THE CULTIVATION OF RICE IN CEYLON*

UNLIKE the plantation industries of tea, rubber and coconuts, for which complete statistical information on areas and yields are available, there are in Ceylon no reliable data on village agriculture. It is estimated that about 800,000 acres of rice are grown annually, the actual area of land being less, as some land carries two crops a year. The latest official estimate of yield by revenue officers is 14 bushels (of 45 lb.) per acre. This figure is admittedly open to serious error, and since 1925 figures for yield have not been included in the statistics. There is reason for supposing that the estimated yield of 14 bushels per acre is too low, and this question will be referred to later. If the average yield is taken to be 20 bushels, the annual production is 16 million bushels of paddy (rice in the husk) or 8 million bushels of husked rice. This is equal to about 4·6 million cwt. The imports of paddy and rice into Ceylon for the five years 1929-33 in terms of husked rice have averaged 9·27 million cwt. It will be seen, therefore, that Ceylon produces about a third of the rice it requires. Why a purely agricultural country like Ceylon finds it necessary to depend on Burma for two-thirds of its rice requirements is due to the magnitude of the plantation industries, particularly of tea and rubber, and to some extent of coconuts. Not only do the plantation industries make use of land, much of which could grow rice or other cereals, but they employ a large labour force whose staple diet is rice. It must be added that it is to its plantation industries that Ceylon owes its prosperity.

In spite of the large areas under tea, rubber and coconuts, there are larger areas of jungle, scrub jungle and savannah capable of growing rice if irrigation-water can be supplied. The construction of new works for the supply of irrigation-water on a large scale will be costly and possibly uneconomic, but the production of rice can be and is being increased by the following means: (i) the restoration of ancient village tanks where old paddy land exists and where there is still a nucleus of population; (ii) the improvement of major irrigation-works and the construction of new channels to bring more land under cultivtaion; (iii) organized colonization schemes under major irrigation-works, where owing to malaria or other reasons land has not been taken up; and (iv) the adoption of improved methods of cultivation, which are being vigorously urged by the Department of Agriculture through propaganda and practical demonstration, and include the use of pedigree seed, improved implements, of green, farmyard and artificial manures, and the adoption of transplanting in those areas where this practice is suitable.

* By L. Lord, Divisional Agricultural Officer, Ceylon, in *The Empire Journal of Experimental Agriculture* Vol. III, No. 10, April 1935.

Climate and Soils.—Rice is chiefly cultivated in the low country, but considerable areas are cultivated in the mid-country up to 2,500 ft. above sea-level. Rice is cultivated between 4,000 and 5,000 ft., but the area is small. The temperature conditions for the bulk of the rice area do not vary greatly. There is, however, considerable variation in the rainfall. Rice is grown all over Ceylon and the rainfall varies from under 50 in. to over 200 in. Under favourable conditions from 50 to 60 in. of rain distributed during the growing-season are sufficient for a 4-months' crop. More than half of Ceylon has a yearly rainfall of under 75 in., and in this part of the Island cultivation that depends entirely upon rainfall is precarious owing to the uncertainty of its incidence. Irrigation-water is generally utilized both to supplement and, in the dry season, to replace direct rainfall. Even in the wetter parts of the Island the run-off from land adjoining the rice fields is utilized. Owing to the risk of floods in the wet season large areas are cultivated under irrigation during the dry season. Generally speaking, there is sufficient rainfall for rice during both the north-east and south-west monsoons only in a small area in the south-west of the Island stretching, roughly, from Kandy in the mid-country to Galle at sea-level. But even here run-off from nearby land is utilized. During the north-east monsoon 5-6½ months' varieties are grown, and during the south-west monsoon 4-5 months' varieties. The seasons are known, in Sinhalese, as *maha*, and *yala* respectively, meaning long and short season. In the rest of the Island direct rainfall is insufficient during the south-west monsoon, when generally 3 motnhs' varieties are grown under irrigation. During the north-east monsoon 4 months' varieties are generally grown, to some extent with direct rainfall only, but generally with supplementary irrigation water. Table 1 gives an idea of the meteorological conditions in two dissimilar parts of the Island.

