E.C. No 418

ESTIMATES COMMITTEE 1964-65

SEVENTY-SEVENTH REPORT

(THIRD LOK SABHA)

MINISTRY OF FOOD AND AGRICULTURE

(Department of Agriculture)

CENTRAL RICE RESEARCH INSTITUTE
CUTTACK

LOK SABHA SECRETARIAT
NEW DELHI
March, 1965
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CORRIGENDA

to

Seventy-seventh Report of the Estimates Committee on the Ministry of Food and Agriculture (Department of Agriculture) – Central Rice Research Institute. Cuttack.

Page 3, para 6 lines 2 3 *for* 'Aid Agencies Programmes' *read* 'Aid Agencies/Programmes'

Page 3 para 6 S No (4) *for* 'manichinery' *read* 'machinery'

Page 3 para 7 marginal heading *for* 'Plan' *read* 'Plan'

Page 4, S No 2, Col 9, *for* '2. 19. 938' *read* '2. 10. 938'

Page 9, para 13, line 4, *for* 'hybidization' *read* 'hybridization'

Page 18, line 12 *for* 'odou' *read* 'odour'

Page 21, para 27 line 9, *for* 'Thechnique' *read* 'Technique'

Page 21, para 28, line 3, *for* 'Following the the' *read* 'Following are the'

P. T. O.

Page 24 Table 1 S No 9 col 3 *for* 13965
read 1365

Page 31 para 37 line 6 *for* 'at time' *read* 'at times'

Page 34 table *delete* 1 against Mysore under 1964
and *insert* 1 against Madras under 1964

Page 62 S No 42 *for* Sub station *read* Saline Water
Sub station West Bengal

Page 63 line 4 from bottom *for* 44 under S No
read '45'

200-LSRP-17-4-65/1,140

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(1964-65)

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*Elected w. e. f. 18th September, 1964, *vice* Shri Lalit Sen ceased to be a member of the Committee on his appointment as a Parliamentary Secretary.

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INTRODUCTION

I, the Chairman, Estimates Committee having been authorised by the Committee to submit the Report on their behalf, present the Seventy Seventh Report on the Ministry of Food and Agriculture (Department of Agriculture)—Central Rice Research Institute, Cuttack.

2. It would be recalled that the Estimates Committee for 1952-53 and 1953-54 had examined the estimates of the Ministry of Food and Agriculture and presented the Sixth Report (November 1953) which *inter alia* dealt with the Central Rice Research Institute. Action taken by Government on the recommendations contained in the above Report was examined by the Estimates Committee (1956-57) who presented the Fifty-Second Report (March 1957) on the subject.

3. The Committee took evidence of the representatives of the Ministry of Food and Agriculture on the 5th December, 1964. The Committee wish to express their thanks to the Additional Secretary, Ministry of Food and Agriculture, Director, Central Rice Research Institute, Cuttack and other officers of the Ministry for placing before them the material and information they wanted in connection with the examination of the working of the Institute.

4. The Report was considered and adopted by the Committee on the 12th March, 1965.

5. A statement showing the analysis of recommendations contained in the Report is also appended to the Report (Appendix V).

NEW DELHI;
March 26, 1965.
Chaitra 5, 1887 (*Saka*).

ARUN CHANDRA GUHA,
Chairman,
Estimates Committee.

CHAPTER I

INTRODUCTORY

A. Oryza Sativa

Rice is cultivated from very ancient times throughout the warmer regions of the Old and the New world. According to R. J. Roscheviez, cultivated rice, *Oryza sativa,* including all its numerous varieties, originated from wild species which are indigenous to India, Indo-China and Africa. *Oryza sativa* is even now met with in the wild state wherever marshy lands occur, in Madras, Orissa and West Bengal. The *Uri* or *Jhara* rice of West Bengal is only one form of wild *Oryza sativa,* which may be the origin of the various *aus, aman* and *boric* paddies. The wild rice is hardier than cultivated rice, and as it is self-sown and is easily carried from field to field, it has been sometimes known to exterminate the cultivated rice and take its place. Wild rice is met with even in dry regions of Madhya Pradesh usually in shallow pools of water.

B. Rice Consumption

2. Paddy cultivation is one of the importent agricultural operations in India. Food consumption in India is dominated by cereals and among cereals rice occupies the most important position. Of the total consumpton of cereals, roughly about one-half is represented by rice. More than 21 per cent of the total annual cultivated area of the country is under the paddy crop.

The demand for rice has been increasing in recent years due to the operation of a number of factors, including growth of population, improvement in the average *per capita* income in the country leading to better standards of living among the poorer sections of the population, and urbanization.

Though India is the largest paddy growing country in the world having cultivated area of about 79 million acres annually under paddy, which is about one-third of the world acreage under this crop, her paddy production falls short of her requirements mainly due to the low per-acre yield of the crop raised.

C. Origin and Growth of the Institute

3. The Central Rice Research Institute, Cuttack was established by the Government of India in September, 1946 with a view to undertake fundamental research in all aspects of rice culture, to investigate such problems as have wide application in the country

and serve as a centre of authoritative information on all matters relating to the rice crop.

In pursuance of these objectives, the Institute has bred several rice varieties with wide range of adaptability in different parts of India which are being released to the States from time to time for their country-wide exploitation. It has made available to extension workers the results of investigations on cultural and manurial schedules, methods and effective time of application of fertilisers, uses of different green manures, plant protection schedules including techniques for forecasting the outbreak of pests and the time of application of these schedules for the control of major rice pests, etc.

The Institute has an area of 253 acres of land at its disposal and has developed its own farm for field experimental work and for multiplication of the seed of improved varieties developed at the Institute.

Cuttack is one of the five centres in the world for maintenance of rice material, the other centres being Tokyo of Japan, Bogor of Indonesia, Habiganj of Pakistan and Maryland of U.S.A. The International Rice Research Institute in Manila is maintaining coordination between these five international centres. The Central Rice Research Institute, Cuttack has been entrusted with the collection of genetic material in so far as India, Nepal and bordering countries are concerned. It has been recognised as a centre for post graduate training and a centre for coordination of technical programmes by the International Rice Commission of the Food and Agriculture Organisation.

D. Organisation and Functions

4. The technical work of the Institute which is mainly concerned with the genetic improvement of the rice crop and allied aspects, is organised in ten different Research Divisions and one Farm Division. The various Research Divisions carry out investigations in their respective fields and assist the Director in Advisory work. The entire technical work is under the coordinated direction and control of the Director, who is the head of the Institute. There is an administrative unit also which functions under the direct control of the Director. The organisation of the Institute and the functions of each Division in brief are given in Appendices I and II respectively.

For studying the special problems of rice cultivation and improvements in saline soils, a sub-station of the Central Rice Research Institute, *viz.*, Central Saline Resistant Rice Research Sub-Station was established in 1959 at Canning, West Bengal. Besides

this, eleven research units were set up in 11 rice-growing States, *viz.* Andhra Pradesh, Assam, Bihar, Jammu and Kashmir, Kerala, Madhya Pradesh, Mysore, Orissa, Tripura, Uttar Pradesh and West Bengal for the evolution of *Indo-Japonica* hybrid varieties suited to different agroclimatic regions.

E. Budget Provision

5. Following are the figures of expenditure incurred by the Institute during the last three years:

	Revenue Grant	Capital Grant
	Rs.	Rs.
1961-62	8,65,692	2,33,234
1962-63	8,87,720	2,00,794
1963-64	10,80,000	5,84,962

The budget provision for 1964-65 is Rs. 19,64,000.

Foreign assistance

6. The Central Rice Research Institute has so far received assistance from the following Foreign Aid Agencies Programmes:

1) Rockefeller Foundation	$1,21,077·50 In the shape of laboratory equipment and books. Also training facilities received by five technicians.
(2) Colombo Plan	£(A) 6,525·00 In the shape of Agricultural Machinery and laboratory equipment. Also training facilities received by three technicians.
(3) FAO and other U.N. specialised agencies.	One trainee was sponsored for International Training in Soil Science in Hyderabad in 1955. Another trainee was sponsored under Expanded Technical Assistance Programme for Nematology.
(4) T.C.M. (now Agency for International Development)	$2,740·22 In the shape of manichinery and machine tools. $5,344·00 In the shape of laboratory equipment and books. Training facilities received by one technician.

Plain Provision

7. A statement showing the allocation and expenditure in respect of the Plan projects is reproduced below:

Sl. No.	Name of the Scheme	Allocations	Expenditure			Revised estimate 1964-65 (Proposed)	Budget estimate 1965-66 (Proposed)	Total (Col. 4 to 8)
			1961-62	1962-63	1963-64			
1	2	3	4	5	6	7	8	9
		Rs.	Rs.	Rs.	Rs.	Rs.	Rs.	Rs.
	REVENUE							
1	Scheme for Intensification of research work in various divisions at C.R.R.I., Cuttack . . .	8,60,000	Nil	42,156	1,21,600	1,75,400	1,65,500	5,04,656
2	Improving of development work in various divisions/Fields . .	3,04,000	[1,429	29,209	47,100	61,100	81,100	2,19,938
	CAPITAL							
3	Building Programme of C.R.R.I. including carryover expenditure on the building project during 2nd Plan	28,36,000	2,33,234	2,00,794	5,64,300	..†	..†	9,98,328
	TOTAL . .	40,00,000	2,34,663	2,72,159	7,33,000	2,36,500	2,46,600	17,22,922

†Provision made under the Budget of the Ministry of Works and Housing.

Revised statement as furnished by the Ministry of Food and Agriculture at the time of factual verification.

CHAPTER II

BREEDING AND PRODUCTION

A. Introduction

8. One of the most pressing problems of the country today is how to increase the production of rice and thereby reduce its import to the minimum. To achieve this end, recourse has to be taken to intensive cultivation, systematic breeding, heavy manuring and pest and disease controlling programmes. The Central Rice Research Institute is engaged on the research on all these aspects of rice production. It has been stated during evidence that from the inception of "Five Year Plans", the rice yield has increased by approximately 30 to 40 per cent per acre.

B. Country-wise Production

9. The yield of rough rice per hectare in various rice growing countries of the world, is indicated in the table below:

Rice Rough

Countries	Average Yield (Kg/ha)
Spain	6206
Australia	6094
Italy	5334
Japan	4837
Egypt	4374
Taiwan	3415
Burma	1653
Pakistan	1592
Thailand	1480
India	1478

From the study of the above table, the Committee note that the average yield of rough rice per hectare in India is the lowest. It is only about 30 per cent of the average yeild in Japan, the most advanced country in the East in this respect.

The Committee are unhappy to note that despite years of production of rice and systematic researches conducted in our agricultural

research institutes, the yield of rice per hectare in India should continue to be so low.

In view of the present pressing need for augmenting food resources, the Committee would strongly urge that this particular problem should be viewed with a sense of urgency and that co-ordinated and concerted efforts should be made to increase the yield of rice per hectare by the application of the latest scientific techniques and more intensive cultivation of the varieties already evolved.

C. State-wise Production

10. The total production of rice and average yield per hectare in India and in the rice growing States during 1963-64 is shown in the table below:

Total production (Clear rice)	(1000 metric tonnes)	Average yield (kg/ha)
India	36489	1029
Andhra Pradesh	4256	1266
Assam	1848	1002
Bihar	4534	853
Gujarat	485	933
Jammu & Kashmir	253	1120
Kerala	1120	1392
Madhya Pradesh	3181	755
Madras	3917	1495
Maharashtra	1518	1147
Mysore	1411	1394
Orissa	4306	1000
Punjab	550	1154
Rajasthan	107	941
Uttar Pradesh	3273	754
West Bengal	5331	1177
Himachal Pradesh	38	808
Manipur	109	677
Tripura	174	946
A. & N. Islands	9	1328
Nagaland	71	976

1 ha-2·4711 acres.

1 metric tonnes—1000 kg.—2205 lbs.

It would appear that comparing the various rice growing States in India inter se, *the yield per hectare in some States is even less than* 50 *per cent of the yield in Madras, Mysore and Kerala. It is noteworthy that States like Bihar, Madhya Pradesh, Orissa, Uttar Pradesh, Gujarat, etc. are lagging behind. Apart from the urgent need for a substantial increase in the average yield per hectare in the country as a whole, the Committee feel that the question of low yield per hectare in particular States needs special attention.*

D. Selection of Varieties from other Countries

11. Research is being conducted at Central Rice Research Institute to introduce Japonica, Javanica and Chinese (Taiwan) etc. varieties which are high yielding and have wide adaptability to varying agro-climatic conditions of the country. A hybridization scheme has also been launched upon for this purpose. Varieties from other countries tested and found useful for introduction in India being early, high yielding and response to heavy fertilization are indicated below:

1. Japonica types—8
2. Javanica types—4
3. Chinese (Taiwan) types—5

The Committee have been informed that some Japanese and Chinese varieties have been accepted, particularly in hills. These are mainly suitable for temperate climate where days are longer. The Chinese variety gives a yield of 100 maunds to 120 maunds per acre in Almora district of Uttar Pradesh. In Kashmir valley also some Chinese varieties are giving easily 80 maunds per acre on an average.

