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Annual growth rate of winter rice (Sali rice) in the Nalbari district of Assam (India)

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Abstract

The present study was carried out in the Nalbari district of Assam to analyze area, production and productivity of rice. The Nalbari district was selected purposively for the study as the district is a predominantly rice growing district and also from the points of convenience and acquaintance of the researcher. A Multistage Stratified Random Sampling technique was used to select the ultimate sample units i.e., the rice growing farmers from six selected villages of two development blocks, viz, Tihu and Borigog-Banbhag. In total 120 rice growers were selected randomly for the study. Compound Annual Growth Rate (CAGR) was calculated for area, production and productivity for summer, winter and autumn rice. The area, production and productivity in the state increased marginally during the last decade. Farm wise distribution of land indicated availability of more numbers of small farmers as compared to marginal, medium and large farmers. Also among the autumn, winter and summer rice, the summer rice indicated positive Compound Annual Growth Rate (CAGR) in area, production and productivity against autumn and winter rice which had negative Compound Annual Growth Rate (CAGR) during (2004-15).

Keywords: Annual Growth rate, autumn rice, winter rice, Random sampling technique, Productivity

1. Introduction

At present, rice (*Oryza sativa*) occupies about two-third of the total cropped area in the state. Being the major contributor towards agricultural GDP, rice plays a significant role in the state economy. Further, its importance in the consumption basket the average monthly consumption per capita is about 13kg (Barah *et al*, 2009) [10] also speaks volumes on the rice orientation of the state. Another specialty is that rice is traditionally-grown throughout the year viz. winter, autumn and summer seasons, with winter (kharif) rice as the main crop. India ranked second after china in terms of rice production. At the national level, Assam covers over 5 per cent of rice area and contributes 4 per cent of rice production. Rice is the major food crop in Assam as well as in the country. The crop accounts for nearly 41 percent of the total area under production (Barah *et al*, 2009) [10] in India and around 20 percent in total world rice contribution. As per Economic survey of Assam 2014-15 the paddy cultivation, during the year 2013-14 occupies 89.0 percent of the net cropped area and 60.0 percent of the gross cropped area in the state. Assam is one of the seven states of northeast India, which is located between 260°N and 5805°N latitudes and 91007°E and 91047°E longitudes. Wide variation of physiographic features and climatic characteristics have resulted three distinct growing seasons of rice viz., *ahu* (Feb /March - June /July), *sali* (June/July - Nov /December) and *boro* (Nov /December -May /June). Rice production in Assam plays an important role because rice is a staple food for Assam. So the production pattern and trend must be ascertained to identify the constraints associated with rice production. There are many threats related with rice production like continuous use of traditional varieties due to the non-availability of seeds, farmer's lack of awareness about high yielding varieties, Poor adoption of improved crop production technology etc. As per Economic Survey of Assam in 2014 rice production in Assam was 2101 kg/ha that was promising but the state need to produce more for exporting rice to improve the state economy. Rice production share in Indian total production by the state was 4.29 percent. Assam has made a significant turnaround in attaining self-sufficiency in rice in the last one decade or more. Total rice production in the state may be increased by cultivating new HYV & Hybrid developed by AAU like *Ranjit* which is a low land rice variety, *Luit* and *Kopili* as post flood rice variety, *Jallashri* as submergence tolerant variety (source: package of practice: kharif crops, AAU, 2009).

2. Methodology

Area, production and productivity of rice

Time series data on area, production and productivity of autumn, winter and summer rice were collected from different publications, websites etc. Compound Annual Growth Rates (CAGR) of area, production and productivity of rice was calculated by using the formula given below.

$$y = abt$$

Or

In log form; $\text{Log}y = \text{log}a + t\text{log}b$

Where, y = Area, production and productivity of rice

t = Number of years

a = Constant

b = Regression coefficient or trend value

The Compound Annual Growth Rate (CAGR) has been defined as,

$$\text{CAGR} = (\text{Antilog}b - 1) \times 100$$

The present study has been conducted with the objectives of to analyze the area, production and productivity of rice in Nalbari district

