differential plant cell may resume its powers of growth and division becoming once again embryonic and thereby resuming its immortality.

" Whatever be the final verdict on Mr. Benedict's discoveries we cannot but be grateful to him for getting away from words and appealing to facts. Nor will horticulturists be slow to accept the moral that it behoves us to go on producing new varieties by cross breeding, for whether or no all existing varieties are doomed sooner or later to old age, the fact remains that there is still room for improvement among all our cultivated varieties of fruits and plants generally."

It would be interesting to have authentic records of the behaviour of Angsana trees raised from seed.

T. F. Chipp.

Echinodia theobromae, Pat.

The following notes are in continuation of the article in the " Garden's Bulletin " Vol. II, No. 5, page 144. Further specimens of *Echinodia theobromae*, Pat. as described by Patouillard in the Bulletin de la Société Mycologique de France " Tome XXXIV, 2nd Fasc. have been obtained growing on small branches of a Quercus in the Botanic Gardens, Singapore. The smaller specimens agree entirely with the original description of Patouillard. In the larger specimens, which do not exceed 3 mm. in diameter, the older or generally middle portion of the specimens developes a typical polyporaceous tissue. The pores whose length is the same as the height of the plant, constitute the whole of the specimen except the thin crust of hyphae which is directly applied to the support, and the crust covering the outside edges of the specimens from which the stilboid fructifications arise. The transition from stilboid to porus formation is abrupt, the stilboid columns at the transition area quickly becoming the pore walls of the inner pore surface. The pore surface often presents a lenzitoid appearance. The diameter of the pores is small about 0.20 mm. No spores were found within the pores. (Singapore Field No. 5143).

T. F. Chipp.

Paddy in the Economic Gardens.

Two adjacent fields measuring together 4398 square feet, or say, one tenth of an acre were put under Paddy on the 20th July.

The land selected is almost an ideal one for the purpose, being a flat of light sandy loam overlying a clay subsoil, which, owing to the low configuration of the ground, drains itself very slowly. After grubbing up the roots, which were heaped and burnt, the land was thoroughly broken up and strewn with the ashes. A corner of the field, 12 feet by 12 (= 144 sq. feet)* was, after 3

* Note—In Cochin China the rule generally followed is to allow, for the nursery 2 hundredths of the acreage to be planted.

hoeings, reserved for a nursery, with a small ridge on all four sides to retain the water which was poured over it from a water-hole near-bye. One coolie was then put to tread the earth to a soft mud consistency, which was then levelled and smoothed. A quantity of 4 ounces of paddy, water-tested, which is equivalent to 75 pounds for one acre, was sown on the surface.

The paddy, so-called "hill paddy," used for seed, was unfortunately a very mixed lot containing many different varieties from the purple red "pulut rice" to various shades of brown and yellow, with black awns, or yellow awns, or no awns at all. One variety showed two well defined longitudinal brown stripes on a yellow husk. Some showed later a tall habit of growth with drooping ears, others grew shorter stems with ears almost erect.

As, however, there was no time to ascertain by selection the respective qualities of each individual variety, the seed was sown as it was received.

Transplanting began in the middle of August, when the seedlings were about 12 inches high. This was done after the nursery had been thoroughly watered, so that, the soil being wet and loose, the seedlings could be taken up with a ball of earth round their roots. The planting was done by women on lines one foot apart with ten inches' space on the lines, more or less regularly. Instructions were given to plant only one seedling per hole, and this was adhered to as much as possible.

So far, the method applied had been that usually followed by natives in planting wet rice, under irrigation, except that the planting of wet rice is done when the fields are already under water, which was not the case here.

From the time of transplanting, the young plants were left to shift for themselves under the ordinary conditions which obtain for "hill" or "dry paddy," that is to say they received only the water from rains and no further labour was spent on them except a weeding before the flowering, and also that of scaring birds away, which was performed by a boy.

It may be here stated that the term "*dry paddy*" is open to misconception, for although hill paddy can be grown without irrigation, it, nevertheless, requires a considerable amount of rain at somewhat frequent intervals. Where such conditions do not prevail, where rains are not fairly dependable, the crop of so-called "*dry paddy*" has but poor prospects.

On the 10th December, about 4 months after transplanting, the cutting of the crop began at the ripest end of the field, the work henceforth was all done by Tamil women, who show quite a liking for it, and a marked expertness.

The harvesting was done by cutting the panicles with their stem down to the top leaf, the straw being left standing. Each woman having secured a handful of panicles tied it with the top leaf and laid the sheaf down to proceed further,

When the cutting was finished the sheaves were gathered and taken to a smooth piece of ground, where they were opened and exposed to the sun. At night the whole was taken up in mats and put under shelter.