No systematic study of the rice soils has yet been made. Typical soils are clays or clay loams that can be puddled to retain water, and have an acid or slightly acid reaction. In the Eastern Province there are considerable areas of sandy-loam soils which produce a good crop when water is sufficient.

Irrigation.—Most of the paddy land is irrigated with water stored in large or small reservoirs, known as tanks. The thousands of tanks, most of them abandoned for centuries, in the northern half of the Island, bear witness to the magnitude of the facilities for irrigation in ancient times. Many of these tanks were constructed before the beginning of the Christian era, and modern engineering science is impressed by the ingenuity displayed in the construction of them and their channels. The channel from Kalawewa tank to Anuradhapura is 75 miles long. There were systematic irrigation schemes and small tanks were fed from large tanks. Most of the thousands of tanks are small, but many were (and are) large. The area of Minneriya tank, the largest, is 4,500 acres; Kalawewa, the second largest, covers 4,337 acres, and Nachchaduwa tank 3,920 acres. There is evidence for the statement frequently made by Ceylonese that at one time Ceylon was the granary of the East.

Most of the modern major irrigation-works are based on ancient tanks that have been restored and improved, and many of the ancient channels have been utilized. The area of land under major works actually sown in 1933 is given as 167,000 acres. Some of the area is cultivated twice a year, so the actual land area is somewhat less. Under smaller village tanks in the same year the area is given as 212,941 acres. Thus nearly half of the total rice area is irrigated by major works or by village tanks.

TABLE I

RICE CULTIVATION: METEOROLOGICAL DATA

District	Month	Total no. of days	Mean monthly temp. °F.	Maximum temp. °F.	Minimum temp. °F.	Mean daily sunshine hrs.	Rainfall in.
Baticaloa, 30 ft.	Mar.		80·2	87·6	69·7	8·4	3·15
a.s.l., SW.	Apr.		82·0	90·6	74·8	8·5	1·95
Season, 3 months'	May		83·6	96·2	74·6	8·0	1·84
rice. *Vellai perunel.* Irrigated.	June	90	84·8	97·7	74·6	7·5	0·96
Batticaloa, 30 ft.	Oct.		80·9	88·6	72·1	7·5	6·49
a.s.l., NE.	Nov.		79·4	90·1	72·1	6·4	13·51
Season, 4 months'	Dec.		77·9	84·1	70·5	5·8	16·48
rice. *Perillanel.*	Jan.		77·6	82·4	69·8	6·7	10·36
Irrigated when	Feb.	120	78·3	87·2	67·4	8·5	3·44
necessary.							
Kandy, 1,611 ft.	Apr.		78·7	89·4	65·8	6·3	6·83
a.s.l., S W.	May		78·3	91·1	67·6	5·7	5·78
Season, 4½-5 months'	June		77·0	88·1	66·2	4·1	9·45
rice. *Suduhinati.*	July	about	76·6	85·5	67·3	4·4	7·39
Irrigated when	Aug.	140	76·2	88·7	67·2	4·7	5·82
necessary.							
Kandy. 1,611 ft.	Sept.		76·2	86·6	64·5	5·5	6·05
a.s.l., NE.	Oct.		76·0	87·1	65·1	5·1	11·62
Season, 6-7 months'	Nov.		75·9	86·0	62·2	4·7	10·51
rice. *Mawi.*	Dec.		75·2	85·8	61·8	5·5	8·85
Irrigated when	Jan.		75·0	85·7	63·4	6·1	5·38
necessary.	Feb.	about	76·6	88·4	53·3	7·0	2·23
	Mar	200	78·4	89·2	64·1	6·9	4·20

Notes. (1) The figures given are means over a number of years.

(2) In the Batticaloa District sowing during the NE. monsoon generally takes place early in November.

