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MEMORANDUM

REGARDING THE

Introduction of Carolina Rice into India,

BY

L. LIOTARD,

OF THE AGRICULTURAL DEPARTMENT.

CALCUTTA:

PRINTED AT THE HOME, REVENUE AND AGRICULTURAL DEPARTMENT PRESS,

1880.

MEMORANDUM

REGARDING THE

INTRODUCTION OF CAROLINA RICE INTO INDIA.

PREFACE.

THIS memorandum is divided into three chapters.

Chapter I. gives a brief outline of the history of the rice plant, and describes the modes in which it is cultivated in some of the chief rice-producing countries. The materials have been obtained from the following publications:

Cyclopædia of India, Vol. IV., by Dr. Balfour.

Annual Reports of the Department of Agriculture, United States, for 1867 and 1870.

Journal of Agriculture of the Agricultural Society of Scotland for 1837-38 and 1855-57.

The "Agricultural Gazette of India", Vol. IV. (1872-73) and Vol. V. (1873-74).

"The Indian Agriculturist", 1876.

Transactions of the Agricultural and Horticultural Society of India, Vol. III. of 1839 and Vol. IV. of 1837.

Quarterly Journal of the Agricultural and Horticultural Society of British Burma for first quarter of 1871.

Annual Reports of the Agricultural and Horticultural Society of Oudh for 1864.

Principles of Rational Agriculture applied to India, by Eugène C. Schrottky.

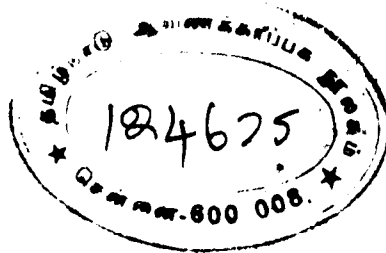
Annual Report of the Superintendent of Government Farms, Madras Presidency, for 1876-77.

Chapter II. narrates the endeavours of the Government of India to introduce the cultivation of the Carolina rice into India. The materials were supplied in the Proceedings of Government. This chapter narrates the experimental sowings of imported seed for each year in all the different Provinces. This way of treating the materials corresponds with the yearly importation of fresh seed from America, and shows what the result of each importation and each yearly trial proved to be. After a time further importations of the seed were discontinued, and experiments were carried on with seed grown in the country: from this period to the end of such trials a different mode of classification of the materials has been followed: the remaining years of trial have been taken together, each Province being treated of separately to the end.

Chapter III. brings together the conclusions which may be derived from the result of the endeavours recorded in Chapter II. and supplies some statistical information showing the importance of rice cultivation in India.

CALCUTTA;
The 23rd December 1879. }

L. LIOTARD.



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CHAPTER I.

BRIEF OUTLINE OF THE HISTORY OF THE RICE PLANT, AND DESCRIPTION OF THE MODES IN WHICH IT IS CULTIVATED IN SOME OF THE CHIEF RICE-PRODUCING COUNTRIES.

1. THE rice plant belongs, as do most of our other edible grains, to the natural order of the grasses, and is classed in the genus *Oryza*.

Numerous varieties of the plant are named by botanists, but they may, for all practical purposes, be resolved into four great heads, namely, the *Oryza sativa*, or common rice, which thrives only on marshy soils, the *Oryza praecox* which also delights in humid situations, the *Oryza mutica*, or mountain rice, growing on the slopes of the hills, and the *Oryza glutinosa*, or clammy rice, which is an intermediate variety between the mountain rice and the other two kinds, and grows alike on wet and dry soils.

2. The cultivation of the plant, at the present date, extends to many countries; and it has been adapted to a variety of climates extending in the Eastern Hemisphere from the 45th parallel of North latitude to the 38th South; and in the Western Hemisphere from 40° North to 38° South latitude.

3. The Native habitat of the rice plant is said by some to be India, while others think that it is indigenous to both South-ern and Eastern Asia on the one side and Eastern America on the other. However this may be, the use of rice, like that of other cereals, extends beyond the reach of record, for Theophrastus mentioned it 2,000 years ago, and it was mentioned by Horace, Pliny and Celsus. Alexander Von Humboldt says that a variety of rice was found growing in some of the valleys of the Himalaya Mountains. Evidence bears in favour of the belief that the common or aquatic species (the *Oryza sativa*) is a native of the East Indies, and is found growing wild in and about the borders of the lakes in the Rajahmundry Sircars of Hindustan. A kind with broader leaves (the *Oryza latifolia*) is indigenous in Brazil, and Bates mentions having seen it growing wild in abundance on some of the tributaries of the Amazon.

4. From India the culture of the plant is said to have extended Eastward to China and Japan, and Westward to Egypt, Greece and thence to Italy and other countries in Europe. The similarity in the popular names of the plant does, in fact, bear out the general belief in this spread of its culture, for, while the old Sanskrit name is *vrihi* and the Tamil is *arisi*, we find the Arabs call it *aruz*, the Greeks *oriza*, and it is *oriza* in Latin, *aroz* in Portuguese and Spanish, *riz* in French, *reiz* in German, *ryst* in Dutch, and *rice* in English.

Eastward, however, the similarity in the names does not exist, and this may, perhaps, be accounted for either by the peculiarity of the Chinese language, or by the fact that the cultivation of the plant did not extend from India, but was common both to India and China. The name is in Chinese *tau*, in Japanese *molaj*, *gome*, or *ko*, in Malay *bras* and *padi*.

At the present date *padi* (*Anglicé* paddy) is understood to be all rice with the husk on. This might, perhaps, be owing to the fact that much of the rice exported from the Malayan Peninsula or Burma is unhusked.

5. At present rice is grown in China, Japan, in the Indian Archipelago, Siam, Ceylon, in India, on both shores of the Red Sea, in Egypt, in the Southern countries of Europe, in France and Germany, on the shores of the Mozambique Channel, in Madagascar, in some parts of Eastern and Western Africa, in the Southern portion of the United States, in the Spanish Main, in Brazil, and in some few other places in America.

6. Indeed, the cultivation of rice is now so extensive that it has been reckoned that, if the human race were divided into families according to the predominant use of the several food-grains, the rice-eaters would occupy the first place in number, while the wheat and

maize eaters would contend for the second with a fair promise of victory to the maize, and the fourth class would come in the rear with rye, oats and barley.

Besides being "the staff of life" in the most populous parts of the earth, rice is now so extensively used among all the other grain-eaters of the human race that it is questionable whether a greater amount of it is not consumed as a food-stuff than of all the other cereals put together.

7. The chief variety of the plant flourishes best in low marshes, or in a soil flooded during the greater part of its growth either by heavy rains or the inundations of rivers, and thus it possesses the advantage of being cultivable on land that is too low and too moist for the production of other useful plants. Nor does it give way to other food-grain products by being confined to such description of soil, for, although cultivated principally within the tropics, it flourishes also well beyond them, yielding heavy and well-filled grain. The *Oryza mutica*, or mountain rice, has been mentioned above. Dr. Balfour in his Cyclopaedia of India says—

"The dry or mountain rice is raised in some parts of Europe on the sides of hills. It is said to thrive well in Cochin China in dry light soil, not requiring more moisture than the usual rains or dews supply. By long culture the German rice, raised by the aid of water, is stated to have acquired a remarkable degree of hardness and adaptation to the climate."

And the upland rice of the United States, said to have been introduced there from Cochin China and Nepal, will grow on high and poor land. Dr. Balfour mentions that it will produce more than Indian-corn would on the same land, even fifteen bushels when the corn yields but seven bushels. At Munzo, in New Grenada, the paddy-fields yield without inundation, and at a mean temperature of 79° Fahrenheit a produce of 100 to 1. In Piedmont, where the sowing takes place at the beginning of April, about 55lbs. of seed are sown per acre, and the usual return of a rice field is about 50 times the seed. Rice at Bourbon forms, with maize and mandioc, the principal article of food amongst the Negroes and coloured people. In Mauritius rice is cultivated in very damp soils, upon which a great deal of rain falls, but which are not flooded; but the process is said not to be so certain, nor the crop so great, as when inundation is employed. On the North of India we find the Bara rice of Peshawar and the Joomla rice of Nepal, both no doubt of the *Oryza mutica* species, growing in high altitudes, the latter especially amidst snow and frost, under such special circumstances as to have merited a name of its own among botanists who call it the *Oryza Nepalensis*.

8. The Bara rice is much prized by Natives in Upper India. It grows in the Valley of Shaik Khan, opposite the fort of Bara, about nine miles South-West of Peshawar, and seems to be of some historical interest, for Dr. Collis, in sending a sample of it to Dr. Bonavia, the Honorary Secretary to the Agricultural and Horticultural Society of Oudh, wrote in 1863:

"This rice, which it is said will only grow in a few fields near Shaik Khan, is so much prized by Natives that, before the conquest of Peshawar by the Sikhs, the Cabul Sirdars had agents to watch the fields in order that none of it might be removed, but that the entire crop might be sent to them. When Runjeet Singh began to threaten Peshawar in 1822 twenty seers of Bara rice was among the presents sent by Yar Mohamed Khan to him in hopes of propitiating him. Even now a great deal of it is sent to Cabul. Of course every zemindar, who cultivates rice in the neighbourhood of the fort or river of Bara, brings his crop into the market as Bara rice. I can, however, vouch for the genuineness of the specimen I now send you, which I got at the time that I was obliged to visit sick prisoners in the fort at Bara once or twice a week."

Dr. Bonavia says that the quantity sent by Dr. Collis was about two handfuls, that it all germinated in Oudh where he had it sown, and that it produced a very fine crop which yielded about a maund of paddy; that the crop was much admired by all the Natives, who said it was very different from the kinds of rice they had been accustomed to sow. Some of it was exhibited in sheaf at an agricultural show: it received the first prize for rice in husk, and was much thought of by all Natives who were conversant with the qualities of good rice. Dr. Bonavia intended sending a large packet of this rice seed to each Deputy Commissioner in Oudh, and he hoped that, if it were distributed in small quantities to persons who are likely to care for it, the Agricultural and Horticultural Society will be able to disseminate it throughout the Province in two or three years. The further results of this enterprise are not, however, traceable in any of the books and papers to which I have access.

9. The Joomla rice is a native of the lofty mountains of Joomla in Nepal, North-West of the great valley; and as its cultivation is carried on at high elevations, and under circumstances of frost and snow, it was thought that it might become acclimatized in the North of Europe. Accordingly such information as was obtainable was gathered by the Resident in Nepal, who also sent samples of the rice seed to the Agricultural and Horticultural Society of Calcutta. Part of this supply was forwarded to the Honourable Court of Directors in London, and a portion was sent to the Colonial Secretary at the suggestion of Lord Auckland, who was of opinion that Canada might, perhaps, answer for its cultivation.

The mountain rice is also abundantly grown at altitudes of 6,000 and 7,000 feet in the Sewalik Hills and in the upland valleys of North-West Himalaya. Dr. Balfour says that it has been reared successfully on the banks of the Thames at Windsor. This sowing was evidently made from the sample of the Nepal or Joomla rice seed sent to England, but there is no distinct information as to this.

Dr. Falconer is said to have introduced into parts of the Presidency of Bengal the numerous and fine varieties of rice cultivated in the Himalayan tracts; of these it is stated that some of the best sorts were, at his suggestion, distributed to cultivators along the Ganges Canal. But here also no record of the result is available.

10. In India generally rice is produced in almost every variety of soil, at every altitude and in every latitude; and there are a great many varieties. These, however, may all be classed under the four heads already mentioned. The different modes of culture followed may be summed up briefly. Beginning from the North of India we find the Joomla rice sown and cultivated in the following manner:

"Take the quantity of grain you intend to sow, and having collected it in a heap in any cool place, cover the heap entirely with layers of moistened earth and rich manure mixed together. In the course of ten or twelve days the grains of rice that have been thus covered up will sprout and send forth green shoots. When this takes place they are ready for sowing. The ground on which you intend to sow must be prepared as follows: it is to be plentifully covered with water and ploughed until the water has become well mixed with the earth. The grain is to be strewn upon the ground whilst in the saturated state, and it will assuredly thrive. Should it appear to require water afterwards, as the crop advances, water must be given at discretion."

This account of the *modus operandi* was furnished from Katmandu (Nepal) through the Resident, and printed in the Transactions of the Agricultural and Horticultural Society of India in 1838 (Vol. I).

Lower down the Himalayan heights we find the mountain rice (*Oryza mutica* and also the *Oryza glutinosa*) grown, without irrigation, at elevations of 3,000 to 6,000 feet, where the dampness of the summer months compensates for the want of artificial moisture.

In Kashmir rice is the staple product. Dr. Balfour gives the following account of its cultivation:

"It is sown in the beginning of May, and is fit to cut about the end of August. The grain is either sown broadcast in the place where it is intended to stand till it is ripe, or thickly in beds, from which it is transplanted when the blade is about a foot high. As soon as the season will admit, after the 21st of March, the land is opened by one or more ploughings, according to its strength, and the clods are broken down by blows with wooden mattocks, managed in general by women, with great regularity and address, after which water is let in upon the soil, which, for the most part of a reddish clay or foxy earth, is converted into a smooth soft mud. The seed-grain, put into a sack or woven grass, is submerged in a running stream until it begins to sprout, which happens sooner or later according to the temperature of the water and of the atmosphere, but ordinarily takes place in three or four days. This precaution is adopted for the purpose of getting the young shoots as quickly as possible out of the way of a small snail which abounds in some of the watered lands of Kashmir, but sometimes proves insufficient to defend it against the activity of this destructive enemy. When the farmer suspects by the scanty appearance of the plants above the water in which the grain has been sown, and by the presence of the snail drawn up in the mud, that his hopes of a crop are likely to be disappointed, he repeats the sowing, throwing into the water some fresh leaves of the Prangos plant, which either poison the snails, or cause them to descend out of the reach of its influence. The seed is for the most part thrown broadcast into about four or five inches of water, which depth is endeavoured to be maintained. Differences of practice exist as to watering, but it seems generally agreed that rice can scarcely have too much, provided it be not submerged, except for a few days, before it ripens, when a dried state is supposed to hasten and to perfect the maturity, whilst it improves the

"quality of the grain. In Kashmir it is customary to manure the rice lands, which is never done in Hindustan. This manure, for the most part, consists of rice straw rejected by the cattle and mixed with cow-dung. It is conveyed from the homesteads to the fields by women in small wicker baskets, and is set on the land with more liberality than might have been expected from the distance it is carried. Many of the rice lands are situated much higher than might be thought convenient to Hindustan, and are rather pressed into this species of culture than naturally inviting, but still yield good crops, through the facility with which water is brought upon them from the streams which fall down the face of the neighbouring hills. In common seasons the return of grain is from thirty to forty for one on an average, besides the straw."

In the Punjab rice is grown in many of the plain districts, especially along the banks of the rivers. The bara rice of Peshawar is celebrated, and scarcely less celebrated is the real basmati of the Kangra Valley, which Mr. Baden-Powell in his book on "Punjab Products" says—"with its large, white and fragrant grains is a most beautiful product." Dr. Balfour states that it is grown abundantly up to 6,000 and 7,000 feet in the Sewalik tract and up the valleys. Its mode of culture is unfortunately not explained.

In Lower Sindh the bhūll rice (apparently belonging to the class of *Oryza sativa*) is grown. The name bhūll is derived from the patches of alluvial deposit which the Indus throws up at its mouth, and which is known by that name in Sindh. The bhūlls are large tracts of very muddy swampy land, almost on a level with the sea, and exposed equally to be flooded both by it and the fresh water. Upon this flooding of the bhūll with salt water depends their cultivation. They have a most dreary, desolate and swampy appearance, are intersected in all directions by streams of salt and brackish water, and are generally surrounded by low dykes or embankments, in order to regulate the influx and reflux of the river and sea. Yet from these dreary swamps a very considerable portion of the rice consumed in Sind (a sort of red rice) is produced. The mode of cultivation is so singular that, at the risk of being too lengthy, I will quote an account of it from Dr. Balfour's Cyclopædia:

"Should the river, during the high season, have thrown up a bhūll, the zemindar, selecting it for cultivation, first surrounds it with a low bund of mud which is generally about three feet in height. These bhūlls, being formed during the inundation, are often considerably removed from the river branches during the low season. When the river has receded to its cold weather level, and the bhūll is free of fresh water, he takes advantage of the first high spring tide, opens the bund, and allows the whole to be covered with the salt water. This is generally done in December. The sea water remains on the land for about nine weeks, or till the middle of February, which is the proper time for sowing the seed. The salt water is now let out, and as the ground cannot, on account of the mud, be ploughed, buffaloes are driven over every part of the field, and a few seeds of the rice thrown into every foot-mark, the men employed in sowing being obliged to crawl along the surface on their bellies, with the basket of seed on their backs, for were they to assume an upright position, they would inevitably be bogged in the deep swamps. The holes containing the seed are not covered up, but people are placed on the bunds to drive away birds until the young grain has well sprung up. The land is not manured, the stagnant salt water remaining on it being sufficient to renovate the soil. The rice seed is steeped in water, and then in dung and earth for three or four days, and is not sown until it begins to sprout. The farmer has now safely got over his sowing, and as this rice is not, as in other cases, transplanted, his next anxiety is to get a supply of fresh water, and for this he watches for the freshes which usually come down the river about the middle and end of February, and if the river then reaches his bhūll he opens his bund and fills the enclosure with the fresh water. The sooner he gets this supply the better, for the young rice will not grow in salt water, and soon withers if left entirely dry. The welfare of the crop now depends entirely on the supply of fresh water. A very high inundation does not injure the bhūll cultivation, as here the water has free space to spread about. In fact the more fresh water the better. If, however, the river remains low in June, July and August, and the South-West monsoon sets in heavily on the coast, the sea is frequently driven over the bhūlls and destroys the crops. It is, in fact, a continual struggle between the salt water and the fresh. When the river runs out strong and full the bhūlls prosper, and the sea is kept at distance. On the other hand, the salt water obtains the supremacy when the river is low, and then the farmer suffers. Much bhūll crop is destroyed in the monsoons and during heavy gales. The rice is subject to attacks also of a small black sea crab called by Natives kookaee, and which, without any apparent object, cuts down the growing grain in large quantities, and often occasions much loss. If all goes well, the crop ripens well about the third week in September, and is reaped in the

"water by men, either in boats, or on large masses of straw rudely shaped like a boat, and which, being made very tight and close, will float for a considerable time. The rice is carried ashore to the high land, where it is dried and put through the usual harvest process of division, &c., and the bhūll is then, on the fall of the river again, ready for its annual inundation by sea water."

In the North-Western Provinces and Oudh a heavy soil and plenty of water suit the rice plant best. The *mihie* and *bansi* are considered the best of the many varieties grown. They are sown in beds and transplanted and placed about five inches apart. By this method, if the soil is good, the plants grow to the height of an ordinary man, and produce a much larger quantity than if otherwise treated. The odour and flavour of these two kinds, when cooked, are superior to those of any other kind. The labour in cultivating them, however, make them dearer than the other sorts, and they are, therefore, used only by those who can buy them. Three other varieties which are considered good are the *bateesa*, the ? and the *phul birinj*. These are sown broadcast in June and left so, and they are the kinds mostly used by Natives.

In Bengal the principal cultivation is that of rice. There are many varieties of the grain differing widely; but they may all be classed under three heads—

- 1st, the varieties sown in spring, reared through the rains, harvested in September, and known popularly as the "aous" rice;
- 2ndly, the varieties sown in June, cut in November and December, and known as the "amun" rice; and
- 3rdly, the variety sown in January reaped in May and known as the "boro" rice.

The first mentioned variety is grown on high, light and sandy soils not subject to inundation; it matures and ripens within a period of ninety days, and is the safest, though not by any means the most abundant. The second is sown on low alluvial tracts, and requires five months to reach maturity: this is usually the most profitable harvest, although, from the position of the land, it is liable at certain times to be seriously damaged by inundation. The third kind, very common only in extensive marshy districts, is cultivated in places where there is a depth of water sufficient to keep the plant moist during the fierce heat of summer.

The respective produce of these three varieties of rice, upon which the hopes and anxieties of some millions of people hang for a large part of the year, cannot precisely be given, as crop experiments, to test the average yield over selected areas, do not seem to have been made, and agricultural statistics do not exist in Bengal.

The practice prevails in certain tracts of the Bengal Province of planting out the rice from nurseries reared near the cultivators' dwellings. In this case the plant is removed when about eight or nine inches high, carried carefully to its destination, and there planted in rows pressed down about the roots with an inclination towards the direction whence the prevailing wind blows. These plants, says Dr. Balfour, are said to thrive remarkably if properly placed, and to attain maturity in an incredibly short space of time.

In Bombay the general mode of rice cultivation is thus carried on. Before the approach of the rains the remaining stubble of the previous crop is burnt, as also leaves, grass, &c., the ashes serving as manure for the coming crop. On the first burst of the monsoon the land is ploughed to a depth of three or four inches only, the ploughing taking place very often when the fields are inundated. In the meantime the rice seed is sown thickly in nurseries, and when the plants have attained a height of four or five inches, they are transplanted out into the fields in small bunches of three or four. One hundred pounds of rice seed are generally used up as seed for one acre of land, and the yield is on the average seven or eight-fold, rarely exceeding, in fact, 900 lbs. per acre. The crop takes from four and half to five months to ripen.

In the Madras Presidency rice is cultivated principally in the low lying districts along the valleys of rivers and near great tanks. The land is profusely irrigated for the first ploughings, and is generally turned into a soft liquid puddle; the seed is sown either broadcast or in nurseries and transplanted, and the plentiful use of the water is never neglected; but as the ears come to maturity the water is drawn off. The usual time from the planting out to the reaping season is about sixty days. Generally speaking, there are two great crops, the *kaar* and the *sumbah* or *peshanum*. The latter is reaped in February and March, and its produce is preferred to that of the *kaar* crop which is reaped in October. In the Teling Circars the two crops are designated *poona* or early and *pedda worloo* or great.

From the expenses attending the necessary irrigation rice is dearer in the Madras Presidency than other cereals, and the great mass of the people in the interior live on dry grains and pulses.

11. In Ceylon, in the Kandian country, says Dr. Balfour, "when paddy is to be cultivated in mud, a piece of ground is enclosed in a series of squares

"or terraces, by ridges raised with mud and turf; a quantity of water is directed into the field from an adjacent stream or tank, and is allowed to remain on it for fifteen days; at the expiration of this time the field is ploughed with a yoke of buffaloes, which operation is repeated at the end of fifteen days more, when by the rotting of the weeds and other matter the field has become manured. After another interval of fifteen days the field is again ploughed and the broken ridges are repaired. Eight days after the field is harrowed, and subsequently rolled or levelled; and when the water has been let out the seed is sown, having, in most instances, been previously made to germinate by being spread on platforms and kept wet. The water is turned in during the night to prevent crabs and insects from destroying the seedlings and let out during the day; and this they continue to do till the plants attain the height of one foot. Water is only retained in the field until the ears are half ripe, otherwise they would ripen indifferently and be destroyed by vermin. A variety of coast paddy, called "moottoo sambou" was introduced into the Kandian Province in 1832, which was found to produce a more abundant crop, by one-third, from the Native. It is of six months' growth."

12. In China, during the growth of rice, I again quote from Dr. Balfour's Cyclopaedia, "the fields are always kept flooded when water can be obtained. The

"terraces near the base of the hills are supplied by the mountain streams, and the fields, which are above the level of any adjoining river or canal, are flooded by the celebrated water-wheel, which is in use all over the country. These machines are of three kinds. The principle in all of them is the same, the only difference being in the mode of applying the moving power—one is worked by the hand, another by the feet, and the third by an animal of some kind, generally a buffalo or bullock. The rice lands are kept flooded in this way until the crops are nearly ripe, when the water is no longer necessary. It is also necessary, or at least advantageous, to go over the ground once or twice during the summer and stir the soil up well amongst the roots, at the same time removing any weeds which may have sprung up. If the weather is wet, the fields retain the water for a considerable time, and then it is not an uncommon sight to see the Natives wading nearly up to the knees in mud and water when they are gathering in the harvest. In the Island of Chusan, and over all the rice country of Cheking and Keangsoo, there are two plants cultivated in the winter months, almost exclusively for manure; the one is a species of coronilla, the other is trefoil, or clover. Large ridges, not unlike those where gardeners grow celery, are thrown upon the wet rice fields in the autumn, and the seeds of the plants are dropt in, in patches at five inches apart, on the surface of the ridges. In a few days germination commences, and long before the winter is past the tops of the ridges are covered with luxuriant herbage. This goes on growing until April when it is necessary to prepare the ground for the rice. The ridges are then levelled and the manure plants are scattered in a fresh state over the surface of the ground. The fields are flooded, and the plough and harrow are employed to turn up and pulverise the soil. The manure thus scattered over the ground and half buried amongst the mud and water begins to decay immediately, and gives out a most disagreeable putrid smell. This mode of manuring is generally adopted in all the rice lands in this part of China, and the young paddy doubtless derives strong nourishment from the ammonia given out in the decomposition of this fresh manure. Firewood is so scarce in the country that a great portion of the straw, cotton stalks, and grass which would go to manure the fields is used for firing, and therefore the plan of growing manure for the land is forced upon the farmers by necessity. The plan of using manure in a fresh state, instead of allowing it first to decay, has doubtless been found, from long experience, to be the best for the young paddy. The Chinese farmer is not a chemist, he knows little or nothing of vegetable physiology, but his forefathers have hit accidentally upon certain systems which are found in practice to succeed, and to these he himself adheres and hands them down unchanged to his children."

13. Java is the granary of the Eastern Archipelago, and the Dutch East India Company occupies itself in rice culture with solicitude, well persuaded that a scarcity of rice might be fatal to its power. Ordinances to encourage and increase this branch of agriculture have been promulgated at different times by the Local Administration, and

the cultivation has increased considerably. Three modes of culture are in practice. "The name of 'sawah' is given to the rice fields which can be irrigated artificially; tepar or tagal are elevated but level grounds; and gagah or ladang are cleared forest grounds. The two last only give one crop; a second crop may be obtained from the sawah, which then most commonly consists of katjang, from which oil is extracted, of kapus, or fine cotton, and of ubie, a kind of potato. There are, says Mr. Crawford, two distinct descriptions of rice cultivated throughout the Indian islands, one which grows without the help of immersion in water and another for which that immersion is indispensably requisite. In external character there is very little difference between them, and in intrinsic value not much. The marsh rice generally brings a somewhat higher price in the market. The great advantage of this latter consists in its superior fecundity. Two very important varieties of each are well known to the Javanese husbandman; one being a large productive but delicate grain which requires about seven months to ripen, and the other a small, hardy and less fruitful one, which takes little more than five months. The first we constantly find cultivated in rich lands, where one annual crop only is taken, and the last in well watered lands, but of inferior fertility, where the two crops may be raised. Both of these, but particularly the marsh rice, are divided into a great number of sub-varieties, characterised by being awned or otherwise having a long or round grain, * or being in colour black, red, or white. *

"The rudest, and probably the earliest practised, mode of cultivating rice consists in taking from forest lands a fugitive crop, after burning the trees, grass and underwood. The ground is turned up with the mattock, and the seeds planted by dibbling between the stumps of trees. The period of sowing is the commencement of the rains, and of reaping that of the dry seasons. The rice, of course, of that description which does not require immersion. The second mode is usually adopted consists also in growing mountain or dry-land rice. This mode is usually adopted on the common upland arable lands, which cannot conveniently be irrigated. The grain is sown in the middle of the dry season, either broadcast or by dibbling, and reaped in seven or five months, as the grain happens to be the larger or the smaller variety. The culture of rice by the aid of the periodical rains forms the third mode. The grain being that kind which requires submersion, the process of sowing and reaping is determined with precision by the seasons. With the first fall of the rains the lands are ploughed and harrowed. The seed is sown in beds, usually by strewing very thickly the corn in the ear. From these beds the plants, when 12 or 14 days old, are removed into the fields and thinly set by the hand. They are then kept constantly immersed in water until within a fortnight of the harvest, when it is drawn off to facilitate the ripening of the grain. The fourth mode of cultivating rice is by forcing a crop by artificial irrigation at any time of the year; thus in one field, in various plots, the operations of sowing, ploughing, transplanting and reaping may be seen at the same period. Mr. Crawford says he had seen lands which had produced, from time beyond the memory of any living person, two yearly crops of rice. When this practice is pursued, it is always the five months grain which is grown. The rapid growth of this variety has indeed enabled the Javanese husbandman, in a few happy situations, to urge the culture to the amount of six crops in two years and a half. Rice cultivated in a virgin soil, where the wood has been burnt off, will, under favourable circumstances, give a return of twenty-five and thirty-fold. Of mountain rice, cultivated in ordinary upland arable lands, fifteen-fold may be looked upon as a good return. In fertile soils, when one crop only is taken in the year, marsh rice will yield a return of twenty-five seeds. When a double crop is taken, not more than fifteen or sixteen can be expected. In the fine Province of Kadu, an English acre of good land, yielding annually one green crop and a crop of rice, was found to produce of the latter 941 lbs. of clean grain. In the light, sandy, but well watered lands of the Province of Mataram, where it is the common practice to exact two crops of rice yearly without any fallow, an acre was found to yield no more than 285 lbs. of clean rice, or an annual produce of 560 lbs."

14. North America seems to be the native habitat of only one variety of rice, the wild rice so called of the North American ponds and lakes. In reality

it is said by botanists not to be a rice, but a reed; not an *oryza*, but a *zizania*, known by the name of *Zizania aquatica*. The Sioux call it pshu and the Chippewas man-om-in.

The American rice planters commonly call it "volunteer rice" from the fact that it puts in an appearance when it is not wanted, or, in other words, it seeds itself from year to year. It is a great nuisance to the planters, inasmuch as it pollutes the more valuable rice crops, and its eradication is troublesome.

I quote the following account of it from the annual report of the Department of Agriculture of the United States for 1870:

"It is a constant article of food with the Northern Indians of the lakes and rivers between the Mississippi and Lake Superior. This plant delights in mud and water 5 to 20 feet deep. When ripe the slightest wind shakes off the grains. After being gathered it is laid on scaffolds about 4 feet high, 8 wide, and 20 to 50 long, covered with reeds and grass, and a slow fire is maintained beneath for 36 hours, so as to parch slightly the husk that it may be removed easily. Its beard is tougher than that of rye. To separate it from the chaff or husk, a hole is made in the ground a foot wide and one deep, and lined with skins; about a peck of rice is put in at a time, an Indian steps in, with a half jump on one foot, then on the other, until the husk is removed. After being cleaned the grain is stored in bags. It is darker than Carolina rice. The hull adheres tightly, and is left on the grain, and gives the bread a dark colour when cooked. The husk is easily removed after being exposed to heat. In Dakota the men gather this grain, but all other grain the women collect."

This wretched indigenous product was supplanted by rice of other and superior varieties introduced from other countries, but there is much uncertainty as to the time when paddy was first introduced into the United States, and also as regards the country from which the first seed was obtained. The most trustworthy accounts show that the crop was first grown some time about the latter end of the seventh century, and that seed was imported both from East India and Madagascar.

There are two kinds of rice cultivated in the States of America, the gold and the white, from the colour of the pellicle which encloses the seed: on the removal of the pellicle, however, both are alike white. The white sort, as it is called, was transmitted to America by Mr. Dubois, Treasurer to the East India Company, in 1647, to Sir William Berkeley, and its cultivation was attended with great success in Virginia. Half a bushel of seed was received, from which Sir William raised 16 bushels of excellent rice, most or all of which was sown in the following year.

The gold seed rice was introduced from Madagascar in the following manner. The account is quoted from Ramsay's "History of South Carolina":

"Landgrave Thomas Smith, who was Governor of the Province in 1693, had been at Madagascar before he settled in Carolina. There he observed that rice was planted and grew in low moist ground. Having such ground in his garden attached to his dwelling in East Bay, Charleston, he was persuaded that rice would grow therein if seed could be procured. About this time a vessel from Madagascar being in distress came to anchor near Sullivan's Island. The master inquired for Mr. Smith as an old acquaintance. An interview took place. In the course of conversation Mr. Smith expressed a wish to obtain some seed rice to plant in his garden. The cook being called said that he had a small bag of rice suitable for the purpose. This was presented to Mr. Smith, who sowed it in a low spot in Longitude Lane. From this small beginning did one of the great staple commodities of South Carolina take its rise, which soon became the chief support of the colony, and its great source of opulence."

