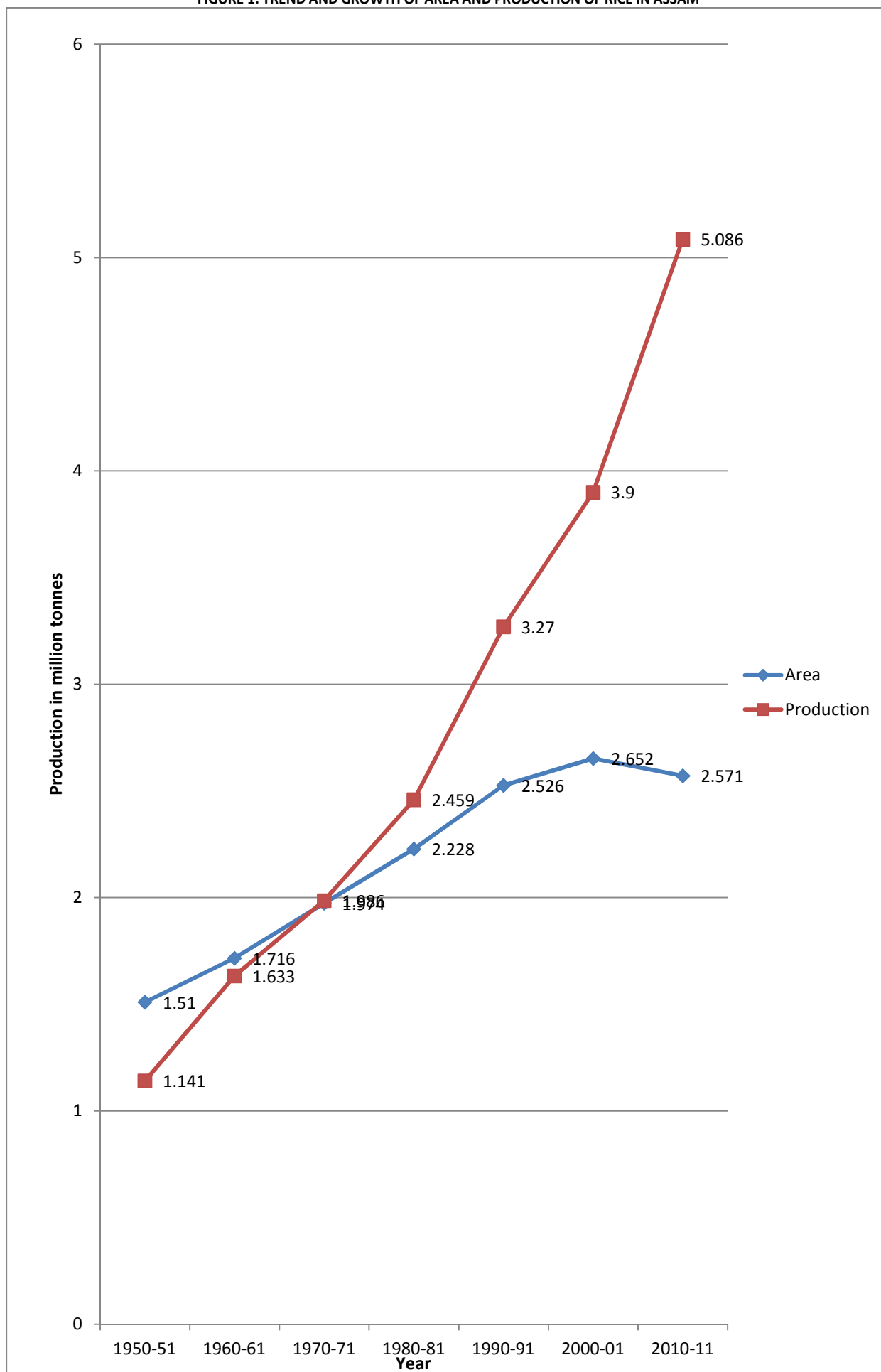
TABLE 2: TREND AND GROWTH OF AREA, PRODUCTION AND YIELD OF RICE IN INDIA (1950-51 to 2010-2011)

