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**SUMMARIES OF GROUP DISCUSSION**

## IMBALANCES IN AGRICULTURAL GROWTH\*

Daroga Singh†

At the outset, I express my gratitude to the members of this learned Society for electing me to preside over its 40th Annual Conference and I consider this as a great honour done to me. My only qualification for being elected to this position is that I have been closely associated with the agricultural research programmes sponsored by the Indian Council of Agricultural Research for the last three decades. This has given me ample opportunities to know the numerous problems engaging the attention of the economists in the field of agriculture. The most serious problem that the country is facing today is the uneven growth of agriculture and the increase of unemployment and poverty in many parts of the country. I have, therefore, chosen the present topic for my address.

Agricultural production constitutes the single largest economic activity in our country. The agricultural sector contributes nearly half of the national product, provides jobs to about three-fourths of the population and supplies raw materials to the industrial sector. Its contribution to the foreign exchange earnings is considerable. The country entered an important phase of agricultural development in early fifties with the launching of the First Five-Year Plan for economic development. Since then, agricultural production has shown sizeable improvement despite year to year fluctuations. There has been a tremendous increase in the output of foodgrains and other crops. Besides crops, the other important segment of the Indian agriculture is rearing animals and livestock. We have the largest cattle, buffalo and goat population. About one-sixth of the cattle, about one-half of the buffalo and one-fifth of the goat population in the world are maintained in the country. Animal husbandry plays an important role and cattle and buffalo are the main sources of draught power in agricultural operations and rural transportation. They supply essential foods like meat, milk and a large quantity of useful by-products.

### PROGRESS OF AGRICULTURE

The progress of agriculture during recent years has been quite impressive. The growth rate of agricultural production for the period 1967-68 to 1978-79 has been estimated at 2.81 per cent per annum. For the same period, the production of foodgrains has increased at the rate

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of 2.77 per cent and of cereals, at 3.05 per cent. It is interesting to note from Figure 1, which shows for each five-year period starting from the First Five-Year Plan, the average, maximum and minimum annual output, that the peaks and troughs also exhibit the same trend as shown by the quinquennial averages. As all these growth rates are greater than the growth rate of population (estimated to be a little above 2 per cent), the cumulative effect of the higher growth rate of production has been to create a feeling that we have made satisfactory progress in agriculture, at least in the production of foodgrains. This feeling is further strengthened by the accumulated stocks of cereals. A detailed examination of the growth in output of agriculture, however, reveals that the situation is not quite satisfactory and much remains to be done.

FOODGRAINS PRODUCTION TREND

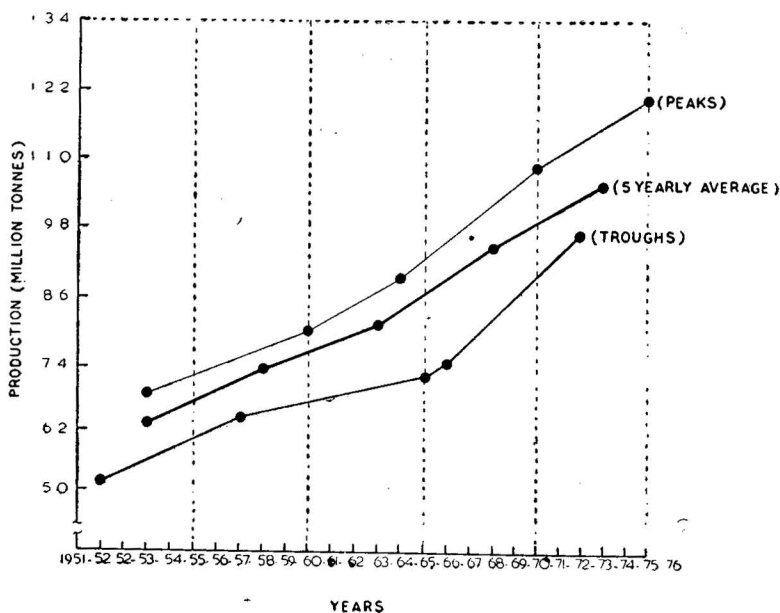


FIGURE (1)

We may begin by observing that even among the cereals the growth rates for the period have been different for different crops. Whereas the growth rate was 6.02 per cent for wheat, it was only 2.64 per cent for rice, 2.07 per cent for jowar and near about zero for bajra and maize. For barley, it showed a decline, the growth rate being -1.95 per cent. Thus, not all the growth in wheat output has been due to better technology but partly due to the diversion of area from other crops. Since the crops represent different regions, the differences also reflect regional imbalances, and the regions producing millets

have suffered a set-back and cannot be considered to have progressed economically; actually their position has deteriorated and farmers depending on the cultivation of these crops are reported to have become poorer.

The position of pulses is even worse. During the same period the output of pulses has grown at the rate of 0.54 per cent, much less than the rate of growth of population. This has led to a chronic scarcity of this nutritionally important group of foodgrains, resulting in high prices and decline in our nutritional standards. The per capita availability of pulses, which was 69 gm. per day in 1961 as against 85 gm. recommended by the nutritional experts, further came down to 48 gm. in 1978. To make up this decline, and fill up the gap in the per capita availability and achieve reasonable nutritional standards the growth rate of production of pulses will have to be around 20 per cent per annum for the next five years. Though this might not appear to be within the range of practical achievement, it shows that strenuous efforts will be necessary to achieve more balanced growth with regard to different crops.

Another group of crops for which the production has not caught up with the demand is the oilseeds group. The growth rate of production of oilseeds during the same period was 1.67 per cent which is better than that for pulses, but well below the population growth rate. Consequently the supply position with regard to edible oils has worsened over the years leading not only to inflationary rise in their prices but sacrifice of considerable foreign exchange on their import.

Amongst other crops which have a bearing on food situation, two crops, *viz.*, potato and sugarcane, are very important. As regards potato, it is a matter of considerable satisfaction that both the production and the productivity of this crop have increased substantially in the last 12 years. Productivity has gone up at the rate of 3.49 per cent per year and production at the rate of 8.26 per cent. This crop helps to achieve better nutritional standard by providing more calories per hectare per month than the foodgrains. Its production has received a great stimulus by development of cold storage facilities, thereby spreading marketing over a longer period, and thus benefiting both the consumer and the producer.

The position of sugarcane is, however, not quite satisfactory. Though its production has increased at the rate of 3.80 per cent annually during the above period and sugar production has increased at a higher rate, the crop has been subject to recurrent crises of glut and scarcity, a phenomenon typical of perishable commodities.