The gold sort, Dr. Balfour says, is considered to be the better of the two, and so kindly did it take to the soil, and so much was it then, and ever since thought of, that the Captain was presented with a handsome gratuity.

Besides being a fine handsome grain, its yield per acre in South Carolina is from twenty to sixty bushels, and under favourable circumstances as many as ninety bushels to an acre have been raised.

The cultivation of this rice was introduced into Louisiana in 1718.

Another variety also is cultivated in America to a limited extent, called Cochin China dry or mountain rice, from its adaptation to a dry soil without irrigation. "It will", says Dr. Balfour, "grow several degrees further North or South than the Carolina rice, and has been cultivated with success in the Northern Provinces of Hungary, China, Westphalia, Virginia and Maryland; but the yield is much less than that of Carolina rice, being only fifteen to twenty bushels to an acre. It was introduced into Charleston from Canton by John Brodly Blake in 1772".

The present culture of rice in the United States is chiefly confined to South Carolina, Georgia, Florida, Alabama, Mississippi and Texas. Of the two varieties of gold and white at present generally cultivated, the gold is much the most extensively used, probably in the proportion of more than six to one, the white rice having the disadvantage of shedding more readily when ripe: and consequently, in case of a wet harvest, the waste is much greater than with the red sort (so says a letter from South Carolina, dated 28th January 1876, forwarded by Dr. Forbes Watson, and printed in the annual report of the Superintendent of the Sydapet Farm for 1876-77).

It is cultivated in South Carolina in the marshy flats which are periodically covered by the floodings of the rivers; and the *modus operandi* is briefly described by Dr. Schrottky in his "Principles of Rational Agriculture" thus:

"Low-lying or marshy land is selected, and the soil thrown up by a hoe in furrows or trenches twelve inches apart and eight to twelve inches deep. The paddy or rice in husk is sown at the bottom of these trenches, a little water being kept in them to assist germination. When the plants are a few inches high, the water is allowed to run off, the weeds are eliminated, and the rice plants thinned where they stand too thick, any vacant spots being filled with such spare plants. Water is then turned on again, and is kept in the trenches to the depth of six or seven inches, or when strong winds are blowing, even within an inch or so of the top, as that tends to keep the stem steady. When the plant begins to ripen the water is allowed to run off altogether."

A fuller account of the cultivation is given by Mr. Robertson, Superintendent of the Sydapet Government Farm, in his annual report of 1876-77. This account has apparently been compiled from an article by Mr. Augustin L. Faveau of South Carolina, published in the annual report of the Department of Agriculture of the United States for 1867.

So rapidly did the cultivation of the imported varieties, chiefly the golden rice, extend in the United States, and principally in South Carolina, that it soon became the chief support of the colony and its great source of opulence; and in 1850 the total rice crop amounted to nearly 100,000 tons. European energy had subjected it to such a careful cultivation in the rich soil of America that, some specimens having been exhibited at the Industrial Exhibition in London in 1851, American rice received honourable mention for its superior quality; and the Carolina rice in particular was pronounced by the Jury "magnificent in size, colour and clearness", and was awarded a prize medal. The Jury also admitted that the American rice, though originally imported from the Old World, was much the finest in quality. This was, however, already known, for it is mentioned that when in 1845 the Directors of the East India Company sent Captain Baytes to America to procure American cotton seed, gins and overseers for the purpose of ascertaining the practicability of raising cotton by the American method in India, they gave him especial instructions to initiate himself thoroughly into the American system of rice culture. The result of these instructions I have unfortunately not been able to trace; and no record of any attempts to introduce the Carolina rice into this country can be found until 1866, when the Government of Madras and the Agricultural and Horticultural Society of India made experiments. The Government of India seem to have begun their endeavours to introduce this exotic into India in 1868.

CHAPTER II.

ENDEAVOURS OF THE GOVERNMENT OF INDIA TO INTRODUCE THE CULTIVATION OF CAROLINA RICE INTO INDIA.

1. In the early part of 1868 ten tons of Carolina rice seed, for experimental cultivation in India, were obtained by the Secretary of State through Dr. Forbes Watson, the Reporter on the Products of India at the India Office. In transmitting the seed Dr. Watson reported it to be in excellent condition, as on testing he found that almost every seed used for that purpose had germinated. The seed was packed in 200 barrels, and was mixed with a certain proportion of kiln-dried rice husks or chaff to preserve it. Each barrel contained 120 lbs. of seed: 120 barrels, or six tons, were for Madras, 45 barrels, or two tons, were for Burma, 15 barrels, or half ton, for Bombay, five barrels for the Central Provinces and 15 barrels for the Government of India.

Before this seed reached its destination the Government of India, having noticed in the Annual Administration Report of the Madras Presidency for 1866-67 a statement to the effect that successful attempts had been made to introduce Carolina rice in that Presidency, and that the seed was in great request, obtained 50 measures of this acclimatized seed for experimental cultivation in other Provinces, and transmitted it to the Government of Bengal in April 1868 to institute experiments "in such manner as may seem proper". No information was given as to the mode of culture which had succeeded in the Madras Presidency.

Shortly after the seed promised by the Secretary of State arrived and was distributed thus :

To North-Western Provinces	...	4	barrels.
To Punjab	...	4	ditto.
To Oudh	...	3	ditto.
To Bengal	...	4	ditto.

the Province of British Burma, the Presidencies of Madras and Bombay and the Central Provinces having also received their share as already detailed. Bengal, besides receiving the four barrels of fresh seed, also received the 50 measures of seed acclimatized in Madras, and distributed the whole to Commissioners of the Divisions of the Province in equal proportion, with instructions to distribute the seed to such planters and zemindars as are willing to undertake its cultivation. This was done in June 1868. In the meantime the Agricultural and Horticultural Society of India had already been experimenting with a large stock of seed obtained by themselves, and in July 1869 they furnished copies of a pamphlet they drew up on the result of their experiments. This pamphlet was at once distributed to the Government officials who received the seed imported by Government.

Simultaneously with this publication the Madras Government issued a paper containing the results obtained in that Presidency, and this also was distributed to officers and others interested in the cultivation of the seed supplied by Government.

2. In June 1869 a memorandum was obtained from Mr. Kittredge, the American Consul at Bombay, as to the mode adopted in Carolina for the cultivation of rice. This memorandum, which ran as follows, was forthwith communicated to all the provincial Governments and Administrations concerned :

"Rice is sown in long drills made by hoes (machinery does not work well) of 'about one foot deep; drills one foot apart; two bushels to an acre. Water is 'let on' as soon as the rice is three inches high, and it is kept under water, that is, 'the water is kept to within two inches of the top until it (rice) is about four inches 'high; it is then drawn off, and the weeds taken out. After this the water is let 'on again; when it begins to head, the water must be allowed to rise just below 'the head (that is the point where the kernels grow). The water must be high 'enough to keep the stem steady in case of wind."

3. But the experiments instituted by the Government of India in the different Provinces had already been completed, and the reports, besides pointing to the fact that seed had been received too late for a fair trial, showed that the cultivation of it had been carried out without any uniform system: the results proved what might have been expected, namely, a long series of more or less complete failures. A few solitary instances, however, gave some promise of future success, and some of the local authorities suggested a fresh trial.

4. Thus the Government of Bengal, who reported that generally the seed reached the interior much too late, and that the very many failures which occurred were probably owing to this cause, had the following experiments which claimed some success :

At Dum-Dum, near Calcutta. Two and a half seers of each kind, Carolina and acclimatized, were put into seed-beds. All germinated freely; a small quantity, however, was carried away by birds. When about a foot high the young plants were transplanted five or six in a bunch. The imported seed produced 1 maund 10 seers of paddy and 13 puns of straw; and the acclimatized produced 3 maunds 7 seers of paddy and 2 kahuns 2 puns of straw. The striking difference in the yield of the acclimatized over the imported seed was attributed to the comparative pureness of the soil in which the former was transplanted and to the inequalities in the two plots of ground, the acclimatized having the advantage over the other in this respect. Both sorts are said to have been unaffected by bad weather; for, after the storm of the 24th October 1868, while the country paddy-crop was lying in heaps, both imported and acclimatized remained unaffected. The result of the paddy husked was as follows :

Five seers imported, gave	...	3	9	of good rice.
Five seers acclimatized	...	3	1½	ditto.

In Cuttack the outturn varied considerably from 4 to 48 times the quantity of seed sown. Where great attention was paid it yielded well, and when little or no care was bestowed it generally yielded fairly. On the whole, the trial is said to have been a success, and the people in general were pleased with the seed.

In Palamow Baboo Deo Narain Singh sowed three seers in a bed in July, and in about four days the whole had sprung up. The seedlings were eventually transplanted into one cottah of deep rice land, being a loam mixed with sand. The ear formed in October, ripened in November, and was cut in December. The yield was 24 seers, which is considered a fair yield. It was considered in every way superior to the Native rice. The plant was a fine healthy one, with broad and very bright green leaves. It suffered a little from want of rain, but not to the same extent as the country sowings did. The grain did not appear to have degenerated from acclimatization. It was said that the result of the experiment would have been more satisfactory had the sowing taken place in June, and that Carolina seed appeared well adapted to the deep rice lands of the country.

5. In Oudh many of the officials, like those of Bengal, stated in their reports that the seed arrived too late for a fair trial, and here the year was characterized for a want of rain in many places. Several experiments were described, but in no case was the mode of cultivation and treatment adopted specified, and almost every trial was reported a failure. The following cases may be noted :

Fyzabad.—In Dostpur some seed was produced and kept for further experiments. In the jail garden a small quantity of seed was also obtained.

Gondah.—Owing to dryness the produce of the Carolina paddy was next to nothing. The ordinary rice crop of the district was not so bad.

Hardoi.—A small quantity was produced in one locality. Instead of keeping it for further experiments it was turned into rice which was of very fine quality.

Sultanpur.—It was sown in a seed-bed and afterwards transplanted and carefully irrigated. Four maunds of seed were produced good and full.

6. In the North-Western Provinces also the seed reached too late, and what with this and the fact that the year had been one of drought, the Lieutenant-Governor thought that success could scarcely have been expected. He, however, hoped that the seasonal conditions would be more favourable in the following year for the experiments which are to be continued.

7. In the Punjab also the seed arrived too late for sowing, and it was made over to the Agricultural and Horticultural Society for experimental cultivation during the ensuing season.

8. In the Central Provinces the seed was received in good time, but the year is said to have proved very unfavourable owing to want of rain, and almost all the trials failed. In Chanda, however, some of the seed produced a good crop, giving 22-fold on land which, when sown with indigenous varieties, gave but ten-fold. But the details of cultivation are not given. Raipur produced the best results: here the Assistant Settlement Officer (Mr. Duncan Sinclair) was allowed to conduct the experiment, and the following are the details of it :

On the 11th June 107 Rs. weight of seed was sown. It sprang up on the 15th very vigorously, and required no water till the 18th, when it was watered five times from a well, and was, on 23rd July, after a heavy shower, transplanted into ground, 7½ poles area, which had been prepared for the purpose with a large proportion of black loam. Two plants were put together at distances of five inches. No rain having fallen up to 2nd August, well water was given, and the plants wore a healthy appearance and took root. A heavy shower then fell, and the plants made rapid progress in their growth. Very little rain during September and in October; irrigation was resorted to largely.

The produce of the 7½ poles of land amounted to 40 seers, or 30-fold. The state of the season considered, this result was said to be extraordinary. The produce of the best qualities of Native seed is (it was reckoned) 15 and 20-fold in good soil with an average fall of rain; that of the inferior 20 and 25-fold. An acre of land is sown by the Natives with Rs. 3,600 weight of seed; this gives per pole Rs. 22½ weight, whereas Rs. 15 weight of Carolina sufficed for the same quantity of land. A saving of 15 seers per acre would be effected by the use of the Carolina seed.

Mr. Sinclair's remarks on the Carolina seed were that it threw forth a strong stem and a number of offshoots (as many as eleven healthy shoots on one stem were noticed), each of which produced an ear as long as that of the main stem. The rice

was coarse, but it cooked well, i. e., had a good appearance after boiling. It had no scent, which was considered a great disqualification by the Natives. The country rice was considered by them superior in quality. Many malguzars nevertheless begged for seed.

9. In British Burma the results were reported not satisfactory; but the Chief Commissioner observed that it had been proved that, with proper care, the paddy

Results in British Burma.

would grow well in that Province. Probably a more satisfactory result might be obtained from the experiments with the acclimatized seed which had been sown this (1868) season, and the Chief Commissioner desired to give the Carolina seed a further trial, if more could be obtained.

The best results were obtained in the Shwegyeen and Amherst Districts, but particularly in the former, where 48 to 50 times the quantity sown were produced. The sowing was made broadcast in Amherst in the month of July and in Shwegyeen in August. The superiority, both of the yield and of the grain, was acknowledged. The crop came to maturity a month earlier than the Burman paddy, having taken only three months to be ready for reaping. The straw was thicker and coarser, the ears longer and fuller, and three times as heavy as those of the ordinary indigenous paddy. The root struck deeper into the ground, thereby offering more resistance to high winds and heavy rains. The seed was said to be unsuited for cultivation in low inundated lands. It thrived better on high land, where there were not more than two or three inches of water during the rains. One officer (the Assistant Commissioner of Martaban) in the Amherst District, referring to some paddy which had been sown "in the best paddy land", reported that "the plants were the finest paddy plants he had ever seen, and the Karens were in raptures about it".

The great tenaciousness, however, of the Carolina paddy to its husk, rendering threshing difficult, was looked upon as a serious objection. Another objection was that, unlike the indigenous rice, the Carolina rice was hard to boil, and was not agglutinous. This, in the opinion of "an intelligent Tounghoo cultivator", rendered it unfit for human consumption; who, however, admitted that "the taste is good, and it is more satisfying than our rice".

10. Of all the trials carried out in the different Provinces that which seems to have been done most intelligently was one in the Madras Presidency.

Results in the Madras Presidency.

The experimenter in this case was Dr. Thompson, Superintendent of the Jail at Chingleput, and the trial was made with one measure of seed under various conditions; half a measure being sown as a wet crop, and half as a dry crop, and each of these two modes of culture being further tried both by broadcast sowing and by transplantation. The quality of the soil on which these experiments were made was, for a depth of a foot and a half, a kind of sandy clay, manured with surface silt from the bed of an adjacent tank. The sub-soil consisted of stones and rubbish, the place having, in fact, been a ditch which had been filled up. Two or three crops of hay had been cut from the ground since it was last tilled.

Before sowing operations commenced the seed was examined by an experienced cultivator, by peeling off the husk from a few grains, and he advised Dr. Thompson not to sow the seeds without having them first dried, as a starchy white spot could be seen occupying about a third of the grain of rice which diminished the size of the germinal spot. And if this be not removed by drying, he said, the seed would either not grow, or, if it did, would not reach maturity easily, or be so productive. On the seed being dried this spot was quite removed; the grains of rice became more transparent throughout their substance, and the germinal point was increased in size.

For the wet cultivation the nursery and beds were prepared in the ordinary Native way, that is, by trampling in leaves and their twigs; and when these were well blended with the mud, the seeds, which had germinated by being submitted to the usual process of soaking, were on the 10th August sown broadcast into No. 1 wet bed and also separately placed in a nursery for transplantation into No. 2 wet bed. In a month from the date of sowing the plants were two feet high, and their roots measured nearly five inches in length. Those that were in nursery were at this period transplanted into No. 2 wet bed. The heat at the time was great, so that the plants withered much, and were in consequence thrown back for about a couple of weeks; but after recovering they grew rapidly, and when the other bed where the seed had been sown broadcast was reaped, which was on the 30th November, they were in full ripe ears and of nearly the same height. They were cut fourteen days after the broadcast crop, and yielded 61½ measures, being an increase of 123-fold. On the whole, the crops in these two beds under wet cultivation required comparatively little tillage; for they had simply to be watered daily, and, when the grain had ripened, had to be protected from birds. They were, however, greatly blown about by strong winds and rain at the beginning of November, when the plants in the broadcast bed, being heavy with ears, fell to the ground and suffered much in consequence.

The dry cultivation also was done by broadcast sowing and by transplantation. For this the two beds and nursery were well ploughed, cleared of weeds and levelled; on the 13th August the nursery was sown with dry seed and the earth again ploughed, raked and watered. The plants were transplanted when a month and seven days old, and although seven days older at this time than the plants in the wet nursery were when they were transplanted, yet they were not near so well grown or healthy-looking. In consequence of this the crop was converted into a wet one: the effect was great: the plants grew rapidly, became quite healthy, tillered well, and although much shorter than those in the wet bed, they were not behind in the quantity of grain produce, for, on being reaped on the 21st December, the yield was found to be 60½ measures, giving an increase of 121-fold.

The broadcast bed was not sown until the 31st August: the plants were slow in growth. When a month old they were very little better in appearance and size than the common Indian paddy; but after being converted into a wet crop, which was when the plants were nearly two months old, they grew rapidly, and tillered even better than all the others. At the time of reporting they were in ear, and the largest quantity of grain was expected.

Dr. Thompson then went on to remark that he formed his opinion that Carolina paddy is easy of cultivation, and can be cultivated at any season of the year when water is at hand, and, moreover, that it is extremely hardy. In proof of the latter, he stated that he tried the experiment (when transplanting twelve plants) of cutting off half of the roots of six, and the entire roots of the rest without (of course) injuring the crown of the stem, and yet they grew and bore ears equally as well as the other transplanted plants in the same bed,—thus bearing out the fact that the order to which cereals belong is characterized by the tenacious vitality of its plants, as is seen in the grasses.

With regard to the water-supply, it appears that the crop should be flooded during the first month, but should receive little water during the second. And Dr. Thompson mentioned that he would give preference to the broadcast method of culture, as by the other method the plants did not tiller so well.

This ends the record of the experiments made in 1868.

11. The Government of India thereon reported to Her Majesty's Secretary of State in October 1869 that, owing to the late receipt of seed and the unfavourable nature of the season, the experiments could hardly be considered to have had fair play, and that it was desirable to wait the result of the further trials then being made with acclimatized seed, as also the result of trials that may be made with 30 barrels of fresh Carolina seed asked for to reach India not later than January 1870.

1869.

12. In this year experiments were continued, in some places with fresh imported seed which had been received too late for sowing in 1868, and in other places with seed raised in the country from fresh seed previously obtained. The results were successful in certain localities, but the success was counterbalanced by complete failures in other places. These complete successes on the one hand, and as complete failures on the other, would, as the Collector of Saharunpur reported, admit of but one explanation: where success was the result the experiment had been conducted intelligently and with good will; where failures were reported the supposed experimenters "simply threw the rice away and reported that they had sown it and that it did not germinate". Or as in the Madras Presidency where the results were so good that the cultivators made deliberate false reports in order to keep the produce all to themselves. Only the successful trials need be noted.

13. In the North-Western Provinces experiments were made with the seed supplied in the previous year but received too late.

Results in the North-Western Provinces.

Muzaffarnagar.—Thirteen seers of Carolina seed were sown by one Lalla Baldeo Suhoy. After seven waterings the seedlings were transplanted into eight bighas of first class manured land, and there watered seven times again. The produce was 31 maunds 27 seers. In comparison with the sorts of moonjee grain in the neighbourhood there was neither

loss nor gain, the outturn being the same on an average. The Board of Revenue authorized the Collector to purchase the seed from Buldeo Suhoy for distribution to other landholders for experiment in 1870.

Saharunpur.—The Collector reported that, while the experiment failed in certain quarters, an intelligent farmer, named Kour Sein, of Hareti, a village about three and a half miles from Saharunpur, succeeded beyond expectation. The outturn of his cultivation was 36 maunds an acre, against the average outturn of 15 maunds per acre of the best kind of Native rice grown in first class irrigated lands. Mr. Webster said that he saw the crop standing on the 1st or 2nd of October, and was struck with the great contrast it presented to the Native rice growing round it. He continued that "it was more than double in length and thickness of stalk, and the heads appeared to be many times larger than those of the Native plant, which had suffered considerably from the late heavy rains and high winds, some of it being beaten down flat to the ground, and a good deal of it injured more or less, while the Carolina rice plants stood up firm and strong, and, as the zemindar remarked, seemed to flourish the more the more it rained". His report concluded with the following remarks:

"The rice as food is considered to be inferior to the best Native produce, and would sell somewhat cheaper in the market, but the extraordinary amount of its yield renders it, in my opinion, a grain, the cultivation of which should be promoted and encouraged as much as possible in the rice-producing tracts of this country."

Bareilly.—At *Philibheet*, 1½ seers of seed were sown in 9½ biswas of land in the Government garden. All the seeds germinated; the plants were watered once and grew to a height of 1½ yards. The ears were splendid and very full. The yield was 25 seers in husk and 14 seers in a cleaned state. This was about the average produce of coarse rice in the locality; and the tahsildar thought that, if the garden had been less shady, the yield would have been greater.

14. In the Punjab the cultivation was tried with seed received too late in the previous year. Reports of the results were received from 14 districts, besides an

experiment in the Agricultural and Horticultural Society's Gardens at Lahore. The greatest success was attained in Chamba, where the rice was found popular and more seed was wanted. The experiment in Lahore was also successful as to the yield, but the quality of the rice was not liked by Natives. In eleven districts the experiments are said to have been failures owing, in most cases, to the seed having been sown too late.

15. In the Central Provinces Mr. Sinclair, the Settlement Officer, who was in charge of the rice cultivation in the Raipur districts, tried the experiments in two fields

in two different ways. One he cultivated somewhat on the same method as obtained in Carolina. The soil of this field was middling clay, possessing no depth of soil. It had lain fallow for years, but it possessed the advantage of forming in itself the basin of some elevated land about it, and therefore received a quantity of silt. It was ploughed once and meagrely manured in June, was planted in July, weeded in August, and the crop was cut in November. "The average height attained by the paddy was five feet, the stalks being as thick as one-fifth of an inch. Each plant had on an average 12 shoots, and each shoot bore an ear. This field was the admiration of hundreds of Natives, and so pleased them that they made several applications for the seed. The ears of the plants averaged in length six inches." The area of the field was 0-3-30, and the yield of the paddy was 590 seers.

The second field was cultivated in the style common in the Chattisgarh District. It had been fallow for one year; the soil was a mixture of clay and sand, and the water-supply was favourable; it was not manured as the rains overtook the preparation of the land. "The seed was sown broadcast, and on attaining a height of one foot was treated after the fashion locally called *be-asna*. This *be-asna* is a mode of cultivation peculiar to the district; the field is bunded up and all escape of water prevented. On there being six inches of water in it a light plough is used and the paddy partially uprooted. The water is left in the field until the paddy takes root, and is then allowed to drain off to give the roots the benefit of the sun. The water, however, is not allowed to flow off unless the weather be cloudy and there be prospects of rain. Some days after this process of *be-asna* the field is weeded, and the reaping alone remains." The quantity of seed sown was three seers, and this produced 48 seers of rice. The height of the paddy in this field was 3½ feet, and the shoots not more than six or seven per seed. The straw was inferior, and the ears about five inches in length and not half as prolific as those of the transplanted beds.

From the above results Mr. Sinclair was convinced that to yield a good crop Carolina seed required the precautions marginally specified. The Chief Commissioner remarked that "altogether the inference to be drawn from the results of this year's experiments would appear to be that, under the ordinary treatment which the Carolina rice may be expected to receive at the hands of the people of this country, the outturn will not exceed that of the country seed, though, by a careful system of transplanting, a well regulated use of irrigation and a proper system of manure, the yield of the foreign seed may be increased. The foreign plant is harder than the indigenous one, and yields more straw; but the grain would not appear as yet to be appreciated by the natives of these Provinces who are very nice and discriminating in their tastes."

- 1st.—The soil must be of loose clay and sand mixed.
- 2nd.—It requires manuring.
- 3rd.—It must be clear of weeds when the plants are put down.
- 4th.—Transplantation is the most satisfactory process.
- 5th.—The seed for transplantation must not be thrown in too thick, or the plants get long and weak, and take a long time after transplantation to acquire vigour.
- 6th.—The plants must be put down eight inches apart.
- 7th.—After transplanting there must not be too much water in the field; in fact, it must be kept as a mere puddle until the plants erect themselves, and then water may be let on or retained in the field sufficiently to cover all but two inches of the tufts; and after the plants are one foot high, and well in the soil, the more water the better.
- 8th.—Low-lying grounds are the best.

The Chief Commissioner, however, added that further trials in the parts where the experiments succeeded best this year (1869) would be carried on in the ensuing year, and the results would be reported.

16. In British Burma the experimental cultivation of Carolina paddy failed in all the districts from one cause or another. In some places the reason assigned

was the unfavourable season, in other places a flood, in others insufficient rainfall; in one place the seed was said to have been sown, and after a time found rotten in the ground, in another place the ryots would not sow it, and so on. The one solitary instance in which success was the result was in the Thayetmyo District, where a Native cultivator is said to have sown one basket of seed in a bed, to have transplanted the young plants, and to have reaped two baskets of paddy.

Some seed was sent to Tonghoo by the Agricultural and Horticultural Society of British Burma to be distributed to cultivators there; but it was reported that the Karens took a prejudice to the grain, inasmuch as they said that the rice was hard, and did not smell in cooking like the common rice, and was decidedly inferior as an article of diet.

The Agricultural and Horticultural Society thereupon remarked that this statement was quite at variance with the experiments made in the Madras Presidency, where the Collectors obtained the individual opinions of rice-eating connoisseurs, namely Brahmins, who invariably reported that it was the best they had ever eaten. As an article of diet, the Secretary to the Society said, its fine white appearance, when served up, was all that could be desired. From the supply obtained from the second year's experiment in the Society's Garden with the acclimatized seed, a quantity was despatched to England for a report to be obtained thereon by competent judges engaged in the rice trade. In October 1869 the Society being informed that Government had despatched a quantity of fresh seed to each Deputy Commissioner, independently of what the Society had done, it offered prizes for samples of this grain grown in British Burma to be exhibited in February 1870 at the annual show. But it was found that not a single response was made to the Society's offer.

1870.

17. For experiments in this year 198 barrels* of fresh seed were obtained from Carolina through the Reporter on the Products of India at the India Office. The Agent who procured the seed for the Reporter stated that the weather was most

* Each containing two bushels, or about 90 lbs. of seed. suitable during the packing, and that not only was the seed of the best description, but that it left Charleston in perfect condition. The Reporter drew attention to the fact that it was purposely mixed with a considerable proportion of kiln-dried rice husks to keep it in good condition.

On the 18th December 1869 the following quantities of this seed were despatched:

30 barrels for the Government of India,
19 ditto Government of Madras,
19 ditto Government of Bombay,
and 130 barrels followed in the first week of January 1870, of which
30 were for the Government of India, and
100 for the Government of Madras.

The Government of India caused their share of 60 barrels to be divided thus :

	Barrels.
Government of the North-Western Provinces ...	5
Ditto of the Punjab ...	5
Commissioner of Assam ...	6
Agricultural and Horticultural Society of India ...	2
Superintendent, Botanical Gardens, Calcutta ...	1
* Chairman of the Justices of the Peace for the Town of Calcutta ...	1
D. Herklots, Esq. ...	4
Commissioners of the 10 Divisions of Bengal ...	36
TOTAL ...	60

18. This distribution seems to have been made in May 1870, and reports of the results began to come in in February 1871. On the whole, it appeared that the experiments met with better success than in the previous years; yet still there were very many failures, and these were attributed in the Bengal Presidency to excessive rains, to inundation, drought, destruction of crops by birds, insects, &c., to want of care, unsuitableness of the soil, and, in some cases of total failures, to causes "quite unaccountable".

In Oudh the experiments failed altogether either from destruction "by a sort of insect", or by a withering of the plants, or by the ears not filling, or by too much rain.

In the North-Western Provinces the causes of the failures were said by the Local Government to have been the severe rains, the want of any regular system, the absence of proper care in the cultivation, and the indiscriminate distribution of seed to anybody willing to undertake the experiment.

In the Punjab failures were attributed to the late receipt of the seed, to excessive irrigation, and in one locality to a cause "not sufficiently explained". But, as in previous years, the experiments were not without the advantage of careful treatment in some cases, and in such cases success invariably seems to have attended the trials.

19. In Bengal, for instance, among a long list of failures (74 in number) there appeared also a large number of successful experiments which the Board of Revenue considered "very satisfactory and encouraging". These experiments had been conducted by official as well as non-official gentlemen, the larger number of reports being, however, from the latter. The information regarding the more successful experiments is condensed in the following table:

District.	Quantity sown.	Abstract.
Dibrugarh ...	Seers. 4	This quantity yielded a return of six maunds. The crop proved tall and strong, and the grain large, heavy and of superior quality. Further experiments will be followed up with the acclimatized seed.
Cachar ...	...	The sowings grew vigorously up to five feet high, but the yield returned no more than the seed sown.
Believed to be in 24-Pergunnahs or Mutlah ...	...	Mr. D. Herklots is of opinion that from the experiments made the Carolina paddy can be most advantageously grown in Bengal, more especially on high lands. Proposes during the ensuing season to cultivate this paddy to some extent in the neighbourhood of the Mutlah, when he promises to report decidedly on the matter. States that this grain is most peculiarly liable to the attacks of beetles, and suffers great devastation from the <i>toonee</i> and other granivorous birds.

District.	Quantity sown.	Abstract.
Tipperah ...	Seers. ...	The seed was sown broadcast, and yielded a far heavier crop, with better straw than the Native paddy. The grain is considerably larger than the Native rice, and the ear appears to be not only heavier, but contains more grains than the Native plant.
Tipperah, Bamunburriah Sub-Division.	10	The experiment was tried on the transplanting system on low land. The plants and stocks were much larger than those of the country crops, and the leaves longer and broader. The out-turn was 50 seers. He has kept the paddy with the intention of making an experiment on the broadcast method.
Lohardugga ...	...	At Hotewar the American grain has not been so prolific as the country; but at Kalamati, where the soil is very superior, the produce has been sixteen measures of grain to every measure sown; and the return is very satisfactory.
Ditto ...	...	The seed was distributed in five villages. In one village half the seed was sown in the ordinary way, and the other half in seed-beds for transplanting. The result of the crop was the same in either case; 2½ seers of seed yielded a return of 20 seers, or about eight-fold. The best return of the ordinary rice crop in the village was about ten-fold; but the Carolina paddy suffered somewhat from blight, whereas the former did not. In the other villages the seed was sown for transplanting in consequence of the wetness of the season. In two the return was eight-fold, while in the fourth village 15 seers of seed produced only 80 seers of paddy; and in the fifth the experiment was a failure, heavy rains washing away all the young plants.
Singbhoom ...	...	The seed was first sown broadcast in a manured piece of land, and afterwards transplanted in similar ground when the plants were about eight inches high, at the distance of ten to twelve inches apart. The land was low, where, during the rains, water was made to stand some inches high. After this piece of land was planted out a few plants were left, and these were planted on land occupied with country paddy. The out-turn from these was better than that of the Native paddy. The plants attained a greater height than the country paddy, and were much thicker. The grains were very closely set in the ear. The small quantity of seed sown may have had something to do in giving such a successful result, the small strip of land being easily manured.
Burdwan ...	...	The seed was properly sown and cultivated, and yielded a good crop at the rate of 20 maunds per beegah.
Ditto ...	4½	Five cottahs of land were cultivated, which produced about a maund of rice, or rather less than half the usual yield of country paddy. Collector is of opinion that, on the whole, considering the long continued drought last year, the experiment has been successful, and on an average the crop would probably be greater than that obtained from country paddy.