Threshing began two days after by beating the ears with sticks, which causes the grain to drop to the ground. The small amount of broken straw which was on top was gathered by hand, leaving the paddy and chaff below. A first winnowing was done with the "neeru," a tray made of bamboo strips, to separate the grain from the finer pieces of broken straw, and a further winnowing was gone through to separate the light empty grains from the full grains, an operation requiring a great deftness of hand.

The crop taken off the 1/10 acre plot planted amounted to 16¼ gantangs, which corresponds to a yield of 163 gantangs, weighing 937 lbs. per acre and is much below what might be expected from a trial made under such generally favourable conditions as described above.

But yet, from the first, the writer was under no illusion as to the possibilities of failure of this plot. It might give a satisfactory return—and it might not. An undrained swamp under a semi-aquatic vegetation of "Pandanus" and wild grasses, the land, until it was broken up, constituted an ideal breeding-ground for fungoid and insect pests, and it was a question whether after the thorough tillage (and thereby aëration) which it received, these pests would rally quick enough seriously to injure a crop new to it and a quick crop at that. Certain rotations, as it is well known, are devised on the immunity of certain crops to pests which attack other crops. If the paddy crop had matured, as some races do, in three months, it would have been a bumper crop but even at an early stage, when Mr. Richards, Entomologist to the F. M. S. Agricultural Department, saw it, the crop was already seriously attacked by a grub which he identified as "*Schoenobius bipunctifer*," a grub frequently found in stems of rice throughout India, and from that time, empty white ears were every day more and more conspicuous throughout the field. This borer belongs to the family of "Pyralidae" which, of all insect pests, is according to Lefroy's "*Indian Insect Life*" one of the most destructive to crops and stored products. The damage is done while in the larval state, it is hidden in the stem and its presence is only revealed when the ear of the paddy is actually dead, no grain being formed for want of the material which has gone to feed the grub.

Added to the toll taken by this pest, the depredations of birds seemed likely at one time to finish the crop. By dint of shouting and empty tin-beating, they were not allowed to have it all their own way, but many ears showed a heavy proportion of emptied husks. It is possible that the damage caused by birds is greater in small isolated spots surrounded, as was the case here, by trees and wild vegetation, where they find immediate shelter (to emerge

again a few minutes later) than on extensive paddy fields, where they have no shelter except by long flights. Be this as it may, they proved to be a most serious cause of loss in the present instance.

The above digression tends to emphasise one point, namely, the necessity of a clean field, especially in the case of so-called "dry" paddy. In the case of "wet" paddy, prolonged immersion under water tends to destroy or to check the breeding of noxious pests living in the ground; this is not the case with "*dry*" paddy which is only partially protected even by the most thorough cultivation. One may, it is true, come across very promising native paddy plots, raised without any cultivation to speak of, on virgin soil newly-cleared of its forest timber, but the case here is very different, for forest land is free from the pests which infest foul grassy plots where *Pyralidae* and *Noctuidae* breed freely.

Reverting to the crop taken from the paddy plot in the Economic Gardens, a test was made with 2 katties of the clean, threshed paddy, after five days' drying. It was made into "*Parboiled*" rice by first steeping the paddy some hours in water, then boiling it for 40 minutes when the husks began to crack, then drying it, and finally husking it with the ordinary mortar and pestle.

The result for 2 kattis (2 lbs., 10 ozs.) was:—

	lbs.	ozs.
Clean rice fit for the the table ..	1	12
Broken rice		$1\frac{1}{4}$
Husk and small broken rice ..		$9\frac{1}{4}$
Fine bran		$\frac{1}{2}$
	2	7

The balance being probably moisture.

The rice, raw, had a pleasant odour and, cooked, an agreeable flavour without the nauseating smell which generally accompanies parboiled rice bought from the shops; smell which is due, most probably, to the steeping of the paddy in water which is rendered foul by the repeated immersions which it is used for.

As already stated, the seed employed in this trial was very mixed and the crop obtained naturally reflected this heterogeneous character. Hence no conclusion can be drawn without further trials, after selection, as to the best variety among the different types harvested, the more so as their destinctive characters, the results possibly of crossings, may not be constant.

The writer is unaware whether investigations have been made in Malaya with a view to the improvement of the local races of rice. Mr. Pasqual's very able pamphlet "Paddy planting in Malaya" has just a few words on the subject. Yet, we read that the relative outturn of paddy per acre in Burma and Malaya is as 13 is to 8, other things being equal, by which is meant, we presume,

equal soil fertility, equal seasonal conditions, equal facilities of irrigation. Thus we may take it that, whereas the Malay wins 150 gantangs, (say), from one acre, the Burmese wins 243 gantangs i.e. 93 gantangs more, or just about enough to feed, under present conditions of shortage, two people for one year.