3. Discussion and Results

3.1 Area, production and productivity of rice in India

The area, production and productivity of total rice in India and the Compound Annual Growth Rate (CAGR) for the period of 2004-05 to 2013-14 is shown in (Table 1)

Table 1: Areas, Production and Productivity of Rice in India

Year	Area (million ha)	Production (million tons)	Productivity (kg/ha)
2004-05	41.91	83.13	1983
2005-06	43.66	91.79	2102
2006-07	43.81	93.36	2131
2007-08	43.92	96.69	2201
2008-09	45.54	99.18	2177
2009-10	41.92	89.09	2125
2010-11	42.86	95.98	2239
2011-12	44.01	105.30	2392
2012-13	42.75	105.24	2461
2013-14	42.4	101.80	2400
CAGR %	0.12	2.05	1.93

Source: All India Rice Exporters Association, 2012 and Agricultural Statistics at a Glance, 2014

The (Table 1) revealed the CAGR of area; production and productivity were 0.12, 2.05 and 1.93 respectively. The historical data indicated that CAGR of area under rice cultivation in India increased at a CAGR of 0.12 percent during 2004-14. In the same period CAGR of production and productivity has increased by 2.05 percent and 1.93 percent respectively.

Production declined during the period 2009-10 due to severe drought, but it reached to 95.98 million tons in 2010-11 and further to highest record of 105.30 million tons in 2011-12. Production and productivity started showing improvement w.e.f 2011-12, due to efforts initiated by the govt. A total number of 33 lakh seed minikits of 419 location specific high yielding varieties of rice were distributed in different rice growing States during the 9th Five Year Plan. The productivity increased due to the subsidy provided up to 50 percent for pump sets, seed drills, rotavators, knapsack sprayers, power weeders, and transplanters. Power tillers were distributed at 25 percent subsidy. In April 2010, a new nutrient-based subsidy scheme was implemented in which farmers were given incentives to use a better mix of nutrients. The scheme provided subsidy on plant nutrients, nitrogen (N), phosphorus (P), potash (K), and sulfur (S), for the farmers during 2010-11. (FAO's FAOSTAT and AQUASTAT, 2012) As on 2008-09, hybrid rice represented an estimated 6 percent of India's 44 million ha under rice cultivation, though the area under cultivation increased significantly from the period 2007 to 2008. Yet hybrid rice is still characterized by a low rate of adoption. Only 6.3 percent of farmers sampled were planting hybrid rice (like: *Pusa-677, IR-36, IR-50, IR-64, PNR-519* etc.) in 2008-09, accounting for only 6.2 percent of total area under rice cultivation. (FAO's FAOSTAT and AQUASTAT, 2012).

According to Ministry of Agriculture on 2011, low productivity in 2009-10 (2125 kg/ha) in the country was solely due to the long spells of one of the worst droughts in many years in various parts of the country in 2009. During this period, the productivity of almost all the crops including rice suffered considerably.

The area, production and productivity of total rice in Assam along with the Compound Annual Growth Rate (CAGR) during 2004-2014 is shown in (Table 2)

Table 2: Area, Production and Productivity of Rice in Assam

Year	Area (lakh ha)			Production (metric tons)			Productivity (kg/ha)		
	Autumn	Winter	Summer	Autumn	Winter	Summer	Autumn	Winter	Summer
2004-05	2.30	9.40	2.69	1534	15021	5269	667	1598	1959
2005-06	2.35	9.50	2.65	2387	14658	4717	1016	1543	1780
2006-07	2.15	8.63	2.67	1932	11400	5385	899	1321	2017
2007-08	2.23	9.94	2.78	2227	13717	6302	999	1380	2267
2008-09	2.24	9.75	3.14	2428	15999	11024	1084	1641	3233
2009-10	2.29	10.20	3.41	2248	19318	10843	982	1894	3180
2010-11	2.13	11.34	3.54	2460	22600	9122	1155	1993	2577
2011-12	2.19	12.8	4.02	2719	22848	11030	1242	1785	2744
2012-13	1.60	11.70	3.61	2107	23376	10703	1317	1998	2965
2013-14	1.43	12.22	2.24	1916	24464	6677	1340	2002	2981
CAGR%	-4.64	2.66	-1.81	2.25	5	2.4	7.23	2.28	4.29