District.	Quantity sown.	Abstract.
Midnapur	Seers.	
...	...	The experiments were undertaken by two gentlemen and proved successful, as the yield of the crop was much larger than that of ordinary rice. The field sown, being within the reach of the Government canal, had the advantage of seasonable irrigation. The plants grew very luxuriantly; the outturn being in excess of that from the indigenous paddy. One of the gentlemen sowed the seed broadcast, and the result was successful. Upon the whole the Collector is of opinion that the soil of his district is not unsuitable for the cultivation of Carolina paddy, which, if carried on with proper care, would yield a much larger outturn than the indigenous paddy.
Darrang	...	† This quantity of seed was sown broadcast in a bed 15 × 15 yards, and the crop yielded a maund of good grain.
Sibsagar	...	...
	...	This is a successful experiment, one crop has been gathered and the stalk is throwing out a second crop. The stems are strong, and the leaves of a dark green healthy colour. The ears are full and heavy. The land is kept moist, and a third crop, it is expected, will be reaped before the plants die out. Mr. Phillips, through whom the seed was distributed, remarks that the cultivation is simple, and, with the ordinary care bestowed on Assam paddy, this variety will thrive well.
Jorehaut Sub-Division	...	‡ This quantity of paddy was planted out on a cottah of medium high and low land. It yielded more than 75 seers of good clear paddy. States that had the paddy been planted on lower land, and in May or June, he has no doubt but that two good crops, yielding together at least 200-fold, would have been procured.
Ditto	...	1‡ The experiment was tried in two descriptions of land, or rather low land and on drier soil. The latter has not turned out well, and will be hardly worth cutting, but that planted in low land has turned out very well. The plants are much longer than the common Assamese kinds, and ought to give a greater yield. The crop is not cut yet, it not being ripe. The Assistant Commissioner pronounces the paddy raised by Mr. Huttman to be very fine, and thinks that, with a little experience as to the best time of sowing, and the quantity of water required by the plant, Carolina rice cultivation would answer exceedingly well and prove very remunerative.
Lakhimpur	...	...
	...	The seed was distributed to several mouzadars and residents of the district, who sowed it as a winter crop. The plants are reported to be nearly all destroyed by excessive rain and by blight. In three instances only did it come to maturity; but the outturn in each case was trifling. The Commissioner, however, learnt during his tour that the experiment had been eminently successful in the hands of some of the planters of the district, and there seems little reason to doubt that when the proper mode of cultivation is understood, this will be the case generally, but careful cultivation seems necessary to ensure success. States that the Assamese grow their paddy with so little trouble and get such good crops that they will be slow to abandon its cultivation even to ensure a more profitable return for their labour.

District.	Quantity sown.	Abstract.
	Seers.	
Pooree	...	5 The seed was sown in August in the jail gardens, was transplanted in September, and was cut in November, yielding 122 seers. The paddy is reported to have stood the excessively heavy rain of October better than common country paddy, which in places rotted. The Commissioner thinks that the result, as far as they go, are good, and the experiment should be tried next year. He is of opinion that it is most probable the rice will prove exceedingly valuable, if grown under canal irrigation.
Jessore	...	...
	...	The first experiment in the jail garden was very favourable, and the second fair enough. In the former a quantity of five seers of seed produced 12 maunds, which was sown thinly in 11 cottahs of land. In the latter case the same quantity of land yielded only 1 maund 17 seers.
24-Pergunnahs	...	...
	...	The seed was distributed among ten gentlemen, of whom only six have reported results. In this district, on the whole, the cultivation proved a success. In one place 4‡ seers of seed sown on a beegah of land produced 6‡ maunds. In the Barrackpore Park the seeds germinated to the extent of only 50 per cent., but the produce was very fine, quite as good indeed as the paddy received, and the ears were very large.

The trials at the Salt Water Lakes failed owing to the reclaimed land, on which the sowing was made, being "continuously and completely submerged since "the rains set in heavily", and the sowing in the Botanical Gardens also failed, but from a cause not specified.

The Lieutenant-Governor of Bengal thought that, considering the disadvantages under which a new cultivation laboured, the reports furnished were on the whole much in favour of the experiment. He observed that in reality in certain places and conditions the Carolina paddy yielded decidedly more than the country paddy, but the disadvantage was that the grain was not understood; it was more difficult to husk, and consequently there was no easy market for it. He was at the same time of opinion that these latter disadvantages would diminish in proportion as the cultivation increased.

The Lieutenant-Governor thought that efforts should be made to continue the experiment, but apprehended great difficulties in doing so in Bengal, as the zemindars had no *neez* cultivation, i. e., no farms, and were not readily made amenable to influence, while ryots could not be expected to risk experiments. His Honor remarked—"The chief advantage in Bengal is the presence of so many European gentlemen in the interior, but they do not cultivate rice, or any ordinary staple "on a large scale, and only grow samples by way of experiment". It was added that "he (the Lieutenant-Governor) very much wishes that Government could make "agricultural experiments as has been done in Madras, but the zemindars are so "entirely separated from agricultural interests, and consequently the work of "improvement is likely to be so difficult, that he abstains from suggesting it till "he can give more attention to the subject than he has hitherto done".

20. In Oudh, as already said, the experiments failed altogether. They were made with seed which had reached too late in the previous year for any trials in 1869, and had been kept for sowing in 1870.

21. In the North-Western Provinces, the experiment proved a failure in nine districts, it was partially successful in seven, and was quite a success in two, namely, in Hamirpur and Saharunpur. In the former district the result showed satisfactorily that, under similar circumstances, the yield of Carolina rice exceeds the outturn from at least one kind of the ordinary country grain. The way in which the experiment was made to sow an equal area in the same field with foreign and country seeds, and to treat both alike. Unluckily the amount of seed varied; but the outturn was 18 seers produce out of 15 chittacks of

Carolina seed, and 20 seers produce out of three seers country seed. This was in Muhoba alone, the site selected was the bed of a tank, and probably this experiment was carried out under favourable conditions. In other places the experiment failed. In one case the crop was destroyed by cattle, in another unsuitable land was selected. The Commissioner suggested that Mr. Harrison might be entrusted with seed to carry out further experiments in another season.

In the Saharunpur District $8\frac{1}{2}$ seers of seed was given to Kour Sein of Hareti. The result was the same as that obtained by him in the previous year (1869). In vigour, amount of produce, and especially in strength and size of stalk, it far exceeded the Native rice. Kour Sein sowed also nine seers of last year's (1869) seed in a field. The crop was a fine one, and quite as high and strong as the new seed crop, but the outturn was not quite so good. Mr. Jenkinson recommended that this experiment should be tried again next year; for in introducing a new kind of rice it was most important to ascertain whether the seed, produced in this country, continues equal to the imported seed, or whether it deteriorates; and he stated that it would not be fair to come to any conclusion on this point from only a single experiment carried out on so small a scale. The cultivation of this Carolina rice by Kour Sein was so successful that Collector was sure that, if seed were obtainable, it would be very extensively sown, and that in time it would, perhaps, entirely take the place of the Native rice. The Collector further stated that the Carolina rice is coarser than Native rice, but in flavour is only inferior to the best Native rice, and that the Natives are of opinion that it is equal to the second quality of rice produced in the district, and will have no objection to take to Carolina rice.

The Local Government in transmitting the general results remarked that "the absence of any scientific system or knowledge on the part of those who tried the experiment, and the inability of district officers to supply this defect, or devote to the experiment the care and attention necessary, render the trial considered as 'one of the suitability of this rice to the North-Western Provinces generally barren of results'". But it was not overlooked that the reports from Hamirpur and Saharunpur were encouraging, and that in the districts in which the success was partial considerable care was devoted to the matter, with results which, on the whole, must be considered encouraging. These results need not, however, be specified here.

22. The successful results in the Punjab were few. The cultivation was tried in Results in the Punjab. seven districts and in the Chamba State.

It succeeded only in two districts (Kangra and Gurdaspur) and in Chamba. In Kangra nine seers were carefully sown on the 29th June 1870 on a piece of ground measuring 2 roods 5 perches. The ground was irrigated dofasli of the best description in the Palam Valley; it was first flooded with canal water, and was ploughed up while under water. After the paddy was sown the ground was kept moist for 20 days, after which it was watered as usual. The crop was reaped on the 30th September and produced—

			Maunds.	Seers.
Uncleaned rice	...	...	7	0
Cleaned	...	...	5	10

In Gurdaspur 20 seers were sown in one acre of land on the 2nd July. The ground was irrigated 22 times by canal water, and rain fell twice. The crop was reaped on the 29th October and produced—

			Maunds.	Seers.
Uncleaned rice	...	...	24	0
Cleaned	...	...	19	8

which was said to be about the same as the quantity obtained from country seed. The grain was a little larger than the country rice, and of a bluish colour.

In the Chamba State some seed was sown in wet ground, which was also much irrigated, and the result was an almost total failure. Some was also sown on higher ground, and only moderately irrigated, and produced a very fine crop, being about one-fourth in excess of an average crop of country rice, but the quantity was not stated. The plants had more substantial and stronger stalks, and were less liable to be beaten down by heavy rain or wind than the ordinary rice; but there seemed to be a serious objection in that in separating the husk from the grain by the usual process of pounding in a mortar, the grain was very much bruised and injured, so much so as to be greatly deteriorated in value.

The Financial Commissioner of the Province remarked, with regard to the results generally of this and the previous year, that it had been established that the yield of the grain was considerable, and that the crop ripens earlier than other kinds of rice, but that the grain is coarse and does not command a high price.

He concluded by saying—

"No one who has tasted Carolina and Indian rice can hesitate in considering that the latter is far the most palatable; and it is not to be wondered at that the people consider the Carolina rice inferior to the produce of country seed, especially when it is remembered that rice cultivation has attracted the attention of the people in the Punjab for centuries, and that a greater number of varieties of rice than of any other crop is known and commonly recognized."

23. In the *Ceylon Government Gazette* an interesting report of results was published in June 1871, and the Government of India took note of it. The Mūdaliyar of the Siyané Koralé received one pound weight of Carolina rice seed from the Government Agent for the Western Province and sowed it at the beginning of February 1868; the drought was severe; he watered the field from a well; the plants grew up very well, were reaped in May, and produced only two pounds weight of paddy. This produce was carefully preserved, and sown on the 2nd October 1868 and reaped in January 1869; the yield was three pecks of paddy; fresh plants sprung out from the stalks left after the first reaping, and produced a second crop which gave a quarter of a bushel, making in all one bushel. This was again carefully preserved, and sown on the 6th November 1869 and yielded 20 bushels at the beginning of February 1870.

Out of these 20 bushels one bushel was sown on the 1st June 1870 in one field, and eight bushels in another field in October 1870; and the remainder was distributed gratis to 21 cultivators for trial. From the first sown field 24 bushels were reaped in October 1870, and the produce was again gratuitously distributed to cultivators. From the second field 160 bushels were produced at the beginning of February 1871, and 25 bushels of it were given by the Mūdaliyar to Government to be sent to the Government Agent of the Southern Province, and the rest was distributed among 40 of the best cultivators of the district. At the time of reporting the seedlings were in the cultivator's nurseries doing well.

The Mūdaliyar stated the results of his experiments thus—

"I have experienced that for the successful cultivation of this paddy it is necessary to have soft and continually moist ground. In fields near the banks of rivers or streams, or at the foot of hills, no artificial manuring is necessary, but they only require a good weeding when the plants are about a foot high.

"If this paddy is to be sown on a poor sandy soil, it ought to be manured either with bone dust, cow-manure, ashes or 'keppetiya' leaves (which are to be had in abundance in almost all jungles) buried in the fields. But transplanting in either soil would yield crops of double the quantity expected.

"Out of my fields, without weeding or manuring, it gave me twenty-fold and by weeding, bone-dust manuring and transplanting, sixty-fold.

"This paddy ought to be sown very sparsely, so that the trees may not be closer than six inches from each other, as they shoot out a far larger number of young plants than the ordinary paddy, more particularly in the best soil; and if sown closer than desired, the paddy trees grow thin, fall off, and the whole crop gets spoiled.

"The excellence of this paddy will commence to manifest itself weekly after the sixth week, until they are reaped, which should not be endeavoured to be done, as with the ordinary paddy, at once as young plants of different growth are springing up from every paddy bush. They ought to be reaped as the paddy ripen from time to time.

"The stumps of these paddy trees are larger and stronger; the leaves broader, thicker, rough, and more dark green than ordinary paddy; the trees never fall down; they grow to the height of four and five feet; and when they commence to blossom they blossom at once; and when they commence to ripen they ripen at once, which is not the case with the paddy of this country; and they give different crops at different times, as the plants shoot out at different ages; and this paddy answers for all the harvests in Siyané Koralé, namely, the Maha, Yala, and Mutes harvests.

"According to the paddy cultivation in the Siyané Koralé, if this paddy is to be sown for the Maha harvest, they should be sown between the 1st and 5th October; if for the Yala harvest, on the 1st and 10th of June; if for the Mutes harvest, on any early day in December, as the high water permits. If they are sown early for the Mutes harvest, they can be reaped before the rising of the river.

"This paddy stands water and all other effects of the climate better than all the qualities of the Native paddy.

"I found great difficulty in inducing the Natives to try and cultivate this paddy, and they were very much disinclined to do so, until they had seen the result

"of my cultivation, after which they flocked in for handfuls of seed paddy from me, and I think that two years hence there will be no other paddy cultivation in Siyané Koralé but that of Carolina paddy. This paddy is gradually improving in size after each cultivation of it, and they are the largest paddy now in existence in Ceylon, and it looks more like wheat than paddy, the husk being thinner, and the paddy heavier than the paddy of this country, and when its rice is boiled for the table, it is much more white, gluey, and more heavy food than the Ceylon rice."

24. The experiments having been so far continued, the Government of India Government of India's further proceedings. recorded, on the 7th August 1871, the following resolution reviewing the results. They said—

"Experiments in the culture of this exotic staple have been carried on since 1868, and the papers * * * contain the results of the experiments made in 1868-1869 and 1870 in the Bengal Presidency and in certain districts of Madras and Ceylon. Although the Government of India is not yet in a position to decide authoritatively as to the exact merits of the Carolina paddy, as compared with the several indigenous varieties, and although the opinions of different officers and the reports of the results attained in different localities are very discordant, there appears to be generally a balance in favour of the superior utility of the American plant.

"The advantages which this exotic possesses over the indigenous varieties may be briefly summed up as follows:

"I.—The Carolina paddy plant is more hardy, as it is less easily injured by gales and heavy rains, which entirely prostrate the Indian kinds. It requires a less amount of water than the Indian plant; it suffers less from drought and also (according to some authorities) from floods.

"II.—The produce of this species of rice is much greater than that of the country kinds—

"(a)—In respect of its yield in grain, it gives a much larger gross weight of rice in the husk, and, the husk being thinner, it yields a larger proportion of clean rice to rice in husk, and, when ripe, it does not drop its seed in consequence of a little rain or wind as the Indian varieties generally do.

"(b)—The straw is longer and stronger than that of Indian rice, and can be utilized for thatching and other purposes for which the Indian straw is almost useless. In Burma it is said to be greedily devoured by cattle.

"III.—It ripens earlier and in a much shorter time than the indigenous varieties, so that in Burma and in some places on the Continent of India it would be possible to obtain two crops of Carolina for one of the common Indian rice.

"IV.—When properly attended to, it appears to improve rather than deteriorate by cultivation in India.

"(2.) On the other hand the following are the disadvantages of the Carolina rice:

"I.—Its quality (according, at any rate, to Indian ideas) is somewhat inferior. It has little flavour and scarcely any scent. It is believed to contain somewhat less nutriment, is less liked by Native consumers, and commands at present a lower price amongst them.

"II.—The grain is much more difficult to thresh out.

"III.—The straw is coarser, and, in some localities, is said to be less liked by cattle.

"(3.) Considering how little justice has, on the whole, been done to the cultivation of this foreign staple, and that it is quite a recent introduction into this country, the Governor General in Council thinks it may safely be concluded that the balance of advantages is in its favour, and that it is expedient to continue the trial. His Excellency in Council accordingly directs that the Local Governments and Administrations in the Bengal Presidency be requested to state as early as possible what quantity of seed they will require, and by what time it should reach them. Application will then be made to the Secretary of State for a supply of seed of the finest quality.

"(4.) His Excellency in Council also directs that, besides the supply it is intended to obtain, instructions be issued to district officers to utilize all existing seed and to take particular care that all seed produced by the cultivation of the supply to be procured through the Secretary of State is carefully preserved for use in 1873.

"(5.) The Governor General in Council attaches great importance to the experimental cultivation of this rice, and trusts that the Local Governments and Administrations will do their utmost to make this trial a really satisfactory and conclusive one,—not necessarily attempting it in all districts, but carefully selecting the most favourable localities and the most careful officers, and making such arrangements as will ensure the receipt from them of full and correct accounts of the results obtained. His Excellency in Council considers that for this purpose it would be advisable for the Local Governments and Administrations at once to decide where and under which district officers the cultivation should be carried on, so that no delay whatever might occur in the distribution of the seed when it arrives.

"(6.) The Secretary of State will be requested to procure and send out as early as possible by the Suez Canal 50 barrels of seed of the first and best quality, with an intimation that, if necessary, a further quantity will be indented for on receipt of replies from the several Local Governments to the enquiry made in paragraph 3."

This resolution was forwarded to all Local Governments and Administrations for information and guidance; and no report having till then been received of the experiments instituted in the Madras and Bombay Presidencies the Governments of those Presidencies were asked for a full report of the results obtained by them, and of the conclusions arrived at in regard to the comparative merits of the Carolina rice and the indigenous varieties.

The Secretary of State was informed of the results reviewed in the above resolution, with the remark that they were "by no means conclusive", although they indicated "on the whole the superiority of the imported over the indigenous seed", and sufficiently justified a continuance of "the trials during another season in a systematic manner". In order to continue the trials the Government of India asked the Secretary of State to furnish them with 50 barrels of the best seed to arrive in time for distribution before the month of January, and it was added that, if the demands of the Local Governments and Administrations exceeded this quantity, a further supply would be asked.

The local authorities, in furtherance of the wish expressed by the Government of India in the resolution quoted, asked for the following quantities, their requisitions being made in October and November 1871:

	Barrels.
Bengal	100
Oudh	5
North-Western Provinces	6
Punjab	6
Central Provinces	15
Berars	5
Coorg	4
British Burma	20
Madras (probably)	40
TOTAL	201

The Government of Bombay asked for 26 barrels direct from the Secretary of State.

The Government of India, to meet the requisitions made, telegraphed to the Secretary of State, on the 7th December 1871, for 150 barrels of the seed in addition to the 50 which had already been asked for; and on the 14th idem sent a further telegram asking that the seed may be delivered by the 21st January 1872 in Calcutta. The sequel to this will be given further on.

Results of experiments in Bombay Presidency, 1868, 1869, 1870.

25. Meanwhile, on receipt of the Government of India's resolution above-quoted, the Government of Bombay furnished (30th October 1871) a summary of the experimental cultivation of the Carolina paddy in that Presidency during 1868, 1869, 1870. The substance of the summary was as follows:

The Secretary of State in his despatch No. 24, dated 13th March 1868, intimated his having given directions to transmit fifteen barrels (containing about 1,725lbs.) of Carolina rice seed for trying experiments in its cultivation in this Presidency.

(2.) Under Government Resolution No. 1384, of 8th April 1868, passed thereon, five of these barrels were sent for distribution in the rice-growing districts in Sind, six for the same purpose in the districts of the Northern Division, and four in those of the Southern Division.

(3.) The Revenue Commissioner, Northern Division, submitted reports of the Collectorates under his jurisdiction :

"The Collector of Tanna stated that the supply received by him was distributed in seven of the talookas in his Collectorate, which offered the most favourable advantages for its growth and acclimatization, and that, with few exceptions, the seed distributed was sown and cultivated with perfect success. The failure which resulted in a few instances was reported to have arisen more from faulty management in planting than any local disadvantages. The Collector described the successful results in the following terms: 'It is estimated that the yield per acre would amount to some four to five maunds. Those best able to judge state that the grain is too sturdy and coarse, ever to enable its being preferred to the indigenous rice, and that its quality is not such as to lead to the expectation of its ever commanding a higher price than the best kinds of country rice.'

"The Collector distributed a considerable quantity to Mr. Ansell, an American from the Southern States, who has settled near Bassein and taken to cultivation. Mr. Ansell intimated to the Collector that the seed sent had proved a success; that from the quantity sent he should be able next year to plant about 20 acres, and that he had a great many applications for the seed from the villagers, to whom he would give as far as he could.

"In Kaira the seed sown was washed away by the flood which took place in August 1868. In Ahmedabad, owing to want of rain in the early part of the season, and the subsequent excessive fall during the month of August, the experiments tried in several villages of the Sanand and Duskroee Talookas had, with one exception, entirely failed. In the exceptional case of the village of Uslalee, where eight pounds of the seed were distributed, the seed was sown in July, once irrigated with tank water before transplantation, and the number of young plants sufficed for only twelve goontas of land: they were reported to have first suffered from the heavy rains of August, and subsequently from the drought, so that the yield was expected not to exceed 15 lbs. of rice in all.

"In Khandesh, the Collector stated that, owing to the very scanty fall of rain that year, the result of the experiment tried with Carolina rice seed in some of the villages of the Pimpulnair and Baglan Talookas was not such as was expected.

"The Collector of Surat stated that the outturn of four seers of the Carolina rice seed sown by one Usmalee in one wussa and five viswassee of land in the village of Kosumree in the Unklesur Talooka, was 58 seers, while the outturn of two seers of the seed sown by another individual in two wussas of land in the same village was only ten seers, and that the rice produced in both these fields was, when dressed, found to be inferior to the sookvel (indigenous) rice both in taste and smell.

"In another report from Surat, relative to the experiments tried with about a seer of the Carolina rice seed in different villages of the Bulsar Talooka, the opinion formed by the ryot was thus described—'The advantages of the Carolina rice are numerous:

"1st.—It grows when sown broadcast, thus all the troublesome and expensive arrangements of nurseries and transplanting are unnecessary.

"2nd.—It requires less water than the Native seed, and will grow in dry crop land.

"3rd.—The yield is much greater than the yield from the indigenous seed, and the quality is vastly superior."

(4.) The four barrels of seed placed at the disposal of the Revenue Commissioner, Southern Division, were distributed by him in equal portions to the Collectors of Poona, Rutnagiri, Canara and Ahmednagar including Nassick.

The Acting Collector of Poona forwarded the following report on the subject from his acting First Assistant Mr. Nairne:

"The Carolina rice received by Mr. Bell was distributed in the talookas of Mawul, Havellie and Jooneer. The returns were very unsatisfactory, in most cases exceeding by very little the quantity sown. But this is attributed by the mamludars to the badness of the season, and they say that the deficiency is about equal to that of country rice grown in the same villages. In one case only, in the Jooneer Talooka, was the outturn good, 1½ pailies having been sown and nine pailies reaped. The quantity of the grain is reported to be not very good, and there is an undue proportion of chaff."

The Collector of Rutnagiri, Mr. Boswell, reported as follows:

"The Carolina rice sown has on the whole not proved a success, though, in some instances, the yield was good. Generally speaking, the return from the rice sown was very small, and it seems probable that the seed was deteriorated by keeping, as many of the plants broke off and were thus lost when being taken up for transplantation. The heads of rice that did come to perfection were very fine indeed, but this would not make up for the small returns. It is possible that the rice might have succeeded better in a more favourable season, but on the whole I am disposed to think that it requires a richer and stronger soil than is generally to be found in this Collectorate, and I do not think that those who have tried it last season will be disposed to renew the attempt. I will, however, endeavour to get the seed that has recently been sent me carefully sown, and give it every chance of succeeding better another year.

"From the reports of the mamludars in the Canara Collectorate it appears that the seed is probably calculated to succeed in the below Ghaut districts. In the above Ghaut district I attribute its unsucces to ignorance as to the proper soil in which it should be planted, and to the seed not having arrived in time for the usual sowing season.

"The produce in the Honore and Coompta Talookas, where the seed was sown in favourable ground, seems to have been a fair average crop, as much as 24 to 1 sown in Honore.

"The mamludars report the rice raised by the Carolina seed to be larger than the common country rice and to be thinner in the husk, so as to make a favourable comparison with it when cleared of the husk; and, notwithstanding its failure in many instances, there is much enquiry for more of the seed among the cultivators. It appears to thrive best in soil in which sand is mixed with the earth.

"Statement regarding the culture and results of Carolina rice seed in the Nassick Districts."

No.	Talook.	How many seers given.	How much land under cultivation.	How many seers produced.	How much obtainable per seer in bazaar.	Total amount obtainable.	REMARKS.
						Rs. A. P.	
1	Nassick	11	6 goontas	33 seers	32 seers a rupee.	1 0 6	Owing to the scarcity of rain the crop was poor.
2	Dindoree	18	10 do.	15 do.	16 seers	0 15 0	At Gondsley the rice seed did not spring up, at other places it was poor; all this on account of the want of rain.
3	Peint (Sawasthan)	16	5 do. 15 annas	23 do.	32 do	0 11 6	Poor on account of the scarcity of rain.
4	Egutpoora	16	9 do. 4 "	11½ do.	32 do	3 9 3	Poor on account of want of rain.

In forwarding the above information the Commissioner observed: "It will be seen that, except in parts of the Canara Districts, the experiment has not been successful, but the trial cannot be considered complete, and I am of opinion that it is desirable that it should be continued. The Canara experiments were decidedly in favour of transplantations, while in Rutnagiri it is stated that the rice stalks broke under transplantation. Information as to the mode of cultivation in Carolina might be useful."

(5.) The Commissioner of Sind observed that from the opinions recorded by the Collectors and Political Superintendents the indigenous seed would appear to be superior to the American description, and it would, he thought, be preferable to watch the results of another season's trial before forming any conclusion.

(6.) In applying for a further supply of Carolina rice seed the Government of Bombay, in their despatch No. 8 of 23rd January 1869, intimated to the Secretary of State generally that the past experiments could not be regarded as conclusive, owing to the season having been exceptionally bad. In his despatch No. 26, dated 31st March 1869, the Secretary of State intimated that as the seed could not be procured and sent so as to arrive in Bombay in the following month, instructions were given for supplying 15 to 20 barrels overland before the end of March 1870.

(7.) With Government Resolution No. 1403, dated 6th April 1869, a memorandum of information furnished by the American Consul regarding the mode of cultivation adopted in Carolina was circulated to Collectors in the districts.

(8.) In submitting a summary of the reports of the cultivators of Poona, Nassick (Nuggur), Belgaum, Canara, Rutnagiri and Dharwar on the results of the experiments tried in 1869-70 in their respective districts, the Revenue Commissioner, Southern Division, stated as follows:

"The result of the experimental cultivation has not been successful, even in the Dharwar Collectorate, where the return was highest, being 27 lbs. of cleaned rice (or 54-fold) to half a pound of seed sown; it has not yielded one-half of what is stated to have been obtained by Dr. Thompson at Chingleput in the Madras Presidency, viz., a return of 123-fold; while, in consequence of the labour which it is necessary to bestow on its cultivation, it is not regarded with favour by the cultivators.

"In the Poona, Nassick and Rutnagiri Districts, especially the latter, which is essentially a rice district, I regard the experiment as a failure, and hardly consider its continuance there to be worth further trial unless it be that the seed having been retained so long was the cause of failure, in which case any future consignment should be received in time for the sowing at the commencement of the monsoon. The seed should be delivered in Bombay in the cold weather, and in the districts before the end of May.

"In the other Collectorates of Dharwar, Belgaum and Canara, the experiment had but very partial success, and there seems little hope of the Carolina seed taking to any great extent the place of the indigenous kinds. If Government think it desirable to encourage further experiments, it is respectfully requested that attention be directed to the condition of the seed and the time of its delivery."

(9.) Government in their resolution dated 4th March 1870, on the above reports, observed as follows:

"The experiments with this seed, which was obtained through Messrs. Stearns, Hobart and Company, appear to have been generally unsuccessful in the Southern Division, but the failure may, perhaps, be ascribed in some measure to the fact that the seed arrived too late for the sowing season of 1867, and had to be kept a whole twelvemonth before it was distributed to the ryots."

(10.) The fresh supply of Carolina rice seed (referred to above in paragraph 6) which was received from the Secretary of State, consisted of 19 barrels containing each about 90lbs. of seed. Under Government resolution dated 25th January 1870,

the entire quantity was placed at the disposal of the Revenue Commissioner, Northern Division, who distributed it in the districts in his division as shown in the margin.

16. The Commissioner in Sind, with his memorandum dated 29th June 1870, submitted a précis of the reports on the results obtained from a second experiment in that Province. The Deputy Collector, Upper Sind Frontier, was stated therein to have reported an instance in which three seers of seed sown yielded six maunds. The Political Superintendent, Thurr and Parkur, was stated to have reported the following results:

	Area cultivated.		Seed sown.		Produce.	
	Acres.	Goontas.	Maunds.	Seers.	Maunds.	Seers.
Kippira ...	5	12	5	26	19	10
Oomercote ...	9	7	6	8	16	15
Sangur ...	2	28	...	33	14	16

(11.) An application for a further supply of the seed was made to the Secretary of State, and the quantity obtained was, under Government resolution of 9th February 1871, distributed as follows,—192lbs. to the Political Superintendent, Upper Sind Frontier, 928lbs. to the Collector of Kurrachee; 960lbs. placed at the disposal of the Revenue Commissioner, Northern Division, and 160 lbs. furnished to the Cotton Commissioner, Central Provinces and Berars.

(12.) In forwarding a statement of the result of the third experiment made in the Thurr and Parkur Districts, the Commissioner in Sind in his memorandum dated 13th May 1871, stated that, owing to insufficient supply of water caused by the supply falling in the Metrow Canal, coupled with the high wind that blew at the time when the crops had not attained sufficient stability, the crops in many places either dried up or were blown down by the wind.

(13.) The Revenue Commissioner, Northern Division, reported, on the 16th June 1871, the result of the experiments tried in his division with the quantity of seed referred to above in paragraph 10:

"Very much success does not appear to have attended these experiments in Guzerat or Colaba. The circumstance, however, that in Surat the ryots have saved the seed produced this year for use in the next, and the reports, if it be true, from Sola in Ahmedabad that the people begged and even stole the seed from a field which had drawn much attention, are suggestive that the ryots are alive to the advantages of the seed wherever demonstrated. The failure in Colaba is the more remarkable as two experiments have succeeded well in Tanna, but the experience gained this season will enable Mr. Duff to have a better chance of success in the next. Mr. Jervoise appears to have overlooked the instructions for planting the seed forwarded with Government resolution dated 6th April 1869, and his attention will be drawn to it.

"Mr. Fretwell's* experiments in Khandesh appear to have been conducted with intelligence, and his third experiment, though in a measure spoilt by mismanagement in transplanting, showed how materially the yield may be increased by daily irrigation, one seer of seed sown having produced sixty-eight seers.

"The seed produced has generally been retained by Collectors for further experiments next season, when it is hoped better results will be obtained."

(14.) Reports on the results of the sowings of the seed distributed under Government resolution dated 9th February 1871 were then awaited.

Results of experiments in the Madras Presidency from 1866 to 1870.

26. The Government of Madras followed up by also furnishing their summary of the various reports received from the Collectors of districts and others who had undertaken the cultivation of the American rice since 1866. Supplies of the seed had been forwarded from time to time to all Collectors, and the experiments had been made with freshly imported seed and also with acclimatized seed obtained from previous crops grown from the seed imported from America. The results were thus reported, each district being considered separately:

Malabar.—From Malabar reports were sent in June 1866, March and May 1867, and in May 1868. The first trial appears to have been a failure, which was attributed to the seed having been sown too late in the year, which, however, could scarcely have been the cause, as autumn has been shown to be a favourable season for sowing.

The report dated March 1867 is very much more favourable. In one of the most successful trials made the seed was sown in June and reaped rather more than four months afterwards. The seed was steeped in water for five days before it was sown, and the ground was prepared by ploughing five times and manuring with cow-dung, leaves and ashes. The crop was transplanted before reaping. Almost all the characteristics of the Carolina paddy given in the "resolution" of the Government of India on the subject were recognized in this case.

The report received in May 1867, dated from Tellicherry, was on the whole highly favourable. All methods of sowing were tried, and the conclusion arrived at was that it is most in accordance with the natural habit of the plant to sow it broadcast, but that the outturn from a transplanted crop would probably be greater. It was found that the seed should not be sown too thickly, as the shoots thrown out are very much more numerous than in the case of indigenous rice, and require more space. The best alluvial soil appeared to be most suitable for the cultivation of this plant, and, except under exceptional circumstances, the land should be artificially irrigated. The results of nineteen experiments were given, and in every case which did not entirely fail the outturn was far greater than that from indigenous paddy sown at the same time, the largest yield reported being 160-fold. The Natives were said to be much struck with the superior qualities of the rice and straw, and to be anxious to cultivate it.