Year	Area (million hectares)	Production (million tonnes)	Yield (kg/ha)
1950-51	30.81	20.58	668
1960-61	34.13	34.58	1013.2
1970-71	37.59	42.22	1123.2
1980-81	40.15	53.63	1335.7
1990-91	42.69	74.29	1740.2
2000-01	44.71	84.98	1900.7
2010-11	42.86	100.00	2240.0

Source: Directorate of Economics and Statistics, Government of India, Krishi Bhavan, New Delhi.

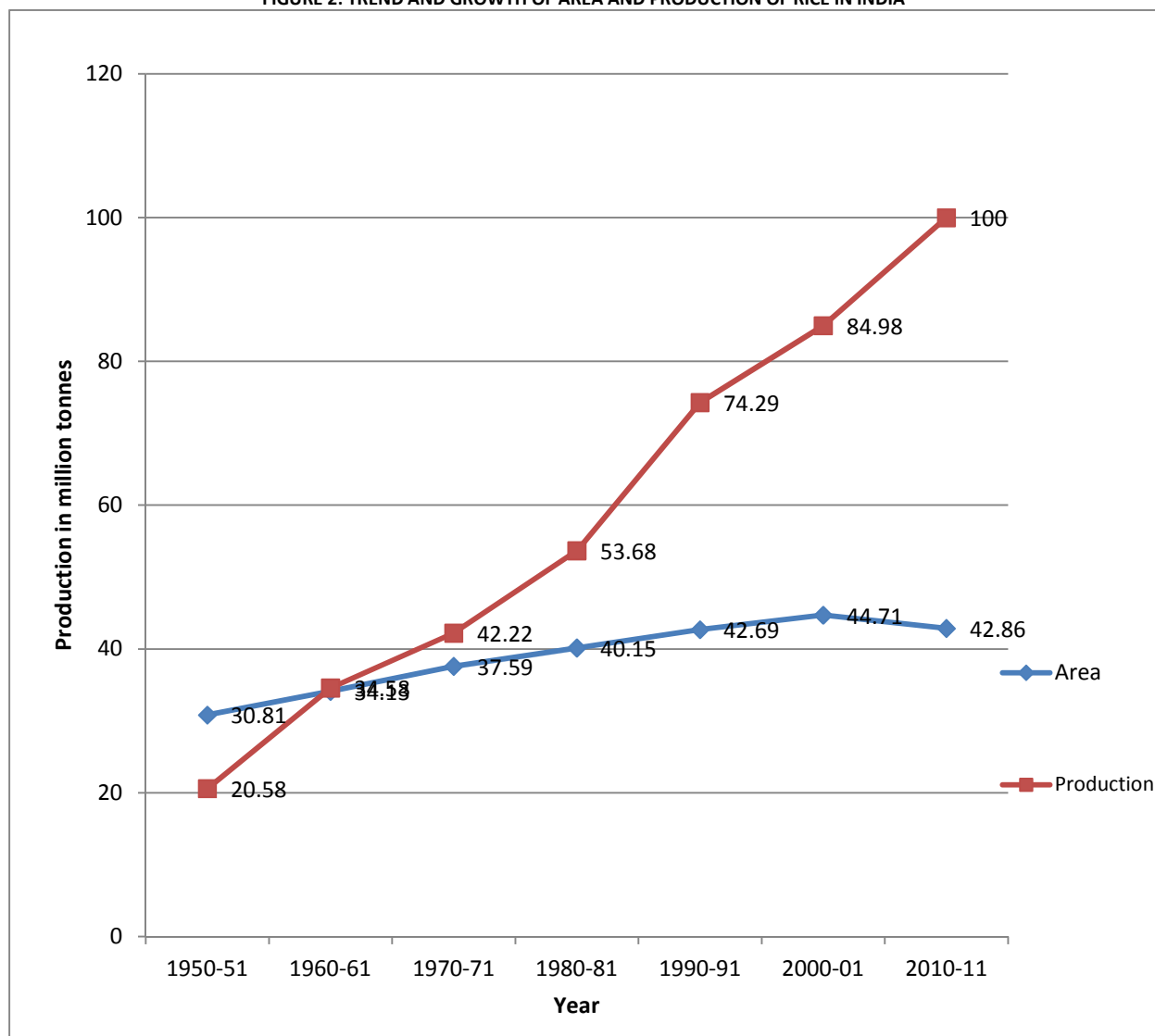
Despite the fact that yield rates of the principal crops have increased since independence, these are still below the average yield rates of the country and significantly below the yield rates of the high performing states. So, this implies that to increase or to meet the projected demand of rice in this state, we have to either increase the production of rice by introducing some new varieties or with the existing modern varieties or steps have to be initiated for the expansion of area under rice cultivation. But more than 83 farmers of Assam are small and marginal farmers and situation is rainfed, hence there is no ample scope to increase the area under rice cultivation. So, the best way to meet the projected demand of rice is to increase the production of rice by introducing some new varieties. According to agronomists, the potential yield and average yield of some varieties of rice like, Ranjit, Bahadur, Kushal, Maniram, Piyolee, Gitesh, Jalashree, etc ranges from about 5-7 t/ha provided, all the recommended practices are followed rightly. Whereas, the present average yield of rice in the farmer's fields ranges from about 1-2.5 t/ha (Saikia and Barman, 2013).

