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PRODUCTION AND PRODUCTIVITY ANALYSIS OF RICE IN NORTH-EAST INDIA

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ABSTRACT

An analysis of production and productivity of rice in different states of North-East India revealed that only Mizoram and Tripura states experienced higher growth rate of productivity. Increase in rice production in different states of the rigion was mainly due to improvement in yield rather than area expansion. The states with higher growth rate witnessed higher instability in rice production. Among the various factors, availability of irrigation facilities, adoption of high yielding varieties (HYV) of rice, rate of fertilizer used, farm size and credit availibility expereinced great impact on rice pfoductivity of the region.

INTRODUCTION

The North-Eastern part of the country comprising Arunachal Pradesh, Assam, Manipur, Meghalaya, Nagaland and Tripura, is a predominantly rice producing region. This region accounts for 7.81% of total area under rice and shares 6.07% of the total rice production in India. But average per hactare yield of rice in the region (1426 kg) is far below the national average (1879 kg). Although rice production in the region has made significant strides, particularly since the inception of green revolution, there has been wide fluctuations in the rice production over the years and also, in different states of the region. Thus, it is of vital necessity to analyse the production and productivity trend of rice in North-East India where rice occupies 89.46% of the total area under foodgrains and contributes 92.32% of the total foodgrains production. In this paper, attempt has been made not only to examine the growth and instability in rice production in North-East India but also to investigate the contribution of area and yield to rice production and reasons for low productivity.

MATERIAL AND METHODS

Time series data on area, production and productitity of rice for the period 1972-73 to 1997-98 for the seven North-Eastern States and also for all India level were collected from the various issues of Basic Statistics of North-East India, Fertilizer Statistics and Area and production of Principal Crops in India and Economic Survey of India. Specific period has been selected as the reorganisation of North-Easter States were completed only in 1972. Annual

compound growth rates of area, production and productivity were calculated by using the following log linear function (Dandekar, 1980).

$Y_t = A (1 + r)^t$ ..... (1)

where,

Y = the value for which growth rate is to be calculated

t = time in years

r = growth rate.

Taking log both sides of equation (1)

$\log Y_t = \log A + t \log (1 + r)$

Putting $\log Y_t = Y$, $\log A = a$ and $\log (1 + r) = b$

$Y = a + bt$

$1 + r = \exp^b$

Therefore, $r = (\exp^b - 1) \times 100$

Coefficient of variation (C.V.) was calculated to study the instability in rice production. The contribution dut to area, yield and interaction between area and yield to the increase in rice production of North-Eastern States and all India was also calculated by using the equation (Sharma, 1977) :

$\Delta Q = A_{o-} \Delta Y + Y_{0-} \Delta A + \Delta A . \Delta Y$ ..... (2)

where, A_0 and Y_0 are area and yield per hectare in base year and ΔQ, AY and ΔA are changes in production, yield per hectare and area respectively between base year and 't'th year. The three terms on the right hand side of the equation when divided by ΔQ provide estimates of the contributions of average yield, area and their interactions (average yield X area) to the increase in rice production.

RESULTS AND DISCUSSION

Growth rates of area, production and yield

Table 1 presnets the state wise growth rates of area, production and yield of rice in North-Easte India. It can be observed from the Table that during the peirod 1972–73 to 1997–98, the area under rice in the region increased marginally at the rate of 0.73% per annum while the per hectare yield inceased significantly at the rate of 1.61% per year. The area expression as well as yield increase cause the output to grow at an annual rate of 2.40% which was significant at 1% level. However, the annual growth rate of production of the region was lesser than the all India average of 3.13% per annum. It was due to higher growth rate of per hectare yield in all India level as compared to North-East India. The low productivity growth rate in North-East India was due to lack of technological breakthrough in most of the States of the region.

Out of seven states in North-East, 4 states have shown positivie trends and 3 states have shown negative trends in growth of area under irce. But except Arunachal Pradesh and Nagaland, the growth rates of area in other states on the region were significantly low (less than 1%). It was due to the various restrictions imposed by the respective State Governments to the prectice of *jhum* cultivation since the late eighties. Rates of growth of production and yield was observed to be positive in all the states except Meghalaya. Mizoram experienced

the highest growth rate of rice production (4.10%) and the least being Meghalaya (–0.24%). The growth rate of per hectare yield was also highest and lowest in these two states.