The experiments reported on in May 1868 appear to have failed from over-irrigation.

North Arcot.—The first report received from North Arcot in March 1866 was unfavourable, the seed supplied having been at fault; but in March 1867 a very full report was received, which showed that the cultivation of Carolina paddy had been most successful.

The Collector, the Sub-Collector, and Head Assistant, each conducted experiments, and all with a certain amount of success.

The Natives appear in each of these experiments to have been unanimous in praise of the qualities of the rice: they seemed, however, to think the straw too coarse for fodder.

The method of cultivation adopted appears to have been similar to that employed in the cultivation of ordinary Indian paddy, the land being frequently ploughed, copiously flooded, and manured with leaves, cattle litter, etc.

The seed, after being steeped in water for three days, was sown broadcast, being then in an incipient state of germination, and the ground was not again irrigated for five days, after which time, until a few days before reaping, it was constantly irrigated.

A further report from this district in April 1871 shows that the cultivation of the American rice has been continued with success. In one case six measures of seed produced 240 measures of grain and eight bundles of straw, and in another the produce of nine measures of seed was 345 measures of rice and 14 large bundles of straw, this latter being the result of an experiment conducted by the Collector.

The results of cultivation by ryots were reported in May 1871, from which it appeared that the experiments had failed, it is to be presumed, from carelessness on the part of the cultivators.

Nellore.—Unsatisfactory reports were received from Nellore in 1866, 1868, and 1869, want of care in the cultivation being the reason of the failures.

In April 1871 a very full and satisfactory report was received from the Deputy Collector at Naidooptet. No pains appear to have been spared to make this experiment a success. Three different systems of cultivation were tried, namely, sowing broadcast in seed-beds (to be afterwards transplanted), and in furrows, in this latter case a kind of hoe being used.

The land was ploughed and manured as for ordinary paddy, one field being ploughed dry and the other two wet.

The seed sown in furrows was not steeped in water nor prepared in any way, and it was sown in the field which had been ploughed dry.

The land in this case was not irrigated at all until the plants were eight or nine inches in height, or a month after sowing, and before irrigation the ground was twice turned up with a hoe between the furrows, and the crop was weeded. After watering had been commenced it was continued, and the crop was again weeded two months and a half after sowing. The crop was sown on the 18th of August and reaped on the 2nd of the following January.

The outturn was not greater than that of ordinary paddy; but this was because only five per cent. of the seed sown was supposed to be vital, and it was confidently asserted that had all the seed sown been good the yield would have been very much more than that of any indigenous paddy.

Both the other crops failed, and, as will appear from a report of experiments made by Dr. Thompson at Chingleput, it seems probable that the plan adopted by the Deputy Collector at Naidooptet, of dry-sowing and irrigation after the lapse of a month, is favourable to the growth of the American plant.

Kistna District.—Reports were received from the Kistna District in June 1866, September 1870, and April 1871. The experiments do not seem to have been very successful. Various methods of sowing were adopted, and in some cases the seed was prepared by being soaked in water. The most successful result was an outturn of eighteen-fold; but the report does not state in what manner this crop was cultivated.

Godavery District.—The experimental cultivation of Carolina paddy in the Godavery District was reported an entire failure until the present year. Reports were received in December 1866, January and April 1868, and August 1869, and the failures were attributed to ignorance as to the peculiar method of cultivation required.

The latest report, however, is much more favourable. In this trial the seeds were soaked in water for sixteen hours, then watered in gradually decreasing measure for nine days, and then sown. The crop was treated as "wet" and was transplanted. According to the report it seems that 6 pounds and 6 ounces of Carolina paddy seed produced 2,464 pounds of rice, the yield from 308 pounds of Indian seed being 2,480 pounds. It was found that the American plant is liable to be damaged by over-irrigation.

Ganjam.—This latter characteristic of the Carolina paddy was mentioned in the reports received from Ganjam, the first of which is dated December 1866. Further reports were forwarded in September 1867, December of the same year,

February, March, and December 1868. In all the experiments made the method of cultivation was similar to that of the superior kinds of indigenous paddy, and it was found that a dry season was most favourable to the cultivation of the American paddy. The earlier experiments made in this district appear to have been fairly successful; but the latter reports are not satisfactory, and the failures are stated to arise in most cases from carelessness on the part of the cultivators.

Kurnool.—A favourable report was received from Kurnool in February 1867; the seed was sown in the same manner as the Indian paddy, and the outturn was nearly half as much again.

Other reports were received in April and May 1868, and in the same months in the following year, but with one exception they were unfavourable.

The trial reported on in April 1869 was a success, the outturn being fifty-four-fold. This crop was a wet one, and had been transplanted. The latest report from this district is dated November 1870, and is unfavourable, the cause of failure being, as in so many other cases, want of attention.

Vizagapatam.—Several reports were forwarded from Vizagapatam, but the cultivation of the American rice in that district seems to have almost entirely failed. In August 1869, out of eight experiments reported on, two only were in any way successful. But little interest appears to have been aroused among the Native cultivators. Their indifference and consequent carelessness is probably the cause of the failure.

Salem.—The Carolina paddy appears to have thriven well in the Salem District. The reports are dated April and August 1867, December 1868, and October 1879. In some cases the outturn was sixty-fold, and in another as much as seventy-six-fold. This crop was sown in the early part of August and reaped at the end of November.

The advantages of the American over the Indian rice were fully recognized, and in a report from Mr. Fischer, the Agent of the Shevagunga Estate, the whiteness and superiority of the rice is noticed, and also the fact that the grain is not so liable to drop from the stalk when cut as in the case of ordinary rice, thereby preventing waste. This same characteristic of the American rice is noticed in other reports, but rather as a disadvantage on account of the supposed difficulty of threshing.

In the experiments made in this district the seed was sown broadcast and was not transplanted, and it was noticed, as in other districts, that less irrigation is required than with indigenous paddy.

Tinnevely.—The earlier reports from Tinnevely were not favourable, and the failure in some cases was stated to be caused by the seed having deteriorated from age.

South Arcot.—The experimental cultivation of the rice in South Arcot appears to have been, on the whole, successful, although a great deal of the seed supplied to the cultivators was bad, being too old. The ryots were stated to take an interest in the culture of the new grain.

Several instances are mentioned in the various reports of a fear which seemed to possess the ryots lest the cultivation of so productive a species of rice should entail some addition to the assessment on their lands, and in one report from South Arcot in July 1869 it was observed that in one of the most successful experiments by a ryot a false report of the outturn had been made, and the crop, which was in truth very large, represented as very poor.

Tanjore.—The experiments made in Tanjore cannot be considered successful.

In a report dated June 1867 the Collector states that out of nineteen trials only two could be considered in any way successful. He alludes to the known method of planting this rice broadcast in America; but observes that transplanting appeared the better method in this country. The two crops which succeeded were both transplanted. It may be here

* Madras Government Order of 4th May 1868. observed that in their orders* on an unfavourable report from Ganjam in March 1868 Government recommend that the Carolina seed should be sown broadcast and not transplanted.

Several of the experiments in Tanjore were stated to have failed from the inequality of the rain supply. The latest report, dated April 1871, was not encouraging.

It is stated that more labour is required than for the cultivation of ordinary paddy. The land has to be ploughed deeper, and more* caution is said to be required in transplanting. The difficulty of separating the grain from the stalk was also made an objection, although the same was quoted in other reports considered above as a great advantage.

South Canara.—The earlier reports from South Canara in 1867, 1868, and 1869 shewed that the same characteristics had been recognized in the American rice as in other districts; but the results of the cultivation were not very successful. The seed was sown in the same way as Native paddy. In 1868 the crop was transplanted, but was reported to be damaged by flooding, thus confirming the reports from other districts as to the liability of the plants to suffer from too much water.

The report in 1869 was more favourable.

In two experiments the yield was seventy-four-fold and forty-four-fold, respectively. The crop in the first was transplanted, and in the latter sown broadcast, but it appears to have been sown too thickly.

From a report received in July 1871 it appears that the experimental cultivation in the previous year was not successful.

In two cases where adjacent crops had been sown, the one broadcast the other transplanted, the former far exceeded the latter in yield and quality. These two crops were sown on one-crop land, whereas other seed sown on two-crop land entirely failed.

It appeared also from these experiments that Carolina rice does not require so much manuring as Indian paddy. The crops appear to have been irrigated from the time of sowing, and the failure was probably owing, as in other cases, to over-irrigation.

The most successful experiment appears to have been conducted by a wealthy proprietor in the Kassargod Talook. In this case the ordinary Native method of cultivation was employed, and the seed sown broadcast and not transplanted. The cultivator in this case was quite satisfied with the result, and has sown a considerable extent of land with Carolina paddy.

Madura.—The first experiments reported from Madura in August 1867 were not very successful. The seed was distributed to several Native cultivators, and the usual method of sowing adopted, which in this district is by transplanting. Some of the seed was also sown broadcast.

The season was very unfavourable, but the ryots reported that but for this the yield of the Carolina would have greatly exceeded that of the Native paddy. Failure was again reported in July 1869, and in this case it was attributed to the deterioration of the seed from age.

Bellary.—The report from Bellary in September 1867 corroborates the other reports as to the nature of the American rice, and the experiment was fairly successful. The seed appears to have been sown broadcast too thickly, and the soil was inferior, otherwise the outturn would have been large.

A further report from Bellary states that the experiments conducted in the following year were not very successful. The same method of sowing as before was resorted to, and the greatest outturn was thirty-four-fold.

Cuddapah.—From a report received from Cuddapah in June 1868 it appears that the season was very unfavourable, and that of eight trials made by Native cultivators one only succeeded.

In this case the seed was sown in the ordinary way, and no extra expense was incurred, the outturn was nearly sixty-fold.

In an experiment reported on in March 1870 great care seems to have been taken in the preparation of the ground, which was ploughed and watered a month before sowing, and received afterwards two ploughings each day on the fifth and second days before sowing. The land was manured with leaves and dung, and again ploughed, and the seed (which had been kept moist for three days after 12 hours' previous soaking) was then sown. The land was irrigated on each ploughing

and on the day of sowing, but the water was not again let in till the plants appeared above the surface. The irrigation after that was continuous.

The result, however, was not very satisfactory, the yield being less than that of ordinary paddy; the grain and the straw were, as usual, of superior character.

Coimbatore.—The first report from Coimbatore was unfavourable; the want of success was attributed to indifference on the part of the ryots.

A report was received in December 1869 of a very successful experiment conducted by a Mussulman ryot; the same features were observed as in other successful experiments.

In a report on the cultivation of Carolina rice in this district from the Superintendent of the Government Farm, Sydapet, it is distinctly stated that, by being sown broadcast, American paddy is placed at a disadvantage as compared with Indian paddy, which is generally sown in seed-beds and transplanted. One cause of frequent failure is also suggested. The American paddy is frequently sown at an unusual time of the year, and being, when ripe, the only ripe crop, is thereby more exposed to destruction by insects, birds, etc.

Trichinopoly.—The experiments made in Trichinopoly seem to have failed entirely.

Madras.—The reports from Madras include that received from Dr. Thompson when Superintendent of the Jail at Chingleput, as well as reports from the Superintendent of the Government Farm at Sydapet.

Dr. Thompson's experiments and the results thereof have already been noticed in a preceding part of this memorandum.

It will have been observed that, in nearly all the experiments reported above, the seed was first soaked in water and sometimes kept moist. Dr. Thompson, on the contrary, had the seed thoroughly dried and tried both wet and dry cultivation, two crops of each being sown, the one broadcast and the other in seed-beds for transplantation.

In their remarks on this result, the Government observed*—"The seed was sown in August, having been previously well dried. The soil was sandy clay enriched with silt from the bed of a tank, and, where wet cultivation was employed, leaves were incorporated with the soil of the nursery bed. But a larger share of success appears to have attended the cultivation of the paddy, which was sown broadcast on dry land and not irrigated until two months had elapsed."

If the results of the experiment made by the Deputy Collector at Naidoo Pett in Nellore be compared with this, it may be inferred that this postponement of irrigation (although, in the experiment at Chingleput, accidental) is highly favourable to the growth of the Carolina paddy.

Among the reports from Madras is one received in June 1869 regarding experiments made in the sub-division of the district, which seems, notwithstanding an unfavourable season, to have been highly successful. In one case a Carolina rice-crop grown alongside one of the best Native paddy, and under precisely similar circumstances, yielded one-and-a-half times as much as the latter. The advantages of the American rice are thus summed up—

- " (1.) It is a four-months' crop.
- " (2.) It requires not more than one-fourth of the water required for the Native kinds of paddy during the same period.
- " (3.) Twenty-four measures of seed suffice for the same extent of land as thirty-two measures of Native seed.
- " (4.) Each seed that germinates is capable of producing from ten to seventeen plants without any particular care, a productive power not possessed by Native paddy to any appreciable extent.
- " (5.) The ears are, out of all comparison, larger than those of Native paddy grown under the most favourable circumstances.
- " (6.) The largeness of its yield.
- " (7.) Its superiority as food-grain.
- " (8.) It yields a larger amount of straw of a sort also more succulent and palatable than that of ordinary paddy."

In this last point the report is somewhat at variance with most of the other reports received.

One important point is noticed, showing the estimation in which the American paddy is held, namely, that, whereas some months before the report was drawn up the seed sold for one anna a measure (the same as Native seed), the price had risen to two annas a measure.

Nilgiris.—According to a report received from the Nilgiris in March 1871, the experiments tried there were complete failures. The seed appeared to thrive until transplanted, when in every case it died. Hares and cockchafers were supposed to have destroyed the young plants.

In addition to the foregoing, reports were received from Travancore and Mysore.

In the latter territory the cultivation of the paddy (in Bangalore) was successful, and the grain appreciated by the Native cultivators.

The reports from Travancore and Cochin are moderately favourable, and coincide, as regards the qualities of the paddy, with other favourable reports.

In Travancore it was also noticed that the best soil for its cultivation is a mixture of clay and sand.

Experimental farms were established by the permission of Government (accorded in September 1869) in the Kistna District and in Cuddapah, South Arcot, Madura and South Canara, and some of the later experiments in these districts were conducted under the supervision of the Collectors and their Assistants.

In March 1869 the Board forwarded a report to Government of the result of the experiments up to that time, of which the following is a summary:

With reasonable care and exertion Carolina paddy may be grown in most districts with profit. Failure, as a rule, has been attributable to causes quite within control in the average of seasons, and, where real care has been taken, success has generally been the result.

The Carolina paddy is harvested as quickly as the most rapidly growing Native grains, and twice as quickly as most others, and is more productive in weight of grain and straw and less dependent on a full supply of water. A smaller quantity of seed also suffices.

There appears, from a review of all the above-mentioned reports, to be little to add to this statement of results, though one or two points regarding the preparations of the seed and the land may be noticed.

It appears to have been usual to soak the seed and to sow it wet; but in one of the most successful experiments made, namely, Dr. Thompson's at Chingleput, the seed was well dried and then sown in dry soil. The reason given by Dr. Thompson for the preliminary drying of the seed has already been stated.

In the preparation of the soil deeper ploughing and less manuring and watering are required than for Native paddy, and, as remarked previously, the postponement of all irrigation for a month or two seems to have been worthy of further trial.

As regards results, the summing up of the advantages of Carolina paddy contained in the "Resolution" of the Government of India was almost entirely corroborated by the experiments made in this Presidency.

Of the three disadvantages named in the Resolution, the second and third were found to exist, but not the first, for on all hands the superiority of the grain in colour and flavour was recognized, and, as appears from the report from Madras, this grain commanded double the price of Native paddy.

In conclusion, it may, in a few words, be asserted that Carolina paddy is in every way superior to Native paddy, but that it is the growth of a higher system of cultivation than is generally prevalent in this country, which system is required to bring it to perfection and to prevent its deterioration.

It is in the early stages of its growth more delicate, and requires more care, especially in sowing (so as to prevent its being sown too thickly), than is usually the case here.

The seed also is liable to deterioration.

The Government of India, in acknowledging the report of the Madras Government said, on the 2nd January 1872, that the measure of success achieved during the last season afforded solid ground for congratulation, and that Mr. Robertson's full report on the subject would be awaited. At the same time an enquiry was made whether any portion of the consignment of Carolina seed shortly expected in Calcutta would be required to carry on the experimental cultivation in the Madras Presidency during the next season.

Further trials in India in 1871.

27. On the 6th August 1872 the Government of the North-Western Provinces reported the results of the trials with Carolina paddy during 1871. Some seed which was in hand was sown in the following districts; Dehra Dun, Saharunpur, Mozufarnagar, Aligarh, Bijnor, Moradabad, Bareilly, Shajehanpur and Allahabad.

The sowing was successful in four districts, and failed in the others; the causes of failure were reported to be in Mozufarnagar, the want of interest by the cultivators; in Bijnor, Moradabad and Bareilly, destruction by heavy rains; in Shajehanpur the cause of the failure was not explained.

The successful cultivations were thus described:

Dehra Dun.—One seer of the paddy was sown in a nursery and transplanted on one bigha of land, the yield was four maunds of paddy, the straw was much larger, and the heads longer than that of the country paddy.

Alongside of this bigha, another bigha was sown with two seers of Native paddy, the seedlings being transplanted, and the crop treated in exactly the same manner. The yield was only two and a half maunds, without reckoning a small patch which was eaten down. Adding this the results would stand nearly thus:

Native paddy, two seers sown, yielded	... 3 maunds.
Carolina do., one seer ditto	... 4 ditto.

Saharunpore.—The small quantity of seed, 6½ seers, received in this district, was made over to Kour Sen, the zemindar of Haraoti. The produce was as abundant as in 1869, being 36 maunds per acre, and this in spite of the unusually heavy rains which fell in 1871 and caused considerable damage to the country rice. This, the local officer reported, was probably due to the superior strength of the staple of the Carolinian species.

Aligarh.—An experiment was made by the Supervisor on the Ganges Canal. A piece of land was selected within canal boundary, and divided equally into four plots, each measuring 35 by 20 feet, or about 2.54 perches, the plots being ready were sown on the 6th June 1871 with 14 chittacks of each of the following kinds of paddy:

Carolina paddy.
Lall dan (table rice).
Mixed dan.
Nach dan.

From the 8th to 15th June germination continued and on the 24th June water was run off, and the crops cleared of all jungle. The Carolina paddy owing to badness of the seed, had only 1,120 plants; while the other three or country varieties came up very closely. In the usual course these should have been thinned, but in order to keep the experiment on equal terms all were allowed to grow. On the 1st October the Carolina paddy plants showed signs of ripening, while the country varieties were in full flower. The respective yields were:

	Seers.	M.	S.	C.
From Carolina paddy	... 28	or 44	3	12 per acre.
Do. Lall dan	... 21	or 33	2	12 do.
Do. Nach dan	... 28½	or 44	35	4 do.
Do. Mixed dan	... 26	or 40	37	9 do.

On examining the Carolina paddy plants before cutting it was found that the heads were nearly all empty.

Allahabad.—A trial was made at the Government Farm on half an acre of the common native soil, prepared and sown in all respects in the same way as the

Native crops of rice, the only difference being in the quantity sown, which was 17 seers to the half acre, instead of 31 or 32 seers as the natives sow. The sowing was made on the 4th July, and the plants grew up strong and luxuriantly, always keeping the lead of the Native rice sown at the same time. The yield was 4½ maunds; but from specimens preserved and sent away, and the fact that two buffaloes and a cow got in amongst the crop one night and destroyed a large quantity of it, the yield cannot be computed at less than 5½ maunds per half acre.

The Local Government, seeing the extraordinary outturn in some places, was led to believe that under certain circumstances the plant might be cultivated with every prospect of becoming a valuable staple; and accordingly directed the district officers to prosecute the trial cultivation (from fresh seed which had been promised by the Government of India) in a systematic manner. According to these instructions seed would be sent to each district, and where there was a settlement officer he would be required to conduct the experiment. Every one receiving seed would be furnished with a form on which to report, the form being framed to shew the area sown, the quantity of seed used, the date of sowing, mode of preparing the area for cultivation, description of the season, number of waterings, weedings, date of cutting, and quantity of crop harvested, proportion of husked rice to paddy, and rate of paddy per acre.

Further results in Madras Presidency.

28. The Government of Madras, on the 22nd July 1872, submitted a report by the Superintendent of Government Farms* in that Presidency on the trials made in 1871: He said that during the

* Mr. Robertson.

past cultivating season no special experiments had been made in the Madras Farms, as previous trials had indicated, in a very conclusive manner, the necessary conditions for its successful cultivation in the district.

Three hundred pounds of the seed were sold, however, to the model farm at Sydapett for ordinary cultivation. The general results were not satisfactory, owing to a change in the physical condition of the soil. It was stated that soils which, in the previous year, had yielded crops of as much as 45 bushels per acre, yielded in 1871 little more than half of this quantity of grain. The falling off was explained thus:

"Paddy land of a rather retentive character, situated at a low level, resting on a stiff sub-soil, through which there is no natural drainage or filtration, invariably becomes sour and unhealthy, after growing a crop of paddy,—conditions quite opposed to the successful cultivation of Carolina paddy, though apparently not so injurious to ordinary country paddy."

The total yield from the 300lbs. sown was 2,929lb., but a considerable proportion of the crop was cut for fodder, as its appearance did not warrant its being kept for the production of grain.

At the time the Carolina paddy was sown, 350 lbs. of country paddy (chumba) were sown on an adjoining piece of land. Both crops received the same treatment. The yield of the latter was 7,002lbs. The results went to show that the country paddy will grow and even thrive under circumstances that would be highly prejudicial to the higher class of Carolina paddy, "which must have a healthy soil, resting on a moderately porous sub-soil, through which the irrigation water must pass."

In illustration of this, specimens of roots were furnished by the Superintendent of the Farms, showing the roots of the Carolina paddy plant and those of the country variety. They were taken from some land of the same description and quality, and the crops had been cultivated in an exactly similar way. The Carolina had longer roots and showed that the plant feeds deep down in the soil, while the country variety had smaller ones, showing that it was a surface-feeder. The Superintendent then concluded:

"it is evident, therefore, that land with a healthy surface, only about three inches in depth, can never produce a good crop of Carolina paddy, though it may produce fair crops of the country variety. In such soils the Carolina grows well enough until its roots begin to pass down into the unhealthy under-soil, when it sickens, turns yellow, and dies; while the country paddy, whose roots never reach this unhealthy under-surface, may thrive and yield fair results."

As regards the question whether Carolina paddy deteriorates in this country, Mr. Robertson wrote as follows:

"11. Carolina paddy, which has been grown in this country under suitable circumstances, is in no way inferior to the seed imported from America. One of the best crops I grew last season, 2,000lbs. per acre, was from seed in the third generation since imported; and I have just issued a fine parcel of grain (the fifth generation), the product of seed which formed part of the yield of that crop, which was quite equal to the seed we imported from America."

"12. Deterioration does undoubtedly take place when the crop is grown under very unfavourable circumstances; but it must be remembered that the finest of our wheats and barleys deteriorate in the best wheat and barley-producing districts in England, if sown at the wrong season, on exhausted soils, imperfectly cultivated. But deterioration is less to be feared than the loss of purity in the sample; fully 50 per cent. of the sample of country grown Carolina paddy, that has been forwarded to me, contains indigenous paddy, varying in amount from 10 to 50 per cent. The presence of this country paddy amongst the Carolina grain is altogether due to the late period in growth at which ryots harvest their paddy; they generally wait until the crop is dead ripe, when from 10 to 15 per cent. of the grain is invariably shed by the wind, and in the harvesting of the crop, the result being that after the removal of a crop of country paddy, the soil generally is sufficiently well seeded for another crop."

"13. When it is intended to grow Carolina paddy on old paddy land, the soil should be invariably watered and stirred a few days before sowing commences; the seed already in the soil will thus be induced to germinate, and can be ploughed in and killed."

"14. I regret that we are not at present able to spare more Carolina seed. I am just sowing Carolina paddy on a few acres of our most suitable land for the production of this grain, and hope before the setting in of the North-East monsoon to have enough, with what may be available in the districts, for the ordinary wants of this Presidency."

Further trials in India, 1872.

29. It will be remembered that Her Majesty's Secretary of State for India had been asked, on the 10th August 1871, for a fresh supply of 50 barrels of Carolina rice seed, and that on the 7th and 14th December following an additional 150 barrels were telegraphed for. In a despatch dated the 4th January 1872, the Secretary of State said that it was impossible to comply with this requisition for an additional 150 barrels, as the supply could be received in England only after the expiration of the time mentioned in the message (viz., 23rd January). As regarded the 50 barrels asked for, it was stated that the quantity was then (4th January) on its way from Charleston, and that on receipt it would be despatched to Calcutta without delay. The seed was received in Calcutta in the month of March 1872, and the following distribution was made:

	Barrels.	Date of distribution.
Bengal	20	15th March 1872.
Oudh	1	19th do.
North-Western Provinces	2	19th do.
Punjab	2	19th do.
Central Provinces	4	19th do.
Berars	1	12th April 1872.
Coorg	1	12th do.
Madras	5	10th April 1872.
Port Blair	10	10th do.
British Burma	4	12th April 1872.
Total	50	

The Local Governments and Administrations concerned were informed of the despatch of the seed and were at the same time asked for an accurate and detailed report of the results of the present year's sowings, accompanied by a note shewing

what further supplies of the seed, if any, would be required for the following year. They were also asked, in the event of the cultivation proving a success, to save as large a portion of the produce as possible for seed, so as, *first*, to determine whether the quality deteriorates, and, *secondly* should this not be the case to render further supplies from America unnecessary.

Reports began to come in from June 1873.

30. The Government of Bengal reported 107 trial sowings, 32 of which were successful, 62 doubtful, and 13 wholly unsuccessful. The last class included all

Results in Bengal.

cases in which no yield was produced, whether owing to accident, badness of seed, improper cultivation, drought, insects, or a withering of the plants after attaining a certain height. Of the doubtful cases many were very nearly failures: the want of success was attributed to divers causes, such as destruction by insects and cattle, want of rain, and the difficulty in pulling up the seedlings for transplantation owing to the length of the roots. In some of the successful cases, it was established that the Carolina paddy plant yields more than one crop from the same stalk. The Board of Revenue noticed that the opinions given by different cultivators on the best mode of cultivation, the quantity of grain and straw produced, and the probability of the cultivation in this country proving a success, were extremely contradictory, and that it was therefore difficult to arrive at any definite conclusion as to the general success of the experiment. The successful trials were thus summarized:

District.	Experiment made by—	Seed sown.	Abstract of reports.
Burdwan ...	Superintendent of the Burdwan Jail Garden.	Mds. S. Ch. 0 2 0	The seed was sown in June on a cottah of land, and transplanted in the middle of July to 11 cottahs and 3 chittacks of land, but one-fourth of the young plants had suffered from blight. The remaining seedlings were specially irrigated on two occasions owing to the scarcity of rain. The crop was gathered in the end of November, and was found to be larger in size and the rice-straw better than the indigenous produce. The total yield was 3 maunds 15 seers. At this rate a standard bigha of land would have produced 16 maunds of unhusked rice. The Collector is of opinion that the Carolina plant takes less time to grow, and that its growth to maturity is more rapid than the ordinary paddy.
Bancoorah ...	Collector and four Native gentlemen.	0 10 0	The Collector received 10 seers of seed and distributed it to four Native gentlemen, keeping a small quantity for himself. He reports that half the seedlings were destroyed by drought in the early part of the season, and the grain when ripening was blighted by a kind of worm which visited the district. The crops were ready for the sickle in the middle of November. One zemindar got 32 seers of paddy from one-half seer of clean seed and another got 22 seers, which they have kept for experimental purposes next season. All the zemindars who tried the experiment have approved of the quality of the grain, and of the power which the plant has of resisting strong winds; and they also appear to be sanguine that under ordinary circumstances the yield of the Carolina paddy would be greater than that of the indigenous paddy.

District.	Experiment made by—	Seed sown.	Abstract of reports.
Midnapore ...	.....	Mds. S. Ch. ...	The Collector states that of the four reports submitted by the experimental cultivators in the sudder sub-division, three were of opinion that the seed grew remarkably well, though two were unable to offer a practical test of its success owing to the severe rain-fall at the end of October. The result of their experience seemed to show that the seed grows best in land permanently covered with a small quantity of water, and that the ear is larger and heavier than the indigenous plants, the outturn being about the same. A report from an experimental cultivator in the Gurbetta Sub-Division showed that out of three modes of cultivation only one, viz., that of sowing broadcast, was successful, but the outturn was small.
Soonderbunds...	Mr. Cowasgi Edulgi ...	...	This gentleman reports that the seed was sown in the middle of July and the plants germinated in seven or eight days. The seedlings were transplanted to about 15 cottahs of land, but having taken deeper root in the soil than is the case with indigenous paddy, portions could not be transplanted. The plants flowered at the end of September, and were ready for cutting much earlier than the country paddy. Owing to this some portions were eaten up by birds, and consequently the yield, 65 seers, which has been reserved for seed next season, was less than it would otherwise have been.
Backergunge ...	.....	...	Success to a certain extent attended the experiment in Potuakhally. The Naib of Babu Brojokant Roy succeeded well in a place South of the bazaar there. The experiment at a place called Mankoran met with a similar result. The Deputy Collector got a small quantity of rice out of the paddy, and obtained the following information from the cultivators:—The paddy grows well in high lands and with less water, and takes as much time to ripen as the indigenous kinds, the straw is thicker and longer, and better suited for thatching purposes, while the husk is thinner than that of the country species. The grain when ripe does not fall off so easily as the country varieties generally do, but is more difficult to thresh out. The rice is a little coarser than that used by the people of the middle class. The Collector is of opinion that if the Carolina paddy were carefully cultivated it would grow well, and if there were two crops in the year it would be more profitable than the Indian species.
Cachar ...	Dr. Monteith	...	Four chittacks of the seeds were sown on a piece of ground well mixed with water. In thirty-two days the plants were about 1½ feet in height, when they were transplanted into a wet bed prepared for the purpose. They did not at first thrive on account of extreme heat, and in consequence were thrown back for about eighteen days, but after recovery they grew pretty well. The bed was reaped on the 28th December and yielded 5 seers, being an increase of twenty-fold. Dr. Monteith remarks that the seeds were sown rather late, and this may have prevented the success of cultivation to some extent.

District.	Experiment made by—	Seed sown.	Abstract of reports.
Noakhally ...	Superintendent of Jail ...	Mds. S. Ch. 0 8 0	This officer reports that the seed received by him was sown in the jail garden in July and reaped in October. A second crop in the same year was not attempted. There were no gales or salt water inundations to affect it. It requires less moisture than the country seed; eight seers sown produced one maund and 15 seers, the average outturn of country rice. The straw is about the same length as country rice, but it is not so good for thatching purposes, on the other hand cattle seem to prefer it to eat. The grain is much more difficult to husk than country rice.
	Babu Obhoy Churn Chowdry.	0 0 6	The Babu reports that out of one seer of paddy received by him only six chittacks were found good, and this was sown on the 9th July and transplanted on the 13th August last. It commenced to ripen from the 14th November and was cut by the 23rd. As it was sown on chur land, a second crop was not tried. It is less subject to injury from gales and heavy rains, but more to injury from salt water than the country paddy. It is liable to be spoiled by floods, but may not (so far as it is known) be affected by drought. The place where it was sown was subject to salt water inundation; and the outturn was one quarter of that of the country paddy, yielding only five seers, while the same quantity of country seed would have yielded 20 seers. The grain is heavy and does not drop readily, and the proportion of clean rice is greater than in the country product. The rice has a good taste but has no scent. It is supposed to be nutritious, and will probably sell at an average price. Transplanting does not suit the plant, because the root extends far into the ground and makes it difficult to remove it from the soil. The grain is not easily threshed out, unless kept some days on the ground after being cut, and the straw is short and inferior to the ordinary straw for thatching. Some of the numerous species of the district paddy are inferior, but most sorts are superior to it.
	Sudder Naib of the Bulloah Estate.	...	This officer reports that the paddy was sown in August and ripened in the latter part of November. It may be grown once a year, it was affected in the same way as the country paddy by heavy rain, is more injured by salt water, does not require much water, but drought would spoil half the crop. More husk is found in it than in country paddy, the proportion of rice to rice in husk is greater perhaps from being heavier than in country paddy, and the seed does not fall. It has fair taste and smell, but is not equal to some species grown in the district. The paddy being oily and coarse may be liked by the lower classes of the people, and may fetch the same price as the country paddy, but it is not so easily threshed out, and its straw is hard and not good either for thatching or for cattle, though it is longer than that of country paddy. Like ordinary rice one seer of seed might yield a maund.