The Committee suggest that the feasibility of introducing some of these varieties in the areas where days are longer may be considered.

The Committee also suggest that the technological processes evolved in Japan for overcoming natural and physical difficulties, like artificial control of the temperature of water for maintaining the crop growth, may also be studied by Indian agricultural scientists and some of the exotic strains requiring shorter period for maturing may be introduced in the predominantly rice producing areas of the country so that 2 *or* 3 *paddy crops may be widely cultivated.*

E. Selection and Evolution of local Varieties

12. The Committee have been informed that there are about 400 varieties of paddy which are cultivated in India. Research is being conducted to reduce the number of the existing varieties and to evolve new ones. The Institute has evolved several rice strains superior to the local varieties of comparable duration. The number of varieties so far evolved at the Institute is given below:

	Nos.
Early duration varieties	2
Medium duration varieties	12
Late duration varieties	3
Disease resistant varieties	7
Non-lodging varieties	14
Varieties possessing high response to heavy manuring	2
	40

The performance of some of the strains evolved at the Institute in various States is indicated in the table below:

Variety	Yield in Kgs. per hectare				
	Assam	Madhya Pradesh	Mysore	Uttar Pradesh	West Bengal
CR 201 . .	..	4060	..	..	3941
CR 202 . .	..	4171	..	..	..
CR 203 . .	..	4665	4531	3302	3915
CR 204 . .	3390	4105	4284	..	..
CR 205 . .	..	3791	3528	..	..
CR 206 . .	..	3791	..	..	..
CR 906 . .	..	..	3430	3922	..
CR 907 . .	..	..	4928	4728	..

The Committee feel that the progress made during the last 18 years in the evolution of high yielding strains and in testing the varieties from other countries useful for introduction in India has been slow and halting. They suggest that vigorous efforts should be made to step up the research activities of the Central Rice Research Institute and other rice research centres in this behalf.

F. Japonica X indica rice hybridization

13. It has been stated that with a view to combining the responsiveness to high fertilization of the *Japonica* varieties with the hardiness and adaptability of *Indica* varieties, chiefly under tropical conditions, hybidization programme was started in the year 1952. This programme envisaged the setting up of 11 units (one in each of the participating rice growing States.) These units function in complete collaboration with the supervision of the Paddy Specialists or Economic Botanists of the respective States, but under the overall technical control of the Director, Central Rice Research Institute, Cuttack. Attempts have also been made under this scheme to assess whether any of the Indica, Javanica and Taiwan types possess responsiveness to progressively increased doses of fertilizers.

The Committee have been informed that certain Indo-Japonica strains have been evolved which have in some cases given marginal increase of 10 per cent, and in some others 20 per cent. They go up to 30—40 per cent in several cases but the results are not yet so reliable as to justify multiplication and further propagation. The economics of this increase in yield has not been worked out so far.

The Committee are distressed to note that no substantial results have so far emanated from the experiments conducted under Japonica—Indica rice hybridization scheme which has been in operation for more than decade. In view of the present imperative need for increasing the food resources of the country even at a higher cost, the Committee would strongly urge that the work of multiplication of such varieties as are expected to give at least 25 per cent extra yield may be undertaken and the economics of their cultivation worked out alongside.

G. Crop Sequence

14. At present the cropping pattern varies from place to place in different rice growing States. The Central Rice Research Institute has been conducting experiments to determine the possibility of growing different legumes and cash crops in sequence with the main rice crop. It has been found that from the point of view of total production of rice, two crops of rice a year have given the maximum production, *viz.* 4708 Kg/hectare. But from the point of view of total productivity, in terms of the value of the produce, the maximum returns have been obtained in Jute/Rice, Groundnut/Rice and Potato Sesamum-Rice rotational cropping patterns.

The Institute has also worked out the detailed economics of these and some other useful rotational cropping patterns; the results of which are given in the table below:

Cost of production of paddy and returns under cropping patterns (1961-62)

Pattern of cropping	Cost of production of paddy per md.	Actual yield from the sequence				Monetary value of the crops grown /ha			Total	Total cost of cultivation/ ha	Net returns	
		Kharif rice		Rabi crops		Kharif rice		Rabi crops			Per ha	Per acre
		Grains kg/ha	Straw kg/ha			Grain	Straw					
	Rs. P					Rs. p.	Rs. p.	Rs. p.	Rs. p.	Rs. p.	Rs. p.	Rs.p
Rabi-Kharif .												
Rice-Rice .	6·36	3073	4092	1635 kg 2356 kg	grain straw	829·70	165·72	441·45 95·42	1532·29	849·83	682·46	276·25
Rice/Jute-Rice .	6·68	2923	4075	1142 kg 1178 kg 950 kg fibre	grain straw jute	789·20	165·04	308·34 47·71 770·10	1080·39	1321·25	759·14	307·30
Cotton-Rice	7·65	2455	2686	315 kg lint	cotton	662·85	108·7 8	866·25	1637·88	998·95	638·93	258·67
Groundnut-Rice	8·46	2205	2686	2532 kg	of pods.	595·35	108·78	1519·20	2223·33	1376·30	887·03	342·88
Berseem-Rice	6·62	2835	4095	16000 kg	fodder	765·45	165·84	700·53	1631·82	1100·75	531·07	214·98
Potato/sesamum-Rice	8·82	2116	2516	8600 kg 380 kg	potato sesamum	571·32	101·90	1634·00 478·80	2786·02	1837·65	948·37	383·95

Rice @ Rs. 10 per md.

Groundnut @ Rs. 0·60 per kg.

Sesamum @ Rs. 126 per quintal

Jute fibre @ Rs. 30 per md.

Berseem @ Rs. 1·62 per md.

Rice Straw @ Rs. 1·50 per md.

Cotton lint @ Rs. 275 per quintal.

Potato @ Rs. 0·19 per kg.

The Committee are glad to note that the Institute has made a study of multiple cropping and has also worked out the economics of different patterns of cropping. They suggest that the results of the study should be publicised and also made available to the Departments of Agriculture in the States who may be asked to put them into practical use so that the benefits of the multiple cropping may eventually be passed on to cultivators.

H. Tripple Cropping

15. The Committee have been informed during evidence that by judiciously adjusting the planting schedule and selection of varieties, it is possible to grow successfully three crops of paddy in a year on the same land under assured irrigation facilities where the temperature range is not very high. Southern States like Mysore, Madras and Kerala are stated to be the areas where three crops are grown, Tanjore being well-known for it. Tripple cropping is possible in certain parts of West Bengal, Orissa and the coastal areas of Andhra Pradesh also, depending entirely on the temperature range of the place. It may, however, be necessary to evolve new varieties of rice for growing in these areas.

The Committee consider that it would be desirable if the areas where three crops of paddy can be successfully raised in a year are surveyed and methods devised in consultation with the concerned State Governments for educating the cultivators of those areas in the techniques of tripple cropping so that increase in yield can be effected without a corresponding increase in acreage.

I. Seed Multiplication

16. It has been stated that a portion of the farm attached to the Institute measuring about 50 acres is being utilised for the multiplication of improved varieties of seed. In addition to this 7 acres of land is utilised for this purpose at the sub-station of the Institute in West Bengal. Whatever the Institute produces as nucleus seed is supplied by them to the Agriculture Department of Orissa State for multiplication in their departmental seed farms and the produce of the seed farms is distributed to the cultivators. During evidence it has been stated that each State does its own seed multiplication for its recommended variety and that this work cannot be centra-

lised. The quantity of seeds produced in the Institute and its approximate value during the last three years is given below:

	Production (rounded of)	Approx. value @Rs. 15/ - per maund
1963	1565	Rs. 23,475/-
1962	1474	Rs. 22,110/-
1961	448*	Rs. 6,720/-*

* The production was extremely low due to severe floods during the year.

The Committee would suggest that the question of distribution of some quantity of seeds produced in the Institute's farm to each rice growing State for further multiplication in their respective farms may be examined so that the quality of seeds produced in these States may be improved.

J. Clonal or Vegetative Propagation

17. Clonal propagation or vegetative propagation is a well-known practice in agriculture in crops like sugarcane, sweet potato and potato which are raised not from seed but from plant body, such as the sugarcane setts, cuttings of sweet potato and tubers of potato. In rice also it has now been proved that a full crop can be raised by practising clonal propagation.

The salient features of different methods of vegetative propagation are as follows:

(i) *From stubbles*: In this method a single stubble of variety GEB. 24 taken in February and planted and separated periodically would occupy an area of 0.75 acres at the time of final planting, without using any seed, and the crop so raised gives higher production by at least 20% as compared to the normal seedlings. In actual practice, however, two to three stubbles may be taken to cover one acre in the main season.

(ii) *From seed within the season*: For the purpose of vegetative propagation within the season, a few seeds are sown in the nursery early in the season, say, by the beginning of May, when each seedling produces 2 or 3 tillers after 3—4 weeks. Then the seedlings are uprooted, tillers are separated and planted individually to induce further tillering. The process is repeated as and when 2—4 tillers develop. This way one single seed of a rice variety, GEB. 24 originally sown in late April is said to give rise

to 356 tillers during the course of approximately three months. It is claimed that besides giving an increased yield of 40 to 50%, this method hardly needs 2 to 3 oz. of seed for covering an area of one acre as against 30 lbs. required for normal planting.

(iii) *Modified Technique*: It consists in transplanting the normally raised four to five week old seedlings with optimum spacing directly in the puddelled field on the usual date of planting, allowing them to tiller for about three weeks or so, and separating the tillers at this stage for retransplanting them with a closer spacing in the same area.

It has been stated that recent studies on potentialities of vegetative propagation in rice at the Central Rice Research Institute have proved that most of the cultivated varieties could effectively be used to exploit the technique of vegetative propagation. Tiller plants have been found to stand later planting, establish quicker, give uniform stand and complete flowering earlier than the seed plants by about a week. Mortality of seedlings in the field is the least with vegetatively propagated treatment. The height of plants, number and weight of grains per plant and the length of panicles are higher in tiller plants than those in seed plants. Percentage of chaffy grains is the least in tiller plants. Both seed and tiller plants behave similarly so far as the response to manuring is concerned. The seed rate is abnormally reduced and purity of seeds is maintained. Above all, the yield is substantially increased, upto 100% by adopting the technique of vegetative propagation as compared with normal seedlings.

In reply to a question whether the cost in the production of paddy will increase by the adoption of the technique of clonal propagation in rice cultivation, the representative of the Ministry stated that—

> "The economics has not been worked out and we are not certain what is the advantage of doing this. Whether this method as opposed to growing from seed has any economic advantage has got to be proved. The economics has not been worked out. Until that is done, we cannot recommend it to farmer."

The Committee are surprised that though enough publicity has been given to this technique of clonal propagation, no efforts have been made so far to ascertain the cost of production of paddy by adoption of this technique.

The Committee would emphasise that the economics of this technique should be worked out as early as possible through extensive trials in different States before it can be recommended to the former and steps taken for its adoption.

K. Methods of Cultivation

18. The Central Rice Research Institute has devised its own method of rice cultivation *i.e.* the "recommended method", and has assessed its efficiency in comparison with other known methods, as is shown in the table below:

	Yield in lb acre during 1957 and 1958		
	1957	1958	Mean
Japanese Method	2840	2736	2788
Wave Method	3081	2236	2659
Thackersey Method	2701	1808	2255
Chinese Method	2900	2178	2539
Recommended Method	2854	2125	2490

42. The Institute has also worked out the economics of some important methods of cultivation which is indicated in the following table:

Yield in lb./acre and cost of cultivation per acre (1959).

Method	Yield of grain	Cost of cultivation per acre
Chinese	2661	Rs. 5849
Japanese	2287	Rs. 475
Recommended	2925	Rs. 412

The main features of various known methods of rice cultivation are given in Appendix III. The method devised by Central Rice Research Institute and recommended by the Ministry of Food and Agriculture (Department of Agriculture) is stated to be best suited to this country. Detailed economics of various processes involved in the 'recommended method' per acre has also been worked out by the Institute which is given in the chart below.