As far as the production of cotton is concerned with a growth rate of 2.71 per cent, the position should be considered satisfactory especially as this growth has been achieved by improvement in productivity. In jute also, the production has grown at 1.51 per cent and production

of mesta at 4.72 per cent. Since these two latter fibre crops are produced mainly for export, their production is linked to international market and it seems that the growth in production of these crops has been adequate to meet export demand.

There is another aspect of our agricultural development which might be described as lopsided. While we have taken great strides in crop production, our progress in livestock sector is dismal. In fact, data on the output of livestock products are scanty but on the basis of whatever data are available we get a gloomy picture of stagnation. Milk is the most important livestock product for our population which, by economic necessity rather than choice, is vegetarian. Its production has not kept pace with the growth of population resulting in the decline in its per capita availability. The per capita availability which was 116 gm. in 1961 declined to 108 gm. in 1966 and to 98 gm. in 1977. Thus livestock development has been a weak spot in the progress of our agriculture.

Thus viewed from the angle of progress in production of individual crops, pulses and oilseeds have not depicted satisfactory progress. But progress in agriculture is to be considered from another angle, namely, whether all regions are progressing in a balanced way.

The uneven growth rate of individual crops has led to the regional imbalances in the rural prosperity depending upon the crops which each region has been cultivating. Even for a crop like rice which is the most important cereal crop of the country, the growth rate has not been uniform in the different States. Since agriculture is the main source of income of the rural population, imbalance in its growth in different regions has led to the imbalances in the incomes and levels of living.

In considering the agricultural growth, it is, therefore, of interest to see how regional disparities in growth have affected the economic position of different States.

In the regions where a large majority of the population is undernourished, to improve the availability of foodgrains the growth rate of food production should exceed the growth rate of the population of the region. Even to maintain the present consumption level, the growth rates of food production and population growth should be almost the same, particularly in the situation where the purchasing power of the bulk of the population is low. The growth rates of food production and population are shown in Table I.

It is evident from Table I that the States of Punjab, Haryana, Karnataka and Gujarat have shown much higher growth rates for food production than the national average, whereas the States of Kerala, Andhra Pradesh, Bihar, Madhya Pradesh, Tamil Nadu, Maharashtra and Orissa have witnessed growth rates much lower than the all-India average. The human population in these States has also grown with uneven rates, with Assam showing the highest rate while Tamil Nadu

TABLE I—GROWTH RATES OF FOODGRAINS PRODUCTION\* AND POPULATION \*\*

States								Food production	Population
								(1960-61 to 1978-79)	(1961-79)
1. Andhra Pradesh	..	..	..	..	..	..	..	1.69	1.68
2. Assam	..	..	..	..	..	..	..	2.36	3.00
3. Bihar	..	..	..	..	..	..	..	1.92	1.69
4. Gujarat	..	..	..	..	..	..	..	3.56	2.34
5. Haryana	..	..	..	..	..	..	..	5.33	2.34
6. Karnataka	..	..	..	..	..	..	..	3.40	1.91
7. Kerala	..	..	..	..	..	..	..	1.39	2.19
8. Madhya Pradesh	..	..	..	..	..	..	..	1.67	2.36
9. Maharashtra	..	..	..	..	..	..	..	1.77	2.19
10. Orissa	..	..	..	..	..	..	..	1.19	2.19
11. Punjab	..	..	..	..	..	..	..	8.01	1.69
12. Rajasthan	..	..	..	..	..	..	..	2.97	2.37
13. Tamil Nadu	..	..	..	..	..	..	..	1.83	1.52
14. Uttar Pradesh	..	..	..	..	..	..	..	2.79	1.68
15. West Bengal	..	..	..	..	..	..	..	2.72	2.34
All-India	..	..	..	..	..	..	..	2.77	2.01

\* Source: Yoginder K. Alagh and P.S. Sharma, "Growth of Crop Production : 1960-61 to 1978-79—Is It Decelerating", *Indian Journal of Agricultural Economics*, Vol. XXXV, No. 2, April-June 1980.

\*\* Registrar General of India.

being at the end of the spectrum. The table also indicates that in some of the States, the population is growing at a faster rate than the food-grain production.

To examine the relative growth rates in these two characters, the States have been classified according to high, medium and low growth rates of foodgrain production as well as of human population. The resulting classification is given in Table II (A). As expected, Punjab State has shown high growth rate of food output coupled with low growth rate of population. The position seems to be distressingly poor in the case of Assam and Madhya Pradesh where high growth rates of population are associated with low growth rates of food output. The States of Orissa, Maharashtra and Kerala have witnessed low growth rate of foodgrain accompanied by medium growth rate in population. The States of Andhra Pradesh, Bihar and Tamil Nadu seem to have per-



formed better on the population front. But their achievement on food front is poor.

TABLE II (A)—STATES CLASSIFIED ACCORDING TO GROWTH RATES OF FOODGRAINS AND POPULATION

	Foodgrain production		
	High (> 3%)	Medium (2.5 to 3%)	Low (< 2.5%)
<b>Population</b>			
High (> 2.3%)	Haryana, Gujarat	Rajasthan	Assam, Madhya Pradesh
Medium (1.8 to 2.2%)	Karnataka	West Bengal	Orissa, Maharashtra, Kerala
Low (< 1.8%)	Punjab	Uttar Pradesh	Andhra Pradesh, Bihar, Tamil Nadu

An alternative way of classifying the States would be to consider them in relation to the national average for the growth rate with reference to the two characters. The resulting two way classification is presented in Table II (B).

TABLE II (B)—STATES CLASSIFIED ACCORDING TO GROWTH RATES IN RELATION TO NATIONAL AVERAGE

	Food		
	Greater than national average	Greater than national average	Less than national average
	Greater than national average	Haryana, Gujarat, Rajasthan	West Bengal, Assam, Madhya Pradesh, Orissa, Maharashtra, Kerala
<b>Population</b>	Less than national average	Punjab, Karnataka, Uttar Pradesh	Bihar, Tamil Nadu, Andhra Pradesh

It is evident from the table that the States of Punjab, Karnataka and Uttar Pradesh have improved their per capita availability of foodgrains

over the period as their growth rates of food production are higher while the growth rates of population are lower than the national average. On the other hand, the situation is different for the States of West Bengal, Assam, Madhya Pradesh, Maharashtra, Kerala and Orissa where the food output has risen at a relatively lower rate than the national average while the population in these States has grown at a relatively higher rate.

The differential growth rates of the two characters in different States have led to the imbalances in food availability, incomes and levels of living in the rural sector of these States. The factors responsible for the imbalances are complex and numerous. Time and space do not permit here to make a detailed study of these situations. However, the two States, *viz.*, Punjab with high growth rate of food production coupled with low growth rate of population and Orissa with typical low growth rate of foodgrain associated with higher growth rate of population have been selected to make a comparative study and for the examination of the factors which have led to the differential growth pattern.