During the SW. monsoon, when irrigation-water almost alone is relied on, sowing takes place from February to June, but a common time for sowing is from March to April.

Varieties.—Lists have been published of over 300 different names of botanical varieties, but there can be little doubt that many are synonyms. A complete study of the varieties has not been made, but those so far examined by Lord and Abeysundera [1] show that the *mawi* (aged 6 months) group of rices are similar to the Burma *midon* type, and the short-aged (3-4 months) rice like *hirati*, *murungan*, *hinkaravel*, *illankalayan*, and *suduhonderawala* (5 months) are similar to the Burma *ngasein* type[2]. A small round-grained variety known as *podiwi* (similar to the Indian *muthusamba*) with a white testa is grown on a small scale and is esteemed as a table rice. The striking peculiarity of Ceylon rices compared with rices in other countries is that they have almost invariably a red testa. Most of the varieties grown on a large scale are unawned.

There is a belief among cultivators that certain varieties are best suited for certain soil conditions, but it is remarkable how well one variety will adapt itself to different soil and climatic conditions. The pedigree selection *perillanel* 26014 may be quoted as an example. This selection gives comparatively high yields on sandy soils at Batticaloa at sea-level and on clay loams in the Province of Uva at 2,000 ft. above sea-level. Another pedigree selection, *vellai illankalayan* 28061, has proved to be a higher yielder than the village varieties over most of the northern half of the Island. There is little doubt that the number of so-called varieties at present grown could be divided by ten without loss of yield and with a very definite gain in uniformity.

Unfortunately, in a country like Ceylon, with large differences in rainfall, different-aged varieties are essential. A variety for a district depending upon direct rainfall must be of such an age that it will flower during a period of light rainfall and mature in a comparatively dry period. The time of sowing cannot be altered very much; it depends on the start of the rains. Under irrigation it is the general custom to grow a 3-months' variety during the dry season and a 4-months' variety during the wet. Other things being equal, the yield of a variety is positively correlated with age.

There are now available for most of the different conditions under which rice is grown in Ceylon, pedigree selections yielding from 15 to 30 per cent. more than the local village varieties. The technique used in selection has been described by Lord [3]. These pedigree selections are now becoming popular with cultivators. Most of the rice produced is husked in a primitive mortar in the home. Until a milling industry using modern machinery is developed, there is no reason why the present red rices should be replaced by white.

Size of Holdings.—Here, too, no reliable statistics are available, but it is believed that the size of the holding worked by one man is from 2 to 3 acres. This does not apply to the Eastern Province where holdings of over 25 acres are common and where one man will work from 5 to 7 acres. The small size of the holdings, apart from the Eastern Province, is due to lack of land and the popularity of paddy cultivation among the Sinhalese, who consider that more prestige is attached to this than to other forms of manual work.

In the east and north of the Island comparatively large rice-fields are found, many being as large as half an acre and a few slightly larger. Even here the tendency is to construct small fields rather than to undertake the necessary levelling of the land to construct large fields. In the rest of the Island rice-fields are very small and many of the picturesque terraced rice-fields in the mid-country are no larger than 10 or 12 sq. ft.

Cultivation.—In small fields the land is tilled by hand with an implement known as a 'mamootie', which is a heavier and larger variety of hoe. It produces the same effect as digging with a spade, the necessary force to penetrate the ground being obtained by swinging the implement over the head. In larger fields tillage is done either by a primitive plough drawn

