REPORT ON RICE GROWING IN COASTAL AREAS IN NATAL AND ZULULAND

By J. E. COLEPEPER.

Introduction.

A recent copy of "Farming in South Africa,"[8] gives the following interesting information on the rice position in the Union to-day :—

It states : "Prior to, and at the beginning of the war, the Union normally imported about 87,000 tons of rice per annum, and at least 98 per cent. of this quantity came from countries like India, Burma, Siam, Indo-China and the Dutch East Indies. With the entry of Japan into the war and the consequent conquest of most of these territories, the rice supplies available to the allied countries were seriously curtailed, and although it was still possible during the first part of 1942 to secure appreciable quantities from India, practically no supplies have been received from this source since the beginning of 1943 owing to local emergency conditions. The only remaining sources are South America and, to a lesser extent, the north and west African territories. The quantities procurable from these areas are, however, very insignificant in comparison with the pre-war imports, and it is, therefore, clear that, until the war is over, the people of the Union will have to content themselves with very little or no rice at all in their normal diet.

It is realised, of course, that a shortage of rice causes considerable inconvenience, to certain sections of the population, but fortunately the position in regard to supplies of other foodstuffs which may be substituted for rice is such that the rice shortage need not cause serious hardship.

In order to ensure the most effective utilization of the small quantities which are available for the Union, it was decided to take over full control of the importation and distribution of rice from the beginning of 1944. The Food Controller will undertake this task in co-operation with the trade, more or less on the same basis as that which is applicable in the case of tea. Although the proposed steps will contribute towards a more proportionate distribution, the position will remain difficult owing to the shortage of supplies.

It is also hoped that it will be possible to provide rice at a lower price level than that prevailing at present. At the existing high prices, which must be ascribed primarily to the excessively high freight from South American countries, rice cannot be used to advantage by the less privileged sections of the population. If, therefore, the price level cannot be considerably reduced, the importation of this foodstuff will probably not be worth while."

In view therefore of the present high price of rice and the difficulty experienced in obtaining adequate supplies, the questions naturally arise :—

(1) What are the commercial possibilities of rice as an alternative crop in the sugar belt ?

(2) What has been the experience of those who have attempted to grow it ?

The writer would like to make it quite clear at the outset that this report is not a paper on how to grow rice, so much as a description of how it is being grown at present in the sugar belt. It is merely an attempt to summarize data collected from various sources during a recent trip through the coastal area of Natal and Zululand, where the opportunity was afforded of visiting numerous rice growers, seeing the results of their labours and discussing with them the local problems and difficulties. It is, therefore, to be hoped that this summary of their experiences will be of assistance not only to those already growing rice but to planters who have not yet made the attempt but wish to do so.

Under the various headings will be set out the diverse methods employed, the results obtained, and such conclusions as it seem permissible to draw from the available information, together with extracts from recent literature on rice growing where these seem applicable to our conditions.

That rice will grow and give crops which compare favourably with yields obtained in other countries when given proper care and attention seems to be established.

It is also clear that the best crops are obtained when the crop is grown in level, enclosed beds completely inundated and where the water can be properly controlled; at least this is so with the present varieties at our disposal, and though it is admitted that the initial cost of preparation of these beds is high it must be borne in mind that this is not a recurrent expense and that the cost of production of subsequent crops is greatly reduced, whilst harvesting costs are also lower owing to a more uniform ripening of the crop.

Satisfactory crops are also being produced by irrigation, yields being dependent on the amount of care and attention given, and frequency and uniformity of water application; and although costs are reduced in preparation of the land, as compared with the flooding system, the distribution of water is more expensive and laborious, and weeding costs are higher.

Information on dryland rice growing is scanty, but there is evidence that reasonably good crops have been grown where the rainfall was good and well distributed throughout the growing season. The initial costs are low and of the same magnitude for subsequent crops, being little more than for any other grain crops such as maize, etc. In the event of the crop being a total failure no great financial loss is incurred, as the rice can be ploughed in as a green manure crop and the field finally planted with cane, or another attempt can be made the following year. At present this method appears to be a gamble, with a fair chance of success in some districts of high rainfall, but no doubt when a bigger selection of dryland rice varieties are available will become more popular.