It is evident from the foregoing analysis that the growth rates of population and foodgrain are not uniform in the two States. It has led to the wider variations in the availability of foodgrain on per capita basis. The per capita foodgrain production is shown in Table III.

TABLE III—FOODGRAIN PRODUCTION ON PER CAPITA BASIS

(kg./year)

Year	All-India	Punjab*	Orissa
1950-51	140.6	223.0	167.9
1955-56	168.7	294.8	157.6
1961-62	184.2	326.8	224.8
1966-67	148.3	313.8	217.4
1971-72	188.0	520.3	194.3
1976-77	199.3	547.3	163.3
1977-78	203.1	583.3	199.3

\* Combined Punjab and Haryana.

It is evident from the table that the State of Orissa which started with a higher per capita output of foodgrain as compared to the national average in 1950-51 did not show any improvement in this respect during

the long period of about three decades of planning, although the national per capita output has notably improved during the same period. The increase in per capita output in the State of Punjab has been spectacular during the same period resulting in its acquiring the status of the main food exporting State in the country.

The other indicator of the prosperity of the region can be the per capita availability of livestock production. It is interesting to note that for the country as a whole, in 1977, the per capita availability of milk was 98 gm. On the other hand, in Punjab this figure was 460 gm., while in Orissa the per capita availability was only 32 gm.

A natural question comes to the mind: what has led the Punjab State to this enviable position and Orissa State to the almost stagnant State? The factors responsible for this situation need careful examination in order to take corrective measures to positively level the imbalanced growth rates. Although the search of these factors and suggested measures to ameliorate the situation are related to the States of Punjab and Orissa here, their applicability may be wider covering the States and regions having similar agro-economic conditions.

#### FOODGRAIN PRODUCTION IN PUNJAB AND ORISSA

A perusal of Table IV shows that the growth rate in Punjab State was 9.54 per cent during 1960-61 to 1969-70 as against the national average of 1.85 per cent. During the same period, Orissa witnessed a growth rate of 2.16 per cent which was above the national average. During the period 1969-70 to 1978-79 the growth rate in Punjab was of the order of 5.15 per cent while in Orissa it was only 0.95 per cent, the national average being 2.74 per cent. During the entire period of 1960-61 to 1978-79 the country witnessed a growth rate of 2.77 per cent against a highest growth rate of 8.01 per cent in Punjab while the lowest rate was observed in Orissa.

TABLE IV—GROWTH RATES IN FOODGRAIN PRODUCTION

(per cent)

Year	Punjab	Orissa	All-India
1960-61 to 1969-70	9.54	2.16	1.85
1969-70 to 1978-79	5.15	0.95	2.74
1960-61 to 1978-79	8.01	1.19	2.77

Among foodgrains, rice occupies the foremost position contributing nearly 40 per cent to the total production of the country. Rice is a major crop of Orissa State occupying about 70 per cent of the total cropped area and contributing more than 75 per cent to the total agricultural output of the State. Hence, the economy of the State, particularly of the rural area, is greatly influenced by the production of rice. During the coming years there is no option, but to strive towards achieving a vertical growth in agriculture, since the scope for further horizontal expansion in area under different crops is very limited and also because the crop output per unit of land is an important indicator of development in the agricultural sector. Though rice is the most important food crop of Orissa State, its productivity continues to be considerably low and below the all-India average whereas Punjab which has recently emerged as an important rice producing State has excelled in productivity and now ranks first. Moreover, the productivity of rice is not only stagnant in Orissa during the past 30 years but also at times it has fallen much below expectations, while in Punjab the productivity level has more than doubled during the last decade. During the period of 20 years, the productivity of rice grew at a rate of 5.9 per cent per annum in Punjab as against the national growth rate of 1.5 per cent [Table V (A)]. In the State of Orissa, on the other hand, the growth rate was negative (-0.2). Total production of rice in Punjab grew at the rate of 12.5 per cent as against 0.3 per cent and 2.3 per cent for Orissa and all-India respectively. The growth rate of rice yield in Orissa was 0.17 per cent per annum during 1969-70 to 1978-79 as against the national average of 1.93. In Punjab, during the same period, yield grew at the rate of 6.98 per cent.

TABLE V(A)—COMPOUND GROWTH RATES OF PRODUCTION, AREA AND PRODUCTIVITY OF RICE

State	Character	Period I	Period II	Overall
		1959-60 to 1968-69	1969-70 to 1978-79	1959-60 to 1978-79
Orissa	Production	1.08	- 0.24	0.33
	Area	0.81	- 0.40	0.57
	Productivity	0.27	0.17	- 0.24
Punjab	Production	5.19**	16.54**	12.47**
	Area	3.06	8.93**	6.23**
	Productivity	2.07	6.98**	5.87**
All-India	Production	1.01	2.78*	2.30**
	Area	0.81	0.84	0.81**
	Productivity	0.20	1.93	1.48

\* Significant at 5 per cent probability.

\*\* Significant at 1 per cent probability.

The description of achievement of Punjab in foodgrain production will be incomplete without making a mention of its spectacular performance in wheat production. Wheat output grew at a rate of 8.93 per cent during 1959-60 to 1978-79 while its productivity rose at the rate of 4.82 per cent as against a national average of 3.97 per cent during the same period [Table V (B)].

TABLE V(B)—COMPOUND GROWTH RATES OF PRODUCTION, AREA AND PRODUCTIVITY OF WHEAT

State	Character	Period I	Period II	Overall
		1959-60 to 1968-69	1969-70 to 1978-79	1959-60 to 1978-79
Punjab	Production	9.38**	4.03**	8.93**
	Area	2.67*	2.49**	3.91**
	Productivity	6.54**	1.50	4.82**
All-India	Production	4.97**	4.99**	7.29**
	Area	1.29	2.65**	3.20*
	Productivity	3.64*	2.28*	3.97**

\* Significant at 5 per cent probability.

\*\* Significant at 1 per cent probability.

#### LIVESTOCK

Next to crop cultivation, animal husbandry is an important occupation which provides gainful employment to a significant proportion of the rural population. Studies have shown that the bulk of the livestock products comes from small land holders and backward communities. The development of livestock industry will, therefore, indirectly help the poor and backward sections of the rural areas. The development of livestock is significantly important from another angle also; for in spite of the recent advances in mechanization of Indian agriculture, the bulk of the work energy for cultivation of crops and rural transport is still derived from animals. As in the case of foodgrains production, there has been uneven regional development in livestock.