FIGURE 1: TREND AND GROWTH OF AREA AND PRODUCTION OF RICE IN ASSAM



Source: Directorate of Economics and Statistics, Department of Agriculture, Assam state.

FIGURE 2: TREND AND GROWTH OF AREA AND PRODUCTION OF RICE IN INDIA



Source: Directorate of Economics and Statistics, Government of India, Krishi Bhavan, New Delhi.

From the figure (1) and (2), it was observed that there has been fluctuation in area, production and productivity of rice both in Assam with the increasing trend, but it is much lower than the national average. To achieve the target of rice production, it is important to increase the rate of adoption of rice technologies. For production of yield fertilizer plays an important role. But the trend of fertilizer consumption in the state in terms of nutrient (NPK) per hectare as much lower than the national average consumption. According to the state agriculture department, consumption of fertilizer in the state was at 67.09 kg per hectare during the year 2010-11. Integrated Pest Management (IPM) is another key component of sustainable agricultural production. Assam having a diverse eco-system with sub-tropical climate, the crop production is associated with loss of biotic stress problem which share 20-30 % of the yield loss. In case of modern rice cultivation farm mechanization is a critical input as it facilitates timely agricultural operation. But in Assam, the growth of mechanization is also slow. At present, the availability of farm power in the state is only 0.90 HP per hectare as compared to 1.40 HP per hectare at national level (Economic Survey, Assam, 2011-12). In order to make the point more clear and to know the variations and extent of growth in area, production and productivity of rice the statistical analysis were carried out by using various statistical tools as presented in table below-

TABLE 3: VARIABILITY, TREND AND GROWTH ANALYSIS OF RICE USING STATISTICAL TOOLS (1950-51 to 2010-11)

Statistical tools	Assam		India	
	Area(million hectares)	Production(million tonnes)	Area(million hectares)	Production(million tonnes)
A.M.	2.16	2.78	38.99	58.61
S.D.	0.17	1.74	22.14	35.40
C.V. (%)	7.87	6.25	56.78	90.79

Source: Computed by Author.

