Highlights of "Global Status of Commercialized Biotech/GM Crops: 2009"

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Dedicated to the late Nobel Peace Laureate, Norman Borlaug

ISAAA Brief 41 is the 14th consecutive annual review, by the author, of the global status of biotech crops since they were first commercialized in 1996. Brief 41 is dedicated, by the author, to the late Nobel Peace Laureate Norman Borlaug, first founding patron of ISAAA. The Highlights summarize the major developments in 2009, and more details can be found at http://www.isaaa.org.

As a result of consistent and substantial, crop productivity, economic, environmental and welfare benefits, a record 14 million small and large farmers in 25 countries planted 134 million hectares (330 million acres) in 2009, an increase of 7 percent or 9 million hectares (22 million acres) over 2008; the corresponding increase in "trait or virtual hectares" was 8 percent or 14 million "trait hectares" for a total of 180 million "trait hectares" compared with 166 million "trait hectares" in 2008. **The 80-fold increase in biotech crop hectares between 1996 and 2009, is unprecedented, and makes biotech crops the fastest adopted crop technology in the recent history of agriculture**; this reflects the confidence and trust of millions of farmers worldwide who have consistently continued to plant more biotech crops every single year since 1996, because of the multiple and significant benefits they offer.

Record hectarages were reported for all four major biotech crops. For the first time, biotech soybean occupied more than three-quarters of the 90 million hectares of soybean globally, biotech cotton almost half of the 33 million hectares of global cotton, biotech maize over one-quarter of the 158 million hectares of global maize and biotech canola more than one-fifth of the 31 million hectares of global canola. Biotech crop hectares continued to grow in 2009 even when 2008 percent adoption rates were high for the major biotech crops in the principal countries. For example, adoption of Bt cotton in India increased from 80 percent in 2008 to 87 percent in 2009, and biotech canola in Canada increased from 87 percent in 2008 to 93 percent in 2009. Biotech soybean continued to be the most prevalent biotech crop occupying 52 percent of the 134 million hectares and herbicide tolerance the most prevalent trait (62 percent). Stacked genes are of growing importance occupying 21 percent of all biotech crops globally and deployed by 11 countries, 8 of them developing countries.

Of the 25 biotech crop countries (Germany discontinued in 2008 and Costa Rica joined in 2009), 16 were developing and nine industrial. Each of the following top eight countries grew more than 1 million hectares: USA (64.0 million hectares), Brazil (21.4), Argentina (21.3), India (8.4), Canada (8.2), China (3.7), Paraguay (2.2) and South Africa (2.1). The balance of 2.7 million hectares was grown by the following 17 countries, listed in decreasing order of hectarage; Uruguay, Bolivia, Philippines, Australia, Burkina Faso, Spain, Mexico, Chile, Colombia, Honduras, Czech Republic, Portugal, Romania, Poland, Costa Rica, Egypt, and Slovakia. **Accumulated hectarage of biotech crops for the period 1996 to 2009 reached almost 1 billion hectares (949.9 million hectares or 2.3 billion acres).**

Notably, almost half (46 percent) of the global hectarage was planted by developing countries, expected to take the lead from industrial countries before 2015, the Millennium Development Goal Year, when global society has pledged to cut hunger and poverty in half. **Biotech crops are already contributing to this goal, and the potential for the future is enormous.**

Remarkably, of the 14 million beneficiary farmers, 90 percent or 13 million were small resource-poor farmers. These farmers are already benefiting from biotech crops like Bt cotton, and have enormous future potential with crops such as biotech rice, to be commercialized in the near term.

