A SURVEY OF RECENT WORK ON THE ECONOMIC IMPROVEMENT OF THE RICE INDUSTRY IN CEYLON

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OF late there has been considerable criticism, both in and out of season, regarding the progress of work for rice improvement in Ceylon. Those better informed acknowledge that some appreciable progress has been made. Success is possible only by securing the active co-operation of the public. The first step in enlisting this interest is to set out in as simple a way as possible the problems and solutions of this complex subject. Hence, the object of this article is to bring to the notice of the general public the present position of the rice industry in Ceylon and the progress effected during the past decade.

Since the last food crisis in 1920-21 new areas have been and are being gradually brought under cultivation, and local production has increased from a yearly average of some $8\frac{1}{4}$ million bushels during 1903-13 to $13\frac{1}{2}$ million bushels during the decade 1914-24 to a little over 15 million bushels during 1929, the last year for which we have estimates. The annual requirements of the Island amount to some 37 million bushels of rice of which only about one-third is produced locally. The remaining two-thirds is imported annually from India and Burma at a cost of about a hundred million rupees, at normal market rates. The estimated population of the Island at the end of 1929 was 5,479,000 and it is assumed to have increased by some 980,000 persons or 21·8 per cent since the census of 1921. Of these about 800,000 are Indian labourers. Rice is the staple food of these labourers and it is estimated they consume about one-third of the imported rice as they have not the facilities for producing it locally. Of the remaining imports one-third is consumed in the townships and the remaining one-third in the rural areas. The rural population do not prefer the cheap grades of unpleasant odoured so-called white rice to the wholesome unpolished local red rice; but because of their economic conditions they are obliged either to dispose, from time to time, of small quantities of locally grown rice, the proceeds from which enabled them to purchase an equal quantity of the cheaper imported grades and in addition find the wherewithal to obtain some of the other ingredients necessary for a meal; or, as in the case of the smaller and poorer cultivators, pledge their crop as security, and in return obtain from the local boutique-keeper the necessities of life. The boutique-keeper stocks the imported polished white

rice as it is both cheaper and keeps better in storage than the unpolished rice and also because dealing in this commodity affords him a greater scope for speculation.

The population has increased during the last two decades chiefly on account of the development of the rubber, tea, and coconut industries and consequent increase of prosperity of the country. The increase in local production is not in proportion to the increase in population, hence as is to be expected the imports have increased. There does not exist the remotest possibility of over-production for home consumption of home-grown rice and Ceylon will essentially always to some extent remain a rice importing country. In 1930 even a small short-lived disturbance amongst two sections of labourers at the Rangoon docks threatened a food crisis in Ceylon. Food crises are bound to occur periodically at short notice. The recent temporary suspension of the Indo-Ceylon train service due to damage caused by heavy rains was reflected in as high a rise in price of rice as Re. 1 per bushel. All this indicates the extent of our dependence on India and Burma for the supply of our staple food.

It is acknowledged that the most important and pressing economic problem of the Island is the development of its rice industry which would greatly influence the prosperity of the other industries and consequently the general prosperity of the country. At the present time when depression hangs over our chief industries greater attention is focussed on the question of local food production—chiefly over rice. The recent increased duty on some of our imported foodstuffs is a blessing in disguise which should stimulate local production. An additional reason for the development of the local rice industry is indicated in the Administration Report of the Director of Agriculture for 1930, in which he states: "There is indication that in some countries rice is being produced under conditions that give insufficient return for the labour expended, and this introduces a factor that may not induce the growers to continue". The possibility of increasing the rice crop obviously depends on the increase in yield per acre and on the increase in area of production by owners of suitable land opening them under rice and gradually extending the area until all suitable available Crown land is brought under cultivation. The adoption of economic methods to increase the yield per acre would reduce the cost of production and make the cultivation of rice more remunerative and a slightly more attractive industry, thereby encouraging new areas to be brought under cultivation. This object could be achieved by improving the conditions under which the crop grows, through better cultivation, and judicious systems of manuring, and by the use of improved seed.

We shall now proceed to draw attention to some of these more economic methods of production that are possible in Ceylon Agriculture.

1. *Preparatory Tillage.*—An essential feature in the management of a paddy soil is that puddling must be very thorough. If a heavy weed growth or a green manure crop has to be ploughed under, the *Ceres* plough is recommended for preparatory tillage even with average village cattle. It is more the later churning than the ploughing which is important. The soil should be rendered very fine and puddled to the consistency of thick gruel. The Department of Agriculture realised that what the *goiya* required was an efficient but inexpensive and portable implement capable of bringing this about with readily replaceable parts and a minimum number of nuts and bolts or preferably none at all. Such an implement suitable for use after the first ploughing is the five-toothed wooden harrow used in Burma and some parts of the Konkan, India. The implement is easily constructed of light jungle timber at a cost of about three rupees and can be conveniently drawn by buffaloes; with the teeth removed it serves the purpose of a leveller. It is so light that it can readily be carried by hand.