by cattle or buffaloes, or by the trampling of a team of six or eight buffaloes driven round and round the field. The latter method is chiefly used on marshy land where animals sink in up to their bellies, and on flooded land where it is difficult to see where the plough has been. But in many places fields are prepared by trampling that could easily be ploughed, because the buffaloes cost less than plough cattle. Plough cattle are small and generally uncared for, but many are quite able to draw a light mould-board plough like Ransomes 'Ceres' or 'P.I.K.' The comparatively high cost of these ploughs, however, precludes their general use. A simple wooden harrow pulled by two bulls is used in Burma to puddle the soil after the first ploughing. The writer has introduced this implement into Ceylon, but it has not yet become very popular. Its use ensures better and cheaper puddling of the soil. After two or three ploughings or tramplings with one or two inches of standing water on the soil, the field is levelled either by hand-levellers resembling a wooden rake without teeth, or by a plank drawn by two cattle. About this time the bunds surrounding the field are generally plastered with mud from the field to fill up crab holes and to render the bunds more impervious to water. After levelling, small drains are made to remove any standing water. Germinated seed is broadcast at the rate of from $2\frac{1}{2}$ to $3\frac{1}{2}$ bushels per acre. In germinating the seed it is first soaked in water (in gunny bag) for 12—23 hours, after which the bag is put in a shed and covered with moist empty bags or with leaves. Sometimes light weights are placed on the top. After from 4 to 7 days, when the radicle and plumule have emerged, the seed is sown. In parts of the Eastern and Northern Provinces appreciable areas are sown during the NE. season with ungerminated seed. The rather sandy fields are ploughed, without flooding, at the start of the rains, and irrigation water is not issued until the rainfall has become inadequate. With good cultivation 2 bushels per acre of seed paddy are ample.

The seed used is mainly that grown during the last corresponding season, which means that the seed is from 5 to 8 months old. The germination rapidly lessens after 10 months from harvesting. Newly harvested rice seed, except the seed of dead-ripe, short-aged, varieties cannot be used for sowing until 2 or $2\frac{1}{2}$ months after harvest.

As a result of the propaganda efforts of the Department of Agriculture, the acreage transplanted, though small, is increasing. Experiments in Ceylon [4, 5] have shown that, with a 6 to 7 months' rice, transplanting increases the yield by from 30 to 46 per cent., and is profitable. With the 3 to 4-months' varieties, which occupy most of the rice area, it is doubtful if transplanting will be profitable. Weeding, with or without thinning the plants, a month after sowing, is carried out in a few districts only. Manuring will be discussed in the following section. The crop is harvested about one month after flowering by means of a serrated sickle-shaped knife. It is threshed by trampling with buffaloes, and winnowed by wind. Threshing is done on the field or on adjacent high land, and although in many places threshing floors are carefully beaten flat and plastered with cattle-manure, frequently the floors are roughly made, and the rice from these floors contains sand and small stones, which are objected to by consumers

as they cannot easily be removed before or during cooking. Efforts are being made to encourage threshing on jute or palmyrah-leaf mats, and the construction of permanent brick and cement communal threshing floors is advocated.

Manuring.—The application of manures to rice-fields is the exception rather than the rule, although green-manuring is fairly extensively practised by Sinhalese cultivators in the Kandyan districts, and by the Tamils in the extreme north of the Island. Green-manure crops, like *Crotalaria juncea.* are not grown for the purpose of green-manuring. Among the trees whose leaves are used are *Azadirachta indica, Cerbera odollam, Borassus flabellifer, Erythrina lithosperma* and *Gliricidia sepium.* Wild Sunflower (*Tithonia diversifolia*), which grows luxuriantly and is found wild in the mid-country, makes an excellent green-manure and its use is extending. The effects of green-manuring on yield have been investigated by Haigh and Joachim [6] and Lord [8, 9], and the chemical changes in the soil by Joachim and Kandiah [7]. It was found that the green material gave its maximum effect if applied under anaerobic conditions (*i.e.*, after the soil had been flooded) and within a few days of broadcasting or transplanting. Applications of 5 tons per acre gave increased yields of 30 and 29½ bushels. An application of 1 ton per acre is more likely to be used. In two experiments in different years this dressing produced increased yields of 12½ and 15 bushels per acre. Farmyard manure is seldom used, is not available in large amounts, and its quantitative effect has not been studied. Its use on rice-fields is being encouraged. The effect of artificial manure on the yield of rice has been studied by Lord [8, 10, 11, 12] and Haigh and Joachim [5, 6]. The effect of manures on the composition of the paddy crop has been investigated by Joachim, Kandiah, and Panditteseker [14].

