

Plant breeding in the tropics at Green World Genetics

Corn is the American name for maize. Two very experienced breeders are in Malaysia, heading a programme to breed maize or corn for the tropics and training Malaysians in modern plant breeding and seed production.

By F.S.P. Ng and P.S. Tong

By pre-arrangement, we met Chua Kim Aik and Mark Frobish, respectively CEO and Director of Plant Breeding, of Green World Genetics Sdn. Bhd. (GWG), at the GWG Batu Arang farm near Rawang in Selangor. There, we saw experimental fields of sweet corn grown in rows. Some were being selfed to multiply pure-line parents. Others were being crossed to make F1 hybrids. Two kinds of corn are being bred by GWG—sweet corn for popular consumption and grain corn for animal feed. Mark Frobish is a sweet corn breeder from the US. His aim is to develop disease-resistant, high-yielding and superior-tasting tropical sweet corn for popular consumption. One thousand F1 hybrids were evaluated last year and six new hybrids are ready for the market.

For grain corn, the breeding programme is headed by Dr Kasemson Suriawan from Thailand. The potential for grain corn, which is the ‘gold standard’ of animal feed is enormous, especially considering that the average yield in the Asia-Pacific is only 3.8 tonnes per hectare compared with the top production of 11 tonnes per hectare in the US. Malaysia requires three million tonnes of animal feed per annum and at present practically all of it is imported.



Chua Aik Kim, Founder and CEO of Green World Genetics

Other crops being bred and tested in this farm are long-bean (*Vigna unguiculata*), ladies fingers or okra (*Abelmoschus esculentus*), brinjal (*Solanum melongena*) cucumber (*Cucumis sativus*), guava (*Psidium guajava*), bitter melon (*Momordica*



Sweet corn breeder Mark Frobish in a corn field



Ladies fingers grown for seed production; note the plant houses at the back





Long beans grown for seed production





Two interns training at the farm

charantia). Some crops are grown in the open but crops that need to be sheltered from rain are grown in plant houses. One of the latter is the melon (*Cucumis melo*), of which two varieties are already in commercial production under the brand names of Permai 5 and Sugar Lady.

The plant houses caught our attention because they are of a design that is new to Malaysia and constructed to a very high standard of workmanship. The primary function of these shelters is to keep out rain, but there is an important second function which is to keep out tiny insects such as aphids, mites and thrips that carry virus diseases. To keep out the rain, the roof is made of transparent plastic sheeting. To keep out insects, the sides are covered with

imported netting of very fine gauge, and all gaps are carefully sealed. Plant houses are not new to Malaysia but the transparent roofs that let in light also trap heat (the so-called ‘greenhouse effect’), so such buildings in the tropics tend to get hot, humid, and very uncomfortable. The plant houses in GWG are comfortable, bright and airy. Quite understandably GWG does not want to refer to them as greenhouses. The roof design is such that two sections overlap leaving a gap in between for rising hot air to escape. The plant houses are also provided with exhaust fans that are automatically set to draw out the hot air if the temperature rises above 32°C. These GWG plant houses are not fully pest proof but they considerably reduce the infestation to a level that can be controlled with minimal application of new generation low-toxicity pesticides.

We also noticed that on the ground, plastic sheets are often used to cover bare soil to reduce weed infestation, hence there are very few weeds in this farm.

GWG was established in Malaysia in 2007 and has already established six breeding farms in the country. A farm in the Cameron Highlands in Malaysia breeds chillies and other vegetables. Another, in Terengganu, will breed crops for coastal sandy soil (*tanahbris*). The crops of interest to GWG also include the tomato (*Lycopersicon*

esculentum); the cabbage, cauliflower and broccoli varieties of *Brassica oleracea*; the pak choi and choi sum (caixin) varieties of the Chinese cabbage *Brassica rapa*; the pumpkin (*Cucurbita moschata*); the angled loofa (*Luffa acutangula*) and the sweet pepper (*Capsicum annuum* var. *grossum*). GWG currently employs eight plant breeders, one for each major crop. Their target is the domestic market for seeds of estimated worth RM75 million and the global market which is estimated to be worth USD45 billion per annum. Tables 1–3 give an idea of what the global market is like.

