Plantation Biotechnology: The way forward

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Abstract

The Plantation Industry has been seen as a traditional unexciting, low risk industry with low growth potential by investors. However, this perception is changing and the industry is undergoing a period of rapid change brought about by changing global circumstances and market requirements. The industry has also been beset by conflicting demands, such as keeping costs low in a climate of increased agrochemical costs and to increase production in a sustainable manner without resorting to expansion of planting area.

Given the unprecedented demand for palm oil for fuel and food, palm oil prices have hit record levels earlier this year and have fallen recently with the onset of the financial crisis and the reduction in fossil fuel prices. There is limited availability of land that is suitable for oil palm cultivation and expansion to satisfy this demand is often not a sustainable route. In addition to this clients demand that palm oil be produced in a sustainable, environmentally friendly manner. The felling of virgin forest for oil palm plantations is not acceptable to clients and there is the negative perception that the plantation industry is contributing to deforestation. Clients also demand healthier oils that have reduced trans-fatty acid content and to a certain extent there is the perception that palm oil is less healthy than competitor oils. These perceptions and trends are challenges that the industry faces but can also be viewed as unique opportunities to create new value.

How can this be done? We can consider successful multinational companies such as Monsanto and DuPont, both of which have been involved in traditional agrochemical manufacturing for many years, as models: Over the past twenty years they have moved their focus from their traditional business area into developing new businesses in agribiotechnology. This has been driven in part by advances in new technology and new knowledge derived from the completion of plant genome projects (including Arabidopsis, rice and maize (corn) genomes). Both companies have been industry leaders in adopting this new knowledge and technology and through this have developed novel products such as herbicide tolerant and insect resistant crops. Herbicide tolerant and insect resistant cotton, soy and corn plants have created an additional US$ 2 billion in value per year for these companies. The study of mutant plants in conjunction with this genome information has led to the identification of genes involved in conferring disease resistance, drought resistance, controlling flowering time, yield and other useful agronomic traits in some model and crop plants. Cognizant of this and the growing demand for seeds, both Monsanto and DuPont have been actively acquiring seed companies to capture value in this

significant market. In 2005 the value of the commercial seed industry was US $ 56 billion with the biotechnology seed market valued at US$ 5 billion. The biotechnology seed market is rapidly growing and it has been estimated that it will double in value by 2010. Part of the business strategy of Monsanto and DuPont is to invest intensively in research to generate a bank of intellectual property (IP) to protect their products from competition in the market place. Both companies are well positioned to capture and retain value in these growing and competitive markets.

Their strategy is validated by the dramatic impact of these technologies on corn with yields increasing from 100 bushels/hact to 160 bushels/hact in just over 15 years. In contrast it took 46 years to increase corn yields from 35 bushels/hact to 80 bushels/hact mainly through the use of double cross hybrids. The introduction of BT corn has resulted in an over 10% increase in yield under the same field management conditions due to reduced losses to the European corn borer. In the future, corn containing other useful agronomic traits will be rolled out including drought resistance, disease resistance, improved nutritional value, reduced fertiliser requirement, lodging tolerance and others. It is estimated that over the next 10 years the cost of production will be contained thus allowing growers and seed companies to capture additional value despite projected increases in fuel and fertiliser costs.

In contrast, oil palm being a perennial crop is not amenable to such intensive breeding efforts. In the space of a year, two or more crosses can be made and tested with corn but the testing of a single cross in oil palm will take a minimum of 7 years. Therefore, application of technology as used by Monsanto and DuPont is essential to accelerate the oil palm breeding process. Wong and Bernardo (2008) have estimated that the use of 200 or more molecular markers for genome wide selection could lead to an 11-23 year time per unit gain and therefore a reduction in overall breeding time. This will enable exploitation of wider crosses for increased yield and other useful agronomic traits in the medium term. The completion of the proposed oil palm genome sequencing project by ACGT and MPOB will enable novel new traits such as novel oil and sugar profiles, compact palms, long stalk and disease resistance to be introgressed/transferred into the production material rapidly either though use of genetic markers or recombinant DNA technology. We envisage that the judicious use of molecular marker technology augmented with directed crop improvement technologies will allow oil palm to keep abreast with improvements in its competitor annual crops.

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