The annual increase in bovine population during the period 1972-77 was about 0.20 per cent for all-India but in the States of Punjab and Orissa it was around 0.90 per cent. If the growth is considered separately for cattle and buffaloes, it was observed that for all-India it was 1.70 per cent for buffaloes and -0.21 per cent for cattle. Although a similar trend was observed in Punjab, the reverse was the case in Orissa where the growth for cattle was 1.0 per cent and for buffaloes

--0.6 per cent. In the case of bullocks, there was a decrease of about 0.12 per cent for all-India as well as for Punjab but an increase of 1.10 per cent in Orissa. The adoption of mechanization in agriculture in various parts of the country, particularly in Punjab, may perhaps be the reason for the decrease in the number of bullocks. In the level of production also there is a contrast between Punjab and Orissa both for cows and buffaloes. A cow in milk as well as a buffalo in milk in Punjab gives per day about 3.2 kg. and 4.1 kg. of milk respectively as compared to only 0.4 and 1.2 kg. per day in Orissa ((Figure 2). Although Orissa accounts for about 5 per cent of the total milch stock in India and Punjab for 3.4 per cent, the contribution to total milk production by Punjab and Orissa is 10.5 per cent and 1.0 per cent respectively.

### AVERAGE DAILY MILK YIELD (Kg) PER ANIMAL

1977

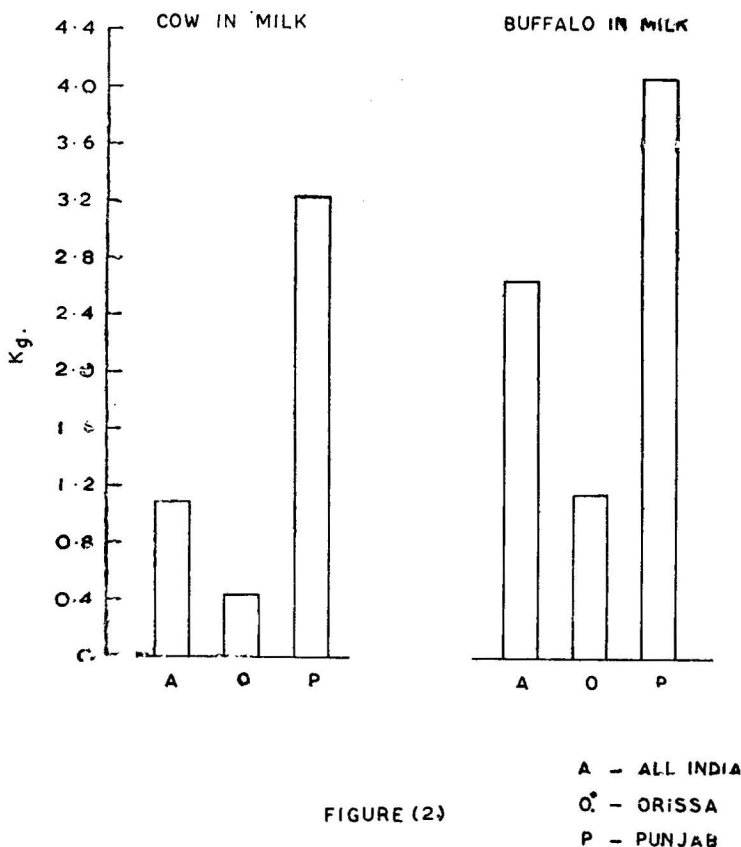
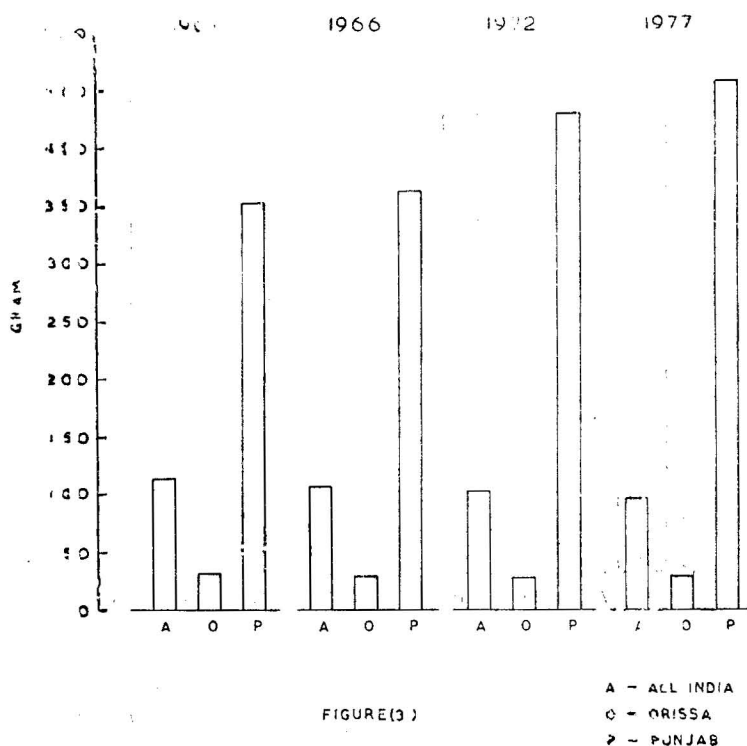


FIGURE (2)

This significant variation in milk production has caused imbalance in the per capita availability of milk which provides essential animal protein for our vegetarian population. For the country as a whole, the per capita availability of milk is about 98 gm. which is below the nutritional requirements (Figure 3). What a contrast, if one compares the figures for Punjab and Orissa. In Punjab, the per capita availability is 460 gm. which is much higher than the national average and also higher than the minimum nutritional requirement. But the picture is quite dismaying in Orissa where the per capita availability of milk is about 32 gm. Comparatively larger number of buffaloes as also relatively more productive milch stock in Punjab is obviously the reason for higher production and higher per capita availability. In Punjab, the per capita availability of milk has been steadily increasing from 354 gm. in 1961 to 460 gm. in 1977. On the contrary in Orissa, it has been stagnant at 32 gm. during the last 15 years.

PER CAPITA AVAILABILITY OF MILK ( gms / day )



According to the 1977 livestock census, there were 128 milch animals (80 cows and 48 buffaloes) per 1,000 persons in the country. The contrast is revealing when one compares the situation in the two States. Of the 197 milch stock per 1,000 persons in Punjab, 63 were cows and 134 buffaloes. In Orissa, however, there were 133 cows and only 15 buffaloes. Although both the States possess higher proportion of milch stock as compared to all-India, the predominant position of buffaloes in Punjab is distinct. This will obviously lead to higher production of milk.

The composition of cattle and buffaloes is fast changing in favour of buffaloes in the agriculturally advanced States. From the figures of previous livestock censuses one can observe that for all-India, the proportion of cattle is more than buffaloes but there is an increasing trend of buffaloes year after year. For all-India the proportion of cattle and buffaloes was 78 : 22 in 1961 and 76 : 24 in 1972. In Punjab, the 1961 census gave the proportion of cattle to buffaloes as 55 : 45 but in 1972 it was 47 : 53. In Orissa, on the other hand, the proportion of cattle to buffaloes was almost stationary, namely, 90 : 10 during the decade.