2. *Manuring.*—Bulky organic manures are a necessity for swamp cultivation not only for the supply of plant food, particularly of ammonia in which form nitrogen is utilised by swamp paddy, but also for the supply of carbon-dioxide for the algae present in a film on the surface of paddy soils. These algae are believed to play an important part in the supply of oxygen to the roots of the rice plant, and to be a necessary foundation in order to obtain the maximum response to artificial manures. The response to green manure is very marked particularly in soils cropped twice a year or where natural weed growth is poor or where cattle are of necessity permitted to graze on the available weed growth in the fields during the off season. Results of field experiments conducted by the Economic Botanist and of laboratory experiments conducted by the Agricultural Chemist clearly indicate that the application of green manure is efficacious in increasing the yield of grain. Green manure for rice should be applied a week to ten days prior to sowing or transplanting in order that the maximum benefits by its application may be obtained. At Peradeniya a 1-ton dressing of green manure has given a very satisfactory increase in yield of grain. If, however, practical considerations necessitate its application early the fields should be kept thoroughly moist until sowing or transplanting as the case may be, since the decomposition of green manure under normal arable land conditions results in the formation of nitrates which the rice

plant does not want. The rice plant prefers nitrogen in combination as ammonia. If green manure is applied late the period of maximum formation of ammonia coincides with the period when the paddy plant is in active need of ammonia. Whenever green manure is applied a few days prior to sowing it is advisable to drain the fields in order to remove any toxic products of decomposition. The application of 1 cwt. of ordinary superphosphate or 100 lb. of steamed bone meal per acre will give, on average Ceylon soils an increase of 25 per cent and the benefits will last and effect a 12 per cent increase on the succeeding crop. Larger dressings or repeated applications of superphosphate result in upsetting the balance of the principal manurial ingredients in the soil and are not to be recommended. High yielding pedigree strains of paddy, when placed in the hands of cultivators are, in the majority of cases, grown on poor unmanured or indifferently cultivated fields. High yielding strains necessarily need more nutrition than poor yielding paddies and unless this requirement is met by improved cultivation their yields will necessarily fall off. Improved seed demands improved cultivation. The normal seed rate for broadcasted field is 2-2½ bushels per acre. In most parts of the Eastern Province where an extensive system of cultivation is in vogue the seed rate is as high as 3-4 bushels per acre. This high seed rate is in order to make allowance for the presence of dirt and empty grain through faulty winnowing of seed-paddy and mainly with the object of establishing a thicker stand of crop in order to smother weed growth. Experiments conducted by the Department of Agriculture have shown that with proper tillage 1½ bushels of good viable seed is sufficient to ensure an even stand of crop. Simple arithmetic will show the colossal waste of big seed rates with no benefit to the cultivator. Overcrowding prevents the production of tillers and also weakens the stems thereby causing the crop to lodge when ear-heads form. The result in either case is a reduction in yield of both grain and straw.

Transplanting.—When cheap labour is available varieties which take over 4 months from sowing to harvesting would, if transplanted, yield increased monetary returns. Based on results of trials a conservative estimate would be an increased yield of 20 per cent or a net profit of between Rs. 10 to Rs. 15 per acre, according to the price per bushel. By transplanting paddy instead of broadcasting there is the additional advantage of affording more time, during the nursery stage, for thorough preparatory tillage of the fields, thereby appreciably reducing weeding expenses. In fields which cannot be dried off at harvest loss of grain could be reduced by transplanting the crop as the

degree of lodging is much less with transplanted than with broadcasted paddy. Single seedlings are recommended, or, where damage by land crabs is appreciable, three seedlings per hill 6 in.-8 in. apart, according to the fertility of the soil. On poor and sandy types of soil it is doubtful whether transplanting produces increased returns commensurate with the additional expenditure incurred.

Weeding.—With proper preparatory tillage the necessity to weed a crop which takes about 3-3½ months from sowing to maturity would not arise. With crops of longer duration a 20-25 per cent increase of grain, through a single weeding about six weeks after sowing would be a conservative estimate.

Use of Pedigree Seed.—Manuring undoubtedly is the quickest method of increasing output but the means of effecting a more important and lasting improvement which involves least expense to the cultivator is the use of selected high-yielding strains. The different varieties of rice grown in various tracts have been found, by experience, to be suited to the particular tracts. These varieties, however, have deteriorated to a marked degree by being grown for considerable periods on comparatively poor soils and through mixture and cross-pollination with inferior varieties. The obvious method of improving such varieties is by isolating some of the better types possessing desirable characters and finally selecting the best types for gradually replacing the original variety in the entire tract.

