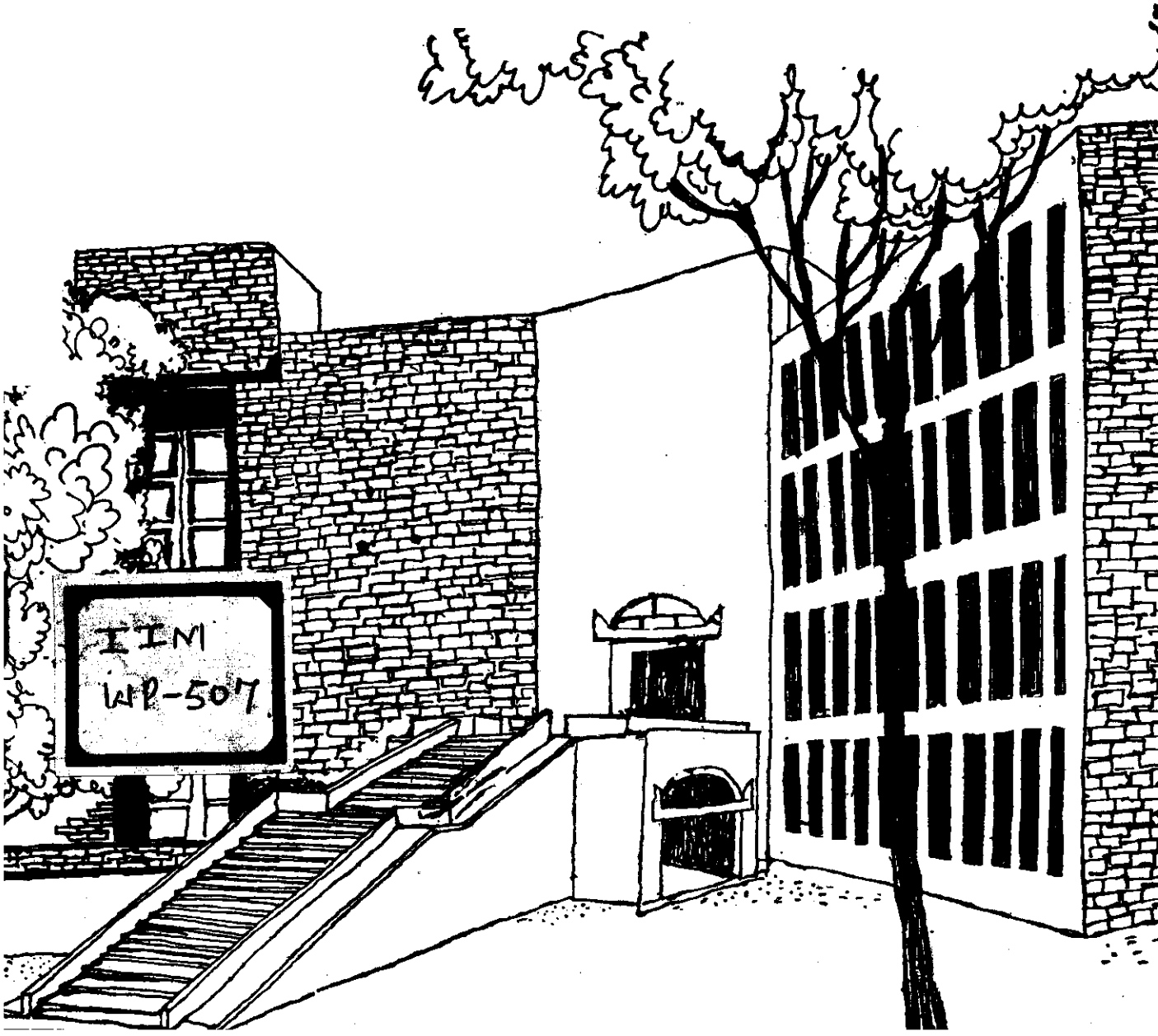
IIM
AHMEDABAD

Working Paper



A NEED FOR LOCATION SPECIFIC RICE RESEARCH IN INDIA

By

D.K. Desai

W P No.507

May 1984

The main objective of the working paper series of the IIMA is to help faculty members to test out their research findings at the pre-publication stage.

INDIAN INSTITUTE OF MANAGEMENT
AHMEDABAD-380015
INDIA

ABSTRACT

This paper pertains to the problems of agricultural research management in India. Rice research has not yielded results of the same order as wheat research. The paper goes into the details of rice production, area and productivity by different states and districts. In the analysis of the growth-rates of production and productivity of different rice-growing districts, it was possible to identify high-production and high productivity growth-rate districts vis-a-vis high production and low productivity growth-rate districts. A conclusion is drawn that different kinds of rice varieties were needed for high-production-low productivity districts. This can be done through a location specific research. Right kind of policy formulation has to be developed to undertake location specific research. It is through the research policies that mini-agro-climatic areas would be taken into consideration while evolving varieties and practices for rice. The socio-economic factors effecting the recommendations of rice research will have to be studied and efforts would be required to be made to either remove socio-economic constraints or take these factors into account in research where it is not possible to remove the constraints.

A NEED FOR LOCATION SPECIFI RICE RESEARCH IN INDIA

Rice in High Yielding Variety Programme

The High Yielding Variety Programme for rice started simultaneously with that of wheat. But rice seems to have lost the race in competition with wheat in terms of the coverage of area under HYV to the total area under the crop. From 1966-67 to 1979-80, the HYV paddy has not been able to cover more than 43% of the total area under paddy, whereas wheat has reached the coverage of 73 per cent. The growth rate of rice production in India during the "post-green-revolution" period (1966-67 - 1979-80) was 2.45 per cent whereas that of wheat was 8.22 per cent.

If we divide the states into two groups[1]: i) traditional rice-growing states and ii) non-traditional rice-growing states and study the coverage of HYV rice, we find that in non- traditional rice-growing states the coverage of HYV in Punjab has reached more than 90% and in Haryana about 57 per cent. In traditional rice-growing states, only Tamilnadu crossed the level of 80% coverage, and Andhra Pradesh had the coverage of 66%. In all other traditional rice-growing states the HYV coverage has not exceeded 40% except Maharashtra (56.5%) in 1975-76.