Due to historical reasons buffaloes continued to be the main milk producing animal in India in most of the regions. Because of this fact the regions with higher proportion of buffaloes among the milch animals continue to produce relatively more milk. The average milk yield per cow in milk in the country is around one kg. and that of buffalo 2.6 kg.

#### FACTORS CONTRIBUTING TO DIFFERENTIAL GROWTH

Although the causes for differential growth rates in food production are many, they can be grouped into natural, physical, socio-economic, technological and institutional, causes. In this study, some important factors like investment in agriculture, extension of irrigation facility, availability of seeds and fertilizers and other infrastructure and technological possibilities will be discussed in detail concerning the two States.

#### *Investment*

Like any other industry, agriculture needs capital investment. Indian agriculture has been greatly starved of productive investment in land for the last several centuries. By taking crops year after year without adding nutrients to the soil, the capacity of the land to produce good crops has been considerably reduced. Indiscriminate use of land has led to soil erosion, the top fertile soil flowing into rivers and finally to the sea. With the advent of planned development which was initiated after Independence, it was envisaged that adequate investment will be made for accelerating the agricultural growth for meeting the needs of increasing population. A large portion of the Plan outlay was



invested in agriculture including irrigation. Priority was given to the supporting industries like fertilizer which would further help accelerate the growth of agriculture. Incentives were extended to the farmers through land reforms and otherwise, to make their own investments. This, however, did not happen uniformly in all the regions of the country. Some regions took advantage of the programme and improved the productivity significantly while others were left behind and this resulted in imbalanced growth.

Table VI shows the total Plan outlay and outlay on agriculture including irrigation on per capita basis in the States of Punjab, Orissa and the country as a whole for the period ranging from the First Five-Year Plan to the Fifth Five-Year Plan. Although the absolute Plan outlays are not strictly comparable over time due to the depreciation of money value, the relative position of the two States clearly comes out.

TABLE VI—PER CAPITA PLAN OUTLAY IN DIFFERENT PLAN PERIODS

(Rs.)

					First Plan	Second Plan	Third Plan	Fourth Plan	Fifth Plan
<b>Punjab</b>									
Total	..	..	..	..	90	91	114	216	618
Agriculture	..	..	..	..	64	50	51	65	149
<b>Orissa</b>									
Total	..	..	..	..	13	59	121	99	236
Agriculture	..	..	..	..	4	32	26	30	72
<b>All-India</b>									
Total	..	..	..	..	62	114	160	284	632
Agriculture	..	..	..	..	14	17	25	68	130

An examination of the figures of Table VI indicates that Punjab gave highest priority to its agricultural development from one Plan to the other. Not only its per capita Plan outlay in the First Plan was nearly seven times that of Orissa, but its per capita investment in agriculture was nearly two-thirds of the total outlay while in the case of Orissa, it was less than one-third of the corresponding outlay. In spite of the poor performance of Orissa agriculture, no corrective measures seem to have been taken in the successive Plans. Even in the last Plan, the share of agriculture was less than one-third of the total outlay, while

this itself was less than two-fifth of that in Punjab on per capita basis. It is worth noting that the per capita Plan outlay in all the Five-Year Plans in Orissa has been significantly lower than that for the country as a whole. If the agriculture of Orissa has remained stagnant, it is not surprising.

Other indicators of the public investment in a State are provision of electricity, roads, railways, etc., which indirectly help in improving the efficiency of agricultural operations. During 1975-76, the consumption of electricity on per capita basis was more than double in Punjab as compared to Orissa. In 1977, all villages had the benefit of electrification in Punjab as against only 28 per cent in Orissa and even this was much below the national average (35 per cent). With regard to railways. Orissa had only 13 km. per 1,000 sq. km. as against 43 km. in Punjab and 18 km. for the country as a whole.

The agricultural industry is completely in the hands of private sector and therefore, major investment for development should come from individual farmers. Hardly any up-to-date and reliable data on the private investment in the agricultural sector are available. However, some inference may be drawn about the extent of private investment in agriculture on the basis of records available with the Government agencies.

The green revolution in Punjab led to huge investment in building up permanent assets like tractors, harvesters, tubewells and pumping sets, etc. According to the latest figures available, it is noted that there are 6 tractors for every 100 holdings in Punjab. On the contrary, in Orissa there is hardly one tractor for every 1,700 holdings. Similarly, for every ten holdings in Punjab, there is, at least, one tubewell/pumping set while in the case of Orissa, one pumping set serves about 750 holdings.

### *Irrigation*

The extension of irrigation facilities plays a vital role in enhancing the agricultural production. It is observed from Table VII (A) that the expansion of area under irrigation has taken place at a faster rate in Punjab. During 1976-77, Punjab State had the highest percentage of irrigated area, 67.2 against 25.8 per cent for the country as a whole, while in Orissa less than one-fifth of the cultivated area was irrigated and the rest of the area continued to depend on monsoon. Irregular monsoon and lack of assured water supply are probably the two main factors responsible for wide fluctuations in agricultural production in the State as the modern agriculture is dependent on the provision of assured irrigation and proper drainage.

TABLE VII (A)—PERCENTAGE GROSS IRRIGATED AREA

Year	Punjab	Orissa	All-India
1960-61	39.6	17.6	18.3
1965-66	41.2	11.8	19.9
1970-71	60.8	16.5	23.0
1975-76	65.5	19.9	25.2
1976-77	67.2	19.1	25.9

*Fertilizer*

The use of chemical fertilizer is considered to be one of the quickest ways of increasing crop yield. However, its effective use is dependent on several other associated factors like good seeds, timely availability of water, etc. The average level of nutrient consumption in both the States during recent years is presented in Table VII (B). It is evident that the fertilizer consumption is quite low in Orissa. In Punjab, the per hectare application of chemical nutrient is 5 to 6 times of that in Orissa.

TABLE VII(B)—CONSUMPTION OF FERTILIZERS\*

(kg./ha.)

Year	Punjab	Orissa	All-India
1960-61	1.0	0.8	1.6
1965-66	6.4	2.0	5.0
1970-71	26.5	4.1	13.6
1975-76	34.9	6.1	16.9
1976-77	43.9	8.6	20.4

\* Fertiliser Statistics, Fertiliser Association of India, New Delhi.