Per acre average cost of production of clean rice by recommended method of cultivation
(Data collected at the Central Rice Research Institute—1963)
(Average yield—36 mds/acre)

Sl. No.	Operation	Labour	Rate	Total Cost	Percentage of cost
			Rs.	Rs.	
1	Preparation of land including incorporation of green manure and puddling	15 pairs	3·50 per paid	52·50	18·14
2	Cost of 20 lbs. green manure seed	..	0·25 per lb.	5·00	1·73
3	Cost of 200 lbs. Superphosphate	..	260·00 per ton	23·21	8·01
4	Cost of 100 lbs. Ammonium Sulphate	..	390·00 per ton	17·41	6·00
5	Cost of raising seedlings, uprooting etc. (640 bundles)	..	3·25 for 80 bundles	26·00	8·97
6	Transporting seedlings and planting	5 Men 12 Women	1·62 per Man 1·37 per woman	21·30	7·35
7	Interculturing twice with a weeder	10 Men	1·62 per man	16·20	5·60
8	Hand weeding the crop twice	16 Women	1·37 per woman	21·92	7·57
9	Plant Protection Measures	..	..	15·00	5·17
10	Irrigation charges and water rate	..	..	9·50	3·28
11	Harvesting, Bundling and threshing	10 Men 12 Women	1·62 per man 1·37 per woman	32·64	11·26
12	Cleaning and drying paddy twice	..	0·10 per md. each time	7·20	2·48
13	Milling charges of 36 mds. paddy	..	1·00 per maund	36·00	12·42
14	Cleaning charges of 23·4 maunds rice (Recovery 65%)	..	0·25 per maund	5·85	2·02
	Total cost of production of 23·4 mds. clean rice=			289·73	100·00

Cost of Production of 1 md. clean rice $\frac{289 \cdot 73}{23 \cdot 4}$ = Rs. 12·38

N. B. Cost of 54 maunds straw (Production on an average) and 12 maunds rice bran received in addition is not included. The rental value of land not taken into account as this data concerns the Institute only.

The Committee are glad to note that the Central Rice Research Institute has devised its own method i.e. recommended method, of rice cultivation which is not only economical but also gives higher yield per acre than other known methods of rice cultivation. The Committee would suggest popularisation of this method among the cultivators and its intensive application.

L. Quality Analysis of Rice

19. The provision for the establishment of Rice Technology Division of the Institute was made in the Third Five Year Plan and the posts of a Rice Technologist and two Research Assistants were sanctioned in 1961-62. The Division, however, started functioning in December, 1963. This Division studies the varietal differences in hulling, milling and cooking qualities and chemical constituents such as proteins, fat, calcium, iron, phosphorus and vitamins etc., loss of nitrogen and vitamins in milling, influence of various manurial and cultural practices on the total nitrogen and vitamins in grains, effect of moisture content, ageing, time and method of harvesting, thrashing, parboiling etc. on the milling quality.

It has been stated that the preliminary results obtained by the Division so far indicate that they will help in pitching and evolution of better quality of rice combining high yield for recommendation to the cultivators and consumers.

It has further been stated that on the basis of high hulling and milling recovery, some varieties have already been screened for utilising them in breeding better quality rices.

The Committee are unhappy to note that although the posts of a Rice Technologist and two Research Assistants were sanctioned in 1961-62, *the Division started functioning in December,* 1963, i.e. *after a time-lag of over two and a half years. The Committee cannot too strongly urge the need for proper planning so as to eliminate delays in setting up an organisation after necessary sanction therefor has been obtained. Now that the Division has been set up, the Committee hope that positive results leading to the selection and evolution of better quality cum better yielding paddy will emanate from the studies undertaken by it.*

M. Rice Processing and Storage

20. It has been stated that with the present level of production 5 to 10 per cent of the produce is lost in defective processing and

another 10 to 15 per cent is lost in faulty storage. These losses can be averted by—

(1) Proper harvesting (3 weeks in case of early varieties and 4 weeks in case of late varieties after flowering) at favourable moisture level and slow drying of the grains in shade.

(2) Taking proper control measures for insects and pests during storage.

It has also been stated that another way to avoid loss is through the improved method of parboiling by soaking paddy in 65 to 75°C hot water for 3 hours and steaming the same for 10 to 15 minutes. This is an economical technique and leaves no unfavourable odour. Under this method the period of soaking is reduced to 3 hours as against 24 hours required at present.

The Committee suggest that concerted efforts should be made in collaboration with the Departments of Agriculture of the concerned States to educate the cultivators in the matter of improved processing and proper storage of crops.

They also suggest that adequate steps should be taken in consultation with the State Governments concerned to impress the advantages of new parboiling technique on Rice Mill Owners.

N. Commercial Classification

21. It has been stated that the present system of commercial classification of rice is based on arbitrary qualitative characters like colour, scent, starch quality, etc. Recently, the Central Rice Research Institute has, however, evolved a new system of commercial classification based on measurable physical characters like length and breadth of grain, volume of 1000 grains, etc. after studying a large number of commercial rice samples from different States. It has been stated during evidence that this system has been accepted by the Marketing Adviser of the Government of India and has been adopted on an all-India basis.

The Committee are glad to note that the system of commercial classification of rice evolved by the Institute has been accepted by the Government of India and adopted on an all-India basis. They suggest that steps should be taken for its early implementation through the State Departments of Agriculture.

CHAPTER III

PLANT PROTECTION

A. Introduction

22. The pests and diseases account for nearly 10—50 per cent loss of rice yields in different years causing on an average 20 per cent loss in yields. This loss can be minimised by taking appropriate control measures. Some of them are prophylactic in nature and others aim at prevention of the loss by specific pests and diseases. The knowledge of the cultivators in India about pests and diseases and how to control them is inadequate. Strikingly high average yields in Japan and Formosa are achieved by timely application of control measures against pests and diseases of rice.

It has been stated that epidemic outbreaks can now be forecast by the techniques developed at Central Rice Research Institute and timely action taken in the field to check the spread of pests and diseases. Economic spray schedules have also been evolved at the Institute to check effectively the pests and diseases.

It has further been stated that resistant varieties have been developed by the Central Rice Research Institute to control the loss caused by pests and diseases. These varieties require to be popularised.

B. Service Station

23. During evidence the Committee have been informed that the Institute is not concerned with the extension work on all-India basis as that is the function of the Plant Protection Directorate. The results so far achieved are, however, being demonstrated under co-ordinated trials also in India. It has further been stated that Indian Council of Agricultural Research has been trying to establish certain service stations for this purpose.

The Committee suggest that Government may examine how far it would be desirable for the Indian Council of Agricultural Research to establish separate service stations in various rice growing States for country-wide propagation of pests and disease controls, and whether the work cannot be undertaken by each of the 11 Indo-Japonica Units which are under the administrative control of the Institute.

In any case, the Committee cannot but regret that so little should have been done all these years to bring home to the cultivators in general the importance of pests and diseases control, and to propagate among them the methods and devices to be adopted to secure substantial results.

The Committee cannot over emphasise the need to take urgent and comprehensive steps to rectify the present state of affairs, keeping in view the great contribution these steps are capable of making in the direction of augmenting the food supplies in the country.

C. Rice Pests and their control

24. *Rice Pests and Insects.*—There are several pests and insects which affect paddy plants, *viz.* (i) Stemborers, (2) Gall Midge, (3) Rice hispa. (4) Gundhi-bugs, (5) Rice grass hoppers (6) Leadhoppers, (7) Army worms and cut worms, (8) Rice case worms, (9) Rice leaf rollers, (10) Rice reel weevils, (11) Rice mealy bugs, (12) Hairy Caterpillars (13) Rice Thrips.

25. *Control of Pests.*—It has been stated that the main recommendation of the Central Rice Research Institute for controlling the pests is to evolve and adopt prophylactic measures. As soon as the climatic conditions of a place deteriorate and are likely to attract insects, the plants are treated with a particular insecticide to avoid occurrence of insects. The important prophylactic measures are: (i) Seed treatment with organo-mercurial fungicide [1 gram of the fungicide in 1 lb. (252 grams)]. This costs only 25 to 35 paise per acre and protects the young seedlings and gives good stand. (ii) Dipping the seedling in fungicidal-*cum*-insecticidal solutions. (About 5 gallons of solution is enough to dip seedlings which will cover 1 acre). This is done to eliminate the changes of carry-over of the infestation from the seed-bed to the field.

26. *Visits to Pest affected fields.*—It has been stated that on specific request the Research workers of the Institute visited the pest-affected rice fields in several states. After studying the local pest problems, they recommended control measures for adoption in each case. Demonstrations of the recommended methods were also undertaken in some cases. Specific instances of visits are cited below:—

(i) "In the main *Kharif* season 1955, in Cuttack District, Orissa, crops were lost due to sudden floods. About 100 acres in the flood affected area were grown during Dalua season with varieties Mtu. 15 and GEB., 24 the seeds

being donated by staff of Central Rice Research Institute as a relief measure. The method evolved for control of stemborers at this Institute was successfully adopted by the staff of the Entomology Division and about 27 mds/acre of yields were obtained.

(ii) Large areas of rice crop were reported to be damaged year after year by a hairy caterpillar pest in Jeypore and Koraput Districts of Orissa. The staff visited the effected areas for 3 seasons (1958—61) to study the pest problem and demonstrated control measures which were recommended to be adopted. The pest has been reared in the laboratory and identified.

(iii) At the request of the Political Officer in Along (NEFA), the staff visited the cultivator's fields, studied the pest problems in NEFA and recommended control measures to be adopted in 1960.

(iv) An unusual yellowing of rice leaves was reported from Sahabad District, Bihar during 1962 and the staff visited the places and the problem was studied. It was found to be partly due to the root weevil and the burrowing nematode. Remedial measures were recommended to be adopted in 1962. Demonstration of recommended methods was undertaken in this area in 1964 in collaboration with the State Government of Bihar.

(v) The areas under package programme in Sambalpur District and some areas in Bolangir District were visited during 1963 at the instance of the Governments of India and Orissa and the endemic nature of gall midge problem on rice was studied by staff of Entomology Division and remedial measures were demonstrated and recommended to be adopted."

The Committee feel that such visits by the Research workers of the Institute to the affected rice fields in different States for on-the-spot study of local pest problems and demonstration of the control measures, would go a long way in the extension of results of research, besides solving immediate pest problems of cultivators. They suggest that similar visits to other rice growing areas by the research workers of the Institute for on-the-spot study of pest problems should be undertaken irrespective of any specific request being made in this behalf.

D. Rice Diseases and their control

27. In India, there are more than 40 diseases of rice, the major ones being (1) Blast, (2) Helminthosporium, (3) Stem-rot, (4) Foot-rot, and (5) Bacterial diseases. It has been stated that due to the limited staff strength (3 persons) of Mycology Section, the Institute concentrated its attention from 1949 to 1961 only on two major diseases of rice, viz., Helminthosporium and Blast. The Institute has secured certain resistant varieties in varietal susceptible trials and have sent seeds to all the states. Thechnique has been evolved for obtaining resistant varieties which are of universal applicability. Economic spray schedules have also been evolved for the control of the diseases. Method of assessing loss caused by rice diseases has been worked out and applied in the field.

Helminthosporium Disease.

28. This disease infects the leaf, sheath, node and the grain. The Central Rice Research Institute has laid down measures for controlling this disease. Following the the selected varieties which are resistant to this disease and are already available for purposes of cultivation:—

Ch. 13, Ch. 45, T. 141, Cam. 10 and Co. 20 Ac. 1351, Ac. 1382, Ac. 2045, Ac. 2466, Ac. 2559, Ac. 2966.

It has been stated that certain hybridization programmes for evolving more resistant varieties have been initiated which will take 3 to 4 years time. An "Extract" has been evolved for making susceptible varieties behave as resistant varieties. The "Extract" is being tested under varying agro-climatic conditions.

Blast Disease.

All the aerial plant parts show symptoms of this disease. On the leaves, broadly spindle-shaped spots, with pale yellow ashy centres and brownish red margins, are seen. The list of varieties resistant or moderately resistant to Blast disease which are available in India is given below:—

Madras	Bombay	Andhra	Central Rice Research Institute
1. Co. 4*	1. Antarsal 67	1. M. 42	1. Bhogjira
2. Co. 25*	2. Antarsal. 90		2. SM. 6
3. Co. 26*	3. Antarsal. 200		3. SM. 8
4. Adt. 25	4. Mugad. 161		4. SM. 9
5. Tkm. 1	5. Mugad. 249*		5. CP. 6

Contd.

Madras	Bombay	Andhra	Central Rice Research Institute
	6. Mugad. 141		6. CP. 9
	7. Mugad. 81		7. Akp. 8
	8. Patni. 6		8. Akp. 9
	9. Bhadas-6		9. Ch. 55
	10. Bhadas. 79		10. H. 755
	11. Krishnasal. 10		11. S. 67
	12. Waner. 1		12. S. 624
	13. 1-B-12-11		13. Ptb. 10
	14. Sathi Dwarf 44-51		14. Ch. 27
	15. Sukhvel 243-4.		15. Ch. 28
			16. Ch. 71
			17. Jap. 7
			18. T—1446
			19. T—1715
			20. T—2009
			21. AC—2082
			22. T— 6522
			23. AC—2489
			24. T—1026
			25. T—1160
			26. CR—906
			27. CR—906

* Found resistant at the Central Rice Research Institute.