Source: Economic Survey of Assam, Directorate of Economics and Statistics, Government of Assam (2014)

The (Table 2) revealed that in case of autumn rice there was a declining CAGR by -4.64 percent whereas production and productivity indicated positive growth rate by 2.25 percent and 7.23 percent respectively. Increased in area resulted a positive impact on the growth and yield and even better increase in productivity. Also in case of winter rice the

annual growth rate in area was increased by 2.66 percent per year and an increase of 5 percent per year in the production was recorded along with positive growth rate in productivity 2.28 percent and in case of summer rice the annual growth rate in area was decreased by -1.81 percent per year and an

increase of 2.4 percent per year in the production was recorded along with positive productivity by 4.29 percent.

The positive growth rate in area in case of winter rice also contributed towards positive growth rate in production, w.e.f 2008-09. The growth rate of productivity for winter rice was also positive at 2.28 percent. The main reason of achievement of this growth in winter rice was due to the bumper production. The autumn rice productivity suffered during 2009-10. The declining trend of growth rate of autumn rice productivity (982 kg/ha) was due to the adverse weather condition experienced during the period. The yield rate of winter rice (kg/ ha) continued its decreasing trend during the years from 2006-07 and 2007-08 with productivity of 1543, 1321 and 1380 kg/ha respectively due to drought like situation and severe floods that the State had experienced during the peak *sali* paddy season of the aforesaid years. However, due to good seasonal rainfall during the year 2008-09 the yield rate of winter rice (1641 kg/ha) has increased about 19.0 percent as compared to the yield rate in 2007-08(1380kg/ha). The rainfall pattern in the State during the kharif crop season of 2010 was favorable both in terms of total rainfall and its spread. So the autumn and winter rice productivity demonstrated increasing trend in the year 2010 by reaching 1155 kg/ha and 1993 kg/ha respectively than the year 2009 where production and productivity was 982 and 1894 kg/ha respectively. However there has been a gradual decline in respect of area covered under cultivation of autumn rice, which has switched over to the summer rice due to its higher productivity. During period 2005-06 to 2013-14, the area under autumn rice cultivation recorded a CAGR of -4.64 percent decline over the period of ten years. During the year 2005-06, the area under autumn rice was 2.35 lakh hectares and declined to 2.15 lakh ha during 2006-07 which further declined to 1.43 lakh hectares during 2013-14. The area covered under winter rice, the principal kharif crop of the state, which declined to 8.63 lakh ha due to serious drought like situation experienced by the state during the year 2006-07

had increased to 11.34 lakh hectares during 2010-11 due to improvement of normal seasonal rainfall, weather condition and irrigation support. According to Directorate of Economics and Statistics, Government of Assam, 2014 the area coverage under the crop further increased to 12.22 lakh ha during 2013-14.

The area covered under cultivation of summer rice indicated a declined growth by -1.81 percent due to poor irrigation. The CAGR indicated an increased productivity by 7.23 percent 2.28 percent and 4.29 percent for autumn, winter and summer rice respectively. Total area under HYV of autumn rice, winter rice, and summer rice *Lachit, Masuri, Joya, Ranjit, Ratna, China Boro, Biplov, Bahadur, Kaveri, Krishna* increased over the years. Considering productivity of farmers preferred the seed of HYV rice, viz, *Mala, IR-36*, etc.(Economic Survey of Assam,2010) The State Agriculture Department has also put special efforts in cultivation of hybrid variety of rice on experimented basis in the State since 2009-10 as the productivity of hybrid rice is more than double compared to HYV rice as well as to enhance farm income. The area coverage under hybrid rice has been increased to 234.0 thousand ha and by 9.1 percent of the total area under rice in the State during the year 2013-14 compared to the area coverage of 97.2 thousand hectares or 3.9 percent of the total area under rice in the state during the year 2012-13. The area under hybrid rice was only 24.2 thousand ha or 1.0 percent of the total area under rice during the year 2011-12. According to the State Agriculture Department consumption of fertilizer in the State was 65.64 kg per hectare during the year 2013-14 compared to 74.58 kg per hectare during the year 2011-12 along with STW for irrigation installed in 2013-14(30,000 no's) was lower than 2009-19(53,208 no's) which leads to poor irrigation to summer rice. (Directorate of Economics and Statistics, Assam, 2015).

