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Celebrating the Life of 'the Man Who Fed the World' - Norman Borlaug, 1914 -2009

Norman Borlaug, came of age at the right time in history; a time when the world needed his dedication and expertise to stave off the looming spectre of global hunger. His research to better wheat is said to have saved hundreds of millions of lives. And for this he was awarded the Nobel Peace Prize in 1970. Borlaug died this September at the age of 95.

Borlaug's wheat breeding efforts began in earnest in 1944 when, on invitation from the Rockefeller Foundation's technical assistance program, he took up the position of research scientist in charge of wheat improvement in Mexico. He began working on a project to boost wheat production in the country.

At the time Mexico was importing a good share of its grain. It was on the research stations and farmers' fields of Mexico that Borlaug and his staff spent nearly 20 years breeding wheat varieties. He worked to solve a series of wheat production problems that were limiting wheat cultivation in Mexico and helped train a whole generation of young Mexican scientists.

In the late 1960s, most experts were speaking of imminent global famines in which billions would perish. 'The battle to feed all of humanity is over," biologist Paul Ehrlich famously wrote in his 1968 bestseller The Population Bomb. "In the 1970s and 1980's hundreds of millions of people will starve to death in spite of any crash programs embarked upon now." Ehrlich also said, "I have yet to meet anyone familiar with the situation who thinks India, will be self-sufficient in food by 1971."" He insisted that "India couldn't possibly feed two hundred million more people by 1980."

But Borlaug and his team were already engaged in the kind of crash program that Ehrlich declared wouldn't work. Their dwarf wheat varieties resisted a wide spectrum of plant pests and diseases, were adaptable to various growing conditions and produced two to three times more grain than the traditional varieties. These wheats and improved crop management practices transformed agricultural production in Mexico during the 1940s and 1950s. In 1965, they had begun a massive campaign to ship the miracle wheat to Pakistan and India and teach Local farmers how to cultivate it property. By 1968, when Ehrlich's book appeared, the U.S. Agency for International Development had already hailed Borlaug's achievement as a 'Green Revolution.'

In Pakistan, wheat yields skyrocketed from 4.6 million tonnes in 1965 to 8.4 million in 1970. In India, they went up from 12.3 million tonnes to 20 million. In the 40-year period since then, wheat production in India has increased to 80.58 million metric tonnes and is now at 21 million metric tonnes in Pakistan. Globally it has risen from 300 to 600 million metric tonnes. Since Ehrlich's dire predictions in 1968, India's population has more than doubled, its wheat production has more than tripled, and its economy has grown nine-fold.

> "More than any other single person of his age, he has helped provide bread for a hungry world, ...

The high-yielding wheat varieties that Norman Borlaug and his many scientific colleagues developed are today grown on more than 75 million hectares (187 million acres) throughout the world and may well be responsible for saving tens of millions of people from starvation. "More than any other single person of his age, he has helped to provide bread for a hungry world," Noble Peace Prize committee chairman Aase Lioneas said presenting the award to Borlaug in 1970.

In the mid-1980's Borlaug teamed up with Japanese philanthropist Ryoichi Sasakawa, to create the Sasakawa Africa Association, which he was President of. Working with former US President Jimmy Carter under the Sasakawa Global 2000 (SG 2000) agricultural programme, they helped an estimated 4 million small-scale farmers in 11 sub-Saharan countries improve food production.

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inside

Cowpea can fight off 'Witch-weed' with help from Science

With the discovery of a gene in cowpea that confers resistance to striga, the assault on this 'wicked' pest in cowpea fields has just had a new weapon added to its arsenal.

Scientists at the University of Virginia presented their findings in the August 28 issue of the journal Science. This discovery will help researchers better understand how some plants can resist Striga, while others, such as maize and sorghum, are susceptible.

Cowpea known by some as the black-eyed pea is one of the key targets of the deceptively beautiful Striga or "witchweed". This parasitic flowering plant, attacks the roots of host plants, draining needed water and nutrients and leaving them unable to grow and produce any grains. Witchweed is endemic throughout sub-Saharan Africa, causing crop losses that surpass hundreds of millions of dollars annually and exacerbating food shortages in the region. In Sub-Saharan Africa, the UN Food and Agriculutre Organisation (FAO) estimates crop losses amounting to $200 million annually.

> A 2009 UN Environmental Programme report estimated that Striga plagues 40 percent of arable savannah land and over 100 million people in Africa.

About 80 percent of the world's cowpea crop is grown in sub-Saharan Africa, mostly by subsistence farmers who lack the resources to purchase expensive herbicides and fertilizers. In this region, cowpea is the primary protein source for millions of people, who consume the entire plant – the pea for soups, stews and breads, the leaves as fresh greens, the stems as hay and fodder for cattle.

As the use of cowpea expanded over time, so did the prevalence of Striga gesnerioides, the type of witchweed adapted to parasitize it. Today, witchweed is so virulent that farmers in this semi-arid region must relocate their cowpea crop to new soil every few years.

"Discovery of this resistance gene is not only important for improving cowpea, but may help us develop strategies for improving resistance to Striga in other affected crops," said Michael P.Timko, the U.Va. Biology professor who led the study.

Currently there are no natural sources of Striga resistance in corn or sorghum, both of which are major cereal grains in the African diet.

"Making plants durably resistant to Striga could have a significant impact on food security for Africa," Timko said.

In recent years, he and other scientists have sequenced the cowpea genome and are using this information to develop cowpea plants with multiple improved agronomic traits.

"We may even eventually breed a more drought-resistant plant and varieties that have higher levels and a better balance of nutrients. We've reached a point where we can manipulate this plant for the good of millions of people," Timko said.

Timko's approach is to improve the performance of plants by identifying genes that control key characteristics, and then using selective breeding to emphasize those traits.

While he is finding success breeding parasite-resistant hybrids, there are at least seven different races of Striga, each capable of adapting to changing varieties of cowpeas.

"We are trying to create a plant that is resistant across the board," he said. "Striga is hyper-virulent. This is warfare between the cowpea plant and its parasite, and we keep trying to stay ahead of the enemy."

(University of Virginia, August 2009)

And now... Iron-rich Rice

Scientists at the Swiss Federal Institute of Technology (ETH) in Zurich have developed rice plants that contain six times more iron in polished rice kernels. They did this by transferring two plant genes into an existing rice variety. In the future, the high-iron rice could help to combat iron deficiency, especially in developing countries in Africa and Asia.

According to the World Health Organization, nearly one-third of the world's population, suffers from from iron deficiency. They tire easily, experience problems in metabolizing harmful substances in their bodies and eventually suffer from anemia. Women and children are particularly affected in developing countries, where rice is the major staple food. Peeled rice, also called polished rice, does not have enough iron to satisfy the daily requirement, even if consumed in large quantities. For many people, a balanced diet or iron supplements are often unaffordable.

Rice actually has a lot of iron, but only in the seed coat. Because unpeeled rice quickly becomes rancid in tropical and subtropical climates, the seed coat - along with the precious iron - has to be removed for storage. Researchers under the leadership of Christof Sautter and Wilhelm Gruissem in the laboratory of plant biotechnology at ETH Zurich have now succeeded in increasing the iron content in polished rice by transferring two plant genes into an existing rice variety. Their work was published in the July 20 edition of "Plant Biotechnology Journal".

The rice plants