Schedules of spraying for the Blast recommended by the Institute are indicated below:—

Sl. No.	Stage of the Crop growth	No. of sprayings	Remarks
1.	Seedling 20—30 days	1	To control leaf infection in the seed beds.
2.	Tillering phase	2 (at an interval of 10 days)	To control leaf blast in transplanted crop
3.	Earhead mergence (Flowering stage)	2 (at an interval of 5 days)	To control neck blast

Spraying should be resorted to only when blast season in a locality (high humidity, low night temperatures and dew formation) happens to coincide with the susceptible stage of crop.

It has been stated in evidence that the Institute has developed an antibiotic which is effective in controlling blast disease. The antibiotic is being further tested on all-India basis under the present co-ordinated trials of the Institute. After tests, attempts will be made to have it patented and passed on to the Hindustan Antibiotic Factory for mass production. It has further been stated that after the existing experiments succeed, a pilot project would be established to demonstrate to farmers the utility of this technique to control blast disease.

The Committee hope that the co-ordinated trials on the "Antibiotic" and the "Extract" will be completed as early as possible. They would suggest that after successful field trials, the question of commercial manufacture of the "Antibiotic" and "Extract" should be examined in consultation with the Hindustan Antibiotic Factory, and the National Research Development Corporation.

The Committee also suggest that the details of the proposed pilot project for demonstration of the techniques should be worked out simultaneously with co-ordinated trials to avoid any delay in their propagation, as soon as they are established.

E. Weed Control

29. It is a well-known fact that the growth of weeds in the paddy fields affects the yield adversely. At present the control of weeds in the paddy fields is mostly done by manual labour. Often this operation is not satisfactorily carried out since it is arduous, time-consuming and very expensive. It has been stated that the Central Rice Research Institute has been attempting to find out alternative methods of weed control with the help of selective herbicides that are extensively used in most of the advanced countries. After investigations and experiments, the Central Rice Research Institute has found that Phenoxylene-30 is an efficient formulation of herbicide and is more efficient particularly for low land conditions where mostly the broad-leaved weeds predominate. But under upland conditions where intensity of graminaceous weeds is comparatively high, a mixture of Phenoxylene-30 and Stam. F-34 has been found to be promising. These findings are stated to be of great value for

adoption especially under conditions of labour scarcity. Charts showing the efficiency of various herbicides and hand-weeding are reproduced below.

Efficiency of Selective Herbicides—Grain yield in Kg./Ha. Variety Mtu. 15

Sl. No.	Treatments	Yield in Kg./Ha.	Percentage over control
1.	Control*	835	100·0
2.	Hand Weeding	1463	175·2
3.	Phenoxylene—30	1794	214·8
4.	Stam F. 34	1517	181·7
5.	Dowpon	1399	167·5
6.	Eptam	1226	146·8
7.	PCP (Granules)	1463	175·2
8.	Tok E. 25	1394	166·9
9.	Reglone	13965	163·5
10.	Gramoxone	1531	183·4

** C.D. (0·05) to compare treatment means=296 Kg/Ha.

*Control means 'No Treatment' : **C.D. means 'Critical Deviation'.

Weed Control in Upland Broadcast Rice—Variety—Ptb. 10

Sl. No.	Treatments	Weed Population per 0·25 Sq. Metres				Grain Yields	
		Cyperous	Graminaceous	Others	Total	Yield in Kg/Ha	Percentage over control
1.	Control	135	78	81	294	1108	100%
2.	Handweeding	55	68	39	162	1720	155%
3.	Phenoxylene-30	55	48	16	119	1191	107%
4.	Stam F. 34	36	30	22	88	1362	123%
5.	Phenoxylene-30 + Stam F. 34	63	6	16	85	1681	152%

C. D. (0·05) to compare treatment means=226 Kg/Ha.

It has been stated during evidence that these weedicides do not kill or damage the paddy plant. One of the chemicals, *viz.*, Stam F-34 has got a peculiarity in that it kills all other plants except rice. On mixing with Phenoxylene-30, the mixture works very well. It has not been popularised so far as it is still at experimental stage. Moreover, being an imported material, it is made available only in small quantities for experimental purposes. The Committee have been informed during evidence that the herbicides can be manufactured in India but only in National Chemical Laboratory and not in any of the research Institutions of the Ministry.

The Committee suggest that since the preliminary investigations of the herbicides, Stam F.-34 and Phenoxylene-30, have established their efficacy as weedicides, the question of their production on a mass scale in the country should be examined urgently. They also recommend patenting of the products and their commercial exploitation by the National Research Development Corporation. If it is found useful, the question of subsidising its sale at the initial stage should also be examined.

CHAPTER IV

SOIL FERTILITY

A. Introduction

30. Fertility of soil plays an important part in plant nutrition and increased crop production. The urgent need to increase food production in the country can be achieved in a shorter time by increasing the yield per unit area through the use of chemical fertilizers. The response to the application of chemical fertilizer depends upon the inherent fertility of the soil and is to an extent influenced by the soil water pattern. A variety grown under upland rainfed condition will have a higher fertilizer requirement than when grown under low land conditions. Application of chemical fertilizers warrants the availability of water either from rain or through irrigation.

B. New Fertilizers

31. The Central Rice Research Institute has been conducting experiments for determining the judicious manuring schedules. It has been stated that *Palm gur molasses* are as efficient a fertilizer as Ammonium Sulphate so far as the rice yield is concerned. Calcium Ammonium Nitrate and Urea have also given as good response as Ammonium Sulphate. There are certain soils where Calcium Ammonium Nitrate is useful and Ammonium Sulphate is likely to cause further damage to the soil. It has further been stated that rice plant responds favourably to foliar spray with 2% urea applied during the active vegetative growth phase. On equal nitrogen basis, this method has been found superior to soil application of urea as well as Ammonium Sulphate. Even half the quantity of nitrogen sprayed in the form of urea solution has given as good a response as double the quantity of nitrogen applied as Ammonium Sulphate.

The Committee suggest that in view of the present inadequate production of Ammonium Sulphate in the country, concerted efforts should be made by the Government in conjunction with the State Departments of Agriculture for demonstrating the use of fertilizers like foliar spray of urea and Palm Gur Molasses to the cultivators.

C. Green Manuring for Rice

32. Green manuring is a time-honoured agricultural practice in India for increasing crop production and maintenance of soil fertility. It comprises incorporation of fresh green plant material into the soil. Its beneficial effect is claimed to be the supply of plant nutrients chiefly nitrogen, and the added organic matter. Despite wide recognition of the merits of this practice, it has not attained universal adoption by farmers due to lack of information on the suitability of different leguminous crops for the varying agro-climatic conditions of this vast country and the inadequate production and supply of reliable seed material besides the lack of irrigation facilities to raise the crop in the off-season.

It has been stated that research on green manure crops has been going on in the country since 1953. Green manure crops suitable for different soil conditions have been determined. The efficiency of green manuring in comparison with Ammonium sulphate has been assessed and it has been found that if a green manure crop can be grown to supply about 6,000 lbs. of green matter, it is not necessary to supplement it with any chemical fertilizer. The optimum time and age of the green manure crop for burying in has also been determined.

As green manuring is cheap and its efficacy is comparable to chemical fertilizers, the Committee suggest that the research on common green manure crops like Dhaincha *for rice should be intensified and the results obtained therefrom disseminated among the cultivators through the extension centres.*

D. Blue Green Algae

33. Blue green algae is a kind of plant having a higher percentage of proteins but "it is mixed with sand" and is available in very small quantity. It acts against the loss of supply of proteins and it fixes nitrogen.

The Central Rice Research Institute established a separate Division in February, 1961, for exploiting the faculty of blue green algae to fix elemental nitrogen abundantly available in the atmosphere for increasing production of rice at least to the level of the conventional fertilizers which may be diverted for other crops. It has been stated that "Several species of blue green algae have been isolated; species pure, nitrogen fixing capacity of some of them evaluated and they have been maintained in cultures. Several introgen fixing forms have been multiplied on mass scale for experimental use."

It has been further stated that the "maximum response to algae could be obtained by inoculation of known nitrogen fixing forms in conjunction with non-nitrogenous fertilizers like lime, super-phosphate and a trace of sodium molybdate. The yield of paddy could be increased by 82% (3800 kg. per hectare) over control (no-manure) (2000 kg. per hectare), the contribution of blue green algae alone being 36%. Algal inoculations have been found to leave beneficial residual effects for the successive crops." It has been found by the Institute that rabbing (burning) of top soil alone has a very favourable effect on the immediate and succeeding crops, the increased yield amounting to nearly 30% over control. A number of co-ordinated trials are being conducted this year in different states, *viz.*, Orissa, Andhra, Madras, Mysore and West Bengal to exploit the potentiality of blue green, algae.

Efficiency of Blue Green Algae alone and in combination with different organic manures and fertilizers found out as a result of field experiments conducted in the main crop season of 1963 is indicated in the table below:—

Variety T. 141

Treatments (over basal dressing of lime, superphosphate and Sodium molybdate.	Grain yield kg/ha.	Percentage on control	Straw yields kg/ha.	Percentage on control
A. Control (No manure) .	2615	100	2496	100·0
B. Farm yard manure .	3392	130	3483	139·5
C. Green manure . .	3907	149	4238	169·8
D. Ammonium Sulphate .	3431	131	3588	143·8
E. Urea	3366	129	3454	138·4
F. Control +Algae . .	3403	130	3657	146·5
G. Farm Yard Manure+Algae	3573	137	3657	146·5
H. Green Manure+Algae .	3902	149	4412	176·8
I. Ammonium Sulphate+ Algae . . .	3472	132	3861	154·7
J. Urea +Algae . . .	3585	137	3715	148·8
C. D. (0·05) . .	215 kg/ha.			
C. D. (0·01) . .	291 kg/ha.		(Area of Plot 31·2 Sq. m.)	

It has been stated that statistically it has been found that the increase in yield due to inoculation of blue green algae alone is at par with the increase derived on the application of 20 kg. of nitrogen per hectare as Farm Yard Manure, Urea and Ammonia Sulphate.

The Committee understand that considerable work has been done in Japan on the utilisation of the blue-green algae as manure in the rice fields. Notable contributions are those of Prof. A. Watanabe and his colleagues. "As a result of applying the nitrogen fixing blue-green algae, *Tolypothrix tenuis*, the yield of paddy was found to increase by 2·7 per cent in the first year, 8·4 per cent in the second year, 19·1 per cent in the third year and 21·8 per cent in the fourth year on an average of eleven fields. It was observed that in the first year, only one third of the algae which multiplied in the paddy fields was decomposed and absorbed by the rice plants and the remains were contained as the nitrogen fertiliser in the soil. This is suggested as the reason why the effect of the algae on the yield of rice increased year by year. In one field it was found that the inoculation of this algae was almost similar to that of manuring the field with 64 lbs. of Ammonium Sulphate per acre as the additional fertiliser."

The Committee suggest that the results of experiments conducted in Japan on the utilisation of blue-green algae as manure in rice fields should be closely studied by agricultural scientists with a view to their practical application in India.

The Committee also suggest that paddy soils in different regions should be surveyed for their indigenous 'algal flora' and formulae developed to bring out the full manifestation of nitrogen fixing species with benefit to rice crop.

The Committee feel that after the successful completion of the coordinated trials etc. of blue green algae, mass culture of nitrogen fixing species may have to be taken up.

E. Basic Slag

34. Basic Slag, a by-product of Steel Industry, which is at present going waste, has been found to be a phosphatic manure. It has been stated in evidence that basic slag in conjunction with nitrogenous organic manure or inorganic fertilizer increases the yield of rice to the extent of 510 kgs. per hectare over no-manure control. Basic slag is at present available in the form of hard lumps but the Steel Industry is stated to be making arrangements for pulverising these slags so that it could be immediately useful to the cultivators. The Central Rice Research Institute has evaluated

basic slag and the results obtained by them are stated to be encouraging. Coordinated trials with basic slag have also been initiated in the States of Kerala, Mysore, Orissa and Tripura, to evaluate its merit as phosphatic fertilizer.

The Committee feel that the present inadequate supplies of chemical fertilizers predicates that special efforts should be made to see that the available manurial raw material is put to maximum use.

The Committee suggest that the research and the coordinated trials on basic slag should be intensified and its economics worked out alongside so that no time is lost in popularising it after the successful completion of the trials. They also suggest that Government should take up the question of pulversing of slags with the Steel Industry.

