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The Role of Plant Biotechnology in Human Health. Public Sector Constraints: The Golden Rice Experience

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When agriculture started about 12,000 years ago, the human population was 3 million people. With around 250,000 (net) additional people every day, it will be ~9 billion in 30 years. Agriculture has the biggest negative impact on biodiversity. And intensive agriculture is the kindest for maintenance of biodiversity by protection of wild lands from food production. Despite the population growing exponentially, farmers have managed to keep food production – yield of the macronutrients carbohydrate and protein – ahead of human population increase by plant breeding, and in the last century by using inorganic fertilizers and chemical pesticides.

Nevertheless, the 2016 G20 Agriculture Ministers remained “deeply concerned that, despite tremendous efforts, 795 million people in the world still suffer from chronic hunger and 2 billion people from [micronutrient] malnutrition”.[i]

Food production needs to double by 2050 due to population growth, yet only around 15% of the land area is suitable for food production with current technology.[ii] And not only macronutrients but also micronutrients – minerals which plants obtain from the soil, and vitamins synthesised by plants or animals – are essential for human development and health. A sufficient source of vitamin A is very important for sight and life. Vitamin A deficiency (VAD) is very common in developing countries and globally the most significant cause of irreversible childhood blindness. In 2014 VAD killed between 1.4 and 2.1 million young children, despite all existing interventions and 25 years UN attention. These preventable deaths are greater than the total death toll from HIV/AIDS or TB or malaria[iii] (or Ebola ~13,000 in 2014-5).

The World Food Prize 2016 was awarded to the team involved with the introduction of orange-fleshed sweet potato as a vitamin A deficiency intervention.[iv] The Director of ‘Harvest Plus’, and one of the laureates is Dr Bouis. Before Harvest Plus started its activities in 2003, Dr Bouis had already joined the Golden Rice Humanitarian Board.

Golden Rice, a ‘GMO-crop’ was created by incorporating in the rice genome two non-rice genes. This occurred once, in around 2004,[v] the year the Cartagena Protocol[vi] came into force. In the same year, rice was providing the global population with 2,000,000 million calories per day. Sweet potato was providing less than 2% as many.[vii]

How can it be that Harvest Plus, which started operations in 2003, has been successful, and Golden Rice, initially created in 1999[viii] has not yet even been grown by farmers by 2016?

The June 1992 Earth Summit in Brazil, the first UN Summit meeting to include non-governmental representatives, agreed 27 Principles which became The UN Convention on Biodiversity (‘CBD’). Principle 1 is that:

Human beings are at the centre of concerns for sustainable development.

They are entitled to a healthy and productive life in harmony with nature.

Principle 15 is that:

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.

This ‘precautionary principle’ has long been a major impediment to good sense in public policy … it has been an invaluable tool for those who want to stop any new scientific development that they dislike”.[ix]

Greenpeace have been long#standing opponents of GMO#crops. They were involved in 1992 in Rio and subsequently boasted that “we won almost all the points we were pushing for”[x] in the writing of the Cartagena Protocol.

Principle 15 of the Rio Declaration became Objective 1 of the Cartagena Protocol, the basis of national regulatory systems for GMO#crops worldwide, which insist first of all on generation of molecular data. A plant breeder can much more quickly, and cheaply, decide if a plant has useful characteristics or not. But in the system which Greenpeace takes pride in, traditional plant breeders work in the field is delayed for several years.

Greenpeace have cynically ignored scientific evidence about GMO crops for fundraising purposes by suggesting that GMO-crops are a unique class of agricultural product, despite longstanding scientific agreement that they are not.[xi],[xii],[xiii] Even large organisations, public and private, have actively avoided GMO#crop-controversy-entanglement.[xiv] Individual scientists have been distracted from their work.[xv]

Activist organisations such as Greenpeace have also promulgated the view that GMO-crops are dangerous to human and environmental health, are solely for use in industrialised countries for ’evil’ multinational company profit and provide no consumer benefit.

Greenpeace’s narrative is false (Golden Rice is one example of why, and there should be many more).[xvi] Nevertheless, Greenpeace’s false narrative has misled some, and intimidated many organisations in the public and private sector, who wished to avoid the anticipated controversy.

Paradoxically the activists’ success has induced the creation of that which they oppose: only multinational companies can afford the costs and complexities of registration of GMO-crops. The result of Greenpeace’s influence has been to reinforce commercial oligopoly for major industrial crops which they purport to object to. The public sector and small companies usually cannot compete.

One of the reasons Harvest Plus has been so successful is that they adopted a ‘no-GMO-crop’ strategy[xvii] from 2003 purposefully to avoid “the hurdles and criticism”, and so successfully raised extensive operational funding, including from some similarly intimidated sources. However, Harvest Plus have also noted that conventional seed breeding techniques cannot achieve success with increasing iron and zinc in rice, and recently, they have acknowledged that only with precision agriculture, using transgenesis to create GMO-crops, have they achieved success with these traits.[xviii] Increases of not only iron and zinc, but also folate and pro# vitamin A in staple crops of the poor are all extremely important for human health. All have been achieved using GMO#technology, where conventional breeding was not possible.

The public sector holds the responsibility for public health delivery through biofortification of food security crops. For biofortification especially, plant breeders need rapidly to catch up with the 12,000-year head start of seed breeding for yield. Precision agriculture, including GMO-crops now provides the tools to assist, both for macronutrients, to adapt yields to climate change and other difficult growing conditions, as well as micronutrients. Most farmers using GMO-crops in 2014 – clearly of their free will – did so on small farms in developing countries.[xix]

Religious leaders, the UN, and Governments have an important leadership role to encourage the use of all plant breeding tools, without ideological overlay, to deliver the food we need. For the sake of humanity, and the environment, Greenpeace should not hinder the applications of Precision Agriculture.

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