Contribution of area and average yield to rice production

Contributions of area, yield and their interaction to the increasing rice production for the period 1972–1973 to 1997–1998 are depicted in Table 2. It could be seen from the Table that the contribution of area in increasing rice production was appreciable in the states of Arunachal Pradesh, Meghalaya and Nagaland. Average yield was the sole contributing factor in increasing rice production in the states of Manipur, Mizoram and Tripura (80, 139 and 101% respectively). In Mizoram and Tripura, the significant yield effect offset the negative area effect. Area and average yield contributed almost equally in increasing the rice production in Assam. The highest contribution of 36% from the the interaction component was noticed in Nagaland. It is interesting to note that except Mizoram the interaction effect was positive in all the states of North-East India. On an average, the contribution of average yield in increasing rice production in North-East India (60%) was lower than the all India level (71%)

Instability in rice production

Rice production in India has remained moderately been stable over the period 1972–73 to 1997–98 at a low level of productivity. The average production during the period was 60,098.2 thousand tonnes with a coefficient of variation (C.V) of 23.42%. Rice production in North-East India was more stable than all India level with an average yield of 3714.32 thousand tonnes with C.V. of 18.59% (Table 3).

In North-East India, the maximum variation in rice production was observed in Mizoram (C.V. 45.47%) and the minimum in Meghalaya (C.V. 8.54%). These are the two states which showed the highest and lowest growth rates of rice production in the region. The variation in rice area was much smaller than that in production both at all India and North-East India levels. The maximum variation in area was observed in Nagaland and minimum in Meghalaya in North East India. The yield per hectare was stabilised at a very low level in all the states except the states of Manipur, Mizoram and Tripura where the coefficient of variation was as high as 19.63%, 37.49% and 22.37% respectively. It revealed that the states with higher growth rate of yield per hectare witnessed high instability in rice production., Mehra (1981) and Pal and Sirohi (1989) reported similar findings in their studies in instability in crop production in India in the context of new technology.

Reasons for low productivity

Table 4 presents the factors associated with growth of rice productivity in different states of the region. The Table indicates that the states with higher productivity growth rates were having relatively lower size of holdings. For instances, the average size of holding in the leading growth states of Mizoram, Tripura and Manipur ranged from 0.97 to 1.38 hectares as against. 1.77 to 6.82 hectares in the low growth states of Meghalaya. Arunachal Pradesh and Nagaland. The aerage size of all India level (1.57 ha) was also lower than the North-East average (2.44 ha). It shows high negative relationship between farm size and rice productivity. The average percentage area under high yielding varieties for North-East India being 50.42 was far below the national average of 65.90%. In the higher growth states of Mizoram, Tripura and Manipur, the percentage varied from 37.5 to 73.55. It reveals that area under high yielding varieties have direct bearing on the productivity of rice in the region.

Mizoram and Tripura states being the centres of high productivity growth had the highest percentage changes in proportion of net-irrigated area (33.93 and 21.60% respectively). Percentage change in fertilizer use per hactare was also high in Mizoram and Tripura states (864.71 and 587.10%, respectively). It follows that fertilizer use had almost a complementary relationship with the availibility of irrigation facilities and finally, increased the rice productivity. Similarly, the availability of credit was highest in Mizoram and the least was Arunachal Pradesh. As shown by the North-East average of 2.80 as compared to the national average of 8.72 tractors per 1000 hectares reveals that agriculture in the North-East India is highly labour intensive.In states such as Assam, Manipur, and Mizoram which have comparatively higher growth rates showed higher rates of tractorisation. The use of pesticides was also found to be on the higher side in the higher growth states of Tripura, Assam and Manipur.