District.	Experiment made by—	Seed sown.	Abstract of reports.
	Baboo Bykontonath Chatterjee on behalf of Baboo Gopi Chunder Sen.	Mds. S. Ch. 0 0 4	Reports that out of one seer of paddy received by him one-fourth was found good and sown, and yielded two seers of paddy. This quantity has been preserved as seed, and nothing can therefore be said as to the taste, smell, or value of the rice, nor how it is liked by the people. It is not easily threshed out, and is liable to injury in heavy rains. The straw suits cattle better, but it is not so good for thatching, though it is as long as the country straw.
Tirhoot ...	Mr. Sharpley, Manager of Raj Sewher.	...	This gentleman reports that, notwithstanding the fall of a heavy shower of rain shortly after the germination of the rice, killing most of the crop, some ten dhoores of land which narrowly escaped the danger yielded 11 seers, or at the rate of 11 maunds per bigha.
Purneah ...	Mr. G. J. Barnek, Mynagore Factory.	...	Mr. Barnek reports that a cask of Carolina paddy reached him in good order, and weighed more than one maund and ten seers, but on winnowing it there was 7½ seers of husk, leaving only one maund 2¼ seers of good paddy. Of this he sowed 23½ seers broadcast on the 27th of June on land neither too high nor too low, and subject ordinarily to an inundation of 18 inches. The remaining 19 seers of seed he cast for transplanting. The seed sown broadcast produced seven maunds and 30 seers, or over thirteen-fold, and the 19 seers transplanted yielded three maunds, 35 seers, or over eight-fold. The transplanted lot Mr. Barnek states, had not a fair trial from want of rain enough for that class of sowings, consequently it suffered and yielded only a poor return. The broadcast portion, Mr. Barnek adds, would have yielded more plentifully had the seed been at hand to sow in the months of April and May last, but having been so late as June it also had not a fair trial. Under any circumstances Mr. Barnek would not care to carry out any future experiments with the Carolina paddy, as the country grain far surpasses it in its yield and gives less trouble.
Cuttack ...	Canal Revenue Superintendent.	...	A plot which the Superintendent sowed in his own garden yielded a fair crop and a good outturn of straw. It was watered from a well when required.
Pooree ...	.....	0 2 0	This quantity of seed, the Commissioner reports, yielded fifteen-fold.
Ditto ...	.....	0 5 0	Mr. W. C. Taylor, Deputy Collector, reports that 5 seers of seed were received from the Pooree jail and sown broadcast after the first rains. About one-half only germinated, and being reaped in the middle of November yielded 75 seers, or about thirty-fold. The land on which the seed was sown had been fallow for many years, and had not been properly ploughed and no manure was used, and as the rains were copious no artificial irrigation was applied, with the exception of the usual cutting and binding of ridges. In this sample of paddy no less than twelve distinct varieties of grain were found, some yielding red, some brown, and some white rice.

At this stage of the experiments, Mr. R. Knight, Assistant Secretary to the Government of Bengal, recorded a note in which he said :

"The importance of the attempt to substitute the cultivation of Carolina rice for the indigenous paddy is hardly as yet generally understood in Bengal. * * *. Patna rice is more esteemed in Europe than any other of the Indian kinds, but it is small grained, though remarkably white. It will bear no comparison, however, with the rice of South Carolina, the superiority of which is sufficiently attested by the fact that it sells in London at 35s. to 36s. per cwt. when Patna will not command more than 14s. to 15s."

* * * * *

"The statement frequently appears in the history of our attempts to acclimatize this rice, that the people would not eat it even if they could grow it. I take the liberty to doubt this; but were it even true, and the grain grown for export only, the experiment is of great importance. The people do not eat jute, but they are glad to grow it for all that."

"The opinions expressed as to the quality of the straw are of almost endless diversity. According to some, the straw is superior as fodder to that of any indigenous paddy whatever; according to others, inferior to that of the worst. According to some reports, it is admirable for thatching purposes; according to others, it is almost worthless for such uses. Now, all this, as it seems to me, simply shows that there has been no systematic, sustained, and careful effort in what we have been doing, combined with watchful observation of the results of every mode of cultivation upon the grain itself, and then upon the straw. The long record of failures from drought, inundation, blight, wild animals, birds and insects may be dismissed with the remark that the league which the birds of the air and the beasts of the field, and the very elements themselves, seem to have made against the experiment simply show how feebly we have conducted it. The marked preference for this rice shown by birds and insects and vermin, over the indigenous kinds, is strong presumptive proof that the grain is worth the attention of man himself. I believe it will be generally found that birds and rats are not bad judges of the quality of food-grains."

"The great fact it is necessary to mark with care, is the fact that the American mode of cultivation is entirely different from the Indian. The Carolina seed that comes to us from America is the product of a very peculiar mode of cultivation, to which the seed has been accustomed for probably 200 years. The rice is sown in the States in rows, in the bottom of trenches about 18 inches apart. The trenches are filled with water to the depth of several inches till the seed germinates, when the water is drawn off. Shortly afterwards the fields are again flooded for rather more than a fortnight, to kill the weeds; and they are flooded once when the grain is near ripening."

"Now, this mode of cultivation is entirely different from the Indian, and although its peculiarities were brought to the notice of the Government several years* ago, I cannot find the record of a single attempt to cultivate the plant in Bengal in the same way."

"Instead of taking these instructions as a guide to be followed as closely as possible, they seem to have been ignored altogether, and the cultivation of the new and peculiarly educated plant attempted in methods wholly foreign to the treatment under which it had been produced in America. We have sown it broadcast and in nurseries, on high land and low land, on wet land and dry land, and in every conceivable way but the one in which we were told to sow it, namely, the way to which it had been accustomed during 200 years of cultivation. The reports from the Board of Revenue of the results of the experiments made with the 20 barrels of seed distributed last year are of the same order as all preceding reports. The seed was received and sent to the Board of Revenue, and by it distributed all over the country; and instead of looking to success in the way of concentrated, careful efforts year after year upon the same spot, we have hoped that by widespread, insulated, desultory sowings, success might 'turn up' somewhere."

"Mr. Kitteridge's instructions show that the water with which the rice is flooded must be under control, and the suggestion naturally arises that the vast canal systems which the Government has constructed at immense cost in various parts of the country—the Soane, Midnapore, and Cuttack Canals—supply us with the means of attempting the acclimatization of the plant, under conditions of cultivation similar to those which have produced it in America. Indian rice lives on the rain-fall; Carolina, on irrigation; and this fact opens up to us an interesting and possibly valuable field of experiment in the neighbourhood of the canals, upon which the State has spent so many millions."

The Government of Bengal circulated this note to all officers and private gentlemen who had undertaken the cultivation of Carolina paddy, and Collectors were requested to cause verbal instructions to be given to ryots, mouzadars, and zemindars who may undertake experiments. The Government acknowledged that it was quite clear that the proper mode of cultivating this rice was not sufficiently known; and it is probable that its high market value is not generally appreciated. It also said: "It may possibly be that in America the rice is raised of a fine quality by a quasi-garden cultivation, and sells higher, just as garden potatoes sell higher than field potatoes. From the description of the Carolina cultivation, it is evident that an artificial supply of water is necessary. The crop should be tried on our canals. If it turns out that with command of water we can really raise a rice very much more valuable than ordinary rice, we may save millions now sunk on canals. In that view the question is of immense importance."

The Government of India caused this note and the Bengal Government's remarks thereon to be distributed to all Local Governments and Administrations. This was done on the 18th September 1873, and copies of the paper were to be furnished to all persons to whom the conduct of the experiments of 1873 was at the time confided. It will be seen what advantage was derived from the information thus supplied. In the meantime the results of the sowings of 1872 were being received by the Government of India.

31. In Oudh the trial cultivation was reported to have been confined to only one district, Rai Barielly, owing to the supply of seed being limited, and to the fact that this was the only district in which much interest was taken in the cultivation during 1871, and success was attained. The experiments were confided to three gentlemen.

Results in Oudh.

1. Major Orr, talukdar, who sowed the seed on the 18th August 1872, in one biswah of well prepared and manured land. The ground was after the sowing twice weeded and once irrigated. On 25th August the plants were transplanted to ten biswahs of well prepared land. When about one foot high they were attacked by the "gundiah" insect and were much injured. On the 14th October the crop was cut, and the produce weighed eight seers, four seers being cleared of the husk, gave 2½ seers of clean rice. The remaining four seers were reserved for future sowing. The difficulty in separating the grain from the ear and the husk from the grain was not greater than that experienced in similar operations with country rice; but the grain of the Carolina paddy became much broken in separating it from the husk.
2. Raja Jugmohun Singh sowed 10½ seers and the outturn of two bighas planted therewith was only 35 seers, much less than the produce of ordinary rice. On the other hand, the acclimatized seed planted by the Raja in two bighas of land yielded 5 maunds 25 seers.
3. Chowdri Bul-bahadur Singh sowed 14 seers on one bigha eight cottabs of land, and the outturn was five maunds 12 seers, valued by him at Rs. 9-10-8. The land on which the seed was sown, and that on which the plants were transplanted, had been well manured. Difficulty was found in separating the husk from the grain without breaking the latter. The Chowdri was also successful with acclimatized seed. Of 32 seers planted out in two bighas of land the yield was eight maunds ten seers; the yield of country paddy under similar conditions was six maunds 21 seers.

32. In the North-Western Provinces it will be remembered that in 1871 special directions were given for prosecuting the experiment in a systematic manner, and for the submission of full reports on the results of the trials of 1872. The instructions reached the district officers too late, and all that could be done was to report the results in the prescribed form. This showed that the rains had been decidedly unfavourable, and that the crop in many places had been swamped; when not swamped it was in some places dried up through the failure of rain when rain was most wanted. The experiment seems to have been tried on every description of land. The largest outturn was obtained in Saharunpore, and the Board of Revenue thought that the success here was due in some degree to the choice of a suitable locality. It has already been noted that in 1871 Saharunpore showed an outturn of 44 maunds per acre. In this (1872) year the yield was 30 maunds of unhusked, or 21 maunds of husked rice. Four seers of seed were sown in 1 rood and 13 poles of low dakur land, which was irrigated from a tank, being twice watered and twice weeded, and the result was 10 maunds of unhusked, or 7 maunds of husked rice. The land was ploughed in the cold weather, and again in May and June 1872. The seedlings were transplanted when about a foot in height.

The next best results were obtained by the Cawnpore Model Farm, which turned out 19½ maunds of unhusked, or 12½ maunds of husked rice per acre. Three half seers of seed were sown on 1,414 square yards of garden land, which was irrigated from wells, and once with steam-pumped canal water, the number of waterings being 7 and of weedings 4. The outturn harvested was 5 maunds 30 seers of unhusked, or 3 maunds 29 seers 4 chittacks of husked rice.

In the Mozuffarnagar District the yield was 11 or 12 maunds of unhusked and 7 or 8 maunds of husked rice. All the other districts showed very ordinary, and a large number insignificant, returns.

The Board of Revenue remarked that both at Saharunpore and Cawnpore the favourable results may have been due to the judicious use of canal water, which may have permitted the American method of cultivation to be carried out. As the experiments at Saharunpore were for two years so signally successful, a report was called for describing in detail the method of cultivation employed. The Board observed that when canal irrigation is available the American method might well be introduced.

33. From the Punjab, the Financial Commissioner reported that the seed had been distributed among the following districts:—Kurnal, Jullundhur, Hoshiarpur, Kangra, Gurdaspur, Sialkot, Lahore, Rawul Pindi, Peshawur, and the Chamba State.

In Kurnal 5½ seers of seed sown on the 25th June on an area of 1 rood, and transplanted in the end of July, irrigated four times with canal water, and reaped on the 18th October, yielded an outturn of 7½ maunds uncleaned rice, which when cleaned gave 5 maunds. This, it was calculated, would be 27 maunds 24 seers of uncleaned and 17-31 of cleaned rice per acre. The ground had been ploughed twice and manured with cowdung, &c., both before and after being planted, and it was weeded once every month.

In Jullundhur the crop was damaged by floods in several instances, but the outturn was nevertheless fair, one seer of the seed having produced 35 seers of uncleaned rice, making a yield of 7 maunds per acre. The Deputy Commissioner remarked that the natives would not, of their own accord, have anything to do with the cultivation of Carolina rice, as the quality of it is inferior, and they do not like it. It was not found possible to obtain two crops in one season.

In Hoshiarpur the seed was sown in six villages, but in three it failed. The yield in the others was fair; the people took little or no interest in the experiment.

In Kangra the experiment was tried in two villages. The land was irrigated and manured, but the plants were not transplanted. The yield was less than that of the rice of the district, and the zemindars considered the quality inferior. Better results were looked for in a district where rice cultivation is so well understood; but the experiment was on a very small scale.

In Gurdaspur the results were successful; but the Deputy Commissioner's report does not state what the natives thought of the experiment.

In Sialkot the seed was found to have been eaten by insects to some extent. A small crop, however, was obtained. The Deputy Commissioner considers the rice to be a little coarser than the best native rice and less nutritious. In several instances the seed did not germinate; but it was difficult to determine whether this was owing to the quality of the seed, the defects in cultivation, or the nature of the soil.

In Lahore the outturn appears to have been large, if correctly reported, as 5½ seers of seed are shown to have yielded 4 maunds and 30 seers of cleaned rice which was, however, considered to be hard, coarse, expensive, and not liked by the people.

In the Rawul Pindi District, the outturn was good, being larger than that of native rice, and the grain was shorter and thicker than the native kinds, but not so white.

In the Peshawur District experiments were made in four plots. In one plot a good yield was obtained, and the grain was preserved for next season's sowing. In the next plot the yield was small, and in the other two there was none at all, owing to the crop having been destroyed by insects and injured by floods.

In the Chamba State the experiments were very successful: one seer of seed yielded 35 seers of rice of a very plump and good description. The straw was about twice the weight of the native straw. When cooked, the rice was pronounced equal to the ordinary rice of the locality. The Superintendent, Colonel McAndrew, considers the rice well suited to the soil and climate of

Chamba. He writes:—"It gives a larger return of both grain and straw than any rice now grown, ripens earlier, and is not so liable to be shaken by wind or injured by heavy rain; it is also as an article of food as good as any rice grown, except the Bans-mutti and one or two superior kinds, which only grow in superior soil, and are cultivated to a limited extent. I have preserved all the seed obtained, and will have it sown next season."

The Financial Commissioner remarked upon these reports that they were not so complete as might have been wished, but he continued as follows:—

"7. The Punjab cannot be considered a rice-growing country.

"The Crop Return for 1871-72 shows the following area of the principal grains cultivated:—

Wheat	...	5,366,000 acres.
Jowár	...	1,925,000 "
Bájra	...	2,480,000 "
Indian corn	...	882,000 "
Barley	...	1,658,000 "
Gram	...	903,000 "
Moth	...	752,000 "
Rice	...	660,000 "

"It will be seen how small the cultivation of rice is as compared with other crops. The greater portion of the rice cultivation is in a few districts, which are either watered by the canal, as Amritsar and Gurdáspur, or enjoy a good rainfall, as Umbálla, or irrigation from hill streams, as Kángra and the upper parts of Hushiárpur. In tracts where there are no canals and where the rain-fall is small, as in the greater part of the Multán and Deraját and Hissár Divisions and in the Southern part of the Rawul Pindi Division, there is very little rice cultivation. Rice is grown principally in the following districts:—Kángra, Umbálla, Hushiárpur, Gurdáspur, Sialkot, Karnál.

"8. Rice is not an article of general consumption among the poorer classes in the Punjab, as it is in Bengal. Whether the small consumption of rice is owing to the limited supply of it to be had in the Province, or to an innate preference for more nutritious food, may admit of discussion. But if there were any great demand for rice in this Province, the railway would doubtless bring up supplies from Bengal, where the article is abundant and cheap. In the North-West Provinces the price is much the same as in the Punjab.

"9. The returns, however, do not show that there is any appreciable import of rice into the Punjab. Its price is always high in proportion to other grain. The reverse is the case in Bengal. Consequently it is only the upper classes here who can afford to use it. The cultivators who grow it do so not for their own consumption but for sale, and they prefer kinds which command a ready market and a good price to new varieties which yield more grain of an inferior quality.

"The cultivation requires plenty of water, and hence it can only be successfully carried on in a limited area in this dry Province. These considerations may tend to explain why so little interest is taken by the people here in experiments with imported rice seed.

"10. It has been shown that Carolina rice can be grown in the Punjab, and the same might be said of many other exotics, if due care is taken in the cultivation; but rice cultivation generally in this Province is not of sufficient importance, as compared with other more popular crops, to render it likely that any great success will ever be obtained in the introduction of a new variety which, after all, the natives believe, to be inferior to what they are in the habit of growing.

"11. Experiments might more profitably be confined to places like Chamba and Kangra, where rice is one of the most prominent crops, where facilities for irrigation exist, and where experience has shown that foreign varieties are better appreciated than elsewhere.

"12. The experiment will again have a fair trial during the present season, and the results will be reported in due course."

The results of this year's trials confirmed the Lieutenant-Governor in the belief that experiments in rice cultivation in the Punjab are unprofitable, seeing that in the Punjab rice is an article of luxury only used by the richer classes, who will not use an inferior grain like the Carolina rice only because it is cheaper.

But later on the Punjab Government forwarded a report of the result of a trial made on canal irrigated land in the vicinity of the Mian Mir Cantonment, near Lahore, by the Treasurer of the Punjab Secretariat. This report showed that 3½

seers of Carolina paddy produced an outturn of 17 maunds, that the grain was much larger than that of the Indian rice, and on being boiled was of a whiter colour and had a sweeter flavour; that the plant was equal to that of good Indian wheat but stronger, not being liable to be thrown down by a strong wind or rain; and that the zemindars expressed their desire to be supplied with small quantities and were of opinion that it was far superior to Indian rice. The Treasurer was asked to distribute a portion of his produce to the zemindars, and to continue the trial himself also.

34. In the Central Provinces "no restrictions were imposed on the nature of Results in the Central Provinces. "the experiments to be undertaken, and it "was left to the discretion of the respec-

tive officers to sow the seed in one place under their own or a subordinate special supervision, or to distribute it among landowners likely to take an interest "in the result of the experiment." Reports on the result having been received, the Chief Commissioner observed that some want of care was evinced in several of the districts in carrying out the experiment, and that the results obtained in the districts of Jubbulpore, Bhandara and Sambalpur were alone interesting. These were thus detailed:

In *Jubbulpore* the seed was sown near the city on an area of three roods, the ground having been embanked and manured. The produce obtained was 600 lbs. or 12½ fold. The outturn of indigenous seed in adjacent land was only six or seven fold. The result of this trial seemed to establish—

- (1)—That the Carolina paddy remained uninjured by wind and heavy rain, when the surrounding indigenous rice was quite prostrate.
- (2)—That the outturn was considerably greater than that of country paddy.
- (3)—The husk is thinner, and yields a larger proportion of clean rice, and does not readily drop its seed.
- (4)—The straw is larger and stronger than that of the country paddy.

The great disadvantage is that the quality of the rice is coarse and inferior, and hence not readily bought for seed purposes.

Bhandara.—Though the soil was not perhaps the most suitable, the water-supply was very good. The plot was ploughed and manured, and the seed sown on 22nd June. It germinated on the 28th June, and on 29th July the young plants were transplanted. On 29th August weeding was commenced. On 22nd September the ears were first visible, and on 18th October the crop was reaped. Each ear contained on an average 126 grains, the yield being about ten-fold. The rain-fall, though copious, was seasonable.

Sambalpur.—One-third of the seed was sown in the jail garden, and the remainder was distributed in small parcels among villages.

The soil of the jail garden is a yellow sandy loam, which forms the prevailing rice soil of the district; the land appears to have been manured, which is not customary with ordinary rice lands. On 1st June 16lbs of good seed were sown broadcast, and the plants as they came up were treated in the manner customary in the district. On 20th October the crop was cut, and yielded 302lbs, or nineteen-fold. The husk was strong and coarse, but the rice was of the best quality. The straw was much stronger and larger than that of the indigenous varieties. Some experiments in the outlying villages were made on a smaller scale than these. Still the results were considered of importance, as they showed that, under precisely similar circumstances, the Carolina seed gave a considerably larger return than did the country varieties. The experiments were watched with much interest by the Gountiyas, and several applications were made for Carolina seed.

In conclusion, the Chief Commissioner considered that the Carolina plant had in these trials shown itself to possess the advantages described in the resolution of the Government of India dated 12th August 1871. He questioned, however, whether, in places like the Central Provinces, where grass is plentiful, rice straw will replace it for thatching purposes.

35. In the Bombay Presidency experiments were tried with 26 barrels of seed imported by the Bombay Government direct, and distributed in the following manner:

	Barrels.
In Sind	6
In the Northern Division	11
In the Southern do.	9

In the first of these three divisions of country the only successful result which could be boasted of was one obtained in the Shikarpur Collectorate where the

outturn was a little less than 30-fold. The grain produced was whiter and thicker than the best quality of Sindhi rice, and according to the native taste it was excellent. The cultivators were anxious to obtain the seed, and the quantity produced was bought up for re-distribution with a view to testing the acclimatized seed. The Deputy Collector added that the straw was coarse and not so suitable for fodder as that of the Sind grain.

In the Northern Division also failures were the general result, except in one village in the Panch Mahals where the produce averaged 50lbs. of rice on 1½lb. of seed: this proportion, however, did not, it was stated, contrast favourably with country rice.

In the Southern Division likewise one successful experiment was reported against many failures. The success was in one village in the Ratnagiri Collectorate, where six seers produced 3½ maunds of paddy. It was stated that in this instance the soil and the mode of cultivation were exactly suited to Carolina rice. It was inferred that the soil for such rice must be the drier description of rice land, and that the mode of cultivation to be followed should be exactly that which is adopted for the "halve" or early growing rice.

Now as to the failures there were 22 reported. The causes of the unfavourable results were explained by the Commissioner of Sind as "owing to the instructions "regarding the sowing of the seed having been but imperfectly followed, to the flood- "ing of the fields that were planted, or to the want of interest taken in the trials."

In the Northern Division the failures were said to have been caused by floods, by the stoppage of irrigation, and more generally to the unsuitability of the soil. In the Southern Division it was reported that the seed did not germinate in some places, and that in others the excessive rain-fall was unfavourable to the growth of the crop.

The Government of Bombay added that the results were almost universally unsatisfactory, and that they were of opinion that except perhaps on model farms, where proper attention could be paid to the subject, it was useless to proceed further.

It may be noted that experiments were made in the year under report in the model farm in Khandeish, and that they failed entirely, some "from the effects of "the late floods", others "from the stoppage of irrigation".

36. In East Berar four trials were made in four different localities, apparently with some care, manure and irrigation having also been resorted to; but the attempts did not produce any useful results. It was reported that the districts were not suited to the cultivation of rice.

In West Berar also the results were not satisfactory; experiments were tried in five localities. In one instance, however, a "small bagful" of the seed, sown in about half an acre of low marshy ground in Bassim produced about 25 lbs of paddy: the plants had grown luxuriantly, the grain was large, compact, and of good quality. The Deputy Commissioner was on the whole of opinion that experiments with Carolina paddy in Berar would merely result in a waste of money, as it had never been a rice-producing country, and it was not likely that the koonbi would abandon his cotton cultivation for that of rice, even if he were provided with means of irrigation which are at present sadly wanting.

The Commissioner of the Berars said "whatever results may yet prove to be attainable towards the introduction of this kind of rice in the Assigned Districts, those which have as yet been obtained are not very encouraging."

37. In the Nizam's Territories experiments were tried in four districts. The results may be summarized thus:

Results in the Nizam's Territories.			
DISTRICT.	Seed sown in seers.	Area and description of ground.	Yield.
			Mds. Srs.
Medak ...	9	320 square yards of land of the first sort.	2 0
Indole ...	7½	.....	3 11
Sahibnagar	40	.....	6 0
Kosgi and Dungal	15	.....	12 3

The Resident in forwarding these reports observed that even the last yield (which is a fair one) "would appear to be below that which may be expected of a seed, the productiveness of which is considered to be so very much superior to that of the indigenous variety. And possibly, the reason for the comparatively small return may be found in the remark made by one of the officials to whom the duty of making these experiments was entrusted by His Highness the Nizam's Government, namely, that if the seed had been sown in the 'thabi', or hot season, the return would have been in the proportion of one maund of 50 seers to every seer of paddy sown."

38. In Coorg, seed was distributed to five gentlemen, two of whom did not send any report. Of the three others, two reported that the experiment was a failure, and the third said that the seed had been given to his horses by a mistake, in place of the ordinary rice. The Chief Commissioner observed thereon that "recent experiments, and those made in previous years, go far to show that the climate of Coorg is unfavourable to the cultivation of this grain." But he added that the experiment "has hardly had a fair and scientific trial."

Results in Coorg.

39. In the Madras Presidency trials were made again in nine districts. But no encouraging results were obtained, except in a few very small patches of ground in three districts. Excess of water from unusual rains seems to have been the chief cause of the failures. But "where accident did not intervene and ordinary care was exercised in the cultivation on suitable soil, the yield of grain was large and the straw was long and good." Thus, for instance, in the three districts referred to, the following results were obtained:

Results in the Madras Presidency.

Results in the Madras Presidency.

		Number of plots.	Total area.	Seed sown.	Grain harvested.	Bushels to the acre.
				lbs.	lbs.	
Nellore	...	3	69	90	1,008	37
South Arcot	...	3	2.90	177	3,780	33
Coimbatore	...	3	1.32	150	1,950	37

The Board of Revenue observed that the ryots showed no willingness to give the exotic paddy a prolonged trial; and the reasons for the comparative failure of the crops were, the Board thought, those adduced in the previous year by the Superintendent of Government Farms with regard to the condition of the sub-soil. This the Board remarked was a "permanent and not easily surmounted" obstacle. But still they noted that in South Arcot the ryots, who grew the Carolina paddy, preferred to take their share in grain rather than in money, and that the Deputy Collector, who conducted the experiments, seemed to have had no difficulty in disposing of the Government share.

There was then a considerable stock of seed on hand, mostly grown in the Presidency, and the Local Government said that no further supply of seed was immediately required.

40. The Chief Commissioner of British Burma furnished his report on the 14th February 1874. Twelve trials seem to have been made in twelve different localities in the Pegu Division. In a great majority of cases the sowings altogether failed, owing, it was said, to proper care not having been taken; to the damage done by bandy-coots and birds; to non-experience in the method of cultivation required; to the want of rain, and so on. One experiment conducted by the Agricultural and Horticultural Society had been promising, the plants were growing vigorously, when a whole colony of small white rats attacked them, and caused destruction to the crops. But the Province was not entirely devoid of good results in this year's trial cultivation, and a certain measure of success was attained in the Henzada District which seems worthy of note. There 15 seers of seed were sown in a portion of paddy land close to the town of Henzada, alongside of some native Kyauk-tsan paddy, and a skilled Burmese cultivator was engaged to attend to it, both the crops being treated in precisely the same way. On the 6th July 1872, the seed was sown broadcast, no manure having been employed in improving the soil, and on the 5th August the

seedlings were taken up with the object of being transplanted: the native plants endured the pulling up very well, whilst fully half the Carolina plants broke off close above the roots, and even those which had their roots perfect failed in numbers. The Carolina paddy, however, matured ten days before the native paddy, and the out-turn of rice from cleaned paddy was twelve per cent. more. Great difficulty appears to have been experienced in threshing out the grain, which adheres to the ear with great tenacity. The Burmans who ate the cooked Carolina rice highly approved of it, and compared it to the best of their own grain.

41. In May 1872 the Superintendent of Port Blair and the Nicobars submitted a report on the experimental cultivation of Carolina paddy there during the years 1870 and 1871. The results obtained, although variable, were very satisfactory in some cases, and an extract from the report may here be quoted:

"2. Early in 1870 ten seers of imported Carolina paddy seed were received from the Agricultural and Horticultural Society of India. The seed was planted in a seed-bed at Port Mout in the last week of May, and was transplanted in July. The crop was reaped in October and 7,010 lbs. of paddy were obtained. In December 1870 a second crop of 3,032 lbs. of paddy was reaped off the same fields, and a small third crop was afterwards cut.

"3. In the following season (that of 1871) the acclimatized seed saved from the 1870 crop was largely distributed amongst ticket-of-leave and self-supporting cultivators and was sown in fields cultivated by labouring convicts at Aberdeen and Corbyn's Cove. The ticket-of-leave and self-supporting cultivators as a rule sowed broadcast in May and early in June, whilst nurseries were prepared at Corbyn's Cove and at Aberdeen Reclamation, section 3. The seed in the former district was put down in the middle of June to form a succession crop to the Indian corn there planted, but unfortunately, through unavoidable delay in the formation in the paddy fields, most of it became too old for transplanting, though a few fields were planted out. The seed sown in section 3 of Aberdeen Swamp in the last week of June germinated well; was transplanted in the end of July into about 7 Bengal beegahs of first-rate paddy land, and the crop was cut in November giving a good return; one beegah was measured up, and its yield was 10 maunds of paddy and about the same weight of dried straw. A second crop was cut in January 1872 off the same beegah, and its outturn of paddy was found to be four maunds, thus giving a return of 14 maunds per Bengal beegah, which is, I believe, a heavy crop.

"4. The Carolina paddy sown broadcast by the cultivators in Phoenix Bay came up strongly and flowered, but most of the crop was destroyed by the 'gundhee' and was not worth the trouble of cutting. Most of the self-supporters' crops in Corbyn's Cove fared similarly: some of them, however, obtained a small return from their fields. In some clearings innumerable caterpillars attacked the plants and reduced them to the condition of broom stalks. The successful Government cultivation in Aberdeen Reclamation would probably have suffered much from the 'gundhee,' had not some weakly men been employed during the time the grain was in process of formation in gundhee catching. This of course could not be done by self-supporting cultivators or in Carolina paddy cultivation on a large scale. The Carolina paddy appears to be more liable to be attacked by the 'gundhee' than the paddy raised from Bengal seed. Last season the two descriptions were growing side by side in the Corbyn's Cove clearing, and the difference was remarkable, much of the Carolina grain being destroyed, while the Bengal plants were comparatively untouched. Our fields during the past year were in a rough state, having only just been cleared, the stumps being left in them, and timber lying in all directions. During the past dry season they have been stumped and cleaned, and possibly we may in future suffer less from the 'gundhee' and caterpillars. The native explanation is that the Carolina being a sweeter grain than the Bengal paddy, is preferred by the 'gundhee'."

"5. It is possible that we do not yet understand the proper amount of water to be allowed to the Carolina plant. In December last I saw a very fine field of Carolina paddy belonging to a self-supporting cultivator in Corbyn's Cove, No. 2 clearing, close to the new village. This field was situated on high land, and its ridges were very small; the field was dry when I saw, and at no time could have retained much water, yet the crop was above its average, and the owner told me that it had quite escaped the ravages of the 'gundhee'."

"6. The paddy planters down here are very divided in opinion with regard to the cultivation of this paddy. On the one hand, they see that the shortness of the stem and the bushiness of the plant enable it to stand the high winds of the South-West monsoon, much better than the Bengal variety. On the other, the destruction of a large part of their crops during the past season by the

"gundhee" has raised doubts as to whether it can be profitably cultivated; with, however, the experience gained last year, several are willing to try it again."

The Superintendent intended prosecuting the trials further, and sowing during the ensuing year (1872) 25 bighas of imported Carolina, the same area of acclimatized Carolina, and the same area of Bengal paddy, in the Government paddy fields, Corbyn's Cove. He also intended distributing some of the imported Carolina seed among the ticket-of-leave and self-supporting cultivators, with orders to each paddy planter to grow at least one field of it. There was an ample supply of acclimatized Carolina paddy seed at the stations where paddy planting had been carried on, and the Superintendent offered to transmit some to Calcutta if needed.