Why is the cultivator in Orissa unenthusiastic about fertilizer use? Obviously, it could be due to agronomic and/or economic factors. Is the response of principal crops to fertilizers less in Orissa? An attempt was made to examine this aspect with the help of data of experiments on cultivators' fields conducted in recent years. One difficulty in mak-

ing such a comparison is the difference in the cropping pattern in the two States. While rice is the predominant cereal crop in Orissa, wheat is the principal crop in Punjab. However, rice has assumed considerable importance in Punjab lately. Therefore, the responses might be examined first with reference to rice.

It is well-known that the average response per kg. of nutrient generally declines for higher doses of the nutrient because of the diminishing marginal returns. Hence the comparison has to be made at the same level of fertilizer application. Even this procedure is not quite satisfactory on account of the fact that the shape of response curves may differ in the two regions, but the procedure may still be adopted as a working approximation. It is found that for paddy the estimated average fertilizer response for medium dose, *viz.*, 60-80 kg. N/ha. in 1977-78 and 1978-79 was as follows :

	Response of paddy in kg. per kg. N	
	1977-78	1978-79
Punjab	19	16
Orissa	14	10

The advantage enjoyed by the Punjab farmer in responsiveness of rice is clearly evident from these figures.

In respect of wheat, the position again for medium dose under assured water supply is as follows :

	Response of wheat in kg. per kg. N	
	1977-78	1978-79
Punjab	11	11
Orissa	8	6

Even in wheat, Punjab has an edge over Orissa. When allowance is made for the fact that the availability of irrigation water is also much less in Orissa, the lower level of fertilizer consumption should not cause surprise.

#### *HYV Seeds*

As the adoption of HYV seeds is associated with the provision of assured irrigation and proper drainage, as such the HYV programme in Orissa State does not seem to have made much headway. The area

under HYV of rice was hardly 13 per cent in 1976-77 while in Punjab it was around 86 per cent, much higher as compared to the all-India average of 32 per cent.

Similarly, the adoption of plant protection measures and consumption of pesticides and insecticides on Orissa farms are considerably low though the rice crop which is the main crop of the area and grown during all seasons is more susceptible to pests and diseases.

### *Land Holdings*

It is often said that modern agricultural technology is neutral to scale. Does it mean that the small farmer has got no constraints in using all those inputs available to the large farmer? If the mechanization of agriculture is considered progress, can the small farmer adopt it with equal facility? Like any industry, the modern agriculture has become capital intensive. The capacity of making investment generally depends on the size of the farm. Larger farmers can mobilize not only their own resources but they can also procure better facilities from agricultural institutions. Consequently, the large farms have been benefited more from the modern technology as compared to the smaller ones. The general belief that the rich have become richer and the poor have become poorer seems not to be incorrect.

If the pattern of distribution of holdings for the two States is examined (Table VIII), it is observed that the large and medium farmers in Punjab together account for 85 per cent of the total cultivated area in the State, while in Orissa such farmers account for only 62 per cent of the area. These are the farmers who can afford capital intensive technology. It is, therefore, not surprising that the Punjab farmers have been using extensively tractors and other farm machinery in their agricultural operations. It is also noted that not only the size of holding is relatively very small in Orissa, it is also divided into a large number of fragments.

TABLE VIII— SIZE DISTRIBUTION OF OPERATIONAL HOLDINGS : 1970-71

Size-group	Orissa			Punjab		
	No. (per cent)	Area (per cent)	No. of fragments	No. (per cent)	Area (per cent)	No. of fragments
Small (below 2 hectares)	76.1	38.4	2.46	56.6	15.0	1.26
Medium (2 to 10 hectares)	22.4	49.1	5.11	38.4	58.2	1.68
Large (10 hectares and above)	1.5	12.5	9.35	5.0	26.8	2.32

Source : I. J. Naidu : All-India Report on Agricultural Census, 1970-71, Ministry of Agriculture and Irrigation (Department of Agriculture), Government of India, New Delhi, 1975.

The number of fragments per farm for large holdings in Orissa is almost 4 times of that of Punjab. Similarly, medium farmers in Orissa operate on fragments which are 3 times as numerous as compared to Punjab. The position is similar for the small holdings also. The fragmentation of holdings acts as a disincentive for making any permanent improvement in land.

### *Credit*

During the successive Plans, efforts have been made to develop necessary infrastructure for making easily available the essential agricultural inputs through credit. No doubt, the farmer's own initiative is an important factor for taking advantage of the available facilities. but flexibilities and simplicities of the procedure laid down by the Government and public institutions also play a key role, particularly among the weaker sections of the farming communities, in spreading the benefits of credits and loans granted by the public institutions. The Punjab farmer, who was already better off, took advantage of the credit facilities developed in the State, while the Orissa farmer got stuck in the procedural hurdles and was not benefited significantly by the infrastructure developed for providing credit for agricultural inputs.

It has been observed that in 1977, there was only one bank (branch) to serve a population of 50 thousand persons in Orissa while in Punjab one bank (branch) served only 12 thousand. For all-India this figure was 25 thousand. In terms of the deposits, it is interesting to note that during 1976 the per capita bank deposit in Orissa was Rs. 60, while in Punjab the figure was Rs. 500 and that for all-India it was about Rs 250. Thus the farmer of Punjab has not only a better capacity to make investment in agriculture but he has also got better institutional facilities for getting the loans.

### *Rainfall*

In spite of the recent advances in the technology of crop production, Indian agriculture is still dependent on rainfall. The fate of millions of farmers is determined and shaped by the distribution pattern of rains. This is more true in the rainfed agriculture. In most of the unirrigated tracts of the country farming is a gamble where the outcome is uncertain. A perusal of data on rainfall during the period June-September and food production in Orissa State indicates that the years of lowest production are also the years which have witnessed deficit rainfall upto the extent of 30 to 35 per cent.

In Punjab also the lowest production was observed to be associated with relatively a large deficit in rainfall in spite of the high percentage of area under irrigation in the State. In Punjab, an examination of rainfall data for 18 years ranging from 1960-61 to 1977-78 shows that the State received less than normal rains in four years and above normal for 14 years. On the contrary, in Orissa the deficit rain was received in 14 years and above normal in four years only. A graphical relationship between rainfall, production and productivity of important crops in the two States is depicted in Figures 4, 5 and 6.

It is evident from the figure that the rice production is dependent mainly on rainfall in Orissa while it is not so in the case of Punjab. This implies that the risk associated with the raising of crops is relatively greater in Orissa. In the presence of higher risk, farmers may not be willing to adopt new techniques of production, which require cash expenses to a larger extent. Lower investment on fertilizers and other inputs might also be the result of higher risk in farming.