The 2008 ISAAA Brief predicted that a new wave of biotech crops would become available, and this already started to materialize in 2009. In a landmark decision on 27 November 2009, China issued biosafety certificates for its nationally-developed proprietary Bt rice and phytase maize, clearing the way for crop registration, which will take 2 to 3 years before commercialization. The significance of this decision is that rice, the most important food crop in the world, has the potential to directly benefit 110 million rice households (440 million beneficiaries, assuming an average of four per family) in China alone, and 250 million rice households in Asia, equivalent to 1 billion potential beneficiaries. Rice farmers are some of the poorest people in the world surviving on an average of only one-third of a hectare of rice. Bt rice can contribute to increased productivity and the alleviation of their poverty and coincidentally reduce requirements for pesticides while contributing to a better and **more sustainable environment in the face of climate change. Whereas rice is the most important food crop, maize is the most important animal feed crop in the world. Biotech phytase maize will allow pigs to digest more phosphorous and coincidentally enhance their growth while reducing pollution from lower phosphate in animal waste. Given the increased demand for meat in a more prosperous China, phytase maize can provide improved animal feed for China's 500 million swine herd (half of the global swine population) and its 13 billion chickens, ducks and poultry. Phytase maize has the potential to directly benefit 100 million maize households (400 million beneficiaries) in China alone.** Given the importance of rice and maize globally, and China's growing influence, other developing countries in Asia and the rest of the world may seek to emulate the Chinese experience. China's lead in embracing biotech crops can serve as a role model for other developing countries and can **contribute to food self-sufficiency**, a more sustainable agriculture dependent on less pesticides and to the alleviation of hunger and poverty. **Given that rice and maize are the most important food and feed crops in the world respectively, these two new Chinese nationally-developed biotech crop products have momentous potential implications for China, Asia and the world.**

Brief 41 includes a fully referenced special feature on **"Biotech Rice – Present Status and Future Prospects" by Dr. John Bennett**, Honorary Professor, School of Biological Sciences, University of Sydney, Australia.

Notably, in 2009, Brazil narrowly displaced Argentina to become the second largest grower of biotech crops globally – the increase of 5.6 million hectares of biotech crops was the highest absolute growth in hectares for any country in the world, equivalent to a 35 percent year-over-year growth between 2008 and 2009. It is evident that Brazil is a world leader in biotech crops and an engine of growth for the future. India, the largest cotton grower in the world, has benefited from 8 years (2002 to 2009) of spectacular success with Bt cotton, which reached a record 87 percent adoption in 2009. Bt cotton has literally revolutionized cotton production in the country. **The accumulated economic benefit to Bt cotton farmers in India for the period 2002 to 2008 was an impressive US$5.1 billion. Bt cotton also cut insecticide requirements in half, contributed to a doubling of yield and transformed India from an importer to a major cotton exporter. Bt brinjal (eggplant), expected to be India's first biotech food crop, was recommended for commercialization by the Indian Regulatory authorities.** Final endorsement by Government is pending. **Continued progress was witnessed in all three countries in Africa – South Africa with a significant 17% growth in 2009, Burkina Faso and Egypt. Bt cotton hectares in Burkina Faso increased 14-fold from 8,500 hectares in 2008 to 115,000 hectares in**

2009, a 1,353 percent increase which was by far the highest proportional increase globally in 2009. Six EU countries planted 94,750 hectares in 2009, 9 percent to 12 percent less than 2008. Spain grew 80 percent of all EU Bt maize and maintained the same adoption rate as 2008, at 22 percent. **RR®sugarbeet achieved a remarkable 95 percent adoption in the USA and Canada in 2009 in only its third year of commercialization, making it the fastest adopted biotech crop globally, to-date.**

2009 saw substitution of first generation products with second generation products, which, for the first time, increased yield *per se.* RReady2Yield™ soybean, the first example of a new class of biotech crops being researched by many technology developers, was planted by over 15,000 farmers on more than 0.5 million hectares in the United States and Canada in 2009.

Updated global impact assessments for biotech crops indicate that for the period 1996 to 2008 economic gains of US$51.9 billion were generated from two sources, firstly, reduced production costs (50%), and secondly, substantial yield gains (50%) of 167 million tons; the latter would have required 62.6 million additional hectares had biotech crops not been deployed, hence biotech crops are an important land saving technology. During the same period, 1996 to 2008, pesticide reduction was estimated at 356 million kg of active ingredient (a.i.), a saving of 8.4% in pesticides. In 2008 alone, the CO_2 savings from biotech crops through sequestration was 14.4 billion kg of CO_2 equivalent to removing 7 million cars from the road (Brookes and Barfoot, 2010, forthcoming).

In 2009, more than half (54 percent or 3.6 billion) of the world's population lived in the 25 countries that planted 134 million hectares of biotech crops, equivalent to 9 percent of the 1.5 billion hectares total global cropland.

Global value of the biotech seed market alone was valued at US$10.5 billion in 2009. The global value for the **corresponding commercial biotech maize, soybean grain and cotton was valued at US$130 billion for 2008,** and projected to grow at up to 10 percent to 15 percent annually.