From the above discussion it has been concluded that only Mizoram and Tripura states experienced higher growth rate of rice productivity. The remaining states witnessed growth rate lower than the national average. Increase in rice production in the region was mainly due to the improvement in yield rather than area expansion. The states with higher growth rate witnessed high instability in rice production. Among the various factors, availibility of irrigation facilities, adoption of HYV of rice, rate of fertiliser use, farm size and credit availability experienced great impact on rice productivity of the region. Thus, the major policy thrust in this context should be on enhancing irrigation facilities in the states which were lagged behind. Development of water harvesting techniques such as micro-watershed based farming system on hill areas can go a long way in increasing rice productivity in the region. There is enough scope to narrow down the adoption gap in the use of fertilizers and high yielding varieties in various states through intensification of extension services and institutional support. The existing pattern of tractorisation in the region was found to be not significant as compared to the other states of the country. In this context implementation of land revenue act and conversion of *jhum* fields into terrace fields in hilly areas need to be emphasised. Besiedes, it will further scale down the average size of holding and consequently, will effect the agricultural productivity. Financing and credit policy of the financing institutions should be liberalised. These measures will facilitate on equitable growth of rice production among the states and overall development of the region.

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Table 1. Compound growth rates of area, production and yield of rice in North-East India (1972-73 to 1997-98)

States	Area	Production	Yield
Arunachal Pradesh	3.26**	4.15**	1.12**
Assam	0.83**	2.35**	1.44**
Manipur	(–) 0.39**	1.77**	2.08**
Meghalaya	0.14 ns	(–) 0.24 ns	(–) 0.36 ns
Mizoram	(–) 0.44 ns	4.10**	4.40**
Nagaland	2.78**	4.04**	1.52**
Tripura	(–) 0.85**	2.22**	3.08**
North East India	0.73**	2.40**	1.61**
All India	0.53*	3.13**	2.58**

* Significant at 5 per cent level; ** Significant at 1 per cent level; ns = Non Significant

Table 2. Percentage contribution of area, average yield and their interaction

States	Area	Yield	Interaction
Arunachal Pradesh	63	21	16
Assam	42	48	10
Manipur	9	80	11
Meghalaya	80	18	2
Mizoram	(–) 21	139	(–) 18
Nagaland	43	21	36
Tripura	(–) 8	101	7
North East India	28	60	12
All India	16	71	13

Table 3. Instability in rice production in north east India *1972-73 to 1997-98)

State	Area (000' hectares)		Production (000' tonnes)		Yield (kg per hectare)	
	Average	C. V. (%)	Average	C. V. (%)	Average	C. V. (%)
Arunachal Pradesh	97.13	23.74	103.23	28.98	1058.36	11.57
Assam	2831.88	6.58	2638.01	18.60	1114.12	12.73
Manipur	164.18	6.78	282.38	18.16	1716.85	19.63
Meghalaya	105.22	3.56	117.95	8.54	1125.20	8.52
Mizoram	57.57	26.19	56.39	45.47	996.20	37.49
Nagaland	105.36	26.47	107.37	44.49	1012.84	16.64
Tripura	275.36	8.86	400.44	18.25	1458.88	22.37
North East India	3134.57	5.78	3714.32	18.59	1170.60	12.94
All India	40652.68	4.50	60098.2	23.42	1467.15	19.49

Table 4. Factors affecting growth of rice productivity in North-East India

State	Average size of holding (ha) (1990-91)	% area under HYV's of rice (1992-93	% change in proportion of net irrigated area (1975-1990)	% change in fertilizer use in kg per cropped area (ha) (1978-1990)	Intensity of tractorisation (No. per 1000 ha) (1990-91)	Use of Pesticides in kg/cropped area (1990-91	Credit availability (Rs/ha) (1990-91)
Arunachal Pradesh	3.62	22.61	5.58	334.78	0.94	0.10	419
Assam	1.31	51.88	(–) 4.09	263.16	3.63	0.13	725
Manipur	1.23	46.67	0.00	253.90	3.27	0.20	605
Meghalaya	1.77	37.5	(–) 7.69	32.26	1.79	0.18	1222
Mizoram	1.38	37.5	33.93	864.71	2.11	0.10	1305
Nagaland	6.82	24.44	(–) 4.89	164.29	7.51	0.06	1251
Tripura	0.97	73.55	21.60	587.10	0.38	0.31	780
N. E. India	2.44	50.42	8.07	247.52	2.8	0.19	901
All India	1.57	65.90	37.04	142.42	8.72	0.37	1046