42. The Government of India on the 17th June 1872 transmitted the above Government of India's further proceedings. report from Port Blair to Her Majesty's Secretary of State for India, and stated that as the results obtained in some places have been so encouraging, especially in Port Blair, where an outturn of five hundred fold had been obtained, they were anxious of prosecuting the experiments, and accordingly they asked that the supply of 200 additional barrels, which could not be furnished in time for trial in the past season, may be sent out direct to India from the United States, as early as possible, and be taken from the very best Carolina production of the year which would ripen in November of the current season.

1873.

43. In January 1873 the Secretary of State advised the Government of India of the despatch of the supply of seed via Liverpool, and intimated immediately after that the seed had been tested by the Reporter on the Products of India at the India Office and reported to be bad, as no signs of germination had appeared.

The seed reached Bombay at the end of the same month, and both there and at the Calcutta Botanical Gardens small portions of some of the barrels were tested; but the seed appeared to be in good condition, and 9-10ths of the small quantity sown at Calcutta germinated freely, and at Bombay also the results were perfectly satisfactory.

The following distribution was then made at the end of February 1873 by the Government of Bombay, under whose care the seed had been retained:

	Barrels.
Madras	20
Punjab Government	8
North-Western Provinces	8
Oudh	6
Central Provinces	16
Hyderabad	6
Mysore	4

The remainder was directed to be sent down to Calcutta, whence were transmitted to—

	Barrels.
Bengal Government	100
British Burma	20
Port Blair	12

44. In May there came a complaint from the Mysore Province to the effect that the seed supplied contained an unusually large percentage of husks. About the same time the Government of Madras reported that the seed received was in very good order, that it contained at least 87 per cent. of vital grains, and that the colour was unusually good and the grain well formed; but that unfortunately it contained about three per cent. of some other variety of paddy which seemed identical with the red kar of the country. The Government of India thereupon called upon all the Local Governments and Administrations to whom the seed had been supplied for a report as to the proportion of husks and rubbish found in it. The reports showed that a few of the barrels contained a fair proportion of good seed, but that the majority had from 20 to 50 per cent. of husks and rubbish. The Government of India represented this to the Secretary of State, and said—

"It has been suggested that all rice-seed received from abroad is packed in husks in order to preserve its vitality; but, even allowing that this precaution was rightly taken, there would appear to have been, in the present instance, a very much larger quantity of husk than was necessary, and there can have been no excuse for the admixture of rubbish."

"Complaints have also been made that the seed was not fresh, and that it did not germinate freely."

"Under these circumstances, it would appear that sufficient care was not taken in the selection and packing of the paddy, and we trust that Your Lordship will cause such steps to be taken as will ensure a more satisfactory character in future supplies."

Thus it is seen at the outset that the experimental cultivation of Carolina paddy was this year begun under unfavourable circumstances.

45. The Superintendent of Port Blair furnished two reports: one was on the results of the sowings which he stated, in the previous year, he intended to prosecute. This showed that the outturn of paddy raised from imported seed exceeded on the average that of the acclimatized seed by just two maunds per bigha, the imported sort having produced 11½ maunds per bigha against 9½ maunds from the seed raised in the settlement. The quantity of straw was in both cases very much the same.

Taking the acclimatized against the Bengal paddy, it was found that the former produced also 2 maunds per bigha in excess of the latter. The Superintendent therefore stated that it would not be necessary to continue importations, as the acclimatized seed "if it does not eventually deteriorate, gives a very satisfactory outturn which is above the Bengal variety."

The sowings of 1873 were thus described: the seed after having been put in wet bags to germinate, was put in nurseries which had been thoroughly ploughed into puddle and well manured with cow-dung. When the plants were about six inches high, a large portion was attacked by caterpillars; they were, however, destroyed by immediately filling the beds with water to a height above the young paddy: the caterpillars floated and were caught by thousands in baskets. No damage was done to the young plants; and transplantation was made in about 24 to 30 days from the date of sowing, in fields which had also been ploughed into puddle, but which were not manured. The quantity of seed used averaged 6lbs per bigha. After transplantation, the paddy grew well; but a small portion of it, that which was sown later in the season, was severely damaged by heavy storms and downpours of rain. Harvesting commenced on the 17th November, and lasted till the end of December. The crop which was in no way damaged by either wind or rain averaged eleven maunds per bigha.

An experiment was also made by sowing the paddy broadcast in the fields, but though the outturn was fair, about eight maunds to the bigha, "the crop was nothing like so fine as that which had been sown in the seed beds and afterwards transplanted."

From these experiments it was deduced that Carolina paddy "is better suited to Port Blair than any other paddy," and that the best native system of growing the Native paddy is also the best system of cultivating the Carolina variety. Concurrency was also expressed in Mr. Robertson's* theory, that perfect filtration, in

which the water will pass down through the soil and away by sub-soil drainage, either artificial or natural, is essential for good crops of Carolina paddy. "Where the soil was somewhat of a sandy character, there the paddy did best. On very heavy soil, where the water was perfectly stagnant, the paddy was decidedly inferior."

In conclusion, the Superintendent was so thoroughly satisfied with the Carolina paddy, that in 1874 he sowed no other description of seed.

In Port Blair then, the experiments of the two last years may be looked upon as having proved that Carolina rice can be grown in the Island, and the results as having established the cultivation of that rice in supersession of "Bengal rice."

46. In Bengal, however, uncertainty as to the results still continued, and in this year (1873) fresh obstacles caused an increase in the failures. The scarcity of rain which was so much felt in this year, and which produced the "Bengal and Behar Famine of 1873-74," was the first cause of failure. A second cause lay in the late arrival of the seed in the interior of the country where the experiments were to be conducted. It seems that the seed, which had arrived in Bombay at the end of January, was detained there for examination and report, and that it was not distributed from there until the end of February. It reached the Board of Revenue at Calcutta on the 22nd March, and was sent off to the Commissioners of the Divisions of the Province in the middle of May. The Commissioners then made their distribution to district officers and others for trial sowings. Complaints then came up from some districts that the seed was bad, from other districts that it came too late, while others again complained of the presence of an undue proportion

of husks and rubbish in it, and some that the seed was not of one variety, but appeared to have been mixed with other sorts not of the real Carolina variety.

The reports recorded for the most part (as observed by the Local Government) various failures "brought about in the usual way by drought, floods, insects, birds, and in some cases by neglect." The Lieutenant-Governor thought that it would be useless to review the history of these failures "as it is upon the successful experiments that our attention must be concentrated with a view to gaining an insight into the conditions which appear to command success." He thought, on the whole, that in spite of a complaint here and there to the contrary, it was clear that the seed was really good, and that it arrived in the districts in full vital condition.

"But," the Local Government continued, "an important question is raised in more than one of the reports as to the homogeneity of the seed, while it is of course essential to the conduct of these experiments that the seed should either be of the same variety throughout, or that notice should be given that it consists of more than one kind, and the varieties be distinctly marked for identification."

Mr. W. C. Taylor, Deputy Collector of Pooree, for instance reported—

"In two barrels of seed supplied by Government in 1871 and 1872, I found many varieties of grain, from one sample no less than 16 sorts, and from the other 10.

"From my own experiment I have found that only one out of the 16 sorts requires deep cultivation, and that all the other varieties can be grown well in exactly the same way as the ordinary Indian sorts of rice. I also doubt that the sort requiring deep cultivation, which forms the bulk of the samples of seed received, yields even under favourable circumstances, heavier crops than some sorts of native dhan."

On the other hand, of the sowings now under report, he said—

"The seed received this year was not mixed, but was all of the dullish red, rough grain yielding white rice, but requiring deep cultivation. This variety will not be popular in this part of the country, as deep cultivation is impossible, and the grain adheres with such tenacity to the straw that the labour of treading out is too much for the people of these parts, who would rather a portion of their crop fell on the field than take so much trouble. The yield also is not much in excess of that of ordinary native sorts of rice."

This belief that the consignment contained several varieties of rice seems to be further borne out by the experience of Mr. Hoskins, Superintendent of the Ranchee Jail. It had always been hitherto asserted that the husking of the Carolina paddy was more difficult than that of the indigenous grain, but Mr. Hoskins reported—

"During the past season all the crops (paddy) were damaged by the failure of the rains, but the produce obtained in this experiment would seem to show that Carolina paddy would be very profitable to the ryots in every way, as it does not require any special labour, care, or skill in the cultivation. A seer or more which has been husked for trial was found to take only about half the usual labour in husking. The husks are brittle, and separate more readily than in the case of ordinary paddy. The rice is of a very good white colour."

The experiment here referred to was made by sowing 4 seers of seed on high sandy soil in the jail garden on the 21st June, and by transplanting the seedlings to a plot of clayey soil which had been well ploughed and manured. The plants attained a height of 5 feet, and the produce was 4½ maunds of paddy, or 45 fold.

Mr. Taylor seems to have tried an interesting experiment with a mixture of seeds, and his results point to the possibility of our obtaining an acclimatized variety of seed, possibly hybrid, or a cross between the Carolina and native varieties, which may produce a largely yielding plant. He said—

"Of my acclimatized seed of sorts picked out from the crops obtained from mixed seed received from the Superintendent of Canal Revenue three years ago, I tried several sorts, two sorts proving very successful. Of one sort, yielding a fine rice of good colour and flavour when cooked, and having a small yellow grain rather broad for its length, I could only pick out one seer in 1872, and this one seer was sowed in a seed-bed in June and planted out in July on four guntas, or 3,036 square feet of land. The yield in October was 161 seers or 161 fold. The land in which this experiment was made was medium quality land, and only a few baskets-full of cow-house manure were applied. The ploughing was such as is ordinarily given by ryots, and the crop was irrigated two or three times, depending chiefly on the rainfall. This variety is likely to prove very popular, as the yield is equal to the heaviest yield in these parts of the late, or sarud dhan, whilst it can be grown on high land, and is an early crop not requiring much care or water. I have saved about 100 seers of seed for distribution. This crop grows to about 3 feet in height and gives an ordinary outturn of straw. It does not require deep cultivation."

Some of this acclimatized seed was given to a Native planter with the following result:

"I also gave the same man three seers of my acclimatized seed, long yellow grain with white rice. He sowed broadcast on four guntas of similar land; but, as it came up too thick, he planted out two guntas more with the thinnings in August, and got a total crop in November of 114 seers, or 38-fold. This rice grows to a great height, and yields a heavy crop of straw, is easily threshed out and does not require deep cultivation."

Mr. Taylor seemed to doubt whether the tap-root variety of the Carolina paddy will yield crops equal to some of the better sorts of Native rice; and he made a statement concerning the yield of ordinary paddy which is worth noting:

"The Carolina plant does not get very bushy, and seldom yields more than two or three heads of grain; whilst most of the surface-feeding varieties throw up numerous shoots, and yield, under favourable circumstances, 10 to 20 ears of paddy. Last year I sowed a single seed of 'Nyagurh Kanhze', a common Native variety not much esteemed by the people. The plant was given plenty of room and water, and I took the trouble to count the grains produced by that one seed, and there were nearly six thousand. This will shew how very prolific ordinary paddy will be under favourable circumstances. A good crop of late paddy frequently gives 65 to 80 maunds of unhusked paddy to the acre, or 30 to 35 maunds of rice. The average yield in Khoordah of husked rice is about 20 maunds of 80lbs per acre, taking all fair crops—early, intermediate, and late—together."

On the other hand, we find Babu Hitlal Misser, zemindar of Mancur, in the Burdwan District, asserting that Carolina paddy requires less time, labour, expense and rain, while it gives a richer harvest than country paddy; and he adds that the rice is "very good in taste, has a peculiar sweet scent, and can be used by the higher classes of the people". This experiment was made with three seers of seed which he sowed on the 27th June, transplanted at the end of July, and reaped on the 30th October, getting three maunds of paddy, or 40-fold. Mr. F. F. Peppé, Sub-Deputy Opium Agent in Lohardaga, sided with the Babu in the observations he made:

"Comparing individual ears of the Carolina paddy with the best heads of rice in the adjoining fields, it was found that two ears of Carolina were equivalent in weight to the best three ears of other rice in the adjoining fields, and that the number of grains in two ears corresponded to the number in 3½ ears of the common rice; and further, that the proportion between the husked rice and unhusked rice was in the common rice as 24 to 40, whereas the Carolina paddy gave 30 to 40, being very greatly in favour of the Carolina. The experiment was considered by all the ryots, who sowed the two kinds of rice in juxtaposition, as highly favourable to the Carolina paddy."

This testimony does not agree with that of Mr. Taylor. Mr. Peppé further quoted some experiments by the Manager of the Court of Wards in Lohardaga, who was convinced from "what he had seen this year that in good open soil, in which the roots of the plant can penetrate deeply and find nourishment, the Carolina paddy will be found superior to any other variety, and that it will fully repay good cultivation, even as an ordinary crop, without any reference to its superior value in Europe. To cultivate it successfully some experience is perhaps necessary, but there is nothing to prevent the average cultivator from producing better crops of this paddy than he could do from any other variety of country paddy."

Mr. Herzog, of Lohardaga, wrote concerning his experiments that the country paddy in the neighbourhood, sown under similar conditions, yielded less, and remarked that a Native near Lohardaga, who gave the seed a trial, reported that the yield was greater than that of country paddy, and was liked very much by the villagers.

The total quantity of the year's produce that was preserved, and believed by the Board of Revenue to be available for further experiments, was—

About 1½ maunds in Balasore (scattered about),
" 4½ " in Burdwan Division,
" 5½ " in Lohardaga District,
" 1½ " in Jessore,
" 4 " in Patna Division (doubtful),

and a few seers in the Sunderbans and 24-Pergunnahs.

The Lieutenant-Governor, however, thought that "in our present state of uncertainty as to the precise variety of the seed in each case, and the exact mode

"of cultivation that has produced it, this half-acclimatized seed is hardly valuable for the purpose of further experiment".

Thus Bengal found itself after the experiments of 1873 just where it was before the experiments had been undertaken, so far as a supply of country grown stock of Carolina paddy was concerned, but it had earned some experience which apparently pointed to the absolute necessity of conducting such experiments in an enlightened, continued, and careful manner, and not in a haphazard desultory fashion.

47. In *Oudh* the trials resulted in complete failures owing, it was said, to a scarcity of rain. In *Sultanpur*, however, where the *Carolina* and country paddies were tried side by side, the country variety produced more than double the amount of *Carolina* paddy, and it also required less irrigation. A similar result was obtained in *Fyzabad*. In *Rai Bareilly* in one place eight seers produced 1 maund and 13 seers.

The Superintendent of the Department of Science, in transmitting these reports to the Chief Commissioner, thought that it was useless to continue the experiments with *Carolina* paddy, as no success worth mentioning had in any case been met with. The Chief Commissioner made no remark, but simply forwarded the reports to the Government of India.

48. In the *North-Western Provinces* the sowing of the *Carolina* rice in 1873 was entrusted to special persons. The rains, however, were very unfavourable to the rice crop, and the Native crop also was an unusually bad one; but the *Carolina* rice appears, on the whole, to have fared worse than the Native rice: in one instance it was attacked by insects when the adjacent crop was not so attacked. This circumstance, the local Board of Revenue remarked, "is not an uncommon one with the finer kinds of rice, which are softer in ear when the rice-attacking insects prevail".

The only district in which any appearance of success was obtained was *Saharunpur*, and this district was the one which, in the previous year, also showed a better result than most of the other districts. In the year under report "the seed was", the Collector said, "distributed to six zemindars in three places; the outturn was more than ten maunds an acre. The crop was not in any way damaged by the rains; and although the outturn this year was not so good and plentiful as in 1872, yet it was larger than that of country rice sown in similar conditions of soil".

It will be noticed that nothing is said as to the quality of the seed, and as to the date of its arrival in the districts. The only cause of failure is said to have been the unfavourable season, but the country rice in some places is said not to have been so bad as the *Carolina* variety, and this would perhaps lead to the inference that either the seed was bad, or that the cultivation was badly carried out.

49. In the *Punjab* all the experiments were made with the imported seed except in *Rawal Pindi* and in the *Chamba* State where the produce of the previous year's seed was used. The general result seems to have been a falling off from the rate of outturn obtained in 1872. The season of 1872 had been a very rainy one; and the failures of 1873 were attributed to a great extent to floods. The reports may be summarized in the following statement:

Districts.	Outturn of 1872.	Outturn of 1873.	Remarks of Deputy Commissioners on the sowings of 1873.
Hushiarpur ...	Not stated ...	Not-stated ...	The progress of the experiment was not looked after, and the results are not trustworthy.
Kangra ...	11-fold ...	9-fold ...	Both years' outturn less than that ordinarily turned out from the indigenous seed.
Gurdaspur ...	30-fold ...	13-fold ...	Very little attention was paid to the experiments.
Sialkot ...	5-fold ...	.....	Outturn considerably under the quantity sown. Causes of failure—inundations, want of rain, blight, field rats, unsuitable soil and carelessness on the part of the cultivators. Natives think the country rice better suited to the soil, and more profitable.

Districts.	Outturn of 1872.	Outturn of 1873.	Remarks of Deputy Commissioners on the sowings of 1873.
Lahore ...	50-fold ...	33-fold ...	Cause of failure—the canal from which the land sown was irrigated, was closed during 28 days. Rice pronounced as before hard and coarse.
Karnal ...	56-fold ...	40-fold ...	Outturn a little over the average yield of country rice. Removal of the grain from the ear difficult owing to its hardness.
Ludhiana ...	Not stated ...	Not stated ...	Soil is sandy and not suited for rice cultivation. Crops, moreover, were damaged by floods.
Hazara ...	.....	9-fold ...	Not liked by zemindars, who pronounce it unpalatable.

In the two districts where sowings were made with the seed produced in the previous year (1872) the following results were obtained:

Districts.	Outturn of 1872.	Outturn of 1873.	Deputy Commissioners remarks on results of 1873.
Rawal Pindi ...	37-fold ...	24-fold ...	Deficiency is attributed to the seed leaving the husk when sown under water. But this is stated to have been the same method of cultivation as that usually employed in the district for Native rice.
Chamba State ...	35-fold ...	Not stated ...	In the previous year a glowing account had been given of the foreign rice. In 1873 no statistics were given, but it was said that the sanguine anticipations of the previous year "have been completely dissipated by the experience of the attempt to raise a second crop from the produce of 1872". The people "have come to the conclusion that the seed greatly deteriorates by acclimatization".

The Financial Commissioner of the Punjab in forwarding these reports said:

"From the general tenor of the reports there seems to be strong ground for concluding that much of the want of success in both years has been owing to the indifference, if not the actual dislike, with which the introduction of a new variety was regarded by the very persons to whom the task of experimenting was entrusted. Colonel Jenkins, Deputy Commissioner of Sialkot, observes that the zemindars 'believe the cereals grown by them and their ancestors to be the only ones worthy of their attention, and best suited to the soil, as well as most profitable to them at the smallest expenditure of money and labour. Their land is too valuable to them, and the people are too apathetic themselves and mistrustful, so that it is impossible to make them embark voluntarily in anything merely experimental in the way of farming'. The opinion seems very prevalent amongst district officers, that experiments of this kind, having for their object the introduction of new staples, improved methods of cultivation, &c., can be carried out with any good results only upon Government farms."

"The *Chamba* experiments are valuable, because it is evident that there the zemindars, unlike those of our districts, took a real interest in them, and expected to gain by the introduction of the new variety. These experiments go some way to show that the *Carolina* seed imported from America, although it can be made to produce an excellent crop for the first season, very rapidly deteriorates by propagation in this country, and the results of the sowings of 1872 and 1873 in the *Rawal Pindi* District tend to confirm this inference.

"Further experiments will be made on the Government Farm at Amritsar and through the agency of Native gentlemen who are interested in agricultural experiments, and for this purpose a further supply of seed is required."

50. In the Central Provinces the year 1873 was a most unfortunate one for experiments in rice cultivation: the rainy season was very unpropitious, and the

Results in the Central Provinces.

success obtained in the preceding year in the Jubbulpore, Bhandara, and Sambalpur Districts were not repeated. But, on the other hand, partially good results were reported in Nagpur and Chanda, where no results worth recording were attained in 1872, and in the Raipur District also the experiments were not without their value. The reports of these three districts may be summarized thus:

Nagpur District.—Of the 320lbs of seed supplied to this district 31 per cent. was bad. The balance of about 220lbs was distributed to the malguzars and cultivators, and a portion was experimented with in the public gardens at head quarters. The results obtained were varying in their character owing to the deficiency in the rainfall of the year; but where irrigation was possible, the outturn was fair, and the crop of straw heavy. In one village 40lbs of seed were sown, the outturn being four maunds of grain, with straw four feet in height. In another village 40lbs of seed gave upwards of four maunds of grain, with straw three feet in height. In the public gardens somewhat less than three maunds of grain were obtained from 60lbs of seed, the straw being four feet in height. With 32lbs of the seed obtained from the trials of 1872, a cultivator took from an area of 16 poles seven maunds and 23 seers of grain, with straw four feet high. The outturn in this circle contained a large percentage of husk, which is attributed to a want of proper preparation of the soil.

Chanda District.—An acre of selected land was sown with 83lbs of seed, which was first steeped; some of the seed was allowed to spring up broadcast, and the rest was used for transplanting. The yield was only 147lbs, or less than two-fold, the seed scattered broadcast being a total failure, and the transplantations being only partially successful. Country rice grown on surrounding fields is said to have thriven well, and to have presented a striking contrast to the poor condition of the crop produced from the exotic seed. Some of the experiments conducted in outlying parts of the district were, however, more successful: for instance, in one place 32lbs of seed sown and transplanted after the Native method yielded a crop of 252lbs of grain, or nearly eight-fold; and in another place, a ten-fold yield was obtained from transplanting.

A trial was made in Chanda to test the truth of the statement that Carolina paddy will yield a second crop in the same year if the ears are only cut and the stalks well watered, but the attempt did not succeed.

Raipur District.—Experiments were made in various soils with the rice seed obtained from the crop of the previous year as well as with the fresh seed. In two cases a three-fold crop was obtained from the fresh seed in soil situated under a tank, and having the advantage of water from it. In similar soil acclimatized Carolina rice seed showed better results than the fresh seed. In high ground above a tank the outturn from the new seed was poor, the grain being small, and the amount of husk disproportionately large, while the indigenous and acclimatized seed produced a fair crop. In other soil again the country outturn was twice and four times as good as the crop from acclimatized and fresh seed severally. Experiments in transplantation resulted in the indigenous seed yielding a three-fold crop, while the fresh Carolina rice failed to reproduce the original amount of seed sown. Seed soaked in water till it sprouted, and then sown, failed to come up at all. In the district generally there was a want of success owing to the unfavourable character of the monsoon, and in no case does the crop from the Carolina seed seem to have been more than four-fold.

The local officer remarked upon these trials:

"Although conclusions from experiment of the kind made must be accepted with caution, the reported results would seem to warrant the assertion that a good acclimatized Carolina seed is far more productive than fresh imported seed, and indeed in one locality the yield of the former is said to have surpassed that of the indigenous seed also. These trials, however, cannot be supervised with the available agency in a thoroughly satisfactory manner except at head quarters, and some of the results reported are not perhaps altogether trustworthy. Still it is noteworthy that the superiority of the acclimatized seed is admitted on all sides."

The Deputy Commissioner of Sambalpur, after the experience of the year, said that he suspected that the superior qualities of the Carolina rice "are the result of high cultivation, and that unless it is carefully attended to and grown on well manured soil, it will not be found to give a better yield than the ordinary Indian rice of either straw or grain."

The concluding remarks made by the Chief Commissioner bears upon this point. He said:

In no district in these Provinces is it possible to follow the American method of cultivation, as might be done in a Province in which irrigation works exist, and

experiments here must of necessity be carried on in a very imperfect manner. Still if the natives of the country could once be brought to understand the merits of the Carolina rice, difficulties connected with its cultivation would be readily overcome, or at least greatly diminished, so that, although the American system could never be adopted in its integrity, still something might be done towards rendering the present Native method of cultivation more suited to it. There is only one district, however (Sambalpur) in which the landholders are said to take an interest in the experiments, and the time has not yet come when real assistance from the Native population can be looked for. And this after all is the practical view of the question, for without the co-operation of the people a few experiments here and there can result in no good.

51. In the Berars there was not one single instance of success, and this unsatisfactory result was attributed to the

Results in Berar.

scanty rainfall of the season and to the unsuitability of the soil and climate to the production of the Carolina rice. The failure can certainly not be put down to any want of attention or care, for in East Berar "the best arrangements that could be made were made by the district officers to give the rice a fair trial". And in West Berar, besides being sown carefully by district officers, the seed was tried on the Government Farm at Akola in three different ways,—

- (1) some seed was sown in beds, well ploughed and manured;
- (2) seed was allowed to germinate in water and then sown in beds; and
- (3) trenches were dug 15' x 1½' x 2', and the plants that were reared in them were almost constantly kept standing in water.

In the three trials the seed germinated well. The first two experiments were entire failures, although the cultivation was carefully conducted and water was regularly given. In one part of the experimental plot manure water was applied, nevertheless the plants withered without coming to maturity and yielded nothing. The third experiment was also a failure; the plants in the trenches survived longer and threw out a few ears, but they all in time withered and died away; water was applied, but with no effect.

The Resident concurred with the local officers in believing that the cultivation of the Carolina rice was unsuited to the soil and climate of the Berars; and it will be remembered that he made a similar statement after the previous year's cultivation.

52. *Results in the Nizam's Territories.*—Better results than the above were obtained in Secunderabad; the trial had been entrusted to a cultivator of long experience who made the following sowings:

Forty-nine seers of Carolina paddy were sown on a good soil below the Hussain Saugor tank, and the yield was 381 seers, and straw 17 bundles of 70lbs each.

Forty-nine seers of Secunderabad paddy (Arcotty) of six months old were sown contiguous to the above, and the yield was 765 seers, and straw 30 bundles of 70lbs each.

Six seers of Carolina paddy were also sown on another piece of ground, and the yield was 66 seers, and straw 2 bundles of 40lbs each.

Six seers of Secunderabad paddy (Arcotty) of six months old were sown contiguous to the above, and the yield was 80 seers, and straw 3 bundles of 40lbs each.

The local officer by whose instrumentality these trials were undertaken remarked:

"The result of the experiment is thus to show a decided inferiority in the Carolina paddy; but the seed was apparently old; some of it had, perhaps, altogether lost its vitality. The soil in which it was sown was not a pure regur soil, but somewhat mixed."

In the Mysore Province the trials, although partially successful in certain districts, did not prove a general success, and the cause was said to be the want of proper water-supply. In the Tumkur District a crop which was in a flourishing condition failed to come to maturity from this cause. Altogether there were about 27 failures reported. Against these can be placed the following partial successes,—

in Kadur a crop was raised on dry ground, with four seers of seed, the outturn being 20 seers;

in Chitaldrug, in two cases (out of seven) an outturn of eight-fold was obtained; and

in Bangalore a piece of good land was sown in January with seven and a half seers of the seed, which had been previously kept moist for three days in straw till the seed germinated. In about a month and half the crop was ten inches high, and was twice weeded. It was harvested in the middle of June, and yielded 480 seers.

In *Coorg* also the experiment was unsatisfactory. The crop, when it succeeded, did not produce more than the common kinds known in the country.

The Chief Commissioner of the two Provinces in reporting these results said he was driven to the conclusion "that these desultory experiments are useless, and that they only take up the time of officers to no purpose". He was further of opinion that "as the growth of Carolina paddy has passed beyond the experimental stage, and the conditions essential to success are tolerably well understood, it is merely wasting the grain to force it upon ignorant ryots who are unacquainted with the mode of culture, and who, should the crop by chance prove a success, will very likely misrepresent the outturn". The Chief Commissioner therefore proposed that for the future the seed should be entrusted only to intelligent agriculturists who might express a desire to make a trial of it; and he offered to take steps to give such agriculturists every opportunity of coming forward.

54. In the *Madras Presidency* the Local Government had sanctioned proposals of the Superintendent of Government Farms for the grant of prizes, on certain conditions, as to extent sown and quantity of seed produced of the Carolina paddy in the districts of Chingleput, Madras, North Arcot, South Arcot, and Nellore. The prizes were to be 60 in number and to range from Rs. 6-4 to Rs. 50. Due publicity had been given to the matter, but apparently only three entries were made, two being from Nellore and one from Madras. In each case second prizes of Rs. 25 each were granted. The following statement gives the chief particulars of these cases :

		In Madras.	In Nellore.	
			No. 1.	No. 2.
Area cultivated ...	sq. yds.	2,700	1,720	1,504
Quantity of seed issued ...	lbs.	61	77	54½
Period of growth ...	days.	123	133	140
Outturn of grain ...	lbs.	300	324	231½
Ditto of straw ...	do.	710	475	425
Ditto of grain per acre ...	do.	538	912	745

The Nellore report stated that the seed was very inferior, only one-third being vital.

The other instances of success were reported from Bellary where a produce of 17-fold was obtained, from Trichinopoly where 14½lbs of seed yielded 168½lbs of grain in 150 days, and from Malabar where 2½lbs yielded 65lbs. But against these successful results there were failures in Ganjam owing to the sowings having taken place late in the season; in Chingleput, owing to the inferior quality of the seed, which did not germinate; in Bellary owing to the want of water; in Trichinopoly owing to the seed being old and decayed; in Malabar owing to excessive rain; in Tanjore owing to the experiments not having been "conducted with any intelligence or interest".

In the other districts of the Presidency no sowings were made.

55. In British Burma the general result appears to have been a fair average one. There were failures more or less in four districts: thus, in Tonghoo the return was very small, and difficulty was experienced in separating the grain from the ear; the cause of the small return is not explained. In Thayetmyo the failure was attributed to deficient rain and bad seed. In Rangoon experiments were made in three places, in only one place the plants came up well, but were destroyed one night by some loose ponies. In Bassein the failure was caused by the seed being old. In Amherst the cause of the failure is not explained. In Akyab difficulty was experienced in separating the paddy from the stalk, and the grain from the husk, but the quantity of produce obtained was not reported.

These failures and difficulties were counterbalanced by three successful attempts. One of them was in the Henzada District. The Deputy Commissioner stated

that, taking advantage of the experience gained in sowing Carolina seed in 1872, the seed was sown in 1873 on low ground and broadcast. Two and a half baskets were sown on the 18th July, and the crop came up splendidly; but when in full ear and ready to be reaped, the latter rains fell unusually heavily, and the crop, owing to weight of ear, was beaten down in the water and a great portion of it destroyed. Had those rains not been so very heavy, the crop would in all probability have been a fine one. In fact, had they been scanty, the Deputy Commissioner reports, it would have been all the better for the Carolina paddy crop, as that portion of it which escaped was fully ripe, and reaped early in November, while the Native crop, which takes much longer to ripen, would probably have suffered.

The Chief Commissioner observed that this quality of early ripening "is a valuable one, as the Carolina paddy would thus find its way into the export market some weeks before the best kind of Native rice was fit for shipment to Europe".

In all 35 baskets, or about 14 bags, were harvested as the outturn of the two and a half baskets sown. The Deputy Commissioner retained two baskets for further experiments, and forwarded the remainder to Rangoon; and the Chief Commissioner made it over to a local firm to be cleaned, sent to Europe, and sold, in order to ascertain what price it would realize as compared with ordinary Burmese rice.

A second (and the most) successful attempt was made in the Akyab Jail, where a piece of ground, 6,000 feet square, was dug up and prepared, the seed being sown first in a nursery on the 2nd June 1873. Only one-fourth of the seed germinated. A month and a half after sowing, when the plants were 18 inches high, they were transplanted into the piece of ground. In a month after transplantation the paddy grew 4½ to 5 feet high, having thick roots and giving an average of ten stalks, and on some of the heads were counted from 195 to 249 grains; the paddy began to ripen in October, and was reaped on the 26th of that month. The total yield was 575lbs, or 115lbs for every pound sown, or, allowing for one-fourth of the seed being bad, the yield per pound was 143lbs.