From the table (3), variability in area under rice was more 56.78 percent for all India level followed by 7.87 percent for Assam. Similarly, the variability in the production of rice was more 90.79 percent for the overall India level. This has indicated comparatively low instability in production of rice at Assam than the all India level. This may due to the soil of the state is mostly fertile alluvial soil and this adjoining with river Brahmaputra are composed of sandy and clay in varying proportion makes it possible to grow different varieties of rice. The Union Government in 2008-09, recognized Assam as the best performing state amongst the seven eastern zone states, which include West Bengal, Orissa, Bihar, Jharkhand, Chattisgarh, Uttar Pradesh and Assam, for its encouraging progress in production and productivity of rice under the National Food Security Mission (The Assam Tribune, 2010).

TABLE 4: CORRELATION ANALYSIS BETWEEN AREA AND PRODUCTION STATUS OF RICE IN ASSAM

Year	X	X ²	Y	Y ²	XY
1950-51	1.510	2.2801	1.141	1.3018	1.72291
1960-61	1.716	2.9446	1.633	2.6666	2.8022
1970-71	1.974	3.8966	1.986	3.9441	3.9203
1980-81	2.228	4.9639	2.459	6.0466	5.4786
1990-91	2.526	6.3806	3.270	10.6929	8.2600
2000-01	2.652	7.0331	3.900	15.2100	10.3428
2010-11	2.571	6.6100	5.086	25.8673	13.0761
N=7	15.177	34.1089	19.475	65.7293	45.6099

Source: - Computed by Author

THE METHOD OF KARL PEARSON'S CORRELATION OF COEFFICIENT

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{\sum X^2 - \frac{(\sum X)^2}{N}} \times \sqrt{\sum Y^2 - \frac{(\sum Y)^2}{N}}}$$

$$= \frac{45.6099 - \frac{15.177 \times 19.475}{7}}{\sqrt{34.1089 - \frac{(15.177)^2}{7}} \times \sqrt{65.7293 - \frac{(19.475)^2}{7}}}$$

$$= \frac{3.3854}{\sqrt{1.203} \times \sqrt{11.5471}}$$

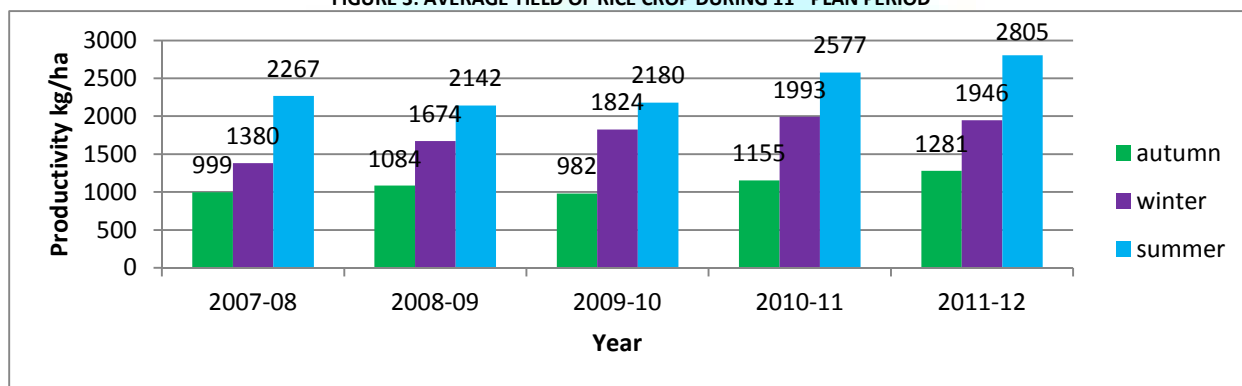
$$= \frac{3.3854}{1.09 \times 3.398}$$

$$= \frac{3.3854}{3.7038}$$

= 0.9140342351 (highly positive correlation)

If we take area under rice as a major aspect in enhancing the rice production throughout the years we may find a highly positive correlation between them that is, +0.9140342351.