Locality and Altitude.

Rice was seen growing at altitudes varying from 1,000 feet to sea level, within a few hundred yards of the seashore, and as far inland as Kearsney. Provided a suitable site can be found, it appears that rice can be grown anywhere in the coastal belt, or outside it for that matter, for Sawer[6] states : "Rice can be profitable on suitable ground under irrigation in any part of the country lying between the escarpment of the high veld and the sea."

Soil and Topography.

Rice appears to do well on all types of soil, from the coastal sands and Table Mountain Sandstone formations to the heavier loams and alluvial flats, provided they are well supplied with organic matter, and water is plentiful. The subsoil is almost as important as the soil itself and where this has a high water retaining capacity, permitting minimum percolation, the best results are obtained. There is greater economy in water, which in turn permits larger areas to be cultivated with the water available. On sandy soils as much as 13 acre/feet of water will be required to produce a crop, whilst on heavier types of soil with an impervious subsoil only 4 to 5 acre/feet are necessary. Ideal soil conditions are stated[3] to be a rich loam overlying a clay.

Protection from wind is of some importance, for when the crop is heavy it tends to lodge. Most estates have one or more sheltered low-lying hollows containing areas of fairly level land capable of being efficiently drained and with small streams of water flowing through them, and where these occur, any one of the three methods in practice can be employed.

Cultural Methods.

The flooding and irrigation methods involve quite a lot of preparation, and the most successful practice seems to be (1) to construct a small dam across the head of the hollow or vlei with furrows to conduct the water along each side of the valley at a level sufficiently high to be clear of the area which the plots will occupy; (2) a deep central drain following the lowest contour to provide good drainage is the next essential. This is important for the efficient control of the water supply and the ability to dry out or flood the plots at the correct stages in growth is very necessary. Wet and soggy conditions are a disadvantage during

the initial preparation of the land, during weeding and cultivation, and especially at harvest time.

After the construction of furrows and drains the area is ploughed and harrowed and reduced to as fine a tilth as possible. Thereafter the method of preparation differs according to the manner is which the rice is to be grown.

Irrigation.

The land receives little or no levelling and the rice is planted and irrigated by means of sluice gates set at intervals in the furrow wall, or, as was noted in some instances, the water is lead on to the land from the dam at the head of the vlei and allowed to flow through the field and drain out at the bottom. Neither of these methods appears to be entirely satisfactory as the application of water is not uniform, is difficult to control and results in uneven ripening. On the other hand the expense of levelling plots and building banks is avoided.

Inundation or Flooding.

The rice beds are levelled and banks built round them to contain the water when this is applied. The size and shape of the beds vary with the slope of the land. The difficulty experienced in levelling usually restricts the size. Except on the alluvial flats where mechanical cultivation can be carried out there seems to be no good reason why these should be made larger than one sixth of an acre. They may be much smaller if the slope between furrow and drain necessitates terracing and contouring. Where a wide terrace would involve digging so deeply on the topside that the subsoil would be exposed, it is more satisfactory to arrange several terraces and divide these at intervals with banks, than to attempt a lesser number of wider plots. A big saving in the cost of preparation was experienced in instances where it was possible to use graders and scrapers, both for levelling and preliminary earthwork of the bunds or banks.

The banks are usually about three to four feet wide at the base, two feet high and about eighteen inches to two feet at the top; smaller dimensions were encountered in some instances but these were liable to seepage and were difficult to walk along. Some authorities advocate comparatively wide bases which give a gentle slope to the sides of the bank, and permit of the passage of ploughs, etc., from one plot to another in the preparation of the land in subsequent years. This appears to be a point well worth considering if green manuring between crops is to be carried out.

The provision of one or more shallow drains in each plot running at right angles to the main drain to facilitate drainage is also suggested.[6]

Application of Water.