The area, production and productivity of total rice in Nalbari district along with the Compound Annual Growth Rate (CAGR) during 2005-2015 is shown in (Table 3)

Table 3: Area, Production and Productivity of Rice in Nalbari District of Assam

Year	Area(ha)			Production(metric tons)			Productivity(kg/ha)		
	Autumn	Winter	Summer	Autumn	Winter	Summer	Autumn	Winter	Summer
2005-06	13285	57959	10012	18662	122963	22747	1404	2121	2271
2006-07	7567	65000	9000	10386	130118	27893	1372	2001	3099
2007-08	7300	65000	8200	12967	168042	21280	1776	2585	2595
2008-09	6600	65000	8750	11757	168731	35966	1781	2595	4110
2009-10	6000	65000	6750	4774	169420	29571	795	2606	4380
2010-11	5250	65000	6950	8259	221034	29646	1573	3400	4265
2011-12	4525	65000	10200	6655	169912	42645	1470	2614	4180
2012-13	4930	65200	10932	11834	202942	48538	2400	3112	4439
2013-14	4679	65450	10980	550	154820	48510	1190	2365	4418
2014-15	4525	63300	10105	3929	115839	34104	867	1830	3375
CAGR %	-10.21	0.89	0.09	-14.43	-0.6	4.13	-4.71	-1.46	4.04

Source: Department of Agriculture, Assam, 2015

The (Table 3) revealed that over the years the CAGR in terms of area, production and productivity of autumn rice declined in the district. In autumn rice the annual growth rate in area was decreased by -10.21 percent per year and production was decreased by -14.43 percent per year in the production, along with negative productivity of -4.71 percent. In case of winter rice CAGR recorded an increase by 0.89 percent in terms of area, but the positive growth rate in area was not reflected in terms of growth rate in production and productivity. Also in winter rice the annual growth rate in area was increased by 0.89percent per year and an decrease of -0.6 percent per year

in the production was recorded along with negative productivity of -1.46 percent and in summer rice the annual growth rate in area was increased by 0.09 percent per year and an increase of 4.13 percent per year in the production was recorded along with positive productivity of 4.04 percent.

According to Assam Tribune, Guwahati,2005 the Nalbari district faced a deficit of 72,872 metric ton of rice production due to severe drought in last two months of 2005, after that drought the area of autumn rice decreased to 7567 ha (2006-07) from 13285ha (2005-06) also the CAGR of autumn rice productivity indicated decrease of -4.71 percent. Whereas the

CAGR in area was decreased by -10.21 percent per year and production -14.43 percent per year along with negative productivity of -4.71 percent. Low rainfall, erratic rainfall drought like situation are the major causes of declining CAGR in production and productivity of winter rice, (Hindustan Times, May, 30,2006) for that the CAGR of winter rice showed a negative value of -1.46 percent. while in 2006-07 the productivity declined to 2001 kg/ha from 2121kg/ha in 2005-06. Because of that many farmers shifted their farming to summer rice by the adopting HYV of summer like *Chilarai*. While the overall seed replacement rate in the state was 23 percent in 2008-09 but in 2013-14 it has increased to as high as 31.15 percent (Directorate of Economics and Statistics, Assam, 2015).

Further the district witnessed major flood during 2004-05 and 2013-14. Because of it there has been reduction of productivity of winter rice in the district. However many farmers shifted to summer rice from winter rice and as result area, production and productivity of summer rice demonstrated positive CAGR in the district.

4. Conclusion

The forgoing discussion and analysis of data clearly indicated that rice has enormous potential in the study area despite a number of constraints being faced by the farmers. Among the autumn, winter and summer rice the summer rice had positive Compound Annual Growth Rate (CAGR) in area, production along with its productivity against autumn and winter rice have negative Compound Annual Growth Rate (CAGR). There are possibilities of bringing in more land under rice cultivation with suitable adjustment of cropping sequences. A selective 'area approach' may be considered as more effective to consolidate the situation and to boost up the production of rice crops in the district.

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