The third successful trial was reported by the Agricultural and Horticultural Society of Rangoon—

"A barrel of the same seed (as distributed to district officers) was received by this Society, and a portion of its contents was made over to a Burman cultivator in the Minga-la-doung Township, Rangoon District, who was highly pleased with the seed, and reported subsequently that it had turned out exceedingly well. He had never, he said, seen paddy seed of such large size before, and was quite taken up with it. A small area of ground was planted out in the Society's garden in September, and of the crop, which was reaped in the last days of December, two barrels of this seed were sent to England for valuation and report at the request of a gentleman here to whom a sample was shown. He pronounced it to be a superior grain, and is a competent authority on the subject."

The Society then went on to say:

"Diverse opinions are no doubt held on the subject of the introduction of this grain into the Province, but there is no question that it is far superior to the 'Ngatesein,' so very largely exported to Europe. To add to its good quality it is a three months' ripening paddy, while the 'Ngatesein' requires fully five months or more to mature its growth."

This speciality of early ripening corresponds with the remarks made by the Deputy Commissioner of Henzada.

56. This ended the series of reports received on the results of the experiments made in 1873, and the Government of India on the 9th March 1875 (owing to the late arrival of some of the reports) recorded a resolution briefly noticing the results—

"From the reports received the Governor General in Council notices that, except in Port Blair, in parts of British Burma, and in a few scattered places in Bengal, the record of the results of the cultivation of Carolina rice during the past year has been one of failure. Throughout Northern India this has been for the most part due to the general failure of the rains, which affected the rice crop everywhere; but in many cases it must also be attributed in some degree to carelessness and want of attention on the part of the officers entrusted with the experiments. The Governor General in Council does not consider it advisable to expend any more money at present in obtaining a further supply of seed from abroad."

"(2.) The experiments during the current year should accordingly be carried on, as His Excellency in Council hopes that those of 1874-75 have been, with the seed saved from the produce of last year's sowings, and they should be concentrated and properly supervised."

* * * * *

"(4.) The Governor General in Council would wish further enquiry, accompanied by experiments to be made respecting the supposed hybrid acclimatized variety of Carolina rice, mentioned in the 3rd paragraph of the letter from the Government of Bengal."

Her Majesty's Secretary of State for India was informed of these Proceedings.

Varieties found in the Carolina paddy grown in India.

57. In the resolution just quoted attention was drawn to two points which seemed to show that the Carolina paddy grown in India from imported seed had produced several varieties of seed. One of these points was the statement made by the Superintendent of the Ranchee Jail that the husk of this paddy was found to separate so readily from the grain that it took but half the usual labour to clean it. The Government of Bengal having instituted further enquiries ascertained that the Superintendent had relied entirely on the testimony of the Native gentleman who had conducted the experiment, and that he had no independent means of verifying his statement.

The second point referred to the experiments made by Mr. W. C. Taylor, Deputy Collector of Pooree in Orissa, with what he described as acclimatized Carolina seeds of different sorts picked out from the crops obtained from mixed seed received by him from the Superintendent of Canal Revenue. The Government of Bengal having asked for further particulars of his trials Mr. Taylor reported that his experiments began in 1871 with a barrel of South Carolina paddy seed received by him from the Superintendent. He distributed the whole of the seed to ryots with the exception of half a seer only, which he sowed in his own garden. The ryots sowed on low paddy land and failed completely, the plants rotting from excess of water.

The history of the remaining half seer is of some importance. Mr. Taylor sowed it in his own garden where no paddy had been grown before within the memory of man, and there could be no mistake as to the genuineness of the produce. The seed germinated and grew well, but there appeared to be more than one sort of paddy in the crop. Some heads ripened much sooner than others; squirrels and rats did much damage; and only 2½ seers of good, though mixed, seed were obtained.

Of this produce Mr. Taylor again sowed two seers at the beginning of the rains of 1872 in a seed-bed in his own garden.

The seed again germinated well, and the growth was planted out on rather high land, not very rich, but commanded by water. Although damaged by blight, the yield was 90-fold the seed; but Mr. Taylor found no fewer than 16 varieties of paddy in the produce of these two seers.

In the same year he sowed five seers of seed received by him from the Pooree Jail, described as "acclimatized South Carolina paddy", on land similar to that in which he transplanted the two seers of "seedlings" from his own garden. Of this seed only 50 per cent. germinated, but although half the seed was thus lost and the crop injured by blight, the yield was about 16-fold the seed sown. In this produce, again, Mr. Taylor found 10 or 12 different kinds of paddy, similar to some of the varieties produced from the two seers sown in his garden; and he not unreasonably concludes that the seed received by him from Mr. Kirkwood in 1871, and in 1872 from the Pooree Jail, were originally from the same source.

From these two crops of 1872 he carefully sorted 16 varieties of paddy in all, and two of these varieties proved strikingly successful in 1873. One of them, a small yellow rice of good colour and flavour, of which one seer was sown as before in a seed-bed in June 1873 and planted out in July, yielded 161 seers produce.

The land was of medium quality only, enriched with a few baskets of cow-house manure. The ploughing was of the ordinary kind, and the crop depended mainly on the rainfall, being irrigated two or three times only. Mr. Taylor concluded that the plant grows about three feet high, gives an ordinary outturn of straw, wants no deep cultivation, can be grown on high land, is an early crop, and requires neither much water nor much care. The variety is likely, says Mr. Taylor, to become popular, and it has obtained from the people at Khurdah the name of *tiki dhan*, or small paddy. A sample of this variety, marked No. 3, was received from Mr. Taylor and deposited in the Economic Museum in Calcutta.

Of the other variety sown in 1873, and which proved successful, 44 seers were partly sown broadcast, it is presumed, and partly planted out. The general result was a yield of 50-fold the seed. In this case, again, the paddy does not seem to require deep cultivation, the plants growing equally well in six inches of soil and in deep mould. Mr. Taylor measured plants seven feet high on the six-inch soil. Planting out, or sowing broadcast, seemed to make very little difference in the yield, which was very good, both of grain and straw. The rice was white and of

good quality, though rather coarse and large. In this instance no irrigation was possible owing to the deficient rainfall, and the experiment was very encouraging.

Two samples of this variety, Nos. 1 and 2, received from Mr. Taylor, were deposited with the other in the Museum.

Mr. Taylor noticed the fact that it was from the produce of these two successful experiments of 1873 that the Burma Administration was supplied with acclimatized Carolina seed last year, concerning which doubts were expressed by the Chief Commissioner as to whether it really was Carolina paddy at all.

The South Carolina paddy usually distributed for experiment, and of which Mr. Taylor submitted a sample (No. 4) requires, he said, very deep cultivation, and is not suited for Orissa. The grain is most troublesome, moreover, to thresh, while the yield is no larger than that of many indigenous varieties much easier to cultivate.

Mr. Taylor's experiments in the last year, 1874, were not so successful as those of 1873, but the plants were very fine; and sample No. 2, sown broadcast, yielded a 36-fold return, and the No. 3 variety, or *tiki dhan*, transplanted, bore 86-fold; while No. 4, the pure Carolina variety, failed altogether.

Upon the whole, the Lieutenant-Governor of Bengal was disposed to think these experiments of Mr. Taylor's to be perhaps the most encouraging and the most important that have yet been recorded in this matter in Bengal. They seem to point to the conclusion that, amongst the numerous varieties of seed which have been imported by Government as South Carolina, there are at least two descriptions of grain to which the soil and climate of Orissa are peculiarly adapted. The seed seems to succeed almost equally well, whether transplanted or sown broadcast, to want no peculiar cultivation, to be nearly independent of irrigation, to ripen early, to require moderately high land only, commanded, if possible, by water, and to yield a heavy return of fine grain and good straw.

Mr. Taylor was requested by the Local Government to follow up these experiments carefully. If in 1875 the sowings again proved successful, an effort would, the Lieutenant-Governor said, be made to diffuse the cultivation further.

The Government of India in acknowledging the results, obtained from the Government of Bengal some specimens of the two varieties of seed found so successful in 1873, and forwarded them to Her Majesty's Secretary of State for the purpose of ascertaining "whether these varieties are already known in America, or whether they are the result of the altered physical conditions under which the American plant has here been brought".

At the same time Mr. Taylor's report was communicated to all the other Local Governments and Administrations, with an enquiry whether the paddy seed had elsewhere been found to contain more than one sort of seed rice. The replies received showed that in Oudh, the Punjab, and in Bombay and Mysore more than one sort was not observed; that in Berar and the Nizam's Territories the cultivation having proved a failure, no information was available; that in the North-Western Provinces four varieties were noticed among the produce of the Cawnpore Farm differing from the ordinary Carolina paddy, of these two were red and two white in colour, of the two reds, one was much larger in the grain and also darker in colour, and of the two whites one was a long small grain and the other was a shorter, thicker sort. The white sorts, when growing, could be readily recognized by the light yellow colour of the husk and straw. Any difference in the outturn of these foreign sorts and the ordinary Carolina was not, however, observed.

In the Madras Presidency, the Superintendent of Government Farms reported that during the past six years only one parcel of the imported Carolina paddy seed received by him consisted of more than one variety of seed. This was, he said, the parcel of 20 barrels received in 1873. In regard to this he had remarked in that year:

"The colour of the sample is unusually good, and the grain is well formed; but unfortunately it is mixed with about three per cent. of some other variety of paddy, apparently a variety identical with the Red Car of this country. I do not remember any former instance in which imported Carolina paddy was found to contain other grains than Carolina paddy."

Since then Mr. Robertson noted that not only "has this seed been remarkably uniform in character, but it has always been very superior in quality". The grain and ear of Carolina paddy are, he said, readily distinguished from the grain and ears of every variety of paddy grown in the Madras Presidency. Though he frequently has grown Carolina paddy in close proximity to the common country paddy, he has known of no instance of a hybrid variety of either having resulted from the practice. He adverted to the possibility of more than one variety of

Carolina paddy having been imported into India; but, on the other hand, he feared mixture of the original imported seed with the seed of the country paddy, and this he said was more to be feared than deterioration of the imported sample.

"But deterioration is less to be feared than *the loss of purity* in the sample; fully 50 per cent. of the samples of country-grown Carolina paddy seed that have been forwarded to me contained indigenous paddy, varying in amount from 10 to 50 per cent. The presence of this country paddy amongst the Carolina grain is altogether due to the late period in growth at which ryots harvest their paddy: they generally wait until the crop is dead ripe before cutting it, when from 10 to 15 per cent. of the grain is invariably shed by the wind, the harvesting operations, &c., the result being that, after the removal of a crop of country paddy, the ground on which it was grown is generally sufficiently well seeded to produce another crop."

In British Burma, the Deputy Commissioner of Akyab found three varieties, varying both in colour and in the size of the grain; and the Agent of the Burma Company sent two samples, one being from seed collected from the 1875 crop out of the original seed given out by the Local Government in 1874, and the other being from seed imported by the Company in 1875 from America; the superiority of the latter seemed to the Agent to point to the deterioration which takes place in the seed and to the necessity of importing fresh seed every year.

In December 1875 Her Majesty's Secretary of State transmitted the replies of two gentlemen of the Southern States on the questions referred to them in regard to the paddy produced by Mr. Taylor in Pooree. The replies were as follows:

Dated Savannah Ga, the 18th October 1875.

From—Messrs. R. HABERSHAMS, SONS AND CO.

To—The Commissioner of Agriculture at Washington.

Your favour of the 2nd instant, and the samples (later) are at hand. We enclose you a sample of a rice like yours in cultivation here, the three larger ones; the long, narrow and small chunky ones are yours; also send you a stalk of it. This is so inferior to our Native kind, that it is never grown on any large plantation, and is generally grown in small patches and dressed in plantation mortars, as the dealer would not buy it, and it is not what we call merchantable, and is discouraged and discountenanced. Many years ago a large planting was made of this India rice on the best tide swamp, and we milled it. It was an experiment, and was given up. Years ago there was what was called the Ward long grain tried. It was longer and larger than your long one. That made the handsomest rice we ever had, but it was given up, we think, owing to the difficulty of milling it. It was milled by Mr. Ward at his own mill as a matter of pride, and would not work well at the free mills.

We have seen much finer samples of India rice than yours from Carolina seed the first year.

The only plan is to plant in India fresh Carolina seed every year.

Even in Louisiana they have to do that, and the only good rice they make is the first year from our coast rice. It does not deteriorate as fast as in India, but the falling off is perceptible every year.

We would like to know how many years your sample was deteriorating.

Dated Georgetown, the 18th October 1875.

From—J. R. SPARKMAN, Esq.

To—The Commissioner of Agriculture at Washington.

Your letter of 2nd instant came duly.

The samples of India rice not received for several days after.

In 1871 seed rice was selected from this immediate neighbourhood for shipment to India, and I have shewn the two samples received from you to the planters who furnished the parcels for exportation.

We are not surprised to find that the choicest Carolina seed has been returned to us so changed as not to be recognised. Our experience is that the modifying influences of climate are universal.

The most Northern latitudes always produce the heaviest grain. With the exception of the small area of tide lands on the Cape Fear River in North Carolina, Georgetown country is the Northern boundary of rice culture, so far as tide lands are cultivated, and most of the seed for the different regions South of this is furnished by the planters of this country, some of whom, by extra care in the growth and

preparation for market, have deservedly made high reputation. One great desideratum, perhaps the greatest, is the selection of seed free from volunteer, or *red*, rice. This volunteer is the growth of the shattered or shelled rice, left on the land during the work of harvesting. What is left by the birds as gleaners is returned to the soil in its preparation for the succeeding crop, and thus becomes incorporated with it, not to be distinguished by the appearance of the plant, but the grain after a few years is more easily separated in its attachment to the stalk, and shells off in handling during the harvest, or drops during a high wind, thus polluting the land and reproducing itself, just in proportion as the crop gets a little over-ripe, or is slovenly and carelessly handled.

This is termed "red" rice from the discolouration of the inner pellicle under the chaff, at first a thin pale red, but each succeeding year of deeper colour, and more tenacious in attachment, so that a parcel heavily polluted with *old volunteer* will require $\frac{1}{2}$ to $\frac{1}{3}$ longer time in milling to clear it of this red pellicle or inner hull. Next to the freedom from *red* is the *uniform size* of the grain in determining its fitness for seed. For hulling or separating the chaff the *paddy* is ground between large stones, set at such a distance as nicely to skin the grain, as it were, without cracking or breaking it. The more uniform the grain in length and size and weight the more thoroughly is the first process executed, and the more easily the second performed of *pounding* preparatory to the third of *brushing*, by which the flour is removed and the grain polished. I allude to these matters pertaining more directly to *milling*, because I detect considerable discrepancy in the grains of the "burra dabu" (long grain) parcel sent me, as to length, size and weight, and I find upon hulling some of it considerable *red* rice. Whether in this red or volunteer the percentage has diminished or increased under culture in India cannot now be determined, as I have no sample of that which was sent from here in 1871. But there can be no doubt as to the deterioration of the grain under foreign culture. The samples sent me are different from our ordinary crop rice, and inferior to parcels selected for seed usually. Our experience is that the best seed will deteriorate under a change of climate so rapidly that, in the more Southern portions of Carolina and throughout Georgia, it becomes necessary to get Northern seed (from us generally) every three or four years.

There are many varieties of rice, and in the same field here at least 12 to 15 different varieties may be detected by any one accustomed to close observation.

In what respect these varieties differ could be pointed out, but this is not what you desire.

The smaller grain sent by you, called "tiku dabu", resembles very much a grain which is frequently mixed in our crops and known here as *Cooter rice*, but it has no advantage for a crop grain, and has not been selected and cultivated separately.

The millers in this country have inspected the two parcels, and pronounce them entirely different from Carolina crop rice.

These opinions of the two American gentlemen were forwarded by the Government of India to all Local Governments and Administrations.

Experiments continued in 1873-1874 to the end.

58. The last experiments, the results of which have been summarized, were those of 1873. While the characteristics of the so-called new varieties discovered in Orissa was being enquired into, the results of further sowings in some of the Provinces were being reported on, and the following is an epitome of those results. It will be noted that no fresh seed had been imported for these trials, which were all carried on with such seed as had been produced and saved in the country from previous imports.

Up to this each year's trials were noticed separately, all the different Provinces being brought together year by year. From this period of the experiments up to the end, it will be well to notice results in each Province separately, the years being brought together.

59. Taking, in the order already followed, the Provinces under the Lieutenant-Governor of Bengal first, the results seem to have continued unsatisfactory. They

had been so in 1873-74, when the last supply of fresh seed was imported. The causes of the many failures were then attributed to the late arrival of the seed in the interior, to the small amount of rain that fell, and to negligence on the part of the persons to whom the trials had been entrusted. The final result was that the sowing proved almost fruitless, the only interesting point noticed being the success of Mr. Taylor, Deputy Collector of Khurdah, with acclimatized seed. There was very little seed left in the different districts from previous sowings, although supplies had been imported year by year up to then. What seed had been left was

tried in several districts in 1874-75. The instances in which any outturn at all was reported were the following, all the other trials having failed entirely :

Tipperah	...	...	In one case an outturn of nearly five seers was obtained from two seers of seed.
Noakhali	...	...	Two and half seers were sown in the jail garden with care, and transplanted: the crop was reaped in November, and the outturn was one maund two seers of paddy, or 17-fold.
			In another place in this district one seer of seed was sown in highland and one seer in low land: the low land produced 1½ seers only and the high land four seers.
Pooree	...	...	As already noted in preceding chapter, Mr. Taylor made three trials in 1874: his sample No. 2, sown broadcast, yielded a 36-fold return; the plants had been very fine, but wind and rain, when the crop was in flower, seriously affected the yield. No. 3 variety, or <i>tiki dhan</i> , transplanted, yielded 86-fold, and No. 4, the pure Carolina variety, failed altogether.
Singbhum	...	...	In one locality one seer produced two seers of paddy.
Hazaribagh	...	...	Eight seers of paddy, sown broadcast in ploughed lands and otherwise well prepared, yielded an outturn of 18 seers.
Burdwan	...	...	The Burdwan Municipality sowed five seers of seed and transplanted. When the crop was in ear the cyclone of October injured it, and the yield was two maunds 15 seers of paddy.
Bancoorah	...	...	Twenty-five seers of seed were sown in well ploughed and manured land adjoining a tank, and the crop was well tended and promised an outturn of 25 maunds; but the cyclone burst the bund of the tank and the whole crop was washed away.
			In another place ten seers were sown and transplanted and irrigated. The crop was well tended, and produced six maunds. Out of this two maunds were reserved for the following year's sowing. The experimenter (Baboo Nudder Chand Roy of Harnasra) was of opinion that, under favourable circumstances, the yield of Carolina seed would be better than that of the ordinary rice of the country.
Midnapur	...	...	Dr. Sconce, Superintendent of the Midnapur Jail, prepared a nursery by sowing seven seers of Carolina seed, and in another piece of land adjoining to it seven seers of country paddy were sown. The Carolina thrived vigorously, and by the middle of October the crop was in full ear and ready for reaping, but just at this time it was almost entirely destroyed by the disastrous cyclone of the 15th October. The country rice was much less advanced when the cyclone occurred, and was therefore less injured. The amount of seed actually obtained from the Carolina stocks was 22½ seers, and from the country paddy 24 seers.
Lohardugga	...	...	Mr. F. F. Peppé, Sub-Deputy Opium Agent, repeated the trials he had previously made—he tried broadcast sowing and the transplanting system. The former produced 2 maunds 32 seers from five seers of seed, while the same quantity of Native paddy only yielded 1 maund 28 seers.

By the transplanting system the outturn was—

		Produce, in seers, of	
		Carolina paddy.	Native paddy.
On an upper field	...	20—23	19—17
Do. lower do.	...	11½—14	87—19

Thus as regards Carolina rice the broadcast sowing proved the best, and next came the transplanting system on upper land. Mr. Peppé observed that in the lower field, where water remained deeper, the plants died off, showing that after planting out there ought to be no surface water.

The Government of Bengal remarked upon these reports :

(3.) As will be seen from the papers now submitted, the results of the sowings of 1874-75 have not been more satisfactory than those of the previous year. There was no seed available for cultivation in the Dacca and Rajshahye Divisions, and the Commissioner of Patna thought it useless to continue the experiments in 1874-75. In all other divisions the experiments were made, but, except in Lohardugga and in the Midnapur Jail, they proved almost entirely fruitless: even Mr. Taylor's sowings in Pooree were not so successful as in 1873-74.

(4.) The only officers who speak favourably of the culture of this exotic paddy are the Deputy Commissioner of Lohardugga, and Mr. Peppé, the Sub-Deputy Opium Agent, who made some experiments in the Lohardugga District. These officers are of opinion that Carolina rice can be grown successfully in any ground, and that it will give as good a return as any of the more hardy Native varieties; but that, until by repeated trials a course of cultivation suited to the soil has been fixed, the cultivators are not likely to take to it. The principal feature of importance noticed by Mr. Peppé in the cultivation of Carolina rice is, that this rice takes less time to come to maturity than any other kind, and that if sown broadcast in an average soil it will be the first to shoot into ear, and will be ready for cutting before any other kind; but that when it is transplanted, this quality does not become so apparent as when sown broadcast early in the season.

The only other experiment which gave any hopeful result was the one made by Dr. Sconce, but a doubt was since raised as to the genuineness of the seed sown at Midnapur. Some of Dr. Sconce's produce was identified—by one authority as a kind that grew abundantly in Burdwan and the 24-Pergunahs, and another stated that it was known in the market as Madras rice.

The Lieutenant-Governor of Bengal concluded :

(7.) The results of the experiments of the past years have abundantly shown that success in the cultivation of Carolina rice cannot be looked for with any degree of confidence unless the experiments are conducted upon a systematic principle, laid down after a mature consideration and digestion of the records on the subject which are already before the Government of India.

And the Government of Bengal awaited further orders of the Government of India on the subject.

Later on, Mr. Taylor submitted a report on the result of his continued experiments in 1875 with seed raised by him in the previous year :

Experiment No. 1 with burra dhan No. 2.—This showed that 22 seers of good seed was sown broadcast, rather thickly, on the 7th June 1875, on 46,330 square feet of land which had been previously ploughed thrice and dressed with eight cartloads of cow-house manure and rubbish, and that a portion of the seedlings was transplanted to low-lying land which had received one cartload of manure and three ploughings. The whole crop was cut from 23rd to 25th November 1875, and gave an outturn of 37 maunds 25 seers, or upwards of 63-fold, notwithstanding that the crop on the low land planted out suffered considerably from excessive

rainfall. There was no artificial irrigation. The outturn both of grain and straw was considerably in excess of the average outturn of local varieties of even winter rice in Khurdah. The portion of the crop on the low land was twice cut with the sickle to check its growth.

Experiment No. 2, with No. 3, or "tiki dhan".—Twelve seers of seed was sown in a seed-bed on the 8th June 1876, and transplanted on the 24th—29th July on 35,466 square feet of land, which, having been previously ploughed thrice, and manured with four cartloads of cowdung and rubbish, was flooded and puddled when transplanting. The crop was weeded in August and September, and reaped from 10th to 15th November 1879. The outturn was two maunds, or 66½-fold. Nearly half of the land on which this crop was grown had been newly reclaimed and was under the shade of a mango tope. But for this and the excessive rain the outturn would have been 100-fold of the seed sown. During the second week of October there was no rain, and the crop received one flooding from an artificial irrigation channel.

Experiment No. 3, by Natives, with "tiki dhan".—Two Natives sowed 14 seers of seed in a seed-bed, and from the plants raised they planted out two plots measuring 29,289 and 5,488 square feet respectively. On the larger plot, which was shaded by mango trees, they reaped 580 seers, and on the smaller, which was more open, 145 seers—in all 725 seers, or 57½-fold of the seed sown. The mode of cultivation was similar to that of No. 2 experiment.

Experiment No. 4.—A ryot of Khurdah sowed 5½ seers of burra dhan No. 2 broadcast on very good land measuring about 8,000 square feet. The yield was 50-fold. The crop would have been better but for the excessive rainfall.

Mr. Taylor, as well as the Natives, reserved portion of their produce for the following year's sowing, and offered the rest to the Bengal Government. The result is not known.

60. The Province of Oudh was one of those in which all previous experiments had failed more or less; and there was not any seed saved in any of the districts of this Province, with the exception of some in the Sultanpur District. In this district a further trial was made with the previous year's produce in four different places. The total figures of the four places showed that seven maunds three seers of the acclimatized seed had been sown on something more than eleven biswas of land and produced an outturn of 51½ maunds, while the same quantity of the Native seed gave on twelve biswas of land a yield of 95½ maunds. No details were supplied as to the mode of cultivation adopted in each case. A further trial was to have been made with the seed produced, but no report seems to have been furnished.

Results in North-Western Provinces.

61. In these Provinces experiments were made in seven districts, thus—

Gorakhpur.—In 1873-74 the experiment had been a failure owing to the drought from which the country plant also failed. During 1874-75 the seed saved from the previous year was sown. The season was a very favourable one and the crop was not attacked by insects. In 1873-74 eleven waterings could not save the crop, while in 1874-75 three waterings were found sufficient. The result was:

Extent of land.	Seed sown.	Date of sowing.	Date of reaping.	Outturn paddy.	Rate per bigha.
Bighas.	Mds. Seers.			Mds. Seers.	Mds. Seers.
3	2 6	10th to 16th July ...	15th and 16th October ...	31 38	10 20

But the rice was not held in great favour by the Natives, some of the finer sorts of Jarhan being considered much superior to it.

Mirzapur.—In this district three trials were made—

- (1) by the Manager of the Kantil Estate, with 1½ maunds of seed. The yield was 13½ maunds, giving an average of 14 maunds seven seers per acre;

- (2) by the Tahsildar of Mirzapur with 17 seers of seed. The yield was 1¼ maunds, or an average of 3½ maunds per acre; and

- (3) by the Manager of the Barhar Estate with 3½ seers of seed. The yield was 20 seers, or an average of 26 maunds 26 seers per acre.

The Director of Agriculture considered the last outturn alone to be satisfactory.

Banda.—The experiment was a failure owing to a kind of winged insect attacking the crops: the outturn was very small.

Fatehpur.—Thirty-five seers of seed were sown, and the yield was 13½, or ten maunds per acre.

Muzaffarnagar.—Mr. Cadell, Settlement Officer, had 11 bighas 4 biswas sown with one maund 37½ seers of seed; the outturn was 73 maunds 15 seers, or an average of 12 maunds 38 seers per acre. Mr. Cadell said that the results of the sowings of 1874-75 "entirely confirm the statement made by agriculturists in 1870 "that with proper treatment Carolina rice should give a return of 18 maunds "per acre".

Budaon.—Two acres three roods and 27 poles were sown with 38 seers of seed; the outturn was 8½ maunds, or an average of two maunds 33 seers.

Moradabad.—Experiments failed from one cause or another.

The Director of Agriculture, on the whole, did not consider the general results from all the districts which took part in the experiments during 1874-75 satisfactory. They shewed, he said, "the difficulty there is in obtaining a fair trial to an "experiment like this through the district officers. Great care was taken in "Gorakhpur and by Mr. Cadell in Muzaffarnagar."

Cultivation on a more extended scale was arranged for the season 1875-76 in the Dehra Dun, Saharunpur, Muzaffarnagar, Moradabad, Fatehpur, Banda, Mirzapur and Gorakhpur Districts, and on the Government Farm at Cawnpore.

The results were not at all satisfactory, owing, for the most part, to the excessive rainfall and the heavy floods which inundated the rice-growing low lands. Fifteen maunds of Carolina seed were sown on 30 acres of land situated in 78 villages of the above-mentioned districts, and the total outturn was 138 maunds of paddy, giving an average of 4½ maunds to an acre and nine times the seed sown. The total average is much reduced on account of the crop in most of the villages being completely destroyed, or heavily injured, by the unfavourableness of the season.

The few places in which the yield was satisfactory are—

1st.—One village in Gorakhpur, where one maund and 36 seers of seed gave an outturn of 41 maunds 10 seers of paddy, or 22 times the seed sown.

2nd.—One village in Fatehpur, which produced 24 seers of paddy for one seer of seed.

3rd.—The experiment made by a zemindar of Muzaffarnagar, where an outturn of 53 maunds was obtained from one maund 35 seers of seed.

4th.—The experiment conducted in the Cawnpore Farm under the Collector's supervision, where 20 seers of seed were sown on 1¼ acres of land; and, although the crop suffered much from want of proper irrigation, an outturn of 15 maunds and ten seers, or 30 times the seed sown, and a yield of 40 maunds of straw were obtained.

"These high outturns", the Director of Agriculture noted, "were not owing "to any exceptional treatment of the crop, but are chiefly due to the fact of their "being beyond the reach of inundation". In Gorakhpur, besides being injured from the rains, the crop was attacked by an insect called locally "gandh phatinga" which is known to be a dangerous enemy to all kinds of fine rice which germinate early at the time the insect is abroad.

The Director of Agriculture ended his report by saying:

"The unusual severity of the season renders it impracticable to form any "opinion from this year's experiment on the prospect of the Carolina paddy cultivation succeeding in these Provinces. Arrangements are being made for further "experiments this year (1876-77) in selected districts, the results of which will "be duly reported."

62. In the Punjab experiments were confined during the seasons 1874 and 1875 to the districts noted in the margin, and were in every case, as in the other Provinces, made with acclimatized seed saved from previous year's sowings. The results which were obtained were again not encouraging. In the Karnal, Rawal Pindi, and Sialkot Districts alone was anything like a fair yield obtained, and even in these localities the results were poor compared with the best results of previous years.

District.	Amount sown.	Date of sowing.	Area sown.	Produce uncleaned.	Produce cleaned.	Mode of irrigation.	Frequency of irrigation.	Date of transplanting.	Date of reaping.	REMARKS	
										On cultivation.	On seed sown.
KARNAL.	M. S. C.		A. R. P.	M. S. C.	M. S. C.						
	0 5 0	12th July 1875.	0 2 20	3 0 0	1 35 0	Canal.	Once, but as there was a sufficiency of rain, no more artificial irrigation was required.	27th July 1875.	12th November 1875.	The ground was ploughed thrice and manured before and after being planted, and weeded twice.	The seeds were first sown in a piece of ground and afterwards transplanted in the fields.
	0 4 0	28th do.	0 2 0	5 15 0	3 0 0	Rain.	...	14th June 1875.	14th Nov. 1875.	This is a decided improvement; the results are satisfactory as compared with the experiments carried out in other parts of the district. The mode of cultivation followed in these experiments was that observed in the cultivation of the indigenous kinds; and although Mr. Knight's suggestions were explained to the cultivators, they seemed to have preferred their own mode as being less troublesome.	
	0 9 0	12th do.	0 3 0	6 10 0	4 0 0	Canal.	5 times.	18th ditto	6th do.		
SIALKOT.	0 9 0	29th do.	0 1 0	4 0 0	2 10 0	Ditto.	Ditto.	19th ditto	10th do.		
	0 4 0	17th July 1875.	0 0 10	2 16 0	1 8 0	By a water-course.	5 times, till the time of produce.	14th ditto	28th ditto	The Deputy Commissioner regrets very much that the cultivation of Carolina rice was not carried out according to Mr. Knight's suggestions as promised in the report for 1873, but strict orders have now been issued on the subject for this year.	
RAWAL PINDI.	0 2 0	20th July 1875.	0 0 2	3 31 8	2 4 8	Ditto.	Ditto.	17th ditto	24th ditto		
	0 10 0	13th June 1874.	0 0 31	5 15 0	...	Irrigated by canal water.	18 times, or every 4th day.	26th June 1874.	5th October 1874.		

Everywhere else, where experiments were tried, either no return at all was obtained, or, where a crop did ripen, the yield was extremely small and below the average yield obtained from indigenous seed. The want of success was attributed by reporting officers mostly to climatic causes; but the Financial Commissioner of the Punjab questioned whether the general failure was not quite as much due to the deterioration of the acclimatized seed used and the indifference of the persons to whom the actual conduct of the experiments was necessarily entrusted. The quality of the rice was not mentioned, except by the Deputy Commissioner of Hazara, who says that it was excellent, but not liked by the people.

The Financial Commissioner remarked:

"The general subject of rice cultivation within the Punjab, and the reasons why it seemed improbable that any great success would ever be obtained in the introduction of Carolina rice, have been fully noticed in previous reports. It will be sufficient, on the present occasion, to remark that the anticipations formed on the subject seem to have been realized. It would appear that the experiments have been repeated year after year without awakening the slightest amount of interest in the localities where they have been made.