F. Distribution of Fertilisers

35. The Committee have been informed that good progress has been maintained in rice production by some of the rice growing States, *viz.*, Madras and Kerala. In Bihar and Uttar Pradesh, the production has remained practically stationary whereas in West Bengal and Assam it went down during the Second Five Year Plan. This has been probably due to the fact that in West Bengal and Assam, the farmers have not adopted the use of chemical fertilizers which is the main factor in bringing about increase in yield. It has been admitted that arrangements for the distribution of fertilisers are not satisfactory.

In view of the shortage of chemical fertilisers and the foreign exchange difficulty, the Committee recommend that the Central Rice Research Institute should direct its research towards alternative indigenous sources of manure, e.g., *compost, green manure, algae, slag, cowdung, etc.*

CHAPTER V

DIVISION OF AGRICULTURAL ENGINEERING

A. Introduction

36. The Agricultural Engineering Division of the Institute was set up towards the end of 1959 to work on the agricultural engineering aspects of rice cultivation including power driven machinery and labour saving devices and to help other Research Divisions in maintaining their equipments in order.

B. Staff and Workshop Facilities

37. During the course of their study tour, the Study Group of the Committee noted that the Agricultural Engineering Division had functioned without any head for some years. Even at present it is being looked after only by an officer of the rank of Assistant Engineer*. The Study Group also noted that the workshop facilities are inadequate with the result that at time the Institute has to entrust the fabrication of spare parts to private manufacturers.

During the course of evidence the representative of the Ministry of Food and Agriculture stated:

> "Now we have got seventeen Research, Testing and Training Centres which have been established since then under the Third Five Year Plan. Therefore, we do not look upon this Engineering Section of Central Rice Research Institute to contribute very much to research."

In a written note furnished to the Committee, the Ministry has stated:

> "At each Research Institute other than the Indian Agricultural Research Institute, there is usually a small section of Agricultural Engineering whose primary duty is servicing and maintenance of the agricultural machinery and equipments of the Institute. The Central

*At the time of factual verification the Ministry of Food and Agriculture informed—"At present the work of Agricultural Engineering Section of the Institute is being looked after by an officer of the rank of Agricultural Engineer Class I (Senior)."

Rice Research Institute has also a section for Agricultural Engineering which is primarily meant for servicing and maintenance of the agricultural machinery and equipment of the Institute. The Section is also expected to test various agricultural implements for rice cultivation, report on their performance, and suggest modifications to increase their utility and efficiency. It is not equipped to do any original research work in agricultural implements in general. The seventeen Research, Testing and Training Centres situated in the States one of which is also situated in the Indian Agricultural Research Institute are primarily research, testing and training centres from whom the bulk of research in agricultural engineering is expected."

The Committee are unhappy to note that the functions of the Agricultural Engineering Division of the Institute have not been properly defined. Besides servicing and maintenance of the agricultural machinery and equipments, which are its primary functions, the Division also is expected to undertake testing of various agricultural implements for rice cultivation and suggesting modifications to increase their performance and utility. The Committee feel that the functions and limitations of the Engineering Divisions of this Institute as also of other commodity research institutes should be precisely laid down and it should be made clear that all research work in regard to designs and improvements of agricultural implements should be undertaken by the Agricultural Engineering Division of the Indian Agricultural Research Institute. The Committee also suggest that the Agricultural Engineering Division of the Central Rice Research Institute should be properly equipped in machineries and personnel to enable it to discharge efficiently its functions to be specifically defined by the Government.

C. Rotary Paddy Weeder

38. The Committee understand that at the instance of the State Government of Orissa, the Institute redesigned and improved a rotary type paddy weeder for a private manufacturer, which is now being used all over India particularly in Andhra Pradesh. The representative of the Ministry has stated during evidence that since the Institute did not prepare the original design but only improved slightly the existing one, it was not considered worthwhile to go in for patent, He, however, stated that in future, if anything new is developed, they would go to the National Research Development Corporation for its exploitation.

The Committee suggest that in future where substantial improvements in the designs of implements are effected, the Institute should take steps to get them patented so that the financial benefits of the research of an institute may not be exploited solely by private interests.

D. Leveller for Rice Cultivation

39. It has been stated that an improved Leveller for rice cultivation has been designed, fabricated and tested by the Institute under different field conditions. In operation it has been found more steady, smooth and uniform as compared to the local country Leveller. It gives nearly 175 per cent greater output and is about 45 per cent more economical than the indigenous type of Leveller used in rice fields.

The Committee suggest that Government may get the efficiency of this Leveller tested by Indian Agricultural Research Institute with a view to explore the possibility of its manufacture on a commercial scale.

CHAPTER VI

TEACHING, TRAINING AND STAFF

A. National Training Course

40. It has been stated that there is a great dearth of trained personnel to man the rice research Schemes in rice growing States and there is ever-increasing demand for them. To meet this demand, a National Training Course for rice technicians was started at the Central Rice Research Institute in 1960. The course provides for theoretical lectures and practical classes in various disciplines of agricultural science as applied to rice breeding and lasts for three months. A certificate is awarded by the Institute to the trainees at the end of each Course.

It has been stated that the Institute can train 36 students at a time. The trainees for the course are nominated by the State Agriculture Departments. They are usually B.Sc. (Ag.) with departmental experience.

The table below shows the number of students trained during the last five years:

State	1960	1961	1962	1963	1964	Total
Manipur	1	1	2	..	..	4
Bihar	..	2	..	..	..	2
Himachal Pradesh	..	1	..	..	..	1
Punjab	..	..	..	2	..	2
Kerala	3	2	2	..	1	8
Maharashtra	..	..	1	2	..	3
Mysore	2	1	1	1	1	5
Madras	1	1	1	..	..	4
Orissa	..	..	..	2	..	2
Andhra Pradesh	1	2	..	..	1	4
Uttar Pradesh	..	..	..	2	..	2
Madhya Pradesh	1	1	1	2	..	5
Gujarat	..	1	..	..	2	3
Goa	..	..	1	..	..	1
Rajasthan	..	2	..	..	..	2
Tripura	1	1	..	..	1	3
Jammu & Kashmir	2	..	..	..	..	2
TOTAL	12	15	9	11	6	53

It has been stated during evidence that one of the reasons for the poor response to this course may probably be that an officer has to come for the training for three or four months and has to incur expenditure for running two establishments one at his own station and another in the out-station and the concerned State Government does not give him any compensatory allowance. Moreover, the State Governments cannot spare their technical staff because of their Grow More Food Schemes.

The Committee feel that the National Training Course started by the Institute in 1960 is of great utility in the context of the need to increase food production. They, however, regret to note that full capacity of the Institute for this training course has not been availed of since its introduction. In 1964 only 1/6th of the total capacity was utilised.

The Committee suggest that the Central Government should impress upon the State Governments the importance of this training course and they should be persuaded to depute their staff regularly for this course.

B. Post-Graduate Training and Research

41. The Central Rice Research Institute has been coaching post-graduate students from the Indian Agricultural Research Institute during the second year of their two years course to enable them to prepare their thesis on a research problem concerned with rice culture.

Since 1962, the Institute has been collaborating with the Utkal Krishi Mahavidyalaya, Bhubaneshwar (now under Orissa University of Agriculture and Technology) in imparting Post-graduate teaching in different disciplines of Agricultural science during the first year of the M.Sc. (Ag.) course and in coaching for thesis a few of them interested in rice problems during the second year. In 1964 there were eight students working on the following subjects for their thesis:

Botony	..	4
Mycology	..	2
Entomology	..	2
	Total:	8

The Institute has ben recognised by several Universities for undertaking research leading to Ph. D. Even the departmental employees are encouraged to work for the Doctorate degree. So far one technician has got Ph.D. from Calcutta University and another

has got Ph.D. from Utkal University. Two more have submitted their thesis to Utkal University and the third to Nagpur University.

There is one foreign scholar also from Philippines undergoing training in Plant Breeding and Genetics. In the past one scientist from Thailand and another from Japan had the benefit of training at this Institute.

The Committee are glad to note that the Central Rice Research Institute is imparting post-graduate training in various disciplines of agricultural science in collaboration with the Utkal Krishi Mahavidyalaya, Bhubaneshwar and the Indian Agricultural Research Institute. They feel that the training programme should be augmented so that more and more students take advantage of the facilities afforded by the Institute. Incidentally the training programme will also be beneficial to the teachers in as much as, this will keep them posted with the latest scientific developments in India and abroad.

C. Incentives to Staff

42. From the statement supplied by the Institute showing the staff position as on 17th October, 1964, it is observed that a number of posts are lying vacant particularly in the grade of Research Assistant. The following figures are revealing:

	Sanctioned strength	Actual strength	Remarks
Class II and above	56	45	
Research Assistants (Class III)	48*	25	*8 studentships sanctioned against equal number of Posts of Research Assistants.

The Study Group of the Committee which visited the Central Rice Research Institute in October, 1964 were informed that properly qualified persons are not willing to join the Institute due to lack of pospects. Qualified scientists when recruited leave the Institute to better their prospects elsewhere. At present only 10 per cent of permanent posts of Research Assistants are kept in Selection Grade which is in accordance with the recommendations of the Second Pay Commission.

The Committee have noted that the flight of trained personnel from one institute to another and from one discipline to another is a feature which is to be noticed in all agricultural research institutes.

The Committee would urge that the question of providing suitable incentives to the deserving research workers should be examined so that they may look for future prospects within the Institute itself. In this context, the Committee feel that the reservation of 10 per cent of the permanent posts of Research Assistants for the Selection Grade is not adequate, and they would suggest that Government should consider the desirability of a suitable increase in this percentage.

D. Education of the Children of the Staff

43. One of the problems facing the staff of the Institute, who hail from all parts of India, is the education of their children. There is only one primary school within the Institute campus which is run on donations from the staff of the Institute. The medium of instruction in this school is the local language. The Achievement Audit Committee (1960) have observed in their report as under:

> "Another problem facing the staff living in the Institute premises is the education of their children. The Institute maintains a transport to take the children to the different schools in Cuttack town in the morning and bring them back in the evening. The same transport is also utilised for other official purposes on holidays and on working days in between the school trips. The main difficulty has been that the flat rate of Rs. 11/- p.m. per child is charged for the transport irrespective of the earnings of the parent. A Class III subordinate drawing about Rs. 200/- and who has two school going children has to spend more than ten per cent of his salary on transport charges. The result has been that most of the Class III staff members are not in a position to avail of the existing facilities and the child does not go to school. The Committee are sure that this is a real grievance for the subordinate staff and recommend, it should be remedied."

The Committee have been informed that no action has so far been taken on this recommendation of the Achievement Audit Committee and that some members of the staff had to leave the service of the Institute for lack of adequate educational facilities.

The Committee suggest that the question of setting up of a Higher Secondary School in the vicinity of the Central Rice Research Institute may be taken up with the State Government at an early date.

The Committee further suggest that pending the establishment of a Higher Secondary School, Government should also consider the

question of reducing or subsidising the transport charges of the school-going children of the staff working in the Institute.

E. Recreational Facilities

44. The location of the Institute being three miles away from the main city of Cuttack, the amenities for recreation normally available there cannot be enjoyed by the staff. It is, therefore, very necessary that suitable recreational facilities for the staff of the Institute are provided in the shape of indoor and out-door games in the Institute Campus. Although there is a club building in the campus of the Institute, it is too small to provide recreational facilities to the staff totalling 325 persons.

The Committee urge that steps may be taken to improve the recreational facilities available for the employees of the Institute and their families in the Institute Campus.

CHAPTER VII

MISCELLANEOUS

A. Liaison with rice growing States

45. Since the functions of the Central Rice Research Institute is to undertake fundamental research on rice and to investigate into problems which have wide application in the country, it follows that researches made and the techniques evolved at the Institute will have to be tested at the State Research Centres and reoriented to suit the requirements of the States. The Committee understand that in order to demonstrate the usefulness of the material and techniques evolved at the Central Rice Research Institute to the research staff at State level and to bring about close liaison among them by the Institute, there was a scheme to locate its own staff member (Liaison Officer) in each State. A beginning was made in 1957 by appointing experienced personnel in two States, *viz.*, Kerala and West Bengal but the scheme was withdrawn after two years when the question of its extension to other States came up for consideration. During evidence the representative of the Ministry stated that the scheme was examined by the Planning Commission and the Ministry in 1959 and they came to the conclusion that it was not worth continuing.

The Committee on Achievement Audit (1960) observed: "The Chairman of the present Committee who had occasion to visit the States and meet the men on the spot was convinced that the arrangement was working satisfactorily and benefitting both the States and the Central Institute. The Committee recommend that the matter be reconsidered and given a wider trial as in the opinion of the Committee this would form one of the best means of promoting and co-ordinating rice research in the country."