An adequate water supply and good drainage seem to be equally essential to successful rice growing. It does not signify that because rice grows in water that it can be established in stagnant swamps. The water in the beds should be frequently changed, but opinions vary as to the correct intervals for this from every three days to once a fortnight with varying lengths of dry periods between floodings. The depth of water also seems to be a subject for discussion. Good crops were seen which had been grown in a maximum depth of one inch of water whilst equally good rice was harvested in another area where owing to heavy rains and lack of adequate drainage facilities the crop at one period stood in two feet of water.

Probably the most successful crop seen actually stood in six inches of water during most of its growing period. The depth of water varies, both with the age of the crop and the variety grown. In all cases where the water supply could be controlled this was cut off and the land allowed to dry out about two to three weeks before harvesting commenced.

Where the water has been deep its removal should be a gradual process, spread over several days, as heavy crops tend to lodge if drained too rapidly.

Preparation of Nursery for Transplants.

In most cases this presents no difficulties. An area corresponding to about one eighth of the total area it is intended to plant ultimately is levelled, divided into seedbeds of a convenient size, cultivated to a fine tilth, thoroughly saturated, the water drained off and the surface allowed to become sufficiently dry to be raked. The seed is usually broadcast on and either covered with a thin layer of soil or raked in, and the surface soil patted down. The plots are then kept moist until germination is complete, either by hand watering or light irrigation at intervals. Instances where seed was broadcast on to the flooded beds were reported to be unsatisfactory, though this method is practised in other countries.

The soaking of seed before planting was carried out in some instances for periods varying from 12 hours to 2 days. In some cases the seed was planted immediately after soaking, in others it was drained and stored in a cool dark place for a further two to three days until germination had commenced. Quite a number of growers sowed unsoaked seed with apparently satisfactory results but with a correspondingly longer period of germination (the soaked seed germinating in about two to three days as compared with eight to twelve for the unsoaked). The young seedlings are watered at frequent intervals until about three to six inches high and the first joints or nodes begin to form. After that they are flooded and kept constantly in water. This is changed at intervals, very often with a 24 to 48 hours dry spell between floodings, until transplanting at a height of eight to ten inches. The period between the planting of seed to transplanting is anything from 35 to 50 days, usually six weeks. About three seedlings are transplanted into each hole in the plots. Some growers pinch off the top portion of the leaves to encourage stooling and to assist in distinguishing the young plants from similar grasses during weeding.

Direct Seeding.

Most growers appear to have tried planting seed direct into the plots and report no apparent difference in yield when compared with the transplanting method, whilst an appreciable saving in labour is claimed, which is an important point in the growing of this crop under local conditions. This particular aspect is dealt with very comprehensively by "Correspondent"[2], and it is not intended to enlarge on this, except to mention a compromise adopted in some areas where, when planting seed direct into the permanent plots, six or eight seeds are put into each hole at the outset instead of the usual three or four; these can be thinned out and used for transplants in areas of poor germination, ditches, drains, etc., which the grower may decide to fill in later.

Direct seeding is done with either dry or soaked seed, by hand into holes made with a small hoe or similar implement, or at intervals in a shallow furrow.

One grower stated that a satisfactory furrow could be made with an ordinary scarifier by removing all except the centre rear tine, and front wheel. The water application for direct seed planting is similar to that for the nursery plots.

Varieties.

At least twelve varieties were observed in the mixtures which have been grown from local seed; the identity and origin of these varieties however is obscure and their names are not known. From this mixture most growers are selecting the seed of two, three or more of the most promising varieties and harvesting sufficient ears of each variety to ensure an adequate seed supply for their future requirements. The selected varieties are in most cases kept separate. In one instance the best ears have been collected irrespective of variety for further planting. The former method is to be preferred as more uniform ripening is likely to result from pure varieties than from mixtures. The most popular selections are :—

1. A medium strawed type with well developed panicle, with numerous well-filled spikelets of light yellow colour, awnless, early maturing. Probably the most popular variety grown.
2. Is similar to No. 1, but awned, seems to mature about the same time and is said to be unattractive to birds on account of the awns. Seed is white, medium length, and moderately plump in both cases; also very popular.
3. A short strawed variety, seen growing well under comparatively dry conditions, a heavy yielder with well developed panicle, the spikelets were well-filled, very short awn.
4. Found growing under similar conditions to No. 3 and doing equally well, is very similar in most respects but the spikelets are much darker.