---

1. Traditional rice-growing States	:	Gujarat, Maharashtra, Kerala, Tamilnadu, Andhra Pradesh, Orissa, West Bengal, Assam, Bihar, UP and Madhya Pradesh etc.
Non-traditional rice-growing States		Punjab, Haryana, Karnataka, etc.

The overall trend of yield per hectare of HYV was declining.* In the non-traditional states, however, the declining trend is not as much conspicuous as it is in the traditional rice growing states.

Problem of Rice Production in India

With the advent of high yielding varieties programme in India in 1966-67, agricultural production in general and wheat and rice production in particular began to move at a faster pace than before. Foodgrains production increased from 66.8 million tonnes in 1966-67 to 132.9 million tonnes in 1980-81. Wheat production increased from 11.3 million tonnes in 1966-67 to 36.0 million tonnes in 1980-81 whereas rice production increased from 30.4 million tonnes in 1966-67 to the maximum level of 53.8 million tonnes in 1978-79.

The total area under HYV varieties increased from 2.8 million hectares in 1966-67 to 35.2 million hectares in 1979-80. The coverage of area under HYV varieties to total area increased from 2.49% in 1966-67 to 28.4% in 1979-80. The coverage of HYV wheat total area under wheat increased from 10.4% in 1966-67 to 61.5% in 1979-80 whereas the coverage of HYV rice increased from 2.6% in 1966-67 to 34.9% in 1979-80. It is clear that rice production and the adoption of HYV rice have lagged behind wheat considerably.

---

* The trend line for yield per hectare of HYV for the country as a whole for the period 1970-71 to 1976-77 was declining as can be seen from the following trend line fit.

$Y_1 = 2.12 - .053\ X$ Where Y_1 = Yield per hectare

$r^2 = .0.06$ X = Year

Rice is the staple food of 233 million people in India. The per-capita-net-availability of rice varied between 158.9 gms/day to 178.9 gms/day between 1951 to 1978. The share of rice in per capita availability of total foodgrains has declined after 1966-67. This causes much hardships to rice consuming population because it is difficult to import rice in substantial quantity. The demand estimates of rice for the year 2000 indicate that a major break-through is needed in rice production to meet the demand.

Rice is grown under different agro-climatic-soil-complexes whereas wheat is grown under specific agro-climatic-soil-complexes. Hence a different research strategy may be needed for increasing rice production. Because of the problem of slow growth of rice production, we decided to analyse the data of rice production, area and productivity for the post 1966-67 period. The data were analysed not only for the country as a whole but also for the states and the districts. The present study gives the details of this analysis.

Production Trends

The all-India rice production growth-rate for the period 1963-65[1] to 1977-78[2] (14 year period, was only 1.96 per cent. Most of the traditional rice growing states had lower growth rates than the all-India growth-rate (Table 1). The worst case was that of Orissa which had a

---

1 = The average of the Triennium 1962-63, 1963-64 and 1964-65

2 = The average of the biennium 1976-77 and 1977-78

negative growth-rate of 0.7 per cent. The non-traditional rice-growing states namely Haryana and Punjab had achieved growth-rates of more than 10 per cent.

When we broke down the 14-year-period into three periods to study the seasonal variations in growth-rates, we found somewhat different picture than the figure of the 14-year-period depicted.

During the 8-year-period (1963-65 to 1971-73)[1], the all-India growth-rate was 1.32 per cent which was lower than the growth-rate of the 14-year-period. In the traditional rice-growing states, Tamilnadu, Kerala, Assam and West Bengal had better growth-rates than in the 14-year-period, whereas the growth-rates of Andhra Pradesh, Bihar, Gujarat Maharashtra and Orissa were negative. In the non-traditional states, Viz., Haryana and Punjab, the growth-rates of rice production were more or less the same as those during the 14-year-period.

During the period (1971-73 to 1974-76)[2], the all-India growth-rate changed from 1.32% to 3.77 per cent. In the traditional rice-growing states there were spectacular increases in the growth rates of Andhra Pradesh (10.39%) and Maharashtra (11.94%). The growth-rates of UP (3.4%) and Orissa (2.07%) had also considerably improved. In the non-traditional states Punjab maintained its high growth-rate (14.19%) but Haryana's growth-rates declined to 2.52 per cent.

---

1 = 1963-65 - The average of 1962-63, 1963-64, and 1964-65
1971-73 - The average of 1970-71, 1971-72, and 1972-73

2 = 1974-76 - The average of 1973-74, 1974-75, and 1975-76

During the next three years (1974-76 to 1977-78)[1], the all-India growth-rate declined from 3.77% to 1.87 per cent. This was mainly because the growth-rate of Andhra Pradesh became negative (-4.39%) compared to 10.34% in the earlier period. The decline in the growth-rate of Orissa, also contributed to the overall decline. In the non-traditional rice-growing states, the growth-rate in Punjab had slightly declined (12.56%) but it had jumped to very high level in Haryana (19.77%).

The comparison of the growth-rates of three periods among various states brings out very clearly the seasonal effects. Rice production in Andhra Pradesh had suffered due to cyclone during 1973-74. The variations in the growth-rates of rice production in these three periods in different states indicate that UP which was having a slow growth-rate was now on the move. West Bengal was keeping up. Andhra Pradesh and Tamilnadu had ups and downs. Surprisingly Bihar was coming out of stagnancy, but Orissa still had a negative growth-rate. In the non-traditional rice-growing state Punjab had kept up a high growth rate of more than 12 per cent during the three periods; however, the growth rate of Haryana had a fluctuating trend.

Association Between Growth-Rates of Aree and Productivity

The analysis of growth rates of area and productivity showed different kinds of association during different periods (Table 2).

---

1 = 1977-78 - The average of 1976-77 and 1977-78

There are four types of association:

1. AA: Negative growth-rate of area associated with negative growth-rate of productivity. This association indicates that rice area is being substituted by other crops and the productivity on the remaining rice area has declined.

2. AB: Negative growth-rate of area associated with positive growth-rate of productivity. This would indicate that the rice area has been substituted by other crops and productivity on remaining area has increased.