While 25 countries planted commercialized biotech crops in 2009, an additional 32 countries, totaling 57, have granted regulatory approvals for biotech crops for import for food and feed use and release into the environment since 1996. **A total of 762 approvals have been granted for 155 events in 24 crops; this includes a biotech blue rose grown in Japan in 2009.**

Future prospects of a new wave of biotech crops between 2010 to 2015 are encouraging: top priority must be assigned to operation of **appropriate and responsible, and cost-effective and timely regulatory systems;** there is **growing political will, financial and scientific support** for the development, approval and adoption of biotech crops; there is cautious optimism that **global adoption of biotech crops, by country, number of farmers, and hectarage will all double** in the second decade of commercialization between 2006 and 2015, as predicted by ISAAA in 2005 (**by 2015, ISAAA predicts 40 biotech countries, 20 million biotech crop farmers and 200 million hectares of biotech crops**); there will be a continuing and expanding supply of appropriate new biotech crops to meet the priority needs of global society, particularly the developing countries of Asia, Latin America and Africa. **The following partial selection of new biotech crops/traits are expected to become available from 2010 to 2015: SmartStax™ maize in the USA and Canada in 2010, involving eight genes which code for three traits; Bt brinjal (eggplant) in India in 2010, subject to government endorsement; Golden Rice in the Philippines in 2012, followed by Bangladesh and India and eventually Indonesia and Vietnam; biotech rice and phytase maize in China within 2 to 3 years; drought-tolerant maize in the USA in 2012 and in**

Sub-Saharan Africa in 2017; possibly a Nitrogen Use Efficiency (NUE) trait and biotech wheat in five years, or more.

Following the food crisis of 2008, (which led to riots in over 30 developing countries and overthrow of governments in two countries – Haiti and Madagascar), there was a realization by global society of the grave risk to food and public security. As a result, **there has been a marked increase in the political will and support for biotech crops** in the donor group, the international development and scientific community and from leaders of developing countries. More generally, there has been a renaissance and recognition of the life sustaining essential role of agriculture by global society, and importantly, its vital role in ensuring a more just and peaceful global society. More specifically, there has been a clarion call to achieve **"a substantial and sustainable intensification of crop productivity, to ensure food self-sufficiency and security, using both conventional and crop biotechnology applications."**

Norman Borlaug's success with the wheat green revolution hinged on his ability, tenacity and single-minded focus on one issue – **increasing the productivity of wheat per hectare** – by intent, he also assumed full responsibility for gauging his success or failure by measuring productivity at the farm level (not at the experimental field station level), and production at the national level, and most importantly, evaluating its contribution to peace and humanity. He titled his acceptance speech for the Nobel Peace Prize on 11 December 1970, 40 years ago – **The Green Revolution, Peace and Humanity.** Remarkably, what Borlaug crusaded for 40 years ago – **increasing crop productivity, is identical to our goal of today** except that the challenge has become even greater because **we also need to** <u>double productivity sustainably, using less resources</u>**, particularly water, fossil fuel and nitrogen,** in the face of **new climate change challenges.** The most appropriate and noble way to honor Norman Borlaug's rich and unique legacy is for the global community involved with biotech crops to come together in a "**Grand Challenge".** North, south, east and west, involving both public and private sectors should engage collectively in a supreme and noble effort to optimize the contribution of biotech crops to productivity using less resources. **Importantly, the principal goal should be to contribute to the alleviation of poverty, hunger and malnutrition**, as we have pledged in the Millennium Development Goals of 2015, which coincidentally marks the end of the second decade of the commercialization of biotech crops, 2006 to 2015.

The closing words are those of Norman Borlaug, who having saved one billion from hunger, was the world's most ardent and credible advocate of biotech crops because of their capacity to increase crop productivity, alleviate poverty, hunger and malnutrition, and contribute to peace and humanity. Borlaug opined that "***Over the past decade, we have been witnessing the success of plant biotechnology. This technology is helping farmers throughout the world produce higher yield, while reducing pesticide use and soil erosion. The benefits and safety of biotechnology has been proven over the past decade in countries with more than half of the world's population. What we need is <u>courage</u> by the leaders of those countries where farmers still have no choice but to use older and less effective methods. The Green Revolution and now plant biotechnology are helping meet the growing demand for food production, while preserving our environment for future generations.***

Detailed information is provided in Brief 41 Global Status of Commercialized Biotech/GM Crops: 2009 by Clive James. For further information, please visit http://www.isaaa.org or contact ISAAA *SEAsia*Center at +63 49 536 7216, or email to info@isaaa.org.