Table 1: Estimated value (in USD billion) of domestic seed market in top 10 countries for the year 2012

USA	China	France	Brazil	Canada	India	Japan	Germany	Argentina	Italy	Others
12.00	9.95	2.80	2.63	2.12	2.00	1.35	1.17	0.99	0.77	9.15

Total USD 44.93 billion

Source: International Seed Federation, updated June 2013

Table 2: The top ten vegetable seed exporting countries by quantity and value

Rank	Country	Metric tonnes	USD million
1	Netherlands	12174	1004
2	USA	21603	485
3	France	9200	298
4	Israel	n.a.	106
5	Italy	10453	106
6	Chile	2316	104
7	Japan	1406	98
8	China	5742	88
9	Germany	1741	55
10	Denmark	9769	53

Source: International Seed Association 2011



Seeds for home gardens marketed under the Little Garden label of GWG and the Green World label of Leckat Corporation, a subsidiary of GWG

Table 3: The top ten seed companies

1.	Monsanto (US)
2.	DuPont (US)
3.	Syngenta (Switzerland)
4.	Limagrain (France)
5.	Land O'Lakes (US)
6.	KWS AG (Germany)
7.	Bayer Crop Science (Germany)
8.	Sakata (Japan)
9.	DLF-Trifolium (Denmark)
10.	Takil (Japan)

GWG has big expansion plans. Breeding farms have been established in Thailand, China and Zimbabwe. The farms in Thailand concentrate on sub-tropical crops and those in China on temperate crops.

Most seeds in Malaysia, except for oil palm, are presently imported. In particular, about 95% of vegetable seeds are imported. GWG is itself a major importer and distributor of seeds through its wholly-owned subsidiary Leckat Corporation Sdn. Bhd. However, GWG is preparing to be a global producer and exporter of seeds—seeds specially bred for the tropics. To become a force in seed production, GWG is training young farmers to set up small farms to produce seeds for GWG on a contract basis. The trainees who we met at the farm were agriculture students from local universities such as Universiti Putra Malaysia (UPM). They do a 6-month internship at the farm where they are taught how to run an intensive production farm of half-acre or more, the size depending on the crops they choose to grow. The 6-month internship is necessary to grow one full cycle of a short-term crop and



Seed germination house, with bottom irrigation of germination trays

the students learn not only how to grow crops but also how to manage a farm and supervise workers. The interns are selected by GWG from candidates proposed by the universities. GWG looks for candidates who are genuinely interested in hands-on farming. At UPM the 6-month internship comes at the end of their four-year degree course. GWG's target is to train 150 growers in 2015, and initiate 70 contract farms in Malaysia supported by the Malaysian Government's Economic Transformation Programme (ETP). The ETP covers 12 National Key Economic Areas (NKEAs) one of which is agriculture. Under the NKEAs, a total of 149 'Entry Point Projects' (EPPs) have been selected. Seed industry development is EPP 14. GWG has been appointed under the Economic Transformation Programme (ETP) of the Malaysian Government as the anchor company

for EPP 14, and Chua appears to be uniquely well-prepared to lead the transformation.

Chua Kim Aik, the CEO of Green World Genetics, grew up in his family farm in Cameron Highlands. Upon graduation, he began his career in agro-industry that has spanned over 30 years, including 10 years with world leading seed companies during which he was posted to many different countries, before founding Green World Genetics.

The tropics account for 64% of the world's arable land yet produces only 43% of the world's food. This is due to low productivity, which can to large measure be rectified by breeding high-yielding plants and making their seeds available. The global seed industry is almost exclusively temperate and sub-tropical and the seeds they



Quarantine house, for study of disease resistance

produce are not optimised for the tropics. The reasons for the lack of a plant breeding and seed industry in Malaysia have been outlined in a paper by Wan Jusoh Wan Mahmood of MARDI in 2006. The main reasons are institutional weaknesses and lack of a reliable dry season

for good seed maturation. Plant breeding and seed production is a competitive business and if this business is left to government agencies, we cannot expect much progress. As for the climate, Chua thinks the problem can be overcome.

Bibliography

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