The Committee note that the appointment of Liaison Officers in the States by the Central Rice Research Institute had also been recommended by the Regional Rice Improvement Specialist of Food and Agriculture Organisation in Bangkok and the Plant Breeding Specialist at Headquarters in Rome who visited India sometime in 1959 and the Ministry had then accepted this recommendation.

In a written note furnished to the Committee, it has been stated that—

> "There is a proposal to convert the existing Indo-Japonica Units as Liaison Units of the Central Rice Research Institute during the 4th Five Year Plan for carrying out regional trials of the techniques and materials developed at the Institute. The existing staff under the present Indo-Japonica Schemes will be further strengthened for this purpose. The total outlay on this project during the Fourth Plan is estimated to be Rs. 7.12 lakhs. This includes the expenditure on the continuation of the existing staff under Indo-Japonica Scheme during the Fourth Plan. The Scheme is already in progress in eleven rice growing States who have already been consulted in this regard. Prior to 1959, when the liaison scheme was started, 14 rice growing States had given their consent to implement the liaison scheme."

The Committee feel that the research made at the Central Rice Research Institute would be barren if it is not simultaneously exploited by the States. They agree with the proposal of Government to treat the existing eleven Japonica-Indica Units as Liaison Units of the Institute.

The Committee would suggest that till such time the above proposal is implemented some stop-gap arrangement should be made for liaison between the State Departments of Agriculture and the Institute so that the benefits of the research may be reflected in practice without any delay.

B. Publicity and Dissemination of Research Results

46. The object of research on a subject like rice culture is to develop new techniques for increasing the yield per hectare as also the nutritive value of the crop. The ultimate aim of research will, therefore, be best served if new techniques of rice culture reach the cultivators and are widely applied by them. The channels for the dissemination of the results of the research have to be devised with this end in view.

It has been stated that at present the dissemination of knowledge of scientific and extension value pertaining to rice cultivation is done through—

1. Publication in an International Scientific Journal called 'Oryza' which is published at Cuttack.

2. Occasional publication in the leading as well as popular journals at home and abroad.

3. Through semi-popular journal called "Rice News Teller" which is being issued by the Indian Council of Agricultural Research. The Director of the Central Rice Research Institute is an ex-officio member of its Editorial Board.

4. Through periodical Symposiums and Conferences of Research workers.

5. Through Bulletins and Pamphlets issued by the Institute.

During their visit to the Institute in October, 1964 the Study Group of the Committee were informed that there is no system or agency through which it could be ascertained whether the results of the research undertaken in the laboratory and experimental farms have trickled down to the farmers.

While the Committee appreciate the efforts of the Institute, to publicise the results of the research undertaken, they feel that much remains to be done in the matter of dissemination and popularisation of the results of research. For this purpose, Government may devise a proper co-ordinated plan in consultation with the State Governments, the extension organisation at the Centre, and the Institute.

C. Establishment of Sub-stations for Special Research

47. At the time the Central Rice Research Institute was established at Cuttack, the programme of work included organisation of a limited number of sub-stations to deal with special problems of all. India importance which could not be dealt with at Cuttack. It was considered that the following three such problems needed attention:

(a) Rice grown in saline lands of the coastal regions;

(b) Rice grown under flooded conditions;

(c) Rice grown in high altitudes.

The Scheme for establishing Sub-stations provided for a Sub-station each in West Bengal for "Saline Water rice"; in Kerala for "Rice grown under flooded conditions"; and in U.P. for "Rice grown in high altitudes." It was kept in abeyance for some time. It was revived during the Second Five Year Plan and the Ministry of Food and Agriculture accepted the proposal. The Scheme was not, however, wholly implemented as it did not find place in the Second Plan.

48. The Committee have been informed that out of the three Sub-stations, the Central Saline Rice Station was established in 1959

at Canning, West Bengal. It deals with studies on the physiology of the saline resistance of rice, the degree of tolerance of certain rice varieties to saline conditions and evolution of saline resistant strains.

The Committee have been informed that the Sub-station has collected 350 varieties of rice known to be resistant to soil salinity and are studying them for their degree of tolerance. A number of varieties of different maturity groups have been tried under different levels of fertility to study their response to manuring experiments are being continued.

The Achievement Audit Committee (1960) *which assessed the work of the Central Rice Research Institute, did not go into the working of this Sub-station presumably because it was then only in its formative stage. Now that a period of five years has elapsed since the setting of the Sub-station, the Committee feel that it would be worthwhile to conduct a critical appraisal of its work with a view to see as to what extent the objectives for which the Sub-station was set up, have been achieved.*

49. *Sub-stations for Flooded conditions and High altitudes*: Regarding sub-stations for flooded conditions and high altitudes the Achievement Audit Committee (1960) recommended that "work on these problems is of great importance and should receive earliest attention, and preferably by Central Rice Research Institute". The Committee understand that the Regional Rice Improvement Specialist in Bangkok and the Plant Breeding Specialist at headquarters of Food and Agriculture Organisation in Rome during their visit to India in 1959 specially recommended the establishment of these sub-stations and the Ministry agreed to this idea.

It has been stated during the evidence by the representative of the Ministry of Food and Agriculture that "Generally the Ministry is inclined to the view that instead of the Central Government establishing a large number of sub-stations under its own control, it would be desirable to develop better ways of co-ordination with the State Governments in the matter of research in different areas. We should not have sub-stations in each State but we should develop methods of co-ordination and co-operation with State Governments for co-operative research. That is the system followed in America."

The Committee are unhappy to note that inspite of recommendations of the Achievement Audit Committee (1960) *and other foreign experts, Government have not decided the question of setting up sub-stations for studying problems relating to cultivation of rice*

under flooded conditions and high altitudes. As there are large areas in the country which are susceptible to floods but are suitable for rice cultivation under certain conditions and there are also high altitude areas growing rice and presenting problems peculiar to them, the Committee are of the opinion that there is a need for research on these special problems for increasing the rice production. They suggest that arrangements should be made for studying them, in case no such arrangement exists at present.

The Committee feel that if research on these special problems is conducted by any State Government at its research centres, the Central Rice Research Institute should coordinate with such research centres in this behalf.

D. Defects in the Institute's Farm

50. The Institute has a farm comprising 155 acres of land attached to it. The Achievement Audit Committee (1960) observed that "There is a tendency for the paddy yields of the Farm Division to go down in the past few years and it is suggested that the Director of the Institute should examine the possible causes for this position, and, if possible, rectify them."

The Committee have been informed during evidence that the tendency for the yield to go down in the farm has been mainly due to lack of drainage resulting in excess water, unexpected flood condition and lack of control of water supply. To improve these conditions, a final estimate amounting to Rs. 1,67,000 was prepared by the C.P.W.D. for the construction of masonary irrigation channel and drainage after two or three critical analyses. The proposal relating to the rectification of defects in the farm drainage has been under the consideration of the Government of India for the last 8 to 9 months.*

The Committee are surprised to note that the paddy yield of the Institute's demonstration farm, which is expected to serve as a model, has been going down and the loss increasing every year. They regret that even after a lapse of 4 years of the Achievement Audit Committee's Report, no tangible action has been taken to improve the irrigation and drainage system the lack of which has been responsible for decreasing yield in the farm. The Committee would urge that the matter may be attended to urgently so that the recurring losses incurred by the farm may be eliminated.

*At the time of factual verification the Ministry of food and Agriculture informed "Administrative approval of Rs. 167000/- for providing masonary irrigation channel & drainage scheme at the Central Rice Research Institute, Cuttack has recently been issued."

CHAPTER VIII

CONCLUSION

51. The Central Rice Research Institute, Cuttack is one of the premier research institutes in the country which is conducting research both on the fundamental aspects and on problems of practical value of rice. The Institute has been dealing with a number of problems relating to paddy cultivation, *e.g.*, evolution of better varieties of strains, control of pests and diseases, improved methods of cultivation, improved fertilisers and their mode of application, better processing and improved storage, etc. and some results have been obtained.

The Committee feel that the present situation where the yield of rice per hectare in India continues to be one of the lowest in the world, should be taken as a challenge and should spur us on to more vigorous and intensified efforts both in the Research Institutes and in the field. If these efforts are commensurate enough, the Committee see no reason why it should not be possible to remove before long the stigma that India, the largest paddy growing country in the world, ranks amongst the countries lowest in productivity.

The Committee would like particularly to stress the fact that besides intensifying the research on various problems of paddy cultivation, Government should give special attention to devise a suitable machinery which would ensure that extension work does not lag behind research and that the results of research reach the farmers in the fields and are fully utilised by them.

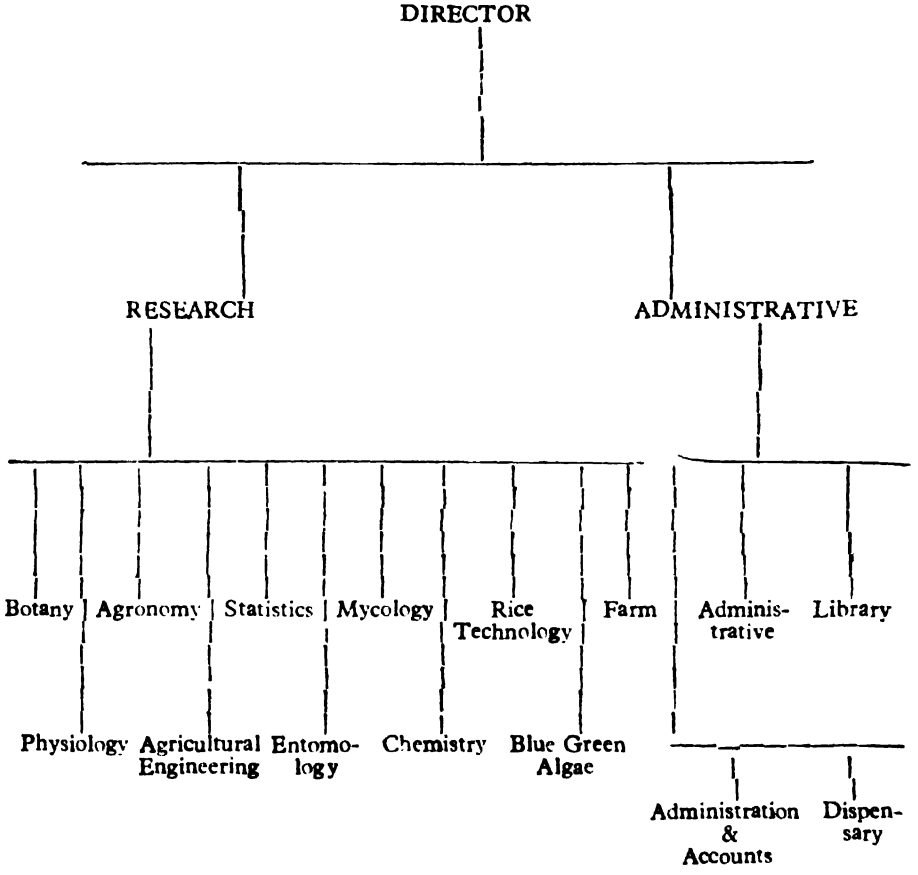
NEW DELHI;
March 26, 1965
Chaitra 5, 1887 (Saka).

ARUN CHANDRA GUHA,
Chairman,
Estimates Committee.

APPENDIX I

(*Vide* para No. 4)

Organisational Chart of Central Rice Research Institute



Statement showing the sanctioned and actual strength of Central Rice Research Institute, Cuttack-6, as on 17-10-64

Name of Office	No. of sanctioned strength (class-wise)		Men in position	No. of post vacant	Remarks
Central Rice Research Institute, Cuttack-6, (Orissa).	Class I Senior	12	12	..	The post of Cytologist and Agricultural Engineer have been kept in abeyance.
	Class I Junior	12	7	5	
	Class II	26	24	2	
	Class II (Non-Gazetted)	3	..	3	
	Class III	151	122	29	One post of Head Clerk has been kept in abeyance.
	Class IV	91	88	3	
TOTAL		295	253	42	

No. of posts sanctioned for the different I.C.A.R. Schemes, functioning at Central Rice Research Institute, Cuttack-6, as on 17-10-64

Class I Junior	1	..	1
Class II	2	2	..
Class III	14	9	5
Class IV	6	6	..
TOTAL	23	17	6
GRAND TOTAL	318	270	48

In addition to above, 3 studentships have been sanctioned under project for undertaking work on irradiation in rice, which is a part of the "Scheme for Intensification of Research Work at Central Rice Research Institute."

APPENDIX II

(*Vide* para No. 4)

A brief statement of the functions and duties of the Divisions and branches are given below:—

I. *Division of Botany.*—The Geneticist & Botanist is in immediate charge of the technical work of the Division. The division is engaged in Botanical, physiological and genetical investigations which include:—

(a) Collection, maintenance and study of indigenous and foreign varieties of the rice, including wild species, for utilisation in the improvement of the rice crop.