"Under these circumstances, and in view of what appears to be now a well established fact that Carolina paddy cannot be successfully acclimatized in India, or at all events in Northern India, the continuance of experiments in the Punjab seems of little advantage; and the Financial Commissioner said he could not recommend their repetition during the current year.

The Lieutenant-Governor concurred in the Financial Commissioner's opinion that there would be little advantage in continuing these experiments in the Punjab.

63. In the Central Provinces the experiments were continued in 1874 with the seed saved from the produce of the previous year's sowings.

Results in the Central Provinces.

Raipur—One of the principal rice-growing districts. Here one khandi and ten khatas of Carolina seed was sown in proximity to four descriptions of country rice, and the result was: "The seeds germinated shortly after being sown in June and July, and by August the crops attained the height of a foot; the crop was then ploughed through, when it appeared to thrive with great vigour. The process of weeding was next gone through, and between the months of September and October the ears began to fill." The outturn of Carolina was four khandis—a return which was not so full as that taken from the country varieties, but a part of the crop is said to have rotted by the excessive rains which fell during September, causing the full ears to droop into the water.

Sambalpur—A neighbouring district in the Mahanadi Valley, also a rice-growing tract. Here the experiments were carried on by private landholders to whom seed had been distributed in 1873, and on a plot of land near the district jail at head quarters. The quantities sown and the outturn were as follows:

	Quantity sown.			Outturn.		
	M.	S.	Ch.	M.	S.	Ch.
At the Jail	...	0	25 8	2	25	0
Private landholders	...	0	6 0	0	22	8
Ditto	...	0	4 8	0	7	8
Ditto	...	0	15 0	0	9	0
Ditto	...	0	3 0	0	3	12

The private experiments were mostly failures, while that at the jail was not much better than that at Raipur. The result is said to be due in great measure to the very heavy rains we had last year, but it would seem to tend still further to confirm the opinion expressed last year that the Carolina rice does not bear excessive moisture so well as the rice ordinarily cultivated in the country.

Jubbulpore—One maund of acclimatized Carolina rice seed was distributed through the Tahsildars to various malguzars, and a portion was also sown at head quarters. The private experiments were reported to be failures, but that at Jubbulpore itself "was all that could be desired; the piece of land, five biswas in extent, was sown with twenty seers of seed, and the produce was 270 seers. This remarkable outturn was, in fact, similar to that reported as having been gathered in the Sunderbans, viz., from 12 to 13 maunds per bigah. It was believed that the result was entirely owing to the rice having been sown in low ground which, through some fortunate coincidence, was peculiarly well suited to the crop. The method of cultivation was as follows: The spot selected was ploughed before the break of the rains and re-ploughed after the first fall of rain. The seed was placed in large earthen pots and watered until it began to germinate; it was then taken out and sown broadcast in the prepared ground. The sowings were made while the rain was falling. The rice was weeded twice and thinned where necessary."

Nagpur Model Farm—The Superintendent reported briefly that "hitherto the rice in question (Carolina) has not proved a successful crop."

The experiments were to have been continued in 1875, but the results do not appear to have been reported. In the season 1876-77 trials were made only in the Bilaspur District where such trials had apparently not been made in any previous year. The seed for the purpose was obtained from the Madras Government in April 1876, and distributed in June to the malguzars with instructions as to the mode of cultivation to be followed. These instructions were "that the seed should be sown in a nursery of well manured ground, and transplanted, after the first heavy rain had fallen, into fields manured with cow-dung; the plants to be at least six inches apart. After the process of transplanting had been completed, water should be permitted to stand on the crop to the depth of an inch or two; and as the plants grow in size, so should the quantity of water be allowed to increase until the plants become yellow or begin to look so, when the water should at once be allowed to drain off. This will enable the plants to resume their natural colour. The fields are to be weeded three or four times and water given to the young plants. In other words, that the rice should be cultivated precisely as the Natives do dhan by transplanting process." But at the same time it was pointed out that a trial should also be made with the other mode of dhan cultivation ordinarily practised in the district.

A more unsatisfactory memorandum of instructions than the above can hardly be conceived and the results will be seen.

Altogether 13 experiments were made in 13 different villages, 12 of which were through malguzars, and one by the Secretary to the Local Fund Committee. Of the 13 trials seven were entire failures owing to excessive moisture; in two cases the crops were destroyed by cattle, though in one there was an outturn of four-fold, notwithstanding the damage done; in one case, through misapprehension that the plants were not rice, owing to the peculiar formation of the young plants, they were nearly all rooted out and thrown away, only a few plants being left which gave a yield of one seer; in one case there was a return of ten-fold, and it "probably might have been greater but for the excess of moisture which it seems the crop was unable to bear". Lastly, in one case, the outturn was stated to have been sixteen-fold, and to all appearances equal to the indigenous description. The experiment through the Secretary to the Local Fund was a failure owing to heavy and continuous rain almost immediately after the seed had been sown.

The moral which the Deputy Commissioner of Bilaspur drew from these results was that they "afford no criterion to form an opinion as to the suitability or otherwise of the Carolina rice for cultivation in this district; though it may be inferred that the crop would do well in localities where the rainfall is moderate and evenly distributed, and that care should be taken to time the sowing during a break in the weather, so as to avoid the possibility of a heavy downpour after the seed is sown".

64. In the Berars experiments were not continued, as the results during previous years did not encourage any further trial. In the jaghir estate of Sir Salar Jung, Minister of His Highness the Nizam, trials were made in 1873-74, and again in 1874-75; neither the result of the experiments, nor the quality of the rice itself, in the opinion of the people of those parts, were such as to encourage the further cultivation of the Carolina rice.

65. The Chief Commissioner of Mysore and Coorg said that, as already reported, the experiments had been discontinued in these Provinces, as there seemed to be no advantage derivable from experiments conducted in the mode hitherto adopted, "for as the results of experiments made elsewhere, and chiefly in the Madras Presidency, it has been shown that the cultivation of this exotic entails considerable risk in consequence of the special care and skill that is required in every stage of its growth. There is, he added, the further drawback that, until a demand is created for the produce, owners of land hesitate to divert their land from its more profitable use."

66. In the Madras Presidency in 1874-75 the only places in which experiments were made were in the Malabar and Coimbatore Districts by Collectors, and in Tanjore by the Native Association of the place. The information supplied as to the results showed briefly that the outturn was small, being 15-fold in Coimbatore and from 2 to 26-fold in Malabar. In Tanjore the Association considered their results satisfactory—"the soil of the Cauvery delta is well adapted for the paddy, and a larger yield than the Native species can be secured if properly cultivated."

The whole of the experiments carried on at different periods in the different districts of the Madras Presidency, and the results produced, were summarized by Mr. Robertson, Superintendent of Government Farms. The following extracts bring out the salient points of the undertaking:

The soils, and their preparation for the crop.

The soils were ordinary paddy soils under irrigation from river-channels, or tanks; generally situated at low levels, and of alluvial origin. The land frequently was terraced, which arrangement admits of the thorough removal of the irrigation water when done with. Much of the land was, however, so situated that it could not be drained excepting by artificial means, and the ryot has not yet recognized

the importance of getting rid of the irrigation water after it has fulfilled its purpose by such means.

In preparing the soil the ordinary Native methods were usually adopted; these varied considerably in different parts of the Presidency. In some localities the land was ploughed seven or eight times when intended to receive seedling paddy plants. During this preparation the soil was generally kept covered with water to a

depth of three or four inches; in this way the surface soil was worked by the plough into a semi-liquid mud, while the layer of soil, immediately below, was puddled and hardened by the feet of the cattle. In some instances, while undergoing preparation, this continued over several days, the soil was manured with the green plant of the muddar (*Calotropis gigantea*), wild indigo, &c., and with the leaves of different descriptions of trees, at the rate of from 400 to 1,000 lbs. per acre; but most of the land was unmanured, excepting by the silt deposited on it by the irrigation water.

Usually the soil was prepared for seed in much the same way as when intended to receive seedlings. In either case the surface was worked into a puddle, the process being more thoroughly performed when it was intended to plant seedlings.

In some instances the soil was prepared without undergoing puddling. The following extract describes this practice:

"In this kind of sowing the ryots generally keep the land ready, well ploughed and manured, and await a moderate shower of rain to commence the sowing. As soon as they get rain and the ground is sufficiently saturated the seed is sown in lines by means of a bamboo seed-drill. If the rain is heavy, they wait for two or three days till the ground is sufficiently drained. If the weather is showery, no irrigation water is applied during the first three or four weeks, and the grass which springs up in the interval is removed by frequent weedings."

There can be no doubt but that the puddling of the soil, as described in some of the foregoing extracts, is highly objectionable. The physical character of the soil is very injuriously affected as, from the semi-liquid state into which the soil is worked, the heavier particles sink below, hence the surface soil, which is formed of the finer matter, is close and compact—a condition highly favourable to the retention of water on its surface, if this was a result desirable to secure; but, as the good effect of irrigation water depends upon the water passing into and through the soil, the condition referred to is very objectionable. It is true that when land has once been puddled, it is difficult at first to work it in a satisfactory manner in any other way, but, if in each year the puddling process is less fully carried out, the soil will gradually be restored to its normal condition. The puddling of the soil is done in order to make the water apparently go further, but, where sufficient water cannot be commanded for paddy, without thus injuring the physical state of the soil, it would be better in every respect to crop the soil with some other crop. Some fairly good results have been obtained in Carolina paddy culture where the soil was puddled, but it is evident that, in such instances, the land was either situated at a moderately high level, which admitted of good surface drainage, or it rested on a moderately porous sub-soil. In some instances, where the land was thoroughly worked in a dry state before irrigation commenced, the results apparently were not better than when the puddling process was adopted, but there may have been causes to account for this, of which the reports have taken no cognizance.

The Carolina paddy plots, in many instances, received better treatment, as regards manuring, than is usual in the treatment of land for ordinary paddy. This probably was because many of the plots were located near the head quarters of a district and away from the larger irrigation rivers, the waters of which usually bring down so much silt that the land they irrigate. Owing to the manure is not considered to be needed on the land they irrigate. Owing to the

swamping of the land during irrigation it is usual, when manure is applied, which is quite the exception, to apply some substance which by gradual decay affords plant food. If a quickly acting manure was used, the probability would be that it would all be dissolved in, or carried away by, the first irrigation flood the land received.

The seed, seedlings, and the method of sowing and planting.

As before noticed, the seed was sometimes sown directly in the land, and at other times it was sown in nursery beds in view to raise seedlings for transplanting. When sown broadcast on the puddled soil the seed was usually in a sprouted state; the process followed in sprouting it is described in the following extract:

"The seed which is to be sown is put in pots at sun-rise and water poured in them to the brim. The pots remain in that state till evening, when some straw is placed in the mouths of each and they are turned upside down. They remain in that state all night, during which time the water drains away. The next morning water is poured in the pots, but is immediately run off, and the pots are inverted again as on the previous evening. In this state they remain all day. The seed is then placed on baskets and wet straw is spread over each and kept on by weights. The following morning the seed begins to germinate when it is taken to the field for sowing."

The practice of transplanting paddy is not common throughout the Presidency. It appears to prevail more generally in those portions where the water-supply is good and labour abundant. Even where the practice is common, it is far from usual to raise the seedlings in nursery beds; frequently the ryot sows one or two of the fields thickly, in view to the plants to be thinned out being used for planting other ground; and perhaps it is to this practice we must attribute some of the failures in the experiments with transplanted Carolina paddy seedlings. It has been shown again and again that, while the roots of the indigenous paddy are confined chiefly to the surface soil, those of the Carolina paddy go deep into the soil when they meet with favourable conditions.

Except an occasional weeding the experimental crops received little attention during growth. The practice of hoeing appears to be almost unknown. But in one or two districts, notably in Nellore, the soil was loosened, between the rows of plants, by means of a light country plough. The almost entire absence of tillage operations on the land while the Carolina paddy plants were growing is, undoubtedly, one reason why in some experiments the results were unsatisfactory. But tillage during growth is possible only on soils on which the plants are growing in lines, and this with paddy is but rarely the case in this Presidency.

Observations made during the growth of the crop and at harvest.

The Carolina paddy generally came into ear at from 10 to 12 weeks after the date of sowing. From many localities complaints were made that all the ears did not mature at the same time, thus making the harvesting of the crop, in a satisfactory way, a difficulty; however, there are equally as many reports in which it is stated that the plants did not shed their seed nearly as readily as do plants of the indigenous varieties of paddy. Hence, if the harvesting was delayed, in order to allow time for the ripening of the backward ears, there was no loss from the shedding of the seed, and the drawback experienced in the delay of the harvesting operations is not felt in any deterioration of the straw, as is usual with country paddy, for the experimenters generally agree that the grain is always ripe long before the straw. It was observed that crops raised from seed matured ten days earlier than crops raised from transplanted plants, the produce of seed sown at the same time. This result was attributed to the check in growth the plants usually suffered from on being transplanted.

Transplanted crops longer in reaching maturity than sown crops. Excepting in the time in reaching maturity there was but little perceptible difference in the crops produced from seed and from transplanted seedlings when grown under similar conditions.

The Carolina paddy plants on many of the experimental plots appear to have been unusually unfortunate in attracting such destructive foes as locusts, hares, &c. From one report the following interesting extract is taken:

"All at once, and this is the strangest part of my story, the Carolina was attacked by locusts which, while leaving unharmed all the country paddy around, deliberately destroyed the Carolina paddy down to the ground."

"It may be that the succulent robust growth of this paddy, which all experimenters admit, afforded a more juicy stem, and therefore a more attractive food than the culms of the country paddy."

The ears of the Carolina paddy were reported, in many instances, to be from one-third to one-half heavier than those of country paddy grown under similar conditions. The average number of grains in an ear varied from 150 to 200, while many plants had from 10 to 12 fertile ears.

The produce.

Many of the experimenters noticed the difficulty that was experienced in separating the grain in threshing. One wrote—

"When the sheaves were threshed it took eight or nine strokes to shake off the grain, whereas for the ordinary country paddy I am informed four strokes suffice."

The reports agree generally as to the uniform size of the grain and its freedom from the thin shrivelled grain which in samples of country paddy forms such a considerable percentage.

The threshing was usually performed by striking the sheaves on a log of wood, the way in which country paddy is threshed. The difficulty with which the grain is separated is not a fault, as some suppose. It is certainly true that more labour must be expended in threshing Carolina than country paddy, the grain of the latter separates so easily, too easily for the ryot's interests, for, even with the greatest care, a considerable quantity of its grain is always shed in the field during the harvesting operations. Carolina paddy is not more difficult to thresh than other cereals; it is certainly much more easily threshed than oats or barley.

Quality of the straw. Regarding the quality of the straw opinions varied greatly:

"The straw was for the most part strong and well grown, thicker, and stouter than the straw of indigenous varieties of paddy, and the ryots themselves say that it would be more valuable as fodder for cattle."

"On some of the experimental plots the straw was of an extraordinary length."

"The straw is undoubtedly coarser and the cattle do not eat it so freely as the straw of the ordinary country paddy."

On this subject the Collector of Coimbatore wrote—

"While appreciating the larger yield of grain the ryots take objection to the quality of the Carolina paddy straw. They said that the cattle would not eat it; and certainly my cattle refused it, but this, I think, was in consequence of its having been rather musty."

It is unlikely that cattle, that so readily eat the hard reedy straw of cholam and cumboo, will refuse the straw of Carolina paddy, when it is in a fresh state.

When the cattle have refused it, the probability is that the straw was, as noticed in the preceding extract, musty and unpalatable. Regarding the strength of the straw, the Superintendent of Government Farms, in reviewing some reports on the cultivation of Carolina paddy, wrote—

"The strength of the straw objected to by some ryots is a valuable characteristic of the Carolina paddy plant; it enables the crop to withstand the effects of rough weather. Storms which would prostrate crops of country paddy pass over crops of Carolina paddy harmlessly."

The produce of grain and straw varied considerably, sometimes at different periods and in different districts, sometimes in the same period and in the same

"The rice of Carolina paddy is decidedly much superior to that of the ordinary paddy."

"It is perfectly white in colour, and when dressed for food is of good taste. In quality it is equal, if not superior, to Peshanam paddy grown in the neighbourhood of Nellore, and which is considered to be the best paddy in this district."

"The quality of the rice is equal to that of the ordinary kind, but not equal to Siromony and other superior kinds."

"The grain is larger and coarser than that used by well-to-do people. The grain is, however, less liable to break in husking than that of ordinary paddy."

"The rice produced is larger, more translucent, and altogether nicer-looking than the Manawari Sumba, and weighs 1½ oz. to the measure heavier."

"The Carolina rice, though a large grain, is white—a quality which no other kind of paddy possesses; its taste, when boiled, is not inferior in flavour to Sumba and Mellaghi."

From these extracts, says Mr. Robertson, and others that might be given, there can be no doubt but that the rice prepared from the Carolina paddy, raised in this country, was really excellent, and superior to much of the rice produced in this country. The flavour of the rice, when cooked, will depend greatly upon the character of the soil upon which the paddy was raised.

General opinions and observations regarding the crop.

The Deputy Collector of Arealur reported—

"Upon the whole I am satisfied, from the two experiments I have already made, that Carolina requires no extraordinary care in its cultivation; like the country Car, it can be easily grown without entailing any extra expense; and the profit to the ryot, I have no doubt, would be much greater than what he would obtain from the country paddy."

The Acting Sub-Collector of Salem, in submitting his report, remarked—

"I am convinced that the Carolina paddy is far more productive than any of the indigenous kinds, and that it is so has been shown by my first experiment."

The Acting Collector of Malabar wrote—

"The experiments were, I think, pretty successful, considering the ignorance of the individuals who made them with regard to the best mode of cultivation and the best soil adapted to the growth of the plant. All soils have been tested—common rice lands, garden land, and dry paremba lands. The seed was sown broadcast and in beds, and the plants were, in some instances, transplanted, and in others left in the beds in which they were first sown."

The Collector of Salem wrote—

"The peculiarities which I observed in the Carolina crop are—

"1st.—That it grows and ripens much faster than the ordinary country kind."

"2nd.—That the stalks are thicker and better able to stand the weight of the ear than the country paddy; it contains a larger number of grains. The country paddy stalks being very thin, they bend, and the consequence is that much of the grain is lost on the ground before the crop is cut."

The opinions of the experimenters agreed generally as to the smaller quantity of water needed by the Carolina plant than for the country paddy plant,

and the opinion was also equally generally held that the Carolina crop suffers less than does a crop of country paddy, when temporarily deprived of irrigation water. If, as has been shown to be the case in several instances, the roots of the Carolina paddy plant feed deep down in the soil, while those of the country paddy plant feed in the surface soil, it is easy to understand why the former suffers less than the latter, when irrigation water is temporarily withheld.

A number of the experimenters agree as to the necessity for the more perfect tillage of land for Carolina paddy than for country paddy.

On the other hand, some experimenters assert that the country paddy requires a much more elaborate preparation of the soil than Carolina paddy, because, while the Carolina paddy sends its roots further in search for food, the roots of the country paddy plant are always near the surface of the soil, and therefore have a more limited feeding area.

Reasons for failures in experiments.

38. Many reasons are given for the failures that have attended so many of the experiments.

"There is, I fear, too much reason to believe that Natives to whom the paddy was distributed were rather disposed to report unfavourably upon it, fearing that Government, on becoming aware of the heavy crops that can be raised on their land, should determine to raise their rents in proportion."

"The experiments seemed to have been unpalatable to the mirassidars generally."

"I believe also that the cultivation did not receive proper attention from the ryots. They do not approve of the condition to give up one-fourth of the produce yielded."

"The reasons generally given for successful results in all these cases are deficiency of rain in the early part of the season and too much rain in the latter part of the season."

"Much of the seed supplied was evidently inferior."

"Hares injured many plants, and rats and birds ate up most of the grains."

"A large portion of the plants was destroyed by cattle."

"A flood came and washed away greater part of the plants."

"Unfortunately three-fourths of the plants rotted from being inundated."

There cannot be any doubt but that by much the largest number of experiments failed from such causes as are mentioned in the preceding extracts—causes which would have proved equally detrimental to country paddy similarly circumstanced.

Where country paddy is grown care is taken that the sowings shall take place at the season of the year that is the most appropriate, when ploughing and watering can be most satisfactorily performed. But the Carolina paddy in many experiments was sown at unseasonable times, and under circumstances that would not have been favourable for country paddy. In some instances this was caused by delay in receiving the seed, but in many cases there are good grounds for believing that the real reason why the Carolina paddy was exposed to unfavourable conditions by many ryots was a desire, on their part, that the experiment should not afford information by the aid of which the fertility of their land could be ascertained.

It was perhaps but natural that the ryots should view with suspicion any course of action suggested by Tahsildars, or Revenue Inspectors, the officials who have so much to do with the fixing of the amount of the rent.

That in many instances the ryots did not give true returns is evident from the facts noticed in several of the reports. For instance—

"The ryot to whom the seed was given for experiment reported an outturn of 22 measures, but now he admits the outturn of 250 measures. He had, it seems, concealed the facts, fearing that half of the produce would have been taken from him as the Government share."

"That in many instances the ryots entered upon the experiments with great hesitation and suspicion is evident from the frequent references to this state of feeling in so many of the reports."

It was feared that in the climate of Madras the Carolina paddy would gradually deteriorate; but it appears to have great power in adapting itself to the varying conditions of the climate of this country. No deterioration in the quality of the grain does appear to have occurred to any appreciable extent, when the crop has been grown under suitable conditions.

"Deterioration does undoubtedly take place when the crop is grown under unfavourable circumstances, but it must be remembered that all our cereals deteriorate if sown at the wrong season on exhausted or imperfectly-cultivated soils. But deterioration is less to be feared than the loss of purity in the sample; fully 50 per cent. of the samples of country-grown Carolina paddy that have been forwarded to me contain indigenous paddy, varying in amount from 10 to 50 per cent. The presence of this country paddy, amongst the Carolina grain, is altogether due to the late period in growth at which ryots harvest their paddy; they generally wait until the crop is dead ripe when from 10 to 15 per cent. of the grain is shed by the wind and in the harvesting of the crop, the result being that after the removal of a crop of country paddy the soil generally is sufficiently well seeded for another crop."

Though a very large quantity of Carolina paddy has been raised in this Presidency, there are grounds for believing that at present no pure seed can be obtained in it in any quantity. Recently Pure Carolina paddy seed cannot now be got in Madras.

every Collector was asked to furnish a supply from his district, and by none of the districts could any pure seed be supplied. This may have been due to the ryots not caring to part with the seed, but such an explanation is improbable, seeing that liberal prices would have been paid for it.

It was supposed that the Carolina paddy would hybridize with indigenous varieties of paddy, but in this Presidency there is no direct evidence that this has occurred; though, when Carolina paddy is growing side by side with country paddy, and both are in flower at the same time, it is not at all improbable but that they may hybridize. But, if the general disappearance of pure Carolina paddy seed in this Presidency is in any way to be attributed to hybridization, the result, though not what was anticipated or hoped for, will not be altogether without benefit. Though the absence of pure seed is unsatisfactory as regards the introduction of the Carolina paddy crop into this country in view to the production here of a rice for export equal in quality to that exported from America, there can be no doubt but that the introduction of such a large quantity of good seed has been attended with benefit to our agriculture.

66. In the Andaman and Nicobar Islands the experiments proved a complete success. The Superintendent reported that in 1874-75, 720 bighas of swamp paddy were cultivated by Government agency. The seed employed was chiefly acclimatized Carolina paddy, and the crop was a highly successful one. An average bigha of this crop was harvested, and the outturn carefully noted: the produce was 10 maunds 27 seers of grain and 13 maunds 5 seers of straw.

In his administration report of 1874-75 the Superintendent wrote: "Carolina paddy has now been thoroughly established in Port Blair. It has stood the test of 'five years' experiments, and is undoubtedly the most suitable description of paddy for cultivation in these islands. The acclimatized produce has in no way deteriorated, whilst its great advantages are the strength of the stalk and the tenacity with which the seed adheres to the plant; it is thus better able to resist the heavy weather which generally occurs at the change of the monsoon just before harvest time."

67. In British Burma, Mr. Hernandez, of the Burma Company, continued his experiments in 1874-75: he sowed two baskets of seed on an area of $2\frac{1}{2}$ acres of the company's land at Kyazoo, "and after a lapse of three months and ten days from the time of sowing 140 baskets of grain was reaped". The soil chosen was a strong clay, and the plant came up very satisfactorily; but a small black worm, which had done much damage in the previous season on the same plain to the Burman paddy, had destroyed many of the young plants by eating into the centre of the stalk. The straw obtained was superior to that produced by Natsaing paddy, but the rice (some of which was given to some Burmans) was considered by them to be hard and tasteless and not so good as their own.

Some of the rice had been sent by Mr. Hernandez to Liverpool for opinion. It was there valued at eight (shillings) per cwt. When cleaned it was said to be more like Port Canning rice than any other description, and "at present would be very unsaleable as cleaned, but would do for distillation at eight (shillings)."

Some seed, the remains of previous year's produce, was sown in the Agricultural and Horticultural Society's Garden at the end of July, was transplanted in August, and was reaped during a week of dry weather in October, the ears being perfectly ripe then. The outturn was about the average of previous years, viz., 26 baskets per acre. Several applicants from the districts were supplied with two, four, or six baskets of the acclimatized seed saved from the garden crop of 1873, and they all spoke of it in high terms.

In the Aykab District the crop was destroyed by a swarm of birds. In the Arakan District experiments failed "more or less from various causes". And in the districts of the Tennasserim Division the cultivation "appears to have resulted in a complete failure".

68. In the Province of Assam, which had hitherto been under the jurisdiction of the Lieutenant-Governor of Bengal, and reports from which were embodied in those of that Presidency, experiments were made in 1874-75 in the Khasia and Jaintia Hills and in Lakhimpur. The results were, as had all along been the case, not successful. And the local officer in the former district attributed the failure to (1) the seeds having been old, and (2) the climate of the hills being unfavourable for want of heat to promote the vigorous growth of the paddy. In the Lakhimpur District the failure was due to the want of vitality in a large proportion of the seed. The seed had been given out by the Bengal Government from the fresh supply imported in 1873.

CHAPTER III.

GENERAL CONCLUSIONS REGARDING THE EXPERIMENTAL CULTIVATION OF CAROLINA RICE IN INDIA, AND THE IMPORTANCE OF RICE CULTIVATION IN THE COUNTRY.

No very definite conclusions can be drawn from the experiments summarised in the preceding chapter. In the Madras Presidency a fair amount of success has attended the trials: the failures are, as reported by the Superintendent of Government Farms, "in many instances, to be attributed to ordinary causes under control in average seasons, and to mismanagement or wilful neglect". In the Bombay Presidency the results do not appear to have been decisive either way. In Bengal, in the North-Western Provinces and Oudh, in the Central Provinces and in British Burma, there have been more failures than successes; and the general result would lead to the belief that, though Carolina rice can be grown successfully in these Provinces if it is properly cultivated, yet the people do not like this rice, and it is liable to risk from which the indigenous variety is free. In the Punjab the poorer and more numerous classes live on dry grains, and the wealthier prefer their own very superior rice grown in Kangra and thereabouts. In Assam, in Berar and in Mysore, the experiments resulted in failure, and a continuance of them has been deprecated by local authorities. In the Andaman Island the trials have succeeded satisfactorily, and the Carolina rice has displaced, or nearly displaced, the Bengal variety which had hitherto been grown.

On the whole it would seem that the Carolina rice seed was too widely and too indiscriminately distributed. It might, perhaps, have been more satisfactory if one or two well-managed experiments had been made in each district and a trustworthy record kept of the results. This is a lesson learnt for future guidance. Meanwhile it seemed desirable to compile and make available a record of the past experiments such as they were, so that, if the experiments in Carolina rice are again undertaken, previous mistakes may be avoided. There can, however, be no doubt that the experimental cultivation, carried out so widely as it has been, must have diffused a supply of fresh seed over a large area of country; but whether the produce of this seed has been mixed up with and lost in the country varieties of rice or not, it is impossible to ascertain. The Government of India have decided not to ask for more experiments, although the Local Governments and Administrations and their officers have full power to continue such experiments where they may see reasonable chance of success.

Whether new varieties of rice are introduced or not, there is much room for improvement in the cultivation of the Indian varieties, which yield in different parts of India from $\frac{2}{3}$ of a ton of unhusked grain (paddy) in the Central Provinces to $\frac{5}{7}$ of a ton in average districts of Bengal, and up to one or even $1\frac{1}{2}$ tons per acre in the best rice tracts of the Sundarbans and of British Burma.

The importance of rice cultivation in this country may be shown by the figures given in the following statement, which furnishes the best available estimate of the average cultivation of rice in British India in an average year:

Provinces.	Total cultivated area.	Area under	
		Total food crops including rice.	Rice only.
	Acres.	Acres.	Acres.
Madras	28,500,000	26,000,000	6,140,000*
Bombay	24,636,000	19,213,000	2,135,000
Bengal	54,500,000	48,500,000	37,825,000*
N. W. P. and Oudh	36,683,000	31,450,000	2,505,000
Punjab	21,100,000	18,520,000	728,000
Central Provinces	15,518,000	13,054,000	4,524,000
Mysore	5,530,000	5,073,000	800,000
British Burma	2,834,000	2,611,000	2,455,000
Berar	6,532,000	3,704,000	31,000
TOTAL	195,833,000	168,125,000†	57,143,000†

* Figures are approximate only owing to the absence of statistics. The figures for Bengal are little more than conjectural.

† These include land twice cropped, and the total of both together consequently exceeds the total area under cultivation by about 15 per cent.

This table shows that Bengal ranks first in importance in the production of rice, that the Madras Presidency comes next, and is followed by the Central Provinces. The Eastern and Southern tracts of Bengal produce the greatest quantity of rice, feed their own millions of people, and furnish supplies to the extent of about 50,000 tons to Behar. Besides this, Bengal also furnishes a supply of about 4,460 tons to the Eastern districts of the North-Western Provinces. The North-Western Provinces, on the other hand, send down about 7,996 tons, and Oudh about 20,000 tons to Calcutta (Howrah) for shipment to foreign ports. The Madras Presidency produces rice in the Eastern districts for the consumption of those districts and for export. British Burma, which has a comparatively small population, produces a large supply of rice, much of which is exported. The general result, as regards export trade to foreign countries, is that the figures stand thus:

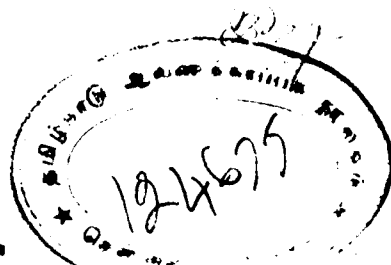
Exported by	In 1876-77.	In 1877-78.	In 1878-79.
	Tons.	Tons.	Tons.
Madras	79,982*	29,886*	65,259
Bombay	10,426*	15,506*	27,655
Bengal	285,651	296,026	320,121
British Burma	618,952	579,770	648,594
Sind	705	232	233
TOTAL ...	995,719	921,420	1,061,862

* Less than normal exports owing to drought and scarcity.

These exports are, so far as can be ascertained, consigned to the following countries:

	1876-77.	1877-78.	1878-79.
	Tons.	Tons.	Tons.
United Kingdom	539,609	524,410	535,307
Germany	4,414	3,442	4,844
Malta	14,905	.....	5,474
Mauritius	74,364	74,904	79,691
Réunion	5,131	3,351	14,034
West Indies	1,142	11,226	11,862
Arabia	19,203	25,801	30,849
Ceylon	180,382	160,210	189,033
Persia	6,287	6,341	7,151
Straits Settlement	55,047	51,121	84,175
Other countries	67,950	49,762	68,665
TOTAL ...	977,337	910,569	1,031,085

The yearly export of rice from India to foreign countries thus amounts to close upon a million tons; and the consumption of Europe is practically met by Indian rice, supplemented by the rice of Northern Italy (Piedmont and Lombardy), Spain and Egypt, and to a smaller degree by the rice of Java, Siam and Cochin China. Very little rice is received in Europe from the United States, and what is received is of such a superior quality that it commends itself only to the wealthy for food and confectionery, and is not employed for any industrial purposes, such as for distillation and starch.



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