Generally, it has been found that phosphoric acid is the limiting factor in Ceylon soils, and that the rice crop responds both to phosphoric acid and to nitrogen in the form of sulphate of ammonia or ammonium phosphate. Excluding the results of manurial trials in the Eastern Province, an examination of the others shows that an application of 1 cwt. of ordinary superphosphate or of bonemeal may be expected to give on an average an increase of from 10 to 15 bushels with a normal crop, and a residual effect of about half that amount. Sulphate of ammonia alone has not given profitable increases, but from dressings of 93-104 lb. per acre of both wide and narrow ratio Ammophos, increases varying from 10 to 25 bushels per acre were obtained. There is evidence to show that the wide ratio ammonium phosphate was more effective than the narrow. There was some residual effect. Recent experiments in the Eastern Province [12] have shown that at three widely separated centres there was at two centres no response, and at one little and non-significant response, to phosphoric acid. Three and four-months' rices were grown and 1 cwt. of concentrated superphosphate (42 per cent. P_2O_5)was applied per acre. The experiments, which were identical at the three centres, included also applications of 1 cwt. per acre of Nicifos (22/18) and Ammophos (13/46). At two centres Nicifos gave significant increases of respectively 11·3 bushels * per acre (4-months'

* Bushels of 45 lb.

rice) and 9·3 bushes (3-months' rice). The response to Ammophos was slightly less. At the third centre the increase due to Nicifos was 10·8 bushels per acre, but the experiment was just not statistically significant. It would appear, therefore, that in the soils of the Eastern Province (and perhaps in other soils in the Island) nitrogen is the limiting factor. Experiments have already been laid down to determine this. For the present it may definitely be said that the application of 1 cwt. per acre of one of the ammonium phosphates will pay when the price of paddy (rice in the husk) is not less than Rs. 1·50 per bushel. In those where rice responds to phosphoric acid alone, manuring is profitable even with a price of Rs. 1 per bushel. There is, however, little likelihood of artificial fertilizers being used on a large scale unless the price of paddy rises to somewhere near Rs. 2 per bushel.

Generally, manurial experiments are carried out in small bunded plots with each replication complete within one field. It has been shown [13] that if a replication extends over two or more fields, the standard error may be largely increased. It has been noticed that where small bunded plots are used, particularly in places where drainage is difficult, the levels of the plots may vary. If heavy rain falls soon after sowing, there may be standing water on some plots and not on others. Standing water at this stage may retard growth, or even destroy the plant, perhaps by burying the seed, with tiny plumule and radicle, under fine mud. Two manurial experiments carried out by the writer in bunded plots were spoiled by rain soon after sowing. Recently, plots have been used without bunds but with a 3-foot space between plots in the middle of which a shallow drain is constructed. This method avoids or reduces errors through differences of level and, judged by the magnitude of the response to fertilizer, there is little if any wash from one plot to another. The space between the plots is sown with rice. Owing to the small size of the fields in Ceylon, experimental plots must necessarily be small if (as is so desirable) a replication is to be laid down in one field. Plots of 1·80 acre, of which an inner area of 1·100 acre is harvested, replicated from four to six times give sufficiently small experimental errors.

Irrigation-water.—No data have yet been obtained on the optimum amount of water necessary for paddy. Generally the Irrigation Department allows 6 acre-feet for a dry-season crop of from 3 to 4 months. Although a fair amount of this water is lost in the channel by percolation, it is ample for a good crop. In parts of the Island it is the custom to allow irrigated fields to dry out after sowing to such an extent that cracks appear in the soil, in the belief that the aeration thus provided is beneficial at this stage. Two pot experiments were carried out to ascertain if drying out had any effect on yield. Three treatments were given: (a) periodic drying as practised by some cultivators, (b) continual submergence from ten days after transplanting until two weeks before harvesting, and (c) a combination of (a) and (b). In the first experiment no significant differences were obtained, but a second experiment in which the treatments were replicated eight times and which satisfied the requirements of the Z test gave the following comparative yields: periodic drying 100, continual submergence 131, and a combination of the two treatments 106. Continual submergence