3. BA: Positive growth-rate of area associated with negative growth-rate of productivity. This would indicate that there has been an expansion in rice area resulting in decreasing the average productivity.

4. BB: Positive growth-rate of area associated with positive growth-rate of productivity. This would indicate that rice crop is either substituting other crops or is grown in the newly cultivated area and the overall productivity of both the old area and new area under rice has increased.

From the point of view of improvement of rice economy, BB is the best situation whereas AA indicates the worst situation. AB would be preferred to BA. The distribution of major traditional and non-traditional rice-growing states according to the classification of types of associations between growth rates of area and productivity shows that most of the states fall under BB classification for three periods under study. This is a very healthy sign. Surprisingly Andhra Pradesh which is considered to be a progressive rice-growing state has shifted its position from BB during 1971-73 to 1974-76 period to AB during 1974-76 to 1977-78 period. This should cause concern for the policy makers of Andhra Pradesh. Orissa and Kerala, two other traditional

rice-growing states have also followed Andhra Pradesh's pattern. Bihar which is considered to be not-so-progressive rice-growing state has improved its position from BA during 1963-65 to 1971-73 to BB in the later period. UP which is not known for its progressiveness has remained in BB position throughout the three periods. Assam and West Bengal have gone from BB (during 1963-65 to 1971-1973) to BA position in later years because of the expansion of rice area in rabi season which had larger area under high yielding varieties. Madhya Pradesh had fluctuated from BB during 1963-65 to 1971-73 to BA position (1971-73 to 1974-76) and regained its BB position in later period (1974-76 to 1977-78). The non-traditional rice-growing states of Haryana and Punjab have remained in BB position throughout the three periods whereas Karnataka has shifted from AB to BB to BA during the three successive periods.

This analysis shows that the growth path in improvement of productivity for the traditional rice-growing states has not yet stabilised. More research is needed to bring and stabilise the traditional rice-growing states in BB or AB positions.

Productivity by States

The average yield per hectare of rice at all-India level increased from 1.01 tonnes in 1963-1965 to 1.20 tonnes in 1977-78 (Table 3). The average yield per hectare in non-traditional rice-growing states improved much more than the traditional rice-growing states. It has been constantly improving in non-traditional rice-growing states during

the period 1963-1965 to 1977-78 whereas in the traditional rice-growir states, the productivity remained more or less at the same level. The was an increasing trend in productivity in Tamil Nadu which had much higher yield per hectare than the average in the traditional rice-grow states. In all other traditional rice-growing states the yield per hectare was equal to or less than 1.5 tonnes except in Andhra Pradesh during the period 1974-76. In the non-traditional rice-growing states the yield per hectare was above 1.5 tonnes and it reached the level of 2.5 tonnes in Haryana (1977-78). The best yield per hectare was much lower than what is required to be achieved on an average by the year 2000 A.D. to meet the demand projections.

Analysis of District Data on Rice Production and Productivity

ABC Classification of districts

Rice is grown in 338 out of 370* districts of India. This shows the adaptability of rice crop in different environmental conditions. For developing production strategies, it will be useful to classify these districts on the basis of A,B,C concept used in marketing management. The market areas are classified on the basis of the market shares of the product:

Marketing areas having 60% share of the market as A category

Marketing areas having 30% share of the market as B category

Marketing areas having 10% share of the market as C category

---

* Union territories and J & K are treated as single districts

A similar concept can be used to classify rice-growing districts in India on the basis of their shares in the total rice production. Table 4 gives such a classification for seven years. It would be seen that one-fourth of the total number of rice-growing districts have nearly two-thirds of the total area and production of rice. These districts are classified as A-districts. They have more than 200,000 tonnes of production of rice per year in each district. Nearly 35% of the number of rice-growing districts covered only less than 5% of the total area and production of rice in 1977-78. These districts are classified as C-districts and they have less than 50,000 tonnes of rice production per year in each district. The remaining districts are classified as B-districts and they have rice production between 50,000 and 200,000 tonnes per year in each district. Thus from the point of view of enhancing the production it may be desirable to allocate efforts involvin funds and man-power following the market management strategy of ABC classification.

It is interesting to find that over the 7-year-period C-districts have a declining trend in the shares of total area and production of rice. The A-districts have maintained their shares (about 2/3) in the total area and production of rice, whereas the B-districts have increased their shares in the total area and production of rice. This gives another dimension to the ABC strategy that adequate attention will have to be paid to B-districts which have shown higher growth.

Productivity in different categories of districts

The average yield per hectare of category A-districts is higher than B and C districts and it has remained consistently higher in past seven years (1971 to 1977) (Table 5). This is a very healthy sign. If efforts are concentrated in increasing productivity of A-districts the impact on total production would be much higher. The present level of productivity is much lower than what is required to be achieved by the year 2000 A.D. to meet the demand estimates of rice. The present productivity will have to be tripled by the year 2000. According to one study yield per hectare for rice would have to be 3.38 tonnes by 2000 A.D. to meet the demand estimates.[1]

Distribution of districts according to productivity classification

Except one district, not a single other district had reached the level of productivity more than 3.5 tonnes per hectare. Table 6 gives the distribution of districts by productivity classification prepared from the average yield per hectare for the 2-year-period 1976-77 and 1977-78 (Map 1). There were ten districts having yield per hectare more than 2.5 tonnes. The location of these ten districts will give us some clue to the factors responsible for high productivity. Out of these ten districts only one district (South Arcot in Tamilnadu) belonged to traditional

---

1 Ifzal Ali, B.M. Desai, R. Radha Krishna, V.S. Vyas, "India 2000 - Agricultural Production Strategies and Rural Income Distribution, IIM, Ahmedabad, 1980, p.289.

rice-growing states whereas other nine districts belonged to non-traditional rice-growing states. Only one district Ludhiana in Punjab had the yield per hectare of 3.8 tonnes. This belonged to Category-B. The second district which had yield per hectare between 3.0 to 3.5 tonnes was Sirsa in Haryana. This belonged to catebory-C. There were eight other districts having yield per hectare varying between 2.5 to 3.0 tonnes. These were Krukshetra and Karnal in Haryana, Chitradurga and Mandya in Karnataka, Ganganagar in Rajasthan, Faridakot and Kapurthala in Punjab and South Arcot in Tamilnadu. They were distributed among A and B categories.