Nos. 3 and 4 were not seen growing north of the Tugela, where Nos. 1 and 2 were most popular.

None of the above varieties appears to shatter very readily, and is not easily confused with the other varieties.

Of the remaining varieties seen, none appeared to be worth further propagation under our conditions. They either shatter very easily or have a much longer growing period and form a vigorous straw with little or no grain. A possible exception is a variety known locally as Bombay Rice (No. 5); this is a fair yielder, short strawed and early maturing, with a well-filled panicle containing medium plump, white grain, which does not shatter easily.

The American varieties Calora, Calusa, Early Prolific, and Supreme Blue Rose, where seen did not appear to be superior in any way to the best local varieties. Calora in one area was doing moderately well, whilst fair crops of Supreme Blue Rose were seen at another. Red Rice (No. 6) appeared to be mixed with the varieties in most of the areas seen, and as this and other useless varieties appear to have self seeded in most of the plots vigilance will be necessary in the preparation of this land for future plantings to eradicate them. Unlike the weeds they cannot be "drowned out" by flooding, and are very difficult to distinguish during the growth of the crop. Red Rice especially greatly reduces the market value of a crop and is most undesirable. Great care should therefore be exercised to avoid planting it in new areas.

It is suggested that before planting a small sample of the seed is dehusked and examined for red grains, and where these are at all numerous the seed should not be used for planting purposes.

Area.

It was not possible to visit all rice growers owing to lack of time and therefore no accurate estimate of the total area can be given. An approximate estimate of the area actually visited would be considerably more than this if the numerous patches grown by Indians were included. Individual growers have areas ranging from half acre plots to 20 acres or more. The total yield from this area would then at best supply no more than one quarter of one per cent. of the Union's annual requirements.

Seeding Rate and Spacing.

Opinions vary as to the amount of seed required to plant an acre, estimates of as little as from 4 lbs. to 5 lbs., to 80 lbs. to 100 lbs. per acre being given, with an average of between 18 lbs. to 30 lbs. Wood in the "Note Book of Tropical Agriculture"[7] gives the number of grains of rice per pound as being 16,000 to 27,000.

With the heaviest weight grain and an average spacing between rows of nine inches planted at six inch intervals with three grains per hole, the seed rate is approximately 22 lbs. per acre; at 18 inches by 18 inches spacing about one sixth of this quantity will be required.

The average spacing is 9 inches by 6 inches for either transplants or seedling direct, with three or four plants or seeds placed in each hole. Some growers advocate 18 inches by 18 inches planting whilst others, basing their opinion on experience of their own conditions, state that they intend to try 6 inch by 4 inch spacing for future plantings.

Broadcasting which has been tried to a limited extent needs about 60 lbs. to 90 lbs. per acre.

Optimum Planting Time.

Most growers find that the best time to plant seed in nurseries is from about 1st to 15th August, transplanting out to the main plots during the last week in September or first week in October.

For direct seeding September or October, depending on the season, is the best.

Some growers tried planting in June and July with poor results, whilst others found that August planting ripened at the same time as rice planted in October. Some December to January planting has been tried under dryland conditions but as the crop has not yet matured no opinion can be expressed on the final results, although at the end of March the crop looked promising.

Period of Growth.

Rice usually takes from three to nine months to mature, depending on variety and locality. The varieties growing in the coastal area seem to take approximately six months from planting of seed to harvesting and actually stand in water for about four months of this period.

Fertilizers.

Little information was available on this point; in most cases virgin land was used, and being high in organic matter good crops resulted. Opinions were expressed that rice appeared to be a heavy feeder, and it is questionable whether satisfactory yields will be maintained without substantial applications of compost, green manures or kraal manure.