from an early stage in the growth of the plants not only gives increased yields but reduces weed-growth, and prevents any serious damage from the Swarming Caterpillar (*Spodoptera mauritia*), which is found chiefly in those areas where drying out of the soil is practised. The depth to which plants are submerged varies from 3 to over 12 in., depending on the height of the bunds (many are made too low), the amount of water available, and the presence or absence of drainage facilities. A depth of 6 in. is considered desirable.

Cost of Cultivation.—Almost all the rice in Ceylon is grown either by small owner-cultivators or, more generally, by tenants on a share system. The share system of tenancy is not conducive to good cultivation as the tenant knows that he will only get half of any increased yield due to manuring, transplanting, or better tillage. The share system, however, appears to be unavoidable; a landlord will not consider cultivating by means of hired labourers on daily pay. In the share system of tenancy the tenant is financed by the landlord. Owing to the different systems of share-tenancy and the numerous loans which are made, generally in kind at 50 per cent. interest, no reliable figures of cost of cultivation under share-tenancy conditions are available.

The cost of cultivating with hired labour, using mould-board ploughs and Burmese harrows, has been recorded at two paddy-seed stations in the Eastern Province. Although these costs are undoubtedly somewhat greater than the cost of cultivating under a share-tenancy the figures may be of interest.

TABLE II

COST OF RICE CULTIVATION PER ACRE

Operation	Station	
	Illupadichchenai	Sengapadi
	Rs. cts.[1]	Rs. cts.[1]
Repairing bunds	0 90	1 88
Ploughing and harrowing ...	8 80	7 86
Levelling	—	2 62
Sowing and making drains ...	0 40[2]	
Reaping	2 60	1 88
Carrying sheaves and stacking ...	1 95	1 52
Threshing	5 46	4 90
Winnowing	1 92	
Fencing	1 99	1 00
Watching and Irrigating ...	7 39	9 20
Water rate	1 30	0 50
Seed Paddy, 2 bushels at Rs. 1·50 ...	3 00	3 00
Total	35 71	34 36
Yield per acre in bushel of 45 lb. ...	30 00	37 00
Wages, men, per day	0 60[3]	0 50
Plough-bulls per pair per day ...	0 75	—
Plough-buffaloes or bulls per pair per day	—	1 00

1. Rs. 1=1s. 6d. 2. Dry sowing of ungerminated seed 3. 75 cts. at harvest.

The rent of land varies largely, but a general rent is between Rs. 7 and Rs. 15 per acre; the price of unhusked rice for the past two years has varied between Rs. 1 and Rs. 1-50 per bushel. At present a movement is on foot to increase the price of rice, either by increasing the existing moderate import duty, or by a system of quotas.