This shows that there are special problems which hampered the productivity in the traditional rice-growing states. Hence, except South Arcot in Tamilnadu no other district had achieved the productivity of more than 2.5 tonnes per hectare. The high productivity districts of Haryana, Punjab and Rajasthan have one thing in common, i.e., irrigation. Moreover, rice-growing in these districts is a recent phenomenon and most of the rice areas in these districts were under high yielding varieties. Fertilizer consumption in these districts was more than 20,000 tonnes (1977-78) except Chitradurga and Sirsa. The natural factors of availability of sunshine during the rice-growing season seemed to play an important role in high productivity. All these ten districts were located in areas with relatively high sunshine days during the rice-growing season.

A large number of districts with low productivity having less than (1 tonne/ha.) belonged to categories B and C. The major concern, however, should be for A-districts which had productivity less than one tonne per hectare. There were 28 such districts in category-A forming about 40% of total A-districts. The location of these 28 districts shows that they all belonged to the traditional rice-growing states as follows:

	State	District
1.	Andhra Pradesh	Srikakulam
2.	Assam	Goalpara, Kamrup, Darrang, Nowgong
3.	Bihar	Purnea, Ranchi Singbhum
4.	Madhya Pradesh	Durg, Bilaspur, Sarguja, Raigarh, Bastar, Raipur
5.	Orissa	Balasore, Bolangir, Cuttack, Ganjam, Koraput, Mayurbhanj, Puri, Sambalpur
6.	Tamilnadu	Ramanathpuram
7.	U.P	Gorakhpur, Basti
8.	West Bengal	Jalpaiguri, West Dinajpur, Coach-dehar

The fact that eight low-productivity-districts belonged to the state of Orissa indicates special socio-economic problems of that state apart from the agro-climatic factors. Similarly, socio-economic factors of six low-productivity-districts in Madhya Pradesh which formed a contiguous area with Orissa need to be studied. The low productivity districts

of Assam, West Bengal and Bihar seemed to form another contiguous geographical area (Map 2). In addition to agro-climatic factors, socio-economic factors which may be responsible for low productivity need to be studied. A comparative study of high productivity vis-a-vis low productivity A-districts will throw much light on the factors affecting productivity.

Growth Rates of Production for 14-year-period (1963-65 to 1977-78)

Out of 275 districts there were negative growth rates in rice production in 62 (22.54%) districts whereas there were positive growth rates in the remaining 213 districts. The most interesting thing was that in 94 (34.18%) districts, the annual growth rates were more than 3.00 per cent (Table 7). Out of these 94 districts 15 belonged to A category, 35 to B and 44 to C category.

The geographic distribution of high growth-rate A-districts was as follows:

Traditional Rice-Growing States	No. of Districts	Name of Districts
Andhra Pradesh	2	Nizamabad, Nalgonda
Bihar	1	Muzaffarpur*
Maharashtra	1	Kolhapur
Tamilnadu	3	North Arcot, Chingleput, South Arcot
West Bengal	2	Hoogly, Malda
	9	

* In October 1972, Muzaffarpur was divided into Sitamarhi, Muzaffarpur and Vaishali Districts

Non-Traditional Rice-Growing States	No. of Districts	Name of Districts
[illegible]	2	
Haryana	1	Karnal*
Punjab	4	Ferozpur, Gurdaspur Amritsar, Patiala
J & K**	1	J & K
	6	

Five out of six districts in the non-traditional rice-growing states have growth-rates more than 10 per cent. One of the nine districts in traditional rice-growing states (Nalgonda in Andhra Pradesh) had a growth rate of more than 5 per cent. The remaining 8 districts had growth-rates between 3 to 5 per cent.

All these districts in the traditional rice-growing states are not so well-known districts for rice production. It would be useful to keep these districts in view while undertaking studies for identification of factors leading to high-growth rates.

Districts with high growth-rates in production

Table 8 gives the list of A-districts with more than 3% growth rates of production in traditional rice-growing states. It will be seen that there is not a single district which had consistent high growth-rate

---

* In 1972 from original Karnal, three new districts were created, viz., Karnal, Kurukshetra, and Sonepat

** J & K is treated as one single district

(more than 3%) during the three periods, although some districts have shown growth rates of more than 3% in overall 14-year-period. This indicates the effect of weather on rice production. Out of the several rice-growing coastal districts of various states only few districts have shown more or less consistent high growth rates in production in the 14-year-period. These are North and South Arcot and Chingleput in Tamilnadu. The other districts which had shown high growth-rates are mostly non-coastal. It appears that the vagaries of monsoon both of South-West and North-East types have factors which seem to impede rice production in the coastal districts. Cyclones and prolonged period of rainy days are some of the impeding factors. It is necessary, therefore, to evolve varieties which can survive and produce more under these adverse natural factors. One of the strategies that can be adopted to accelerate rice production with the existing varieties is to concentrate on non-coastal rice producing districts. Non-coastal districts which have shown high growth-rates in production are Nizamabad and Nalgonda in Andhra Pradesh, Nowgong in Assam, Santhal, Parganas, Monghyr, Saharaa, Bagusarai, Purnea, Kathihar, Gaya and Singhbhum in Bihar, Rajagarh, Durg, Bilaspur, Raipur and Balabhat in Madhya Pradesh, Kolhapur in Maharashtra, Mayurbhanj and Bolangir in Orissa, Hooghly, Malda, Burdwan, Birbhuman and Murshidabad in West Bengal. It seems that in Tamilnadu, the majority of coastal districts had more than 3% growth rate in production. This indicates that if proper human efforts are made, it is possible to achieve high growth-rates even in coastal districts.

