

The rain tree—*Samanea saman*—and its yellow form

This iconic tree of the tropics has engendered an attractive yellow form.

By F.S.P. Ng



Yellow rain trees around the Band Stand in the Botanic Gardens, Singapore

The rain tree, *Samanea saman* (also known as *Pithecellobium saman*) is the best-known tropical tree in the world. Visitors arriving in Singapore's Changi Airport see them as impressive umbrella-shaped trees lining the road into the city. In the Philippines this is the 'monkey pod' often used for carved souvenir items. In Hawaii, the rain tree and the coconut are grown to emphasize the image of Hawaii as a tropical resort.

In Malaysia, rain trees were commonly planted during the colonial period as avenue trees to provide much-needed shade for pedestrians and cyclists. Most of the old avenues have now been cut down in road-widening for modern motorised traffic and the concept of growing

roadside trees for shade is almost forgotten, but one of the oldest avenues still survive, in Taiping, the former capital of the state of Perak. These trees were planted when the town's lake Garden was established over 100 years ago. The garden was laid out on land that had been mined for alluvial tin. The mining left vast holes in the ground which filled with water. As a result, Taiping became a lake district with large lakes around which a public garden and a golf course was laid out. The lakes soon became infested with crocodiles that had wandered inland from the mangrove forests 15 km to the west.

Sir George Maxwell, who began his career in the Colonial Civil Service in Perak, tells in



A century-old avenue of rain trees on a misty afternoon at the Lake Garden of Taiping





The rain tree in flower

his book *In Malay Forests* how he and a local crocodile hunter Abdulmanap bin Muhammad Arsad overcame and killed a crocodile after a terrifying, close-contact struggle. This story (and the whole book) has been digitised by Google and can be read free of charge on the internet. George Maxwell served in Perak in various capacities (Magistrate, District Officer, etc.) between 1892 and 1905 and in Maxwell's time, the Taiping Lake Garden was already in use for riding and golfing and the crocodiles had to be eliminated because of the danger to children playing at the water's edge.

The rain trees form an avenue running along the side of the largest lake and the branches curve over the road to hang low over the water. This avenue become one of the great attractions of the town. Other attractions are a well-managed zoo, the oldest museum in Malaysia, a hiking

trail through virgin forest to the summit of Maxwell Hill (1448 m), and the cool often misty atmosphere. Taiping is the 'rain capital' of Malaysia, because it rains almost every day. Consequently the branches of the rain trees are covered with moss and other epiphytes. Maxwell Hill was named after Sir William Maxwell, who was the father of Sir George Maxwell. Sir William was Assistant Resident (Assistant British Advisor to the Sultan) of Perak.

The rain tree has dark green foliage but a yellow form appeared in the Malay Peninsula and attracted scientific attention in the 1960s. This yellow form stands out attractively against the normal dark green foliage of other trees and has been popularised in Singapore Botanic Gardens where it is grown around the Band Stand. At the Forest Research Institute, where I started work as a young botanist in the 1960s and my



The 'flower' of the rain tree is a cluster of florets



A batch of seedlings, some green and some yellow

boss was Wong Yew Kwan who later headed the Parks and Gardens organization of Singapore, we speculated about the origin of the yellow

trees. The prevailing theory was some nutrient deficiency in the soil in which the yellow trees were growing.

However, we noticed that some trees were yellow only on one branch while the rest of the crown was green. This suggested that the yellow colour was due to a localised genetic mutation.

In the 1970s I got one of my research assistants, Wong Swee Meng to locate all the yellow rain trees in the Kuala Lumpur area. These were kept under monthly observation to obtain seeds for me to test. I wanted to know if the seeds would produce yellow plants. Wong kept the trees under observation for several years and found that the yellow trees almost never flowered whereas but the green ones could flower as often as twice a year, in six-month cycles in which old leaves would be shed, followed immediately by the flushing of new leafy shoots that would terminate in flowers.

In contrast, in those parts of tropical America between Mexico and Brazil where the rain tree is indigenous, there is an annual dry season of up to six months and the trees would be leafless during the dry season. In Malaysia and Singapore there is no dry season and the leaf-cycles follow each other without a break or at most a break of a few days.

I next directed Wong to collect seeds from green trees growing in the vicinity of yellow trees. He located two big trees, one yellow and one green growing side-by-side on low hill near the centre of Kuala Lumpur. From the green tree he obtained seeds which I germinated. Two batches of seeds were obtained, in December 1983 and



A 31-year-old yellow rain tree, at the entrance of the Forest Research Institute Malaysia (FRIM) in 2015, grown from a seed germinated in 1983–1984

January 1984. The first batch, of 815 seeds, produced 625 seedlings with green cotyledons and 189 with yellow cotyledons. The second batch, of 320 seeds, yielded 246 seedlings with green cotyledons and 74 yellow. In both cases the ratio of green to yellow was 3.3:1. The ratio was very close to 3:1, which anybody who has studied elementary genetics would recognize one of the famous Mendelian ratios.

From Mendelian theory, the ratio of 3 green to 1 yellow would be the result of the parent tree carrying the gene for green as well as the gene for

yellow but the tree would appear green because green is 'dominant' and yellow is 'recessive'. If we designate green as 'G' and yellow as 'g', The parent's genetic make-up would be 'Gg'. In the flowers, the genes would be separated in the germ cells (pollen and ovules) so that 50% will carry 'G' and 50% will carry 'g'. When these are recombined to make seeds there will be four possible combinations: GG, Gg, gG and gg. The first three will produce green seedlings. Only the last combination gg will produce yellow seedlings because the yellow will express itself in the absence of G.

To prove that the yellow colour of the cotyledons is a reliable indicator of the tree colour, I grew the seedlings to maturity in several places in Kuala Lumpur and found that seedlings with yellow cotyledons always grew into yellow trees and those with green cotyledons always grew into green trees.

Although the rain tree is grown everywhere in the tropics, the yellow form is found only in the Malay Peninsula and even so, only in pockets in the Selangor and Singapore. The recessive yellow gene would have first appeared in one tree and was subsequently spread by seeds to the other locations. Our original (green) mother tree and the sterile yellow tree next to it were probably 30–50 years old when first detected.

Looking back, it was clear that we had a lucky break. Our original Gg mother tree must have flowered out of step with other rain trees in the vicinity so that all the flowers were selfed. Had the flowers been outcrossed with pollen from GG trees, the yellow would have been suppressed. In fact we made other seed collections from this tree and other trees but never obtained a 3:1 ratio again. The proportion of yellows was always very depressed, indicating that cross pollination was normal and 100% self-pollination was rare.

Vegetative propagation of the yellow trees is possible, using the apical shoots of yellow trees as scions to graft on to the root stocks of green seedlings, but quite often the union fails probably because of incompatibility between scion and stock.

Bibliography

Maxwell G. (1907). In *Malay Forests*. William Blackwell & Sons (now digitised by Google and available free on the internet)

Ng F.S.P. and Wong S.M. (1985). The rain tree and its yellow form. *Nature Malaysiana* 10 (4):26-31.