(b) Studies in breeding techniques.

(c) Inter-racial and inter-specific hybridisation for production of superior varieties.

(d) Cytological and genetical investigation.

(e) Evolution of Japonica—Indica hybrid varieties and their utilization in different regions.

2. *Division of Plant Physiology.*—The Plant Physiologist is in-charge of this Division. The work of this Division relates to:—

(a) Physiological investigations including vernalisation, photoperiodism, drought resistance & saline resistance etc.

(b) Chemical analysis for total sugar and nitrogen in the growing plants as a criterion of nutritive status.

3. *Division of Agronomy.*—The Agronomist is in-charge of this Division. The work of this Division relates to:—

(a) The Study of cultural methods, crop sequences and manurial practices in relation to soil fertility and crop production.

(b) Testing of small implements for rice cultivation and rice processing.

(c) Determination of suitable layouts for field experiments and statistical evaluation of results.

(d) Irrigation & micro-climatic and soil water plant relationship investigations in rice.

4. *Division of Rice Technology.*—The rice technologist is incharge of this Division. The research investigations in this division include:—

(a) To deal with technological aspect of rice research such as hulling percentage, cooking quality, protein content etc.

(b) To study the nutritional qualities of different rices by dietic studies on biological organism, like albinorates.

5. *Division of Mycology.*—The Mycologist is the technical head of this Division. The functions of the Division are:

(a) The survey and study of the major fungal diseases of rice with a view to discovering control measures.

(b) Cooperative investigations with Botany Division for Breeding disease resistant varieties.

(c) Studies on the host-parasite relationship on helminthosporiose of rice.

(d) Epidemology and forecasting outbreaks of major diseases of rice.

(e) Investigation on virology.

6. *Division of Enthomology.*—The Enthomologist is in-charge of this Division. The research investigations in this Division include:—

(a) The survey and study of the insect pests of the rice plant in the field and of grain in the store.

(b) Estimation of loss due to various insect pests and the formulation of control measures.

(c) Biological control of major pests of rice.

(d) Epidemology of rice pests.

(e) Investigation on Nematology.

7. *Division of Chemistry.*—The Agricultural Chemist is incharge of the Division. The research investigations in this Division include:—

(a) The study of rice soils in relation to productive capacity.

(b) The investigations of fertilizer requirements and methods of application for increasing production.

(c) Research on water logged soils—Chemical & Physical changes.

(d) Investigations on micro-biology of water logged soils.

(e) Nutrition uptake and fertilizer needs of rice crop.

(f) Investigations in collaboration with Mycology, Botany and Agronomy Divisions.

(g) Soil physics studies.

8. *Division of Blue green Algae.*—The Botanist is incharge of this Division. The research programme includes:—

(a) Collection of algae from the paddy fields in Rice Research centres situated in different parts of India and from the villages around them during different seasons.

(b) Collection of algae as well as water & soil samples every month from the three different types of paddy fields in the Central Rice Research Institute Campus, for studying floral, Chemical and physical variations of the paddy environment.

(c) Culturing of species in different media with & without nitrogen supply and selection of the most useful species.

(d) Mas culture of the useful species, preservation of the same in a viable condition for application in the Field and the economics of this mode of manuring.

(e) Strengthening of known nitrogen fixers in the paddy fields of Central Rice Research Institute Campus to Study the effect of such operation on rice production.

9. *Division of Agricultural Engineering.*—The Agricultural Engineer is in-charge of this Division. The research programme includes:—

(a) To conduct investigations and trials for the improvement of tools and implements used for paddy cultivation under wet conditions.

(b) Investigations and trials of seed drills for dry sowing as well as sowing paddy in wet fields.

(c) Investigations, trial for improvements in tools and implements for weeding and interculture of paddy crop.

(d) Study of problems and scope for utility of grain harvesting machines in the harvesting of paddy crop and investigation for improvement of hand harvesting tools.

(e) Study of threshing and winnowing problem, trials to study the economic aspects for introduction of small machines for the purpose.

(f) To assess the suitability of different harness to improve the draftability of the animals.

(g) Investigations and development of a harness for working of implements by a single bullock.

(h) Upkeep and servicing of precision instruments.

10. *Division of Statistics.*—The statistician is in-charge of this Division. The programme of works includes:—

(a) Evolving suitable sampling techniques for different requirements.

(b) Correlation studies between yield and plant characters.

(c) Analysis of accumulated data on long-term cultural and manurial experiment.

(d) Linkage studies and obtaining of suitable formulae for estimation of linkage.

(e) Analysis of data collected on genetics of quantitative characters and study of genetic variability in successive generations.

(f) Biometrical studies on quantitative inheritance.

11. *Division of Farm.*—A Farm Superintendent who is a Class II Officer, is in-charge of this division. The functions of this division are:—

(a) Farm Management.

(b) Maintenance and multiplication of nucleus seed stocks.

(c) Large scale trial of improved methods of cultivation.

(d) The supervision and implementation of extension work in the 'Associated Farm' fields near the Institute.

12. *Dispensary.*—The Medical Officer who is a Class II Officer is incharge of the Dispensary. The main function of the Dispensary

is to relieve the sick employees by examination, proper prescription and dispensing medicines.

13. *Administrative Division.*—*The Accounts Officer who is a Class II Officer is in-charge of this Division. The Superintendent is looking after the establishment side and the Accountant is in-charge of the accounts side. The establishment deals with correspondence on technical and administrative matters, diary, despatch, maintenance of records, other establishment matters and the general upkeep of the Library whereas the accounts section deals with cash and accounts.

APPENDIX III

(*Vide* para No. 21)

Salient features of different methods of cultivation

A. *Wave Method*:

Devised by Japanese inmates at Arvindashram, Pondicherry.

1. Selection of bold seed, treatment with fungicide.
2. Nrsery sowing @ 20 ib/acre. Spraying with fungicide when ten days old.
3. Transplanting when seedlings have 3 leaves.
4. 20 cartloads of compost at puddling time per acre.
5. Line transplanting with a spacing of 20"x6", using 2 to 3 seedlings per hill.
6. Three mulchings to be given with a special type of hoe.
7. Top dressing with 150lb of mixed fertilizer before mulching.
8. Medium or late duration variety to be used.

B. *Japanese method*:

1. Selection of bold seed, treatment with fungicide.
2. Nursery sowing @ 15 lb/acre on raised beds, heavily manured.
3. Two and a half tons of compost and 6,000 lb of green leaf per acre at puddling time.
4. Line transplating with spacing of 10"x10" using 3 to 4 seedlings per hill.
5. Application of 100 lb. of ammonium sulphate and 100 of super phosphate per acre at transplanting. A similar dose to be applied one month after planting.
6. Three intercultures done by Japanese rotary hoe.
7. Medium or late duration variety to be used.

C. *Chinese method (I.C.A.R.)*:

1. Sun drying for 2 days, selection of bold seed, soak in sodium bicarbonate solution (4:8 per cent) for 2 days and germinating in wet gunny bag.
2. Sowing in wet nursery @45 ib. acre. Very light manure of nursery bed. Seedlings dipped in 0·5 per cent solution of ammonium sulphate before planting.
3. Digging of main field upto 3′ in 6 separate layers of 6″ each. Farm Yard manure @ 20 tons per acre is divided into 6 equal parts and each part mixed with each layer of soil and mixed thoroughly. Then, each layer is put back in the same order.
4. Application of 40lb.N as ammonium sulphate+40lb. P_2O_5 as super phosphate + 40 lb. K_2O as Potassium sulphate at the time of puddling.
5. Transplanting 25 days old seedlings with a spacing of 6″x6″ using 2 seedling per hill.
6. Application of 40 lb. N as ammonium sulphate, 4 weeks after planting and 20 lb. N as ammonium sulphate just before flowering.
7. Interculture with Rotary hoe in early stages.
8. Propping the crop when nearing maturity.
9. Medium or late duration variety to be used.

D. *Thackersey method*:

Devised by the Prithvi Trust, Bombay.

1. Soaking seed in water for 24 hours, sowing in raised seed bed @ 24 lb./acre.
2. Using 6″ tall seedlings for transplanting. Treating seedlings with copper sulphate solution (3 grams in 4 gallons of water) before planting.
3. Application of organic manure (compost or green manure) @ 20 lb. N/acre at puddling.
4. Line planting with spacing of 6″ x 6″ using single seedling per hill.
5. Two to three weeks after planting, retransplanting is done by shifting one whole line into the next and so on, thus making a spacing of 12″ x 6″.

6. After another 2 to 3 weeks, retransplanting is again done restoring the original spacing of 6" x 6" or else, pruning is done.

7. Top dressing of ammonium sulphate in two split doses of 15 lb. N each per acre.

8. Using a medium or late duration variety.

E. *Recommended method (C.R.R.I.)*:

1. Seed treatment with fungicide.

2. Nursery sowing @ 30 lb./acre on seed beds manured with compost @ 8 tons/acre.

3. Application of 100 lb. super phosphate/acre to the green manure crop.

4. Ploughing in green manure crop to supply 20 lb. N/acre.

5. Line planting with spacing of 9" x 6" using 2 to 3 seedling per hill.

6. Pruning the top foliage one month after planting.

7. Sub-surface application of chemical fertiliser. One dose @ 15 lb. N/acre one month after planting and another similar dose 3 weeks before flowering.

8. Three intercultures with rotary hoe.

9. Using a medium or late duration variety.

F. *C.R.R.I. Modified method*:

This is the same as item E. except that the individual seedlings are originally planted at a greater spacing, and a month after planting the tillered plants are separated and retransplanted with closer spacing. This has been found to give upto 28 per cent increase in yield over normal method.

APPENDIX IV

Statement showing the summary of the conclusions/recommendations of the Estimates Committee contained in the Report

Serial No.	Reference to para No. in the Report	Summary of Conclusions Recommendations
1	2	3
1	9	The Committee note that the average yield of rough rice per hectare in India is the lowest. It is only about 30 per cent of the average yield in Japan, the most advanced country in the East. The Committee are unhappy to note that despite years of production of rice and systematic researches conducted in our agricultural research institutes. the yield of rice per hectare in India should continue to be so low. In view of the present pressing need for augmenting food resources, the Committee would strongly urge that the problem of low yield of rice should be viewed with a sense of urgency and that co-ordinated and concerted efforts should be made to increase the yield of rice per hectare by the application of the latest scientific techniques and more intensive cultivation of the varieties already evolved.
2	10	Comparing the various rice growing States in India *inter se*, the yield per hectare in some States is even less than 50 per cent of the yield in Madras, Mysore and Kerala. It is note worthy that States like Bihar, Madhya Pradesh, Orissa, Uttar Pradesh, Gujarat, etc. are lagging behind. Apart from the urgent need for a substantial increase in the average yield per hectare in the country as a whole, the Committee feel that the question of low yield per hectare in particular States needs special atention.
3	11	The Committee suggest that the feasibility of introducing some of *Japonica*, Chinese etc. varieties in the areas where days are longer may be considered.
4	11	The Committee suggest that the technological processes evolved in Japan for overcoming natural and physical

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		difficulties, like artificial control of the temperature of water for maintaining the crop growth, may also be studied by Indian agricultural scientists and some of the exotic strains requiring shorter period for maturing may be introduced in the predominantly rice producing areas of the country so that 2 to 3 paddy crops may be widely cultivated.
5	12	The Committee feel that the progress made during the last 18 years in the evolution of high yielding strains and in testing the varieties from other countries useful for introduction in India has been slow and halting. They suggest that vigorous efforts should be made to step up the research activities of the Central Rice Research Institute and other rice research centres in this behalf.
6	13	The Committee are distressed to note that no substantial results have so far emanated from the experiments conducted under Japonica-Indica rice hybridization scheme which has been in operation for more than a decade. In view of the present imperative need for increasing the food resources of the country even at a higher cost, the Committee would strongly urge that the work of multiplication of such varieties as are expected to give at least 25 per cent extra yield may be undertaken and the economics of their cultivation worked out alongside.
7	14	The Committee are glad to note that the Institute has made a study of multiple cropping and has also worked out the economics of different patterns of cropping. They suggest that the results of the study should be publicised and also made available to the Departments of Agriculture in the States who may be asked to put them into practical use so that the benefits of the multiple cropping may eventually be passed on to cultivators.
8	15	The Committee consider that it would be desirable if the areas where three crops of paddy can be successfully raised in a year are surveyed and methods devised in consultation with the concerned State Governments for educating the cultivators of those areas in the techniques of tripple cropping so that increase in yield can be effected without a corresponding increase in acreage.