Districts with high growth-rates in productivity

It seems that the majority of districts with high growth-rates of production have also high growth-rates of productivity. This means that it is the improvement in productivity rather than increase in are which had led to high growth-rate in production. Again we find that except in Tamilnadu not a single coastal district had high productivit In the non-coastal districts Nizamabad in Andhra Pradesh, Kolhapur in Maharashtra and Hooghly in West Bengal had more than 3% growth-rate, f in productivity over the 14-year-period (Table 9). The weather effect is markedly seen on the growth-rates of productivity. Except for Chingleput, North Arcot and Hooghly, no other districts have appeared consistently as high growth-rates-productivity-districts in the three periods studied. Another interesting fact is that the 3-year-period (1971-73 to 1974-76) has many more districts with high growth-rates in production and productivity. This may be due to favourable weather conditions. The problem of getting consistent high growth-rates in productivity appears to be much more difficult. Even with the high growth-rates in productivity the levels of yields per hectare achieved in these districts are not very high (Table 10). Bihar which had high-growth-rate-productivity-districts in later two three-year-periods did not have a single district which had crossed the productivity level of 1.5 tonnes per hectare. This poses the problems for evolving varieties which would yield consistently at high levels both in coastal and non-coastal districts. It also raises questions about policies which would encourage high productivity in the districts which are capable of achieving high growth-rates.

Association between growth-rates of productivity and area in A-districts

The analysis of the high growth-rate-productivity-districts with respect to their growth-rates in area shows that in the majority of these districts, high growth-rate in productivity has association with a positive growth-rate in area (Table 11, Map 3). This means that farmers have not only attempted to increase yields on the same area but have tried to expand areas also. This has happened primarily in non-traditional rice-growing states. In the traditional rice-growing states, there were more districts with high-growth-rate in productivity, which were associated with negative growth-rate in area. This means that in traditional rice-growing states farmers were concentrating their productivity efforts on more suitable areas, and reducing low productivity areas in rice. However, there were some districts in traditional rice-growing states which achieved both high growth-rate in productivity and positive growth rates in area. These districts were Nizamabad in Andhra Pradesh, Chingleput, and South Arcot in Tamilnadu and Hooghly in West Bengal. In the 3-year-period (1974-76 to 1977-78) eleven districts achieved both high productivity and positive growth-rate in areas in traditional rice-growing states. These districts indicate a new spurt in farmers' efforts. The administrators should take note of this new spurt and encourage it as much as possible. Again we find that most of these districts in the traditional rice-growing states except Tamilnadu are non-coastal districts.

Moving the Rice Economy - Strategies for Rice Research

The aggregate picture of rice economy of India appears pretty gloomy and makes one pessimistic. The growth-rate of production which was 3.4% during the period 1949-50 to 1960-61 declined to 1.7% during the period 1960-61 to 1973-74. The growth-rate of rice production from 1963 to 1977 was only 1.96 per cent. During these fourteen years, the growth-rate showed ups and downs. For the first eight years (1963 - 1971), the growth-rate was 1.31% which rose to 3.77% during the 3-year-period of 1971-74 but it again declined to 1.87% during the 3-year-period of 1974-1977.

The main reason for the decline in the growth-rate of production was the decline in the growth-rate of productivity. The long-term growth-rate of productivity (1949-50 to 1971-72) of 1.7% came down to 1.07% for the period 1963 to 1971. It rose slightly to 1.47% for the 3-year-period 1971 to 1974 and came down again to 1.26% during 1974 to 197

The aggregate picture of growth-rates of rice production and productivity and its comparison with wheat creates a feeling of despair. In reality the rice story is different. It suffers from the "average" of a large size and varied soil-water-climate complexes and "nationalities with varying socio-economic constraints. When the aggregate picture of rice in India is disaggregated not only by states, but by districts, the picture looks much different.

The productivity of the non-traditional rice-growing states was higher than the all-India average during the four triennia from 1963 to 1978 (Table 3). In the traditional rice-growing states, Tamilnadu, Andhra Pradesh, West Bengal and Kerala had higher productivity than the all-India averages.

The rice-growing districts were classified into A, B, and C districts on the basis of their volumes of production. Fortunately, the average productivity of A-districts was higher than the all-India averages during the seven years from 1971 to 1977.

In the year 1971-72, there were 72 out of 311 districts which had higher productivity than all-India average. This number increased to 75 during 1976-78. Out of 75 districts, 28 belonged to Category A, 34 belonged to Category B and 13 belonged to Category C (Table 6).

The results of the study of growth-rates of productivity of all the rice-growing districts for the 14-year-period (1963-65 to 1977-78) showed that 63 and 212 districts had negative and positive growth-rates respectively. Out of 212 districts with positive growth-rates 78 had growth-rates of more than 3 per cent per annum. Out of these 78 districts, 12 belonged to Category A, 29 to Category B and 37 to Category C.

The districts which had achieved growth-rates of more than and equal to 3% in productivity during the 14-year-period or its break-up of 8-year, 3-year and 3-year-periods in the traditional rice-growing states were separately listed (Table 9). The productivity of these

districts for the year 1977-78 was found out. There were 48 such A-districts (Table 10). Out of these 48 A-districts 26 had productivity higher than the all-India average for the year 1977-78.

A list was also prepared for the districts which had low productivity (less than 1.0 tonne/hectare) and the productivity growth-rates for the 14-year-period and other periods were found out. There were 17 such A-districts, five of which belonged to Orissa, three belonged to Assam and three to West Bengal. They had either negative or very low growth-rates

Do the policy makers, agricultural scientists and social scientists have the tools to make these low growth-rate-low-productivity-rice A-districts moving ? Is it possible to substitute wheat for rice in these districts ? If so, upto what level ? Even in the high growth-rate A-districts, a substantial number is with low productivity. The policy makers have to make up their minds regarding the use of scarce resources in the rice districts to achieve high productivity in these districts.

The results of the new rice production technology both at research stations and cultivators' fields indicate that it is superior to the existing technology. The economist then asks questions: "If the new technology is definitely better than the existing technology, why is it not spreading fast" ? The coverage of HYV rice has not gone beyond 43 per cent. The technologist answers: We have to demonstrate, test and adapt the new technolggy on farmers' fields on a large scale to convince them". Is there the problem of effectiveness of extension

services ? It appears that the new technology does not have that quantum jump which would come over the natural risk consciousness of farmers. Rice farming is largely in the hands of small farmers. In India the risk bearing capacity of small farmers is limited. It is here that the crux of the problem lies. We have not developed technology, industrial, and organizational structure which would overcome farmers' aversion to risk taking. There is a lack of knowledge as to which socio-economic constraints come in the way of farmers' risk bearing capacity. However, the technologists believe that it is the lack of awareness on farmers' part about the profitability of the new technology which comes in the way.