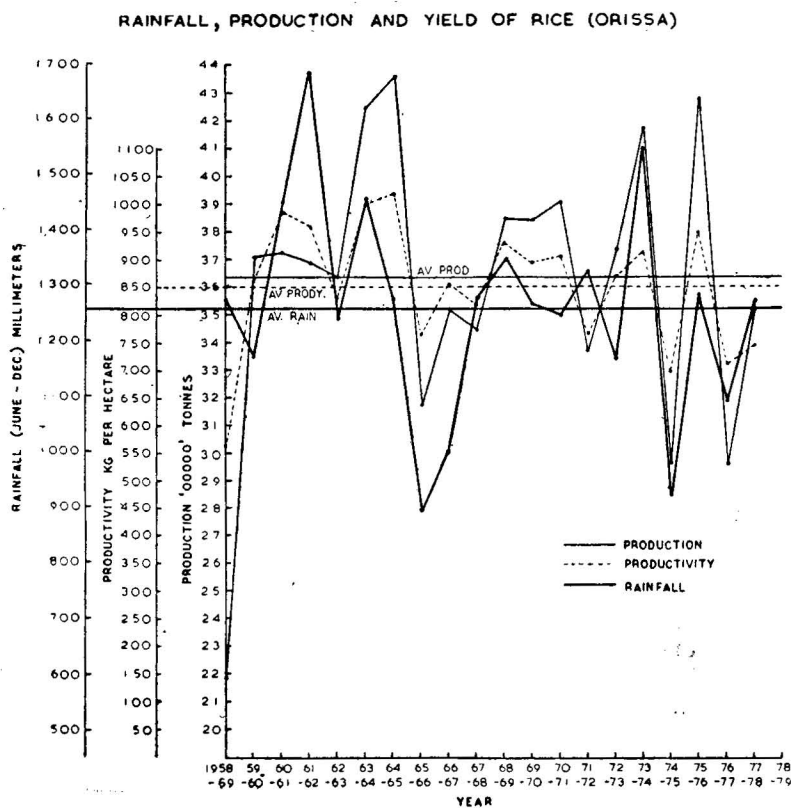


FIGURE (4)

RAINFALL, PRODUCTION AND YIELD OF RICE (PUNJAB)

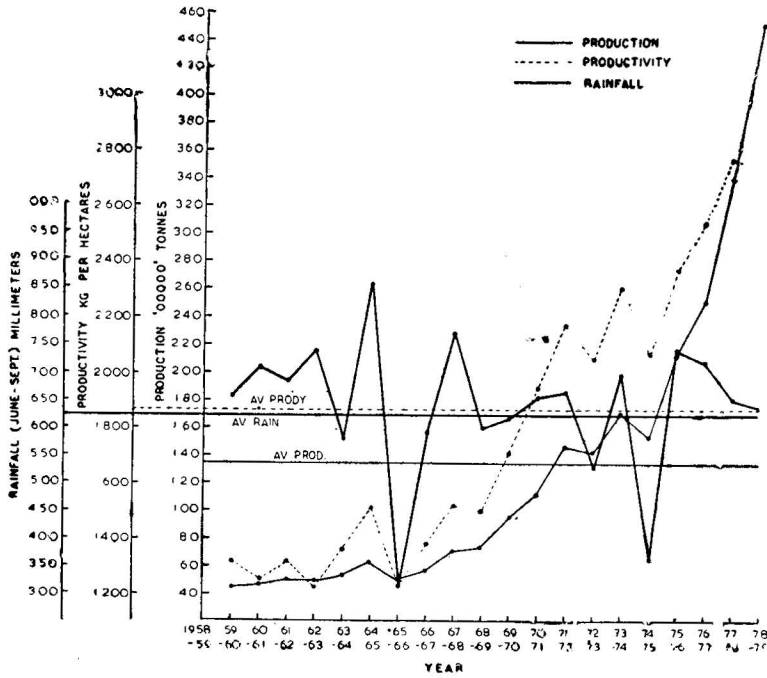


FIGURE (5)

RAINFALL, PRODUCTION AND YIELD OF WHEAT (PUNJAB)

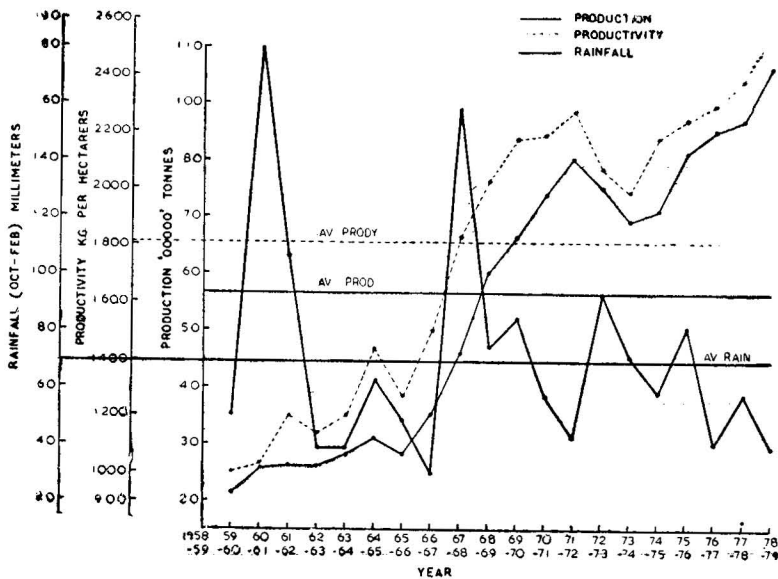


FIGURE (6)



The stability as measured by the deviations of the production and productivity for individual years from the trend lines has been studied by using two methods, namely, coefficient of variation and comparison of mean squares based on the deviations from trends for different periods. The data for 30 years ranging from 1949-50 to 1978-79 have been examined and the results are presented in Tables IX (A) and (B). The conclusions arrived at by using the two methods are not different. It seems that the stability has not improved over the period in either of the States. The position remains the same for the country as a whole. Unexpectedly, even in Punjab which has the largest proportion of area under irrigation, the stability of production has not improved significantly over time. It seems that large quantities of modern inputs go along with the irrigation water to the farms and these factors interact significantly with the weather factors. During the years of good weather there are significantly positive deviations from the trend line while the opposite is true during the bad years.

TABLE IX (A)—COEFFICIENT OF VARIATION OF FOODGRAIN PRODUCTION

State	Periods					
	1949-50 to 1958-59		1959-60 to 1968-69		1969-70 to 1978-79	
	Production	Yield	Production	Yield	Production	Yield
Punjab	7.50	9.63	14.79	10.55	9.40	7.05
Orissa	9.05	7.79	10.68	11.06	13.07	10.94
All-India	7.78	5.51	8.79	7.54	6.94	5.41

TABLE IX (B)—MEAN SQUARES DUE TO DEVIATIONS FROM TREND LINES\*

State	Years					
	1949-50 to 1958-59		1959-60 to 1968-69		1969-70 to 1978-79	
	Production	Yield	Production	Yield	Production	Yield
Punjab	106.9	136.2	271.3	144.0	107.7	54.5
Orissa	92.2	62.9	136.5	119.2	179.7	113.0
All-India	87.8	37.4	85.1	58.8	54.0	32.1

\* Based on 8 degrees of freedom.