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9	16	The Committee would suggest that the question of distribution of some quantity of seeds produced in the Institute's farm to each rice growing State for further multiplication in their respective farms may be examined so that the quality of seeds produced in these States may be improved.
10	17	The Committee are surprised that though enough publicity has been given to this technique of colonal propagation, no efforts have been made so far to ascertain the cost of production of paddy by adoption of this technique. The Committee would emphasise that the economics of this technique should be worked out as early as possible through extensive trials in different States before it can be recommended to the farmer and steps taken for its adoption.
11	18	The Committee are glad to note that the Central Rice Research Institute has devised its own method *i.e.*, recommended method of rice cultivation which is not only economical but also gives higher yields per acre than other known methods of rice cultivation. The Committee would suggest popularisation of this method among the cultivators and its intensive application.
12	19	The Committee are unhappy to note that although the posts of a Rice Technologist and two Research Assistants were sanctioned in 1961-62, the Division of Rice Technology started functioning in December, 1963, *i.e.* after a time-lag of over two and a half years. The Committee cannot too strongly urge the need for proper planning so as to eliminate delays in setting up an organisation after necessary sanction therefor has been obtained. Now that the Division has been set up, the Committee hope that positive results leading to the selection and evolution of better quality-*cum*-better yielding paddy will emanate from the studies undertaken by it.
13	20	The Committee suggest that concerted efforts should be made in collaboration with the Departments of Agriculture of the concerned States to educate the cultivators in the matter of improved processing and proper storage of crops.

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14	20	The Committee suggest that adequate steps should be taken in consultation with the State Governments concerned to impress the advantages of new parboiling technique on Rice Mill Owners.
15	21	The Committee are glad to note that the system of commercial classification of rice evolved by the Institute has been accepted by the Government of India and adopted on an all-India basis. They suggest that steps should be taken for its early implementation through the State Departments of Agriculture.
16	23	The Committee suggest that Government may examine how far it would be desirable for the Indian Council of Agricultural Research to establish separate service stations in various rice growing States for country-wide propagation of pest and disease controls, and whether the work cannot be undertaken by each of the 11 Indo-Japonica Units which are under the administrative control of the Institute.
17	23	The Committee cannot but regret that so little should have been done all these years to bring home to the cultivators in general the importance of pests and diseases control, and to propagate among them the methods and devices to be adopted to secure substantial results. The Committee cannot over emphasise the need to take urgent and comprehensive steps to rectify the present state of affairs, keeping in view the great contribution these steps are capable of making in the direction of augmenting the food supplies in the country.
18	26	The Committee feel that the visits by the Research workers of the Institute to the affected rice fields in different States for on-the-spot study of local pest problems and demonstration of the control measures would go a long way in the extension of results of research, besides solving immediate pest problems of cultivators. They suggest that the visits to rice growing areas by the research workers of the Institute for on-the-spot study of pest problems should be undertaken irrespective of any specific request being made in this behalf.
19	28	The Committee hope that the co-ordinated trials on the "Antibiotic" and the "Extract" for controlling 'blast' and 'helminthosporium' diseases respectively will be completed as early as possible. They would suggest

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		that after successful field trials, the question of commercial manufacture of the "Antibiotic" and the "Extract" should be examined in consultation with the Hindustan Antibiotic Factory and the National Research Development Corporation.
20	28	The Committee suggest that the details of the proposed pilot project for demonstration of the techniques should be worked out simultaneously with co-ordinated trials to avoid any delay in their propagation, as soon as they are established.
21	29	The Committee suggest that since the preliminary investigations of the herbicides, Stam F-34 and Phenoxylene-30, have established their efficacy as weedicides, the question of their production on a mass scale in the country should be examined urgently. They also recommend patenting of the products and their commercial exploitation by the National Research Development Corporation. If it is found useful, the question of subsidising its sale at the initial stage should also be examined.
22	31	The Committee suggest that in view of the present inadequate production of Ammonium Sulphate in the country, concerted efforts should be made by the Government in conjunction with the State Departments of Agriculture for demonstrating the use of fertilizers like foliar spray of urea and Palm Gur Molasses to the cultivators.
23	32	As green manuring is cheap and its efficacy is comparable to chemical fertilizers, the Committee suggest that the research on common green manure crops like Dhaincha, for rice should be intensified and the results obtained therefrom disseminated among the cultivators through the extension centres.
24	33	The Committee suggest that the results of experiments conducted in Japan on the utilisation of blue-green algae as manure in rice fields should be closely studied by agricultural scientists with a view to their practical application in India.
25	33	The Committee suggest that paddy soils in different regions should be surveyed for their indigenous 'algal flora' and formulae developed to bring out the full manifestation of nitrogen fixing species with benefit to rice crop.

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		The Committee feel that after the successful completion of the coordinated trials etc. of blue green algae, mass culture of nitrogen fixing species may have to be taken up.
26	34	The Committee feel that the present inadequate supplies of chemical fertilizers predicates that special efforts should be made to see that the available manurial raw material is put to maximum use.
27	34	The Committee suggest that the research and the co-ordinated trials on basic slag should be intensified and its economics worked out alongside so that no time is lost in popularising it after the successful completion of the trials.
28	34	The Committee suggest that Government should take up the question of pulverising of slags with the Steel Industry.
29	35	In view of the shortage of chemical fertilisers and the foreign exchange difficulty, the Committee recommend that the Central Rice Research Institute should direct its research towards alternative indigenous sources of manure, *e.g.* compost, green manure, algae, slag, cowdung. etc.
30	37	The Committee are unhappy to note that the functions of the Agricultural Engineering Division of the Institute have not been properly defined. Besides servicing and maintenance of the agricultural machinery and equipments, which are its primary functions, the Division also is expected to undertake testing of various agricultural implements for rice cultivation and suggesting modifications to increase their performance and utility. The Committee feel that the functions and limitations of the Engineering Division of this Institute as also of other commodity research institutes should be precisely laid down and it should be made clear that all research work in regard to designs and improvements of agricultural implements should be undertaken by the Agricultural Engineering Division of the Indian Agricultural Research Institute. The Committee also suggest that the Agricultural Engineering Division of the Central Rice Research Institute should be properly equipped in machineries and personnel to enable it to discharge efficiently its functions to be specifically defined by the Government.

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31	38	The Committee suggest that in future where substantial improvements in the designs of implements are effected, the Institute should take steps to get them patented so that the financial benefits of the research of an institute may not be exploited solely by private interests.
32	39	The Committee suggest that Government may get the efficiency of the Leveller fabricated by the Central Rice Research Institute, tested by Indian Agricultural Research Institute with a view to explore the possibility of its manufacture on a commercial scale.
33	40	The Committee feel that the National Training Course started by the Institute in 1960 is of great utility in the context of the need to increase food production. They regret to note that full capacity of the Institute for this training course has not been availed of since its introduction. In 1964 only 1 6th of the total capacity was utilised. The Committee suggest that the Central Government should impress upon the State Governments the importance of this training course and they should be persuaded to depute their staff regularly for this course.
34	41	The Committee are glad to note that the Central Rice Research Institute is imparting post-graduate training in various disciplines of agricultural science in collaboration with the Utkal Krishi Mahavidyalaya, Bhubaneswar and the Indian Agricultural Research Institute. They feel that the training programme should be augmented, so that more and more students take advantage of the facilities afforded by the Institute. Incidentally, the training programme will also be beneficial to the teachers inasmuch as, this will keep them posted with the latest scientific developments in India and abroad.
35	42	The Committee have noted that the flight of trained personnel from one institute to another and from one discipline to another is a feature which is to be noticed in all agricultural research institutes. The Committee would urge that the question of providing suitable incentives to the deserving research workers should be examined so that they may look for future prospects within the Institute itself. In this context the Committee feel that the reservation of 10 per cent of

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		the permanent posts of Research Assistants for the Selection Grade is not adequate, and they would suggest that Government should consider the desirability of a suitable increase in this percentage.
36	43	The Committee suggest that the question of setting up of a Higher Secondary School in the vicinity of the Central Rice Research Institute may be taken up with the State Government at an early date.
37	43	The Committee suggest that pending the establishment of a Higher Secondary School in the vicinity of the Institute, Government should consider the question of reducing or subsidising the transport charges of the school-going children of the staff working in the Institute.
38	44	The Committee urge that steps may be taken to improve the recreational facilities available for the employees of the Institute and their families in the Institute Campus.
39	45	The Committee feel that the research made at the Central Rice Research Institute would be barren if it is not simultaneously exploited by the States. They agree with the proposal of Government to treat the existing eleven Japonica-Indica Units as Liaison Units of the Institute.
40	45	The Committee would suggest that till such time the proposal regarding conversion of eleven Indo-Japonica Units as Liaison Units is implemented, some stop-gap arrangement should be made for liaison between the State Departments of Agriculture and the Institute so that the benefits of the research may be reflected in practice without any delay.
41	46	While the Committee appreciate the efforts of the Institute, to publicise the results of the research undertaken, they feel that much remains to be done in the matter of dissemination and popularisation of the results of research. For this purpose, Government may devise a proper co-ordinated plan in consultation with the State Governments, the extension organisation at the Centre, and the Institute.
42	48	The Achievement Audit Committee (1960) which assessed the work of the Central Rice Research Institute, did not go into the working of this Sub-station presumably because it was then only in its formative

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		stage. Now that a period of five years has elapsed since the setting of the Sub-station, the Committee feel that it would be worthwhile to conduct a critical appraisal of its work with a view to see as to what extent the objectives for which the Sub-station was set up, have been achieved.
43	49	The Committee are unhappy to note that in spite of recommendations of the Achievement Audit Committee (1960) and other foreign experts, Government have not decided the question of setting up sub-stations for studying problems relating to cultivation of rice under flooded conditions and high altitudes. As there are large areas in the country which are susceptible to floods but are suitable for rice cultivation under certain conditions and there are also high altitude areas growing rice and presenting problems peculiar to them, the Committee are of the opinion that there is a need for research on these special problems for increasing the rice production. They suggest that arrangements should be made for studying them, in case no such arrangement exists at present.
		The Committee feel that if research on these special problems is conducted by any State Government at its research centres, the Central Rice Research Institute should coordinate with such research centres in this behalf.
44	50	The Committee are surprised to note that the paddy yield of the Institute's demonstration farm, which is expected to serve as a model, has been going down and the loss increasing every year. They regret that even after a lapse of 4 years of the Achievement Audit Committees Report, no tangible action has been taken to improve the irrigation and drainage system the lack of which has been responsible for decreasing yield in the farm. The Committee would urge that the matter may be attended to urgently so that the recurring losses incurred by the farm may be eliminated.
44	51	The Committee feel that the present situation where the yield of rice per hectare in India continues to be one of the lowest in the world, should be taken as a challenge and should spur us on to more vigorous and

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		intensified efforts both in the Research Institutes and the field. If these efforts are commensurate enough, the Committee see no reason why it should not be possible to remove before long the stigma that India, the largest paddy growing country in the world, ranks amongst the countries lowest in productivity.
		The Committee would like particularly to stress the fact that, besides intensifying the research on various problems of paddy cultivation, Government should give special attention to devise a suitable machinery which would ensure that extension work does not lag behind research and that the results of research reach the farmers in the fields and are fully utilised by them.

APPENDIX V

Analysis of Recommendations in the Report

I. CLASSIFICATION OF RECOMMENDATIONS :

A. Recommendations for improving the organisation and working :

S. Nos. 2, 4, 5, 10, 12, 14 15, 17, 19, 21, 22, 24, 25, 26, 27, 30, 35, 39, 40, 41, 42 and 45.

B. Recommendations for effecting economy :

S. Nos. 1, 3, 6, 8, 11, 13, 16, 23, 29, 31, 32, 43 and 44.

C. Miscellaneous Recommendations :

S. Nos. 7, 9, 18, 20, 28, 33, 34, 36, 37 and 38.

II. ANALYSIS OF MORE IMPORTANT RECOMMENDATIONS DIRECTED TOWARDS ECONOMY :

S. No. as per Summary of Recommendations (Appendix IV)	Particulars
(1)	(2)
1	Coordinated and concerted efforts should be made to increase the yield of rice per hectare by the application of the latest scientific techniques and more intensive cultivation of the strains already evolved.
16	Government may examine the desirability of entrusting the work of country-wide propagation of pest and disease controls to the existing Indo-Japonica Units instead of establishing separate service stations by the Indian Council of Agricultural Research.
23	Green manuring being cheap and its efficacy being comparable to chemical fertilizer, the research on common green manure crops should be intensified and results disseminated among the cultivators.
31	Where substantial improvements in the designs of implements are effected, steps should be taken to get them patented so that the financial benefits of the research of an institute may not be exploited solely by private interests.
44	Urgent steps should be taken to improve the irrigation and drainage system of the Institute's farm to eliminate the recurring losses incurred on this account.

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