Need for Rice Research Management

This study leads us to conclude that if we want to meet the expected demand of rice in the year 2000 from domestic production, the growth-rate of rice production will have to be doubled. This cannot be abhieved without a breakthrough in rice research.

The disaggregate analysis of rice production at the district level suggests that rice research will have to be much more location specific than it has been so far. It appears that the rice varieties for the traditional rice-growing states should be different from those of non-traditional rice-growing states where there is a better control of irrigation and other weather factors. The varieties for the coastal districts should be different from the non-coastal districts in the

traditional rice-growing states. Rice research should take into account the socio-economic factors which cannot be easily handled by the developmental policies.

This raises questions regarding the research policies for rice. Evidently it is assumed that we have a good research set-up which may be assumed to frame the needed rice policies to achieve the goals framed by the society. Is this a realistic assumption ? The Sixth Five Year Plan, has fixed a target of 63[1] million tonnes of rice production by 1984-85. This means that the growth-rate of rice production should be 4.27 per cent.[2] Considering the growth-rate of rice production of the past 14 years, it is not realistic to assume that the growth-rate of 4.27% would be achieved by 1984-85.

The research programmes for rice in Sixth Five Year Plan do not indicate that efforts are geared to have a break through. On the contrary, the target of 63 million tonnes is fixed on the assumptions that the additional production of 12 million tonnes will be achieved through (1) increase in area under HYV from 13.6 million hectares to 25 million hectares; (ii, increase in irrigated area by 2.5 million hectares with adoption of package of practices; (iii) intensification of existing scheme

---

1. Govt. of India, Sixth Five Year Plan, 1980-85, p.149.

2. The base level is considered as 47.0 million tonnes (the average of the biennium 1976-77 and 1977-78). The Sixth Five Year Plan has given the compound growth-rate of 4.2 per cent with the assumed base of 51.24 million tonnes in 1979-80, Govt. of India, op.cit.

of community nurseries of rice, minikit demonstrations and training; and (iv) intensive steps to increase the yields of upland rice through adoption of latest technology.[3]

According to this programme the area under HYV rice should increase at the compound growth-rate of 12.95 per cent. The actual growth-rate of HYV area under rice from 1974-75 to 1978-79 was only 8.97 per cent. This means that there should be a breakthrough in the extension of HYV area under rice. To achieve this a breakthrough should occur in the evolution of new varieties within a short period of five years which is not practical.

The formulation of research policies to achieve a break-through in rice production forms an important part of research management. This study points to the need of a well-geared agricultural research management which includes topics from the policy formulation to the evaluation of impact of research recommendations.

Management of Agricultural Research

Management of agricultural research deals with the total agricultural research sub-system of the agricultural system. The agricultural research sub-system can be described in a three dimensional form. The two dimensions dealing with fields/commodities and people form the setting of the agricultural research sub-system in which the management process

---

3. Gov. of India, Ibid, p.120

takes place. It is this setting which differentiates management of agricultural research from the management of other agricultural sub-systems such as agricultural supply management, agricultural production management, agricultural processing and agricultural marketing management. The understanding of the setting in which the sub-system operates is very important for the lack of this understanding leads to many general management experts in giving prescriptions which have no relevance to the peculiarities of the setting. For example, while dealing with rice research management, it is important to understand the complexities of rice crop which is produced in a variety of agro-climatic situations.

The knowledge about people who are directly or indirectly connected with the rice research is another necessary condition for the study of management problems. The people include at one end, the policy makers, administrators and financiers while at the other end we have producers, processors and consumers. The core people who are intimately connected with the research are the scientists, other research workers and the extension workers who carry research results to the users.

The actual management process in agricultural research deals with the following aspects:

1. Formulation of Research Policies
2. Objectives
3. Planning, Project identification and preparation

4. Assessment of resource requirement, mobilization and allocation

5. Management of resources:

   a) Management of research scientists

   b) Management of other research personnel

   c) Management of physical resources

   d) Management of financial resources

6. Organizational aspects of intra-project, inter-project and inter-institutional nature

7. Co-ordination between research and other activities of the institution

8. Monitoring and Implementation

9. Transfer of research results

10. Evaluating impact of research results

11. Feed-back

Formulation of Rice Research Policies

The study of rice research indicates that it is assumed that varieties evolved over a large agro-climatic zone, a state, a part of a state or a group of states will solve the problem. The district analysis of rice production indicates that the performance of high yield varieties between coastal and non-coastal districts is different. It is necessary therefore, to take mini-agro-climatic areas into consideration while evolving varieties and practices for rice. The need for location specific rice research should be taken into account while formulating rice research policies.

The socio-economic factors also seem to affect the recommendations of rice research. The performance of HYV in Tamilnadu coastal districts is much different from the coastal districts of Orissa. In such cases efforts should be made to either remove socio-economic constraints or take these factors into account in research work when it is not possible to remove the socio-economic constraints.

Table 1 Growth-Rates of Rice Production in Different States

Rice Growing States	1963-65 to 1977-78 (14 years)	1963-65 to 1971-73 (8 years)	1971-73 to 1974-76 (3 years)	1974-76 to 1977-78 (3 years)	1963-65 to 1974-76 (11 years)	1971-73 to 1977-78 (6 years)
Traditional						
1. Andhra Pradesh	0.97	-0.32	10.34	-4.39	2.48	2.70
2. Assam	2.01	2.41	1.46	1.51	2.15	1.48
3. Bihar	0.81	-0.74	1.62	3.12	-0.03	2.43
4. Gujarat	2.11	-1.14	1.43	12.07	-0.45	6.62
5. Kerala	0.85	2.25	0.43	-2.35	1.75	-0.97
6. Madhya Pradesh	1.22	1.56	-2.25	3.76	0.53	0.71
7. Maharashtra	3.13	-1.44	11.94	7.23	2.04	9.56
8. Orissa	-0.70	-1.2	2.07	-2.09	-0.32	-0.03
9. Tamilnadu	2.24	3.77	-0.88	1.35	2.48	0.23
10. Uttar Pradesh	2.71	1.01	3.29	6.81	1.63	5.03
11. West Bengal	1.86	2.16	1.37	1.57	1.95	1.47
Non-Traditional						
1. Haryana	10.74	10.69	2.52	19.77	8.34	10.81
2. Karnataka	1.21	2.48	3.77	-4.52	2.83	-0.46
3. Punjab	13.82	14.16	14.19	12.56	14.17	13.36
All India	1.96	1.32	3.77	1.87	1.98	2.81