*Possibilities for Increasing Production*

During the recent years, the efforts of farm scientists and developmental efforts of the Government coupled with the initiatives taken by the farmers had opened up new vistas of agricultural development. Tremendous progress has been achieved in respect of crops like wheat, rice, etc. The yield potentials for rice and wheat have increased to a great extent. However, full potential has not been achieved adequately by the cultivators in any of the States. The results of the national demonstrations on rice and wheat crops have shown that there is high production potential under various agro-climatic conditions in the country. These demonstrations reveal that the majority of the States in the country are hardly able to realise 20 to 40 per cent of the yield potentials which have been demonstrated on farmers' fields. Table X shows the potential and average yield of paddy and wheat in the States of Orissa and Punjab.

TABLE X—POTENTIAL AND AVERAGE YIELD OF PADDY AND WHEAT  
(AVERAGED OVER 1974-75 TO 1977-78)

State	Potential yield (kg./ha.)		Average yield (kg./ha.)		Percentage realised	
	Paddy	Wheat	Paddy	Wheat	Paddy	Wheat
Punjab	6815	3826	3829	2434	56	64
Orissa	4715	3276	1275	1735	27	53
All-India	5073	3551	1754	1404	34	39

A perusal of the table shows that even the agriculturally most advanced State of Punjab has hardly achieved more than 50 per cent of the potential for the principal crops of the country, *i.e.*, paddy and wheat. The gap between the potential and actually achieved yield in Orissa is much larger. Even for paddy, the main crop of the State, the potential achieved is slightly more than one-fourth. The study of the performance of the HYV undertaken at the Indian Agricultural Statistics Research Institute has shown that the best five per cent of wheat farmers in Punjab have achieved as high a yield as that achieved in national demonstration. Even in Orissa, the best five per cent paddy farmers' yield is fairly close to the national demonstration yield. This shows a great technical possibility of improving the productivity.

*Suggestions for Reducing Imbalances*

The most distinctive feature characterizing the difference between the two States is that Punjab agriculture has an assured water supply

through an extensive irrigation system whereas in Orissa in spite of almost double the rainfall the assured water is available to only a small fraction of the cultivated area. It seems, therefore, that highest priority in Orissa should be given to the management of water. Orissa is one of the few States which account for the maximum run-off. More than two-fifths of the total rain water passes to the sea through the run-off. This water is not only unavailable for any useful purpose but it also frequently causes floods, soil erosion and considerable damage to the crops and property. If a suitable scientific plan for conservation of water is prepared and implemented, it will not only improve the potential of Orissa agriculture but will also reduce the chances of flood occurrence.

The cheapest way of storing rain water appears to be the development of local water reservoirs such as tanks and ponds at the village level. Therefore, the improved tank irrigation system needs to be given priority. It is unfortunate that the small tanks and ponds which are more appropriate devices for harvesting run-off water and as such were common in the past, have receded in the background in recent years. At one time these tanks were a very important part of our agriculture. The entire approach to organization and administration of tanks for water conservation should be reoriented and made scientific. In this connection, the policy recently announced by the Union Minister of Irrigation regarding the development of water conservation grid system is a step in the right direction.

One thing that stands in the way of conservation and efficient utilization of water is the fact that the agrarian structure in Orissa, as noted earlier, is characterized by predominance of small and fragmented holdings. The first step towards the project of water conservation should be improving the land through consolidation of holdings and this should be followed by the levelling of land. These steps are essential to provide adequate incentive for further investment of land resources. It will lead to better utilization of resources and ensure proper water harvesting. Soil erosion will also be minimized.

Such a programme has another advantage too. Its implementation will utilize local resources of manpower which is available in plenty. By and large, a largest portion of the cultivated area is monocropped in this region and the farmers remain idle for most part of the year. The surplus manpower could be utilized under the programme of water and soil conservation in the off-season. Such programmes are not uncommon but usually are undertaken as a part of relief work during famines and crop failures. It is wondered whether such programmes cannot be taken up as a regular activity of the State Government as a part of the land and water development programmes.

The analysis has indicated that the public investment in terms of outlay during different Plans has been inadequate in the State of

Orissa. Massive investments have been made by the Government in constructing dams and power houses in various parts of the country. It is not clear why an investment of similar order or even of a larger order cannot be made in States like Orissa which suffers from low productivity. In such investment programmes, land development through mechanical devices should be given the highest priority. This should be followed by investment in water lifting devices, both the surface and underground water. The capacity of the farmers of the State to make such investments is limited. The public investment should come forward on a large scale in this sector.

Credit and marketing institutions for agriculture are very few. Their number should be multiplied and the procedure should be flexible enough so that even the smallest farmer can get advantage of these facilities.

The foregoing analysis has also shown that the yield of rice, the principal crop of Orissa, is much lower than the national average in spite of the fact that the premier rice research organization of the country, namely, the Central Rice Research Institute, is located in the heart of the State. Another research organization, the Orissa University of Agriculture of the State does not seem to have achieved its objective in full. The future development of the State might be influenced considerably by the extent to which these institutions are able to develop location specific technologies suitable for the State.

The potential of food production in the State is comparable with the national average, however, its realization is very low. This seems to be mainly because of lack of adequate extension efforts to popularise the high-yielding varieties seeds, application of fertilizers and adoption of new techniques of production. There is a greater need to strengthen the extension agencies in the State which are necessary for educating the farmers for adoption of new technologies. It is wondered whether the Agricultural Extension Department of the State cannot be helped through the central aid by drawing experts from progressive States. If the developed nations can assist the developing nations by providing aid through the international agencies why should it not be possible for more developed States to extend such assistance through the central aid?

What has been stated about Orissa State is perhaps equally applicable to other States which have not been able to take advantage of the modern agricultural technology. No doubt, the work is stupendous but no time should be lost as the delay instead of solving the problem will aggravate it further. The social conflict which is seen today in some parts of the country is perhaps the result of the economic backwardness of those areas. The potential is indeed great and not beyond the possibilities of achievement. However, even if we succeed

in achieving half the potential, it will mark substantial progress over the conditions now prevailing.

In this great effort I have no doubt that the economists have to contribute a lot by undertaking studies at the micro level to demonstrate and convince the farming community as well as policy makers that what is possible technologically, is also economically feasible. This area does not seem to have received sufficient attention so far and it would help future progress greatly if it now receives the attention of the research economists.