Yields.—It has already been stated that the official estimate of the yield of rice* is 14 bushels per acre, or less than half the yield in India, where conditions are not greatly dissimilar. Although the estimate of 14 bushels is too low, there is little doubt that average yields in Ceylon are really lower than in India. This may be ascribed to the following reasons: (i) A proportionately greater area of short-aged rices is grown in Ceylon and, other things being equal, the longer the age the higher the yield. (ii) Ceylon figures for area include twice over land that is cropped twice a year, and it is belived there is more double cropping in Ceylon than in India. Double-cropped land per crop yields less than once-cropped land. (iii) Appreciable areas of land in Ceylon fail to mature a crop or a normal crop, owing to failure of rains or shortage of irrigation water. (iv) Transplanting is widely practised in India. In Ceylon it is the exception, and it is doubtful if transplanting is profitable with short-aged varieties. A more reliable estimate of yields is contained in the report of the Director of Irrigation, and in 1931 the yield of over 161,000 acres of rice under major works is given as 21·2 bushels per acre. Of these figures the area is based on measurement, the yield on estimates and not on crop cuttings. Estimates of yields, which are made after consultation with cultivators, are invariably on the low side as both landlords and tenants are reluctant to divulge the true yields. Excluding areas which fail to mature a normal crop due to lack of water, the yield of rice in Ceylon is probably between 20 and 30 bushels per acre. The following yields, using 3-4 months' pedigree selections, and with good cultivation but no manuring, have been obtained recently in the Eastern Province: 354 bushels from 10 acres in 1932-33 (35·4 bushels per acre), 297 bushels from 10 acres in 1933-34 (29·7 bushels per acre), 438 bushels from 12½ acres in 1933 (35 bushels per acre), 465 bushels from the same area in 1934 (37 bushels per acre). In 1934, at the paddy-seed station of Tamblegam, which is situated on good soil, the following high yields were obtained, without manuring, from a broadcasted crop : 3 month's rice, 53·2 bushels per acre; 3¾ months' rice, 71·3 bushels per acre. There is evidence from all over Ceylon that with good cultivation yields of 30 bushels per acre can be obtained without difficulty.

Pests, Diseases, Weeds.—Insects are much more important than fungus diseases, but even the damage caused by insects is not extensive. In some areas, where bunds are low and irrigation-water is not issued at the right time, serious damage may be caused by the Swarming Caterpillar (*Spodoptera mauritia*). The Paddy Fly (*Leptocorisa varicornis*) is universal, but the damage caused is noticed only in small patches, which mature before or after the bulk of the crop, or in small areas of rice-land surrounded by extensive tracts of jungle and grassland. It is possible that the damage

* Except where otherwise stated, 'rice' in this paper means 'rice in the husk' or 'paddy'.

by Paddy Fly is more than is realized. The stem-borer (*Schoenobius bipunctifer*) is also universal, but it is not found in large numbers, and the damage caused is slight. Two pests of stored rice are Paddy Moth (*Sitotroga cercallela*) and the Paddy Weevil (*Calandra oryzae*). The former attacks rice in the husk only. At Peradeniya the germination of rice in four months was reduced by 15 per cent. due to damage by these two insects. Fungus diseases like *Rhizoctonia solani* and *Sclerotium oryzae* [15] cause, on the whole, little damage, but under certain conditions the latter may become serious. At Peradeniya, for example, the young plants of a foreign rice were almost completely destroyed by this disease.

In the sparsely populated parts of Ceylon the far too numerous wild elephants and pig do considerable damage to the rice crop, and elephants occasionally kill cultivators watching their fields at night. Land crabs (*Paratelphusa oziotelphusa hydrodromus*) are found in large numbers in paddy fields in Ceylon. They eat young plants and the seed-rate is heavy to make up for this loss. Crabs live in burrows in the bunds and the most serious damage occurs in the terraced cultivation of hill-sides, where the burrows may form channels for the water impounded in the field. Not only is water lost, but the passage of the water weakens and in time destroys portions of the bund. Crabs can be trapped in earthenware pots whose diameter in the middle is much larger than the diameter of the mouth. The most effective way of catching them is by boys who can catch from 100 to 200 per day. On an area of about 5 acres at Peradeniya 55,925 crabs were caught in the course of one year. Except where breeding or fine experimental work is in progress, it is not considered economic to attempt to reduce the number of crabs by traps or by boys.

Fimbristylis miliacea and several species of *Cyperus* are very common weeds on rice-fields and at times are present in such abundance that yields are greatly reduced. *Panicum crus-galli* is also common but not so serious. Good preliminary cultivation, together with shallow submergence of the fields as soon as the plants are about 3 in. high, increasing to 6 in. submergence as soon as the plants are about 9 in. high, will check or prevent weed growth. Where water is not available for submergence in the early stages of the growth of the plant, weeding is advisable, but is seldom done outside the Kandyan districts.

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