Associations Between Growth Rates of Area and Productivity in Rice in Different States

Types of Association			PERIOD					
			1963-65 to 1971-73 (8 years)		1971-73 to 1974-76 (3 years)		1974-76 to 1977-78 (3 years)	
			Traditional states	Non-traditional states	Traditional states	Non-traditional states	Traditional states	Non-traditional states
1.	AA:	Negative Area Negative Productivity						
2.	AB:	Negative Area Positive Productivity	Andhra Pradesh	Karnataka	Tamil Nadu	-	Andhra Pradesh Kerala Orissa	-
3.	BA:	Positive Area Negative Productivity	Bihar Orissa	-	Assam Madhya Pradesh West Bengal	-	Assam West Bengal	Karnataka
4.	BB:	Positive Area Positive Productivity	Assam Kerala Madhya Pradesh Tamilnadu Uttar-Pradesh West Bengal	Haryana Punjab	Andhra Pradesh Bihar Kerala Orissa Uttar-Pradesh	Karnataka Haryana Punjab	Bihar Madhya Pradesh Uttar-Pradesh	Haryana Punjab

Table 3: Productivity in Different States in Different Periods

(Tonnes/ha.)

States	1963 to 1965 (Triennium) AV.	1971 to 1973 (Triennium) AV.	1974-1976 (Triennium) AV.	1977-78 (Biennium) AV.
Traditional Rice Growing States				
1. Andhra Pradesh	1.3	1.4	1.6	1.4
2. Assam	0.9	1.0	1.0	1.0
3. Bihar	0.8	0.8	0.9	0.9
4. Gujarat	0.8	0.9	1.0	1.3
5. Kerala	1.3	1.5	1.5	1.5
6. Madhya Pradesh	0.7	0.7	0.7	0.8
7. Maharashtra	1.0	0.9	1.3	1.5
8. Orissa	0.9	0.8	0.9	0.9
9. Tamilnadu	1.5	2.0	2.0	2.2
10. Uttar Pradesh	0.7	0.7	0.8	1.0
11. West Bengal	1.1	1.2	1.2	1.3
Sub-Total	0.9	1.06	1.10	1.13
Non-Traditional Rice Growing States				
1. Haryana	1.2	1.7	1.8	2.5
2. Karnataka	1.4	1.8	1.8	1.8
3. Punjab	1.1	1.9	2.3	2.4
Sub-Total	1.34	1.79	1.94	2.14
All-India	1.01	1.10	1.16	1.20

stricts in India According to ABC Classification of Rice Production from 1971 to 1977*

973			1974			1975			1976			1977	
ı-Area ı	No.of Dist.	Produ- ction	Area	No. of Dist.	Produ- ction	Area	No.of Dist.	Produ- ction	Area	No.of Dist.	Produ- ction	Area
%		%	%		%	%		%	%		%	%
3 63.1	69	63.4	57.4	85	68.5	66.1	76	63.5	59.4	85	67.2	64
8 31.6	116	31.7	33.7	123	28.1	29.2	126	32.0	35.1	133	29.8	32.3
6 5.3	150	4.8	9.0	130	3.4	4.8	136	4.5	4.6	120	2.9	3.7
100 (37931)	335	100 (40197)	100 (37335)	338	100 (49349)	100 (39702)	338	100 (42603)	100 (38431)	388	100 (51506)	100 (40015)

tion and area in thousand tonnes and hectares respectively.

because rice-growing was undertaken in the later years

Table 5: Yield Per Hectare in ASC Categories of Rice Production (1971-1977)

Category of Rice Production Districts	Yield per hectare in tonnes						
	1971	1972	1973	1974	1975	1976	1977
A	1.16	1.19	1.22	1.17	1.29	1.18	1.35
B	1.05	0.97	1.09	1.00	1.19	1.01	1.18
C	0.76	0.57	0.78	0.56	0.88	0.89	1.00
Average	1.10	1.10	1.20	1.10	1.20	1.10	1.30

Table 6: Distribution of ABC Districts According to Productivity

Productivity yield per Hectare (in tonnes)			Number of Districts							
			A		B		C		Total	
			1[a]	2	1[a]	2	1[a]	2	1[a]	2
		1.00	37	28	24	49	84	61	145	138
1.00	-	1.5	18	22	41	49	36	54	95	125
1.5	-	2.00	19	13	39	19	14	8	72	40
2.00	-	2.5	-	12	-	9	-	4	-	25
2.5	-	3.00	-	3	-	5	-	-	-	8
3.00	-	3.5	-	-	-	-	-	1	-	1
3.5	-	4.00	-	-	-	1	-	-	-	1
			74	78	104	132	134	128	312	338

Source: D.K. Desai, Background Paper on Rice Production and Productivity submitted to Ford Foundation, India in 1974.

1 = Pertains to year 1971-72

2 = average of the year 1976-77 and 1977-78

Table 7: Distribution of Rice-Growing Districts According to Growth Rates of Rice Production (Period 1963-65 to 1977-78)

Classification of Growth Rates of Rice (%)	Number of Districts			
	A	B	C	Total
-2.00 & less	3	3	14	20
-2.00 - 1.00	2	2	6	10
-1.00 - 0.00	12	9	11	32
00.0 - 1.00	16	15	14	45
1.00 - 2.00	22	20	7	49
2.00 - 3.00	8	13	4	25
3.00 - 4.00	6	10	6	22
4.00 - 5.00	3	9	9	21
5.00 - 10.00	1	7	16	24
> 10.00	5	9	13	27
Total	78	97	100	275

Table 8: A-Districts in Traditional Rice-Growing States with More than 3% Growth Rate in Production