When we read this, we naturally seek an explanation in one of the two following reasons, or in both:—

No. 1 Faulty cultivation.
" 2 Poor seed.

The writer lays no claim to expert knowledge in the cultivation of rice, having had but a passing acquaintance with it, until a few months ago. Having, moreover, never been to Burmah, he is unable to compare the two modes of cultivation of the Burmese and the Malays, the only comparison he is able to make is with the little he has seen of it in Java, and in Cochin china, and judging by these standards, he cannot but be of opinion that the Malay paddy planter is the less efficient of the two. Perhaps it is due to the scarcity of buffaloes that the land is less thoroughly puddled, less plowed and rolled; to the scarcity of Kampong population, that the preparation of the land is so scanty, the maintenance of its fertility so little thought of, the embankments so inefficiently made. During a recent trip of the writer through the Malay States, as late as last November, Malays could be seen in the Krian District, still preparing their land for the planting of the paddy crop—that is, if such work as he saw can pass as preparing the land. This consisted in cutting the stubble and rank grasses with the "Tajak" and piling it in straight lines, in squares, actually to form the banks. That stubble which should have gone back to the soil for the sustenance of the crop, was made simply to serve as pathways through the fields. Such treatment of the land not only tends to starve it, but it must also foul it, as these piled up grasses will surely, bye and bye, serve as harbours for rats and vermins, and then what of the crops?

Regarding the amelioration of the seed, that is a matter in which the individual planter can do but little. He may, and does, in countries where husbandry is highly developed, like Japan, obtain by rough methods of selection, a certain degree of uniformity in his crops, but the establishing of improved strains of a permanent character is a work of slow processes, which Governments alone are competent to carry through.

Such work is now being eagerly pursued in regard to wheat in all wheat-growing countries and, now, following the methods of pedigree cultures from single seeds initiated by the Slavof Station in Sweeden, Japan, Java and India have also opened stations for the close study of the cultivation and improvement of rice. High yielding varieties have already been obtained and Buitenzorg was credited, a few years ago, with having raised on its trial fields a variety yielding 76 pickels of rice per bouw (2¼ tons per acre).

As an illustration of the difficulties which confront the plant-breeder in the selection and improvement of rice, the crop now under review affords an instance. The paddy with awns was found after stripping it of its awns to be lighter than the awnless paddy, but, on the other hand, it was 12 to 15 days earlier in ripening, thus combining the very desirable quality of earlier maturity with the twofold drawback of lighter weight and of awns which are a decided disadvantage as, in the sifting with the "neeru," they have a way of sticking fast to the empty grains, thus hindering the proper sorting of the paddy.

Without aiming at such severe and necessarily slow methods, it should be possible for the paddy cultivator, if not always to improve, at least to maintain the quality of his crop, by a system of simple selections, which should commence in the field, by plucking separately a few, say a couple of hundred, of the best panicles, those that present the largest number of spikes with well formed and close-growing grains. If, as in the case here, the crop is a very mixed one, further classification is necessary by separating the samples under their most prominent character of external appearance, such as shape, colour of the glumes, colour of the awns, and absence of awns. If the ears taken off the field present a general appearance of uniformity, the grain should be picked off the upper third of the ears, and amongst those grains the heaviest and brightest coloured should be selected for seed for the future crop. There is not a doubt that the grains on the top part of the ear are the best and heaviest. The writer has made several comparative weighings of grains taken from the lower half of the panicles, and of grains from the top, and, for an equal number of grains, the difference of weight has always been in favour of the upper grains; in one case, 100 full grains of the upper part of the panicle weighed as much as 156 full grains of the lower part. This difference is observed in husked as well as in the unhusked grain. Having proceeded so far in his selection the cultivator may immerse his seed in water and throw out any grain which floats, thus eliminating all weaker and damaged seed: lastly, following the Japanese method, he can drop the seeds in salt solutions of varying strengths—thus securing, for sowing, the denser seeds which are generally found to germinate and ripen quicker.

Instead of sowing his seeds straight away in the nursery, they can be previously made to germinate under wet gunny bags, and sown after germination. Here again selection can take place to some extent.

In the writer's opinion the trend of selection should be, after weight of grain and early maturing grain, from the awned to awnless, and from dark-coloured rice to white, but of course, the cultivator knows best where his interest lies, and it is up to him to answer the demand of his market.

E. Mathieu.