On behalf of the rice industry the Department of Agriculture undertook in 1920 the task of improving the local paddies by selection of high-yielding strains. A collection of Ceylon paddies were sown at the Experiment Station, Anuradhapura, and on the limited area available at the Experiment Station, Peradeniya. Owing to the overwhelming amount of material in hand it was decided to work on a few of the most popular paddies only. Selection work was confined to straight selection for high yield. Several extremely promising selections were isolated and sent for trial in the areas from which the original varieties were obtained. Unfortunately most of the selections failed owing to the period from sowing to flowering or sowing to maturity altering to a remarkable degree. It was then realised that the paddy plant is very susceptible to changes in environment and that selection for a particular area should be made in that area under normal conditions. Except in the flat, drier parts of Ceylon where rice is grown under irrigation, climatic factors, such as rainfall, temperature and elevation, and soil conditions vary to such an extent that even in tracts a few miles apart it is necessary to grow different varieties of paddy. In fact it is not uncommon to find the same variety requiring

different maturing periods in different tracts not far remote from one another. After several years of selection work, on the same lines as that in Ceylon, the experience of Java has been the same. When this knowledge was brought to light small paddy seed stations were established in the important rice-growing tracts of the Island with the object of testing the existing pedigree selection for suitability to particular tracts and for selection work on the local varieties in their customary environment. The best selection amongst those which yield at least 15 per cent more than the local paddy is released for distribution amongst cultivators. At these stations it is necessary to maintain the purity of the successful selections, as the pedigree paddies in the hands of cultivators would again in a few seasons deteriorate by mixture and hybridisation with inferior paddies.

Areas under selected seed.—A summary of progress made in some areas and based on a conservative estimate would be as follows:

About 90 per cent of the 2,000 acres sown for *kalapokam* or *maha* under the Iranaimadu Tank is under a pedigree selection of *vellai illankalayan* which was tested at, and distributed from, the Paranthan Paddy Seed Farm. The same selection is popular in the North-Central Province and its cultivation is rapidly spreading around Alankulama, Anuradhapura, and Ratmale.

A shorter-aged selection of *vellai illankalayan* occupies about 500 acres under the Karachchy scheme during the *sirupokam* season. In Harispattu and Yatinuwara during the *maha* season the *mawi* selections occupy about 500 acres. In the Colombo District pedigree selection of *kurulutuduwi*, a small grained samba type, tested at, and distributed from Belunmahara Paddy Seed Station is popular. The same selection is also popular in the Negombo and Ratnapura districts. In the Pasdun Korale East and West a selection from *kaharamana* is popular. This selection is also spreading from the Borala Paddy Seed Station in the Weligam Korale in the Southern Province. *Suduwi* selected at the Batugedera Paddy Seed Station is being taken up in the Nawadun Korale.

Around about Tissamaharama, over 600 acres, at *maha* 1931-32 are under the *sudu heenati* selection which was made at the Tissamaharama Paddy Seed Station. This selected paddy is in high favour and is rapidly spreading. It will yield some 36 bushels an acre, whilst the local paddies give about 24 bushels. It is hoped that by next *maha* season half of the 15,000 acres sown under the Tissa tanks will be of this variety in which case the increased yield due to selected seed will at a conservative estimate be not less than 50,000 bushels in this one district. When the small annual expenditure incurred on the Tissa Experiment Station is compared with such a result the wisdom

of incurring such is evident. The same selection is suitable both for *maha* and *yala* seasons. This indicates the vast possibilities of increasing local production by use of improved seed, on the already *asweddumized* land capable of cultivation. It is now considered that greater progress could be made by concentrating on selection of paddies suited to the large, more or less uniform, paddy tracts in the flat drier parts of Ceylon. The introduction of suitable selected strains has been necessarily slow and has met with considerable difficulties in the wet zone owing to the existence of such marked variations in soil and climatic conditions in the paddy tracts, even those in close proximity to one another. Improvement by selection, however careful it may be, has its limit; but the possibilities of increasing the heritable yielding capacity of a selection are further afield. The modern method of breeding by cross-fertilization has a much wider scope. Further improvements could be effected by combining in one strain desirable economic characters which hitherto existed in two or more different strains. This process known as hybridisation when followed by selection makes it possible to evolve desirable new strains. That this is not mere theory will be acknowledged by those who are aware of the enormous strides made in other countries with crop improvement work. The gradual establishment of desirable proved pedigree strains provides material for further improvement by hybridisation combined with selection, and this work will be undertaken as room and conditions warrant. With the ultimate object of establishing a milling industry in the Eastern Division attempts are being made along these lines to breed a short-aged, high-yielding white coated rice. Intensive work in the Eastern Division has been taken in hand recently. Speedier and greater progress in increasing the Island's yield of paddy is correlated with factors. The promulgation of laws ensuring more equitable conditions of tenancy; greater security of tenure and encouragement and compensation for improvements effected by tenant-cultivators; the prevention of fragmentation of holdings into infinitesimal shares; the provision of properly co-ordinate irrigation and drainage facilities; the establishment of regulated communal pastures; the emancipation of cultivators from recurrent state of indebtedness and the availability of cheap credit; the establishment of proper marketing facilities; and the provisions of medical aid and adoption of sanitary methods to combat malaria are some of these.

In matters of rural development all State Departments concerned should act in unity. It is acknowledged that extraordinarily difficult problems await solution. It is for all directly or indirectly interested in the agricultural welfare of Ceylon to develop her rice industry to the utmost, and in order to do so these problems must be tackled.