Name of States	No.of Dist.	1963-65 to 1977-78 (14-year-period)	No.of Dist.	1963-65 to 1971-73 (8-year-Period)	No.of Dist.	1971 -73 to 1974-76 (3-year-Period)	No.of Dist.	1974-76 to 1977-78 (3-year-Period)
1. Andhra Pradesh	1	Nizamabad Nalgonda	1	Nalgonda	6	Krishna East Godavari West Godavari Nizamabad Nalgonda Guntur	-	-
2. Assam	-	-	-	-	1	Newgong	1	Goalpara
3. Bihar	1	Muzaffarpur	-	-	4	Santal Parganas Monghyr, Muzaffarpur Purnea	3	Rohtus, Gaya Singhbhum
4. Madhya Pradesh	-	-	-	-	1	Rajgarh	4	Durg, Bilaspur Balaghat, Raipur
5. Maharashtra	1	Kolhapur	-	-	3	Ratnagiri Thana Kolhapur	2	Kolaba, Kolhapur
6. Orissa	-	-	-	-	4	Ganjam, Mayurbhanj Sambalpur, Cuttack	2	Balasore Bolangir
7. Tanilnadu	3	North Arcot Chinglepet South Arcot	6	Chingleput Ramanathapuram Tiruchirapalli Thanjavoor South Arcot Tirunelveli	-	-	4	South Arcot North Arcot Chingleput Madurai
8. U.P.	-	-	-	-	1	Gorakhpur	1	Basti
9. West Bengal	2	Hooghly Malda	4	Hooghly Malda Jalpaiguri Coach Behar	5	Hooghly, 24 Parganas Nadia, Murshidabad Burdwan	5	Malda, West-Dina Birbhum, Bankura Burdwan

Table 9: A-Districts in Traditional Rice-Growing States with High Growth Rate (more than 3%) in Productivity

Name of State	No.of Dist.	1963-65 to 1977-78 (14-year-period)	No.of Dist.	1963-65 to 1971-73 (8-year-period)	No.of Dist.	No.of	1971-73 to 1974-76 (3-year-period)	No.of Dist.	1974-76 to 1977-78 (3-year-period)
1. Andhra Pradesh	1	Nizamabad	1	West Godavari		5	East Godavari Nalgonda Guntur Nizamabad West Godavari	-	-
2. Assam	-	-	-	-		1	Nowgong	-	-
3. Bihar	-	-	-	-		3	Santhal Parganas Monghyr Purnea	2	Gaya, Singhbhum
4. Madhya Pradesh	-	-	-	-		1	Raigarh	4	Durg, Bilaspur Balaghat, Raipur
5. Maharashtra	1	Kolhapur	-	-		3	Ratnagiri, Thana Kolhapur	2	Kolaba, Kolhapur
6. Orissa	-	-	-	-		2	Cuttack, Mayurbhanj	2	Balasore, Bolangir
7. Tamilnadu	4	North Arcot Tiruchirapalli South Arcot Chingleput	8	Chingleput South Arcot North Arcot Coimbatore Tiruchirapalli Thanjavoor Madurai Tirunelveli		2	Chingleput Salem	6	Chingleput, S. Arcot N. Arcot, Tiruchira Palli, Madurai, Tirunalveli
8. U.P.	-	-	-	-		1	Gorakhpur	-	-
9. West Bengal	1	Hooghly	2	Hooghly Malda		2	24 Paraganas Murshidabad	4	Burdwan, Malda, Birbhum, Hooghly

Table 10 Yield/ha. of High Growth Rates Productivity (More than 3%) A-Districts in Traditional Rice-Growing States for 1977-78

Name of State	Name of District	Yield/ha. (in tonnes)
1. Andhra Pradesh	Nizamabad	1.9
	East Godavari	1.9
	West Godavari	1.9
	Nalgonda	1.6
	Ongole	1.2
	Guntur	1.1
	Nellore	1.4
	Kurnool	1.4
2. Assam	Nowgong	1.0
3. Bihar	Santhal Parganas	1.1
	Monghyr	0.8
	Saharsa	0.9
	Begusari	0.9
	Purnea	0.8
	Katihar	0.8
	Gaya	1.1
	Singhbhum	0.9
4. Madhya Pradesh	Raigarh	0.8
	Durg	0.8
	Bilaspur	0.9
	Raipur	1.8
	Balaghat	1.1
5. Maharashtra	Kolhapur	2.2
	Kolaba	1.8
	Thana	1.2
	Ratnagiri	1.4
6. Orissa	Mayurbhanj	0.8
	Cuttack	1.0
	Puri	0.9
	Balasore	0.9
	Bolangir	0.9

Contd...

Name of State	Name of District	Yield/ha. (in tonnes)
7. Tamilnadu	Chingleput	2.3
	South Arcot	2.7
	North Arcot	2.3
	Tiruchirapalli	2.2
	Coimbatore	2.4
	Thanjavoor	2.1
	Madurai	2.4
	Tirunelveli	2.3
	Salem	2.3
	Dharmapuri	1.9
8. U.P.	Gorakhpur	0.9
9. West Bengal	Hooghly	2.0
	Malda	1.1
	24 Parganas	1.2
	Murshidabad	1.3
	Burdwan	1.8
	Birbhum	1.6

Table 11 Association of High Growth Rate of Productivity (more than 3%) with Growth Rates of Area in A-Districts

pe of sociation	1963-65/1977-78 (14-year-period)			1963-65/1971-73 (8-year-period)			1971-73/1974-76 (3-year-period)			1974-76/1977-78 (3-year-period)		
	No. of Tradi-tional Dist.	No.of Non-Tradi-tional Dist.	No. of total Dist.	No. of Tradi-tional Dist.	No. of Non-Tradi-tional Dist.	No.of total Dist.	No. of Tradi-tional Dist.	No. of Non-Tradi-tional Dist.	No. of total Dist.	No. of Tradi-tional Dist.	No. of Non-Tradi-tional Dist.	No. of total Dist.
A	3	-	3	7	1	8	11	-	11	9	-	9
B	4	5	9	4	6	10	8	6	14	11	4	15
otal	7	7	12	11	7	18	19	6	25	20	4	24

A = High Growth rate of productivity (more than 3%) associated with negative growth rates of area.

B = High growth rate of productivity (more than 3%) associated with positive growth rates of area.