Karroo manure was tried broadcast at the rate of two tons per acre on sandy patches and at the rate of 1,500 lbs. per acre on heavier soil but no separate yield figures were available. Whale guano is reported to have given visible responses, whilst at 3 to 1 mixture of Karroo manure and "D mixture" has also been tried, but again no comparative figures are available. Reed and Sturgis[5] after a two-year investigation by means of pot tests state: "Large increases in the growth and yield of rice were obtained from the addition of leguminous organic matter. Commercial fertilizers were not as effective, but substantial increases in yield were obtained from applications that included phosphorus.

Inorganic nitrogen and potassium were ineffective when applied singly or in combination with each other, but were effective when applied with phosphorus." These authors also note, in analyses of rice soils after harvesting: "a marked diminution in nitrates, ammonium nitrate and phosphorus." Bonemeal at the rate of 400lbs. per acre is also stated to have given beneficial results, whilst the growing of sunn hemp is also recommended as a source of nitrogen and organic matter.

Harvesting.

The most popular period seems to be from 15th February to 15th March. Two methods are practiced: (*a*) the ears are reaped separately as they ripen, and threshed immediately at some central point in the field by means of flails or tramping, only the panicle and top six inches of straw being harvested; (*b*) the whole straw is cut a few inches above the ground level, tied into bundles of a convenient size, transported to some central point and threshed by beating the heads on a log or bench, under which a sail has been spread. Some growers stack the bundles for a short period before threshing.

The first method is laborious and is evidently a result of planting mixed seed with different ripening periods, and also in part due to uneven water distribution. These disadvantages are likely to be overcome in subsequent plantings.

The second method appears to be more satisfactory and it is stated that a boy can thresh two bags a day in this manner.

After threshing the paddy is spread out to dry before winnowing and bagging. This usually takes about three days. Some growers lost a fair quantity of paddy from shattering, through harvesting too late.

A recent rice growing pamphlet by the N.S.W. Department of Agriculture[4] states: "To obtain the heaviest yields and best quality rice it is necessary to keep the water on the crop until the last few grains towards the base of the head are out of the milk stage and in the dough stage, with the panicles well turned down."

Few attempts have been made to utilise the rice straw as a stock feed, some growers stating that neither cows nor horses eat it very readily. Although in other countries it is mentioned that properly cured and supplemented it forms an excellent feed. Composted and returned to the fields it should provide a valuable addition to the organic content of the soil.

No mechanical methods of harvesting were seen, very few places being suitable; moreover the areas planted at present do not justify the purchase of special machinery for this purpose.

Removing the Rice Husk.

With one exception this is at present being done by hand with the primitive pestle and mortar. It is a lengthy and laborious method and in the absence of proper rice milling machinery growers are issuing the rice ration to their labour in the form of

"paddy" or unhusked rice. Enquiries regarding the availability and approximate price of various types of rice milling machines have been made and it is hoped this information will be available shortly.

Parboiling.

Where dehusking is done manually it is usual to boil the paddy until the grains swell and split the husks; this usually takes about 45 minutes. The paddy is then thoroughly dried, pounded in a mortar with the pestle, and winnowed, the resulting grain being darker in colour than the unboiled product and is said to keep better. The grain produced by this method is known as "rough rice" and is about 80 percent. of the paddy, rice husks constituting about 20 per cent. are of little or no commercial value. Rough rice has a thin aleurone layer surrounding the grain, this skin containing most of the characteristic flavour. Milling and polishing operations remove this together with the oily embryo but improve the keeping qualities.

The following proportion of products from paddy is given by Boonstra[1]:—

Milled Rice.	Per cent. total weight.	Per cent. market value.
Heads	57.0	82.8
Second Heads	3.5	4.0
Screenings	6.0	5.9
Brewers	2.0	1.8
Polish	2.0	0.8
Bran	8.5	2.6
Hulls	20.0	2.1
Waste	1.0	—

From this it will be seen 150 lbs. of paddy will yield approximately 85 lbs. of whole grain and 15 lbs. of broken grain of varying sizes.

Yields.