The present paper is divided into seven sections. Starting from introduction, review of literature, objectives and statement of the problem in section I, II, III and IV respectively, section V deals with the methodology in the context of rice cultivation in Assam. The section VI portrays the results and discussions of rice cultivation and it is followed by findings, suggestion and conclusion as whole in section VII.

FIGURE 3: AVERAGE YIELD OF RICE CROP DURING 11th PLAN PERIOD

Source: Directorate of Economics and Statistics, Assam

Winter (kharif) rice dominates both area and production in Assam, followed by autumn (pre-kharif) rice and summer (rabi) rice). But the share of winter rice declined from 78 percent in 1952 to 66 percent in 1999. Thus, the state should adopt appropriate policy strategy to enhance the yield of winter rice at least to the level of national level. The area under summer rice showed an increasing trend over the period of last eleven years (1998-99 to 2008-09). It was 10.28 percent more in 2008-09 as compared to the area during 2007-08 (3.23 lakh hectares). The production of summer rice in the state was 7.68 lakh tonnes during the year 2008-09 which was recorded as all time high in the state. It was about 4.88 percent higher than for the year 2007-08 (7.32 lakh tones). However the yield rate of summer paddy was marginally low during 2008-09 as compared to the yield rate of 2007-08 (Gogoi and Bordoloi, 2011). During 11th plan period yield of summer rice has increased by about 24 percent which is quite satisfactory.

TABLE 5: TARGET OF AREA, PRODUCTION AND PRODUCTIVITY OF RICE CROP DURING 12th PLAN PERIOD (AREA IN LAKH HECTARE, PRODUCTION IN LAKH MT AND PRODUCTIVITY IN KG PER HECTARE)

Rice	2012-13	2013-14	2014-15	2015-16	2016-17
Area	27.20	27.90	28.40	29.50	30.00
Production	65.00	68.00	70.00	73.40	75.00
Productivity	2420	2470	2495	2515	2530

Source: Directorate of Economics and Statistics, Assam.

MAJOR FINDINGS OF THE STUDY

1. There is a slight increase of area under rice in Assam from 1.510 million hectares to 2.571 million hectares during 1950-51 to 2010-11 period followed by production and productivity from 1.141 million tonnes to 5.086 million tonnes and 855 kg/ha to 1983 kg/ha in the same period.
2. There is slight variation in the area and production of rice in Assam and the overall India levels.
3. A highly positive correlation (+0.9140342351) exists between area and production of rice in Assam.

SUGGESTIONS

1. A proper research programme is required to be carried out for improving physiological efficiency of plant for better photosynthesis efficiency and translocation so as to reduce sterility under low light intensity, thereby increasing productivity.
2. Cultivation of hybrid rice is required to be popularized among the farmers in suitable so that production and productivity areas can be increased.
3. Use of Bio-fertilizers such as Blue Green Algae, Azospirillum, Azotobacter and Azolla may be encouraged among the farmers for supply of nitrogenous nutrient and thereby reducing the cost of chemical nitrogenous fertilizers.
4. To encourage the Integrated Pest Management approach for effective control of pests and diseases by emphasizing the need based application to pesticides.
5. Strong extension network for effective transfer of latest technologies, improvement of credit and market facilities and crop insurance are required for rainfed lowland ecology.
6. Sustainability from both ecological and economic point of view is important for increasing rice productivity in different ecosystem.

CONCLUSION

Being the main item of food basket, rice was of crucial importance to the agricultural economy as we have analyzed above. Though there is an increasing trend of area and production of rice in Assam, its production has been subjected to multiple risks. Slow technical change and negligible support of infrastructure including surface irrigation facility, hampered the growth of rice production system in Assam. Besides, low input use also affected rice production. The use of chemical fertilizer was lower than the national average. Thus the Government should come forward and take appropriate policy measures for the upliftment of this sector.

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