The only figures obtainable are those for paddy and vary from seven bags (weighing approximately 150 lbs.) under dryland conditions to 30 bags per acre on small plots under water; the average being somewhere in the vicinity of 15 to 20 bags per acre. This would correspond to approximately 12 to 16 bags of 150 lbs. of rough unpolished rice. Soil and varietal conditions being equal, the yield appeared to be largely dependent on the amount of care, attention and water applied to the crop.

Wood[2] mentions 3,000 lbs. grain per acre may be considered a good average crop, whilst Boonstra[1] gives the Texas yields as 55 bushels (2,500 lbs.) and Louisiana yields as 40 to 45 bushels (2,000 lbs.); this would be equivalent to approximately 30, 25 and 20 bags of 150 lbs. paddy per acre respectively.

Costs of Production.

Costs quoted ranged from 30/- to 65/- per 150 lb. bag of paddy, this wide margin of difference being due chiefly to methods adopted and labour employed. It must be borne in mind that in most cases the crop was being grown for the first time and the initial cost of preparation of the land was included in this total, in addition to which the growers had no previous experience to guide them. Further, the seed mixtures planted contained many unprofitable varieties which either did not form grain, or bore good crops which shattered badly before harvesting. It is generally agreed that costs could be reduced by at least one third in subsequent crops, where extensive land preparation has already been done. The biggest reduction in costs, however, is likely to be effected when large areas can be planted and modern mechanical methods employed.

Milling.

The paddy is poured into the hopper at the receiving end of the mill. From thence it passes to the cleaning riddle, which removes the stones, straw and dust, and other impurities. The cleaned paddy then passes into the sheller or de-husker. This machine consists of two flat discs, covered with artificial mill stone, the lower of which revolves. The paddy passes through the narrow space between these discs and in doing so, the points of most of the grains are split open and the husk removed.

The resulting mixture of shelled rice, husk and a small proportion of paddy, a little bran and the "points" pass over a winnowing aspirator which recovers the bran and points, the grain passing on to a paddy separator which removes the paddy and passes it back into the sheller.

The dehusked grain (brown rice) which is still covered with the oily inner skin passes into the pearler, a conical millstone revolving inside a wirecloth cage, which scours off the skin. The resulting meal or bran passes through the meshes of the cage and is delivered into bags. The grain passes from here to the classifier where it is separated into heads, second heads, screenings and brewers grain.

Where a finer degree of finish is required, the grain is polished and coated with glucose and talc.

Unfortunately no accurate costs for rice milling are available at present. Boonstra[1] gives the average milling costs in Louisiana as 60 cents per barrel of 162 lbs. (equivalent to ¼d. per lb. or about 3/- per bag of paddy) it being customary for the miller to retain all by-products of the milling process.

Owing to the initial cost of rice milling machinery and the comparatively small areas grown, individual milling will be likely to prove costly and the possibilities of co-operative milling are worth investigation.

Ratooning.

This is being attempted by some growers. It is not possible to form any definite opinion at this stage as to whether this will prove to be worth while, but it is stated in some instances that where it was tried in previous seasons only indifferent crops were obtained, the onset of winter not permitting the proper maturity of the second crop and yields being less than half the original crop. In view of the foregoing remarks under "Fertilizer," it seems that the sounder policy would to be sow the land to a quick growing green manure crop, preferably a legume, or if the lateness of the season prevents this to apply liberal quantities of organic matter, plough this in and leave the land fallow until spring, when it is prepared again for planting.

Ploughing should not be too deep as the germination of weed seeds present in the soil should be encouraged, and the weeds ploughed in before seeding, to reduce weeding costs during the growth of the crop.

Pests.

Birds are the most serious pests and it is necessary to provide some means to prevent their depredations from germination until harvesting is completed. They attack the young seedlings as they emerge and pulling them up devour the attached grain; again when the grain is forming and in the "milk" stage the crop is very liable to be damaged by birds.

Guinea fowl, field rats and mice are reported in some instances to cause minor damage, and in one case a species of beetle caused some damage to young seedlings.

Conclusions.

It would be premature to venture an opinion as to whether rice could ever be grown as a profitable alternative crop in the sugar belt. To employers of Indian labour, in view of the difficulty in obtaining adequate stocks of rice and the prevailing high price, it may prove to be well worth while to develop suitable areas for rice, as a temporary wartime expedient. One of the chief difficulties appears to be to obtain the extra labour necessary to carry out the work entailed owing to the general shortage of labour at present. Provided this can be overcome, there seems to be no good reason why paddy at any rate, should not be produced at reasonable cost. If, also, suitable rice milling machinery can be obtained, it should be possible to provide some part at least of our rice requirements, until normal supplies are again available from overseas.

Acknowledgments.

The writer would like to take this opportunity of expressing his appreciation and thanks for the active help and information given by all the growers visited, without whose co-operation it would have been impossible to compile this report.

Summary.

Rice has been grown in the coastal belt of Natal and Zululand in recent years with some success; the methods used and results obtained are described.

Approximate costs of production are given and the possibilities of future development discussed.

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April, 1944.

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[1] Boonstra, C. A. (1942): Rough Rice Marketing in Louisiana. La. Bull. No. 340, 24.

[2] "Correspondent" (1943): S.A. Sugar Jl., August, 345.

[3] Hunter, H. (1931): Encyclopaedia of Scientific Agriculture, 2, 1048.

[4] N.S.W. Department of Agriculture Bull. (1929): Rice Growing, 9.

[5] Reed, J. F., and Sturgis, M. B. (1937): A Study of the Fertilization of Rice. La. Bull., 292.

[6] Sawer, E. R. (1909): Cedara Memoirs on S.A. Agriculture, 1, 190.

[7] Wood, R. C. (1935): Notebook on Tropical Agriculture, 50.

[8] (1944): Farming in South Africa, 173.

The PRESIDENT, in opening the paper for discussion, said that the author must have been confronted many times by opposing opinions and findings, and that made the task of the investigator very difficult. He thought it only right that we should attempt to provide our labourers with what, to many of them, was their staple food. It was probably wrong to take it for granted that the price of rice would ever again drop to the very low figure it was before the war. Perhaps it was a blessing that the importation of rice at such a low cost was stopped. It might put us in a position to produce enough to supply the requirements of that portion of the community who depended entirely on rice as their main diet. It behoved us to make a serious start on rice production, and to help in that way he suggested that this report be published in bulletin form and circulated to all sugarcane planters.

The President wanted to know what the possibilities were of using rice straw as ensilage. He thought it ought to do very well for bedding material for cattle, and could, of course, later on be incorporated in compost heaps.

Mr. DODDS pointed out that some years ago it had been found at the Louisiana Experiment Station that rice husks were suitable for making decolorising carbons for sugar refining purposes and a large refinery in New Orleans began using it. He thought that if it was contemplated going in for rice growing on a considerable scale in this country, the much discussed Pongola area could possibly be utilized. Certain conditions there would suit rice growing admirably, but he did not have any information as regards the suitability of the soil.

Dr. HEDLEY said that he recently read a report by Lord McGowan. Reference was made to a process worked out by the Imperial Chemical Institute, whereby stalk of various cereals were converted chemically into a valuable animal food. This process was now being used on 3,000 farms in England. Should rice be grown extensively in this country, details of the process could probably be obtained from Umbogintwini, and the straw used as cattle feed.

Mr. COLEPEPER said he had no information as to the suitability of rice straw as ensilage, but he pointed out that it was considered of low nutritive value. It was, of course, excellent for bedding material, but it probably would not appeal to the sugar planter, who already had a surplus supply of trash.

Mr. RODGER said that he had had twenty years' experience of growing rice in India, and he was therefore very interested in rice experiments in this country. He considered we were in a position to compete favourably with most other rice producing countries. Labour in India was cheaper than in this country. An Indian labourer was paid one shilling a day, as compared with two shillings and sixpence in Natal. The cost of production in India before the war was about four shillings per bag of "dhan," and to this was to be added the cost of transport, etc. In India it is estimated that half a man per acre was required for eight months of the year. Here one man per acre would surely be more than sufficient, and he thought it possible to produce a bag of rice for about 16/- here. We should be able to obtain a yield of about 35 to 50 bags to the acre. One local estate actually harvested 72 bags from two acres, and he thought about one-third of the crop was lost as a result of pests, handling, theft and irregular growth. He was accustomed to planting rice 9 inches by 4 inches, so that each plant had one-quarter of a square foot. He thought that one plant to 2½ square feet could not give a profitable return. He did not believe in attempting to ratoon rice. It was false economy not to keep enough rice seed. If there should be a surplus it could always be used as rations.

Another PLANTER gave the following as his experience of paddy rice cultivation in Zululand. Twenty acress of rice were planted on the following types of soil: 12 acres of heavy black clay, 5 acres of chocolate loam, and 3 acres of dark porous soil mixed with gravel. These soils sloped from 1 foot in 100 feet to 1 foot in 15 feet.

Immediately after removing the cane crop in July, 1943, all the surplus vegetation was collected and destroyed. This was necessary owing to the short time available before planting, as otherwise the rotting-down process would have been detrimental to the young rice. Very little clearance was necessary where the land had been under pumpkins. Cultivation was done as speedily as possible by tractors and oxen. Owing to lack of time fallowing was found impossible. It was found necessary to plough three times, followed by heavy discing to break down the soil. During successive ploughings large clusters of cane roots were collected and used later in the formation of check ridges for irrigation.

Three different methods of planting were tried. Seeds were broadcast in well prepared seed beds, raked in and watered daily as required. After five to six weeks, when the plants were from eight to ten inches high, they were transplanted. Clusters of three plants were planted out in 6-inch drills spaced 8 by 8 inches apart. The fields were then flooded daily until the plants firmed and the flooding process maintained until maturity. This method requires a great deal of personal supervision, and there was the risk of losing heavily if the seed beds were damaged by rats, birds, cattle, etc. Transplanting costs in heavy soils and with unskilled labour were extremely heavy.

Another method of planting was to drop three or four seeds into shallow drills 8 by 8 inches apart, followed by a light raking and an initial flooding. No further water was applied until the seeds were up. After that flooding was practised to maturity. This method had the disadvantages that one was liable to plant too deep in the drills; destruction was caused by rats and birds excavating the drills to feed on the grain, and it was costly in labour and time. Seed was used very economically, however.

The last method tried was to broadcast the seed by hand on dry, well-prepared paddy beds (approximately 50 lbs. per acre) and to rake in by means of a light harrow. This was followed by an initial flooding for one day to induce germination. Permanent flooding was again practised after the plants were well up. Thinning out was done later and the blanks filled in so as to give the same spacing as in the other methods. This method was considered the most satisfactory. There was a considerable economy in time and labour and less danger from damage and destruction from animals and pests as the crop was spread out more.

It had since been learned that seed should be soaked and sprouted before planting. This would undoubtedly be advantageous.

Abundant water with efficient control proved to be of paramount importance. Automatic water control, which was possible on the paddy beds, resulted in economy of water and labour and was of great benefit to the crop. It was possible in this case to regulate flow-in at the upper end, with continuous repetition from bed to bed day and night. Water control in areas where terraces or no terraces or beds were made, proved infinitely more costly and inefficient, with a resultant heavy drop in yield. Continuous flooding was employed in all cases up to December, when the flowering heads began to droop with the weight of grain. The water was then drawn off when signs of maturity appeared, so as to force an even ripening.

Growth was slow in September and October, probably on account of the cold weather, but it improved and was greatly accelerated during the next two months.

On reaching maturity the crop was cut at ground level, stacked in large heaps, threshed on the spot, winnowed and transported to sheds to dry.

The average yield was about 20 bags of paddy to the acre, but that included 8 acres from which the yield was extremely poor because proper watering control could not be practised on the area. No serious pests or diseases were observed. Birds and rats proved the most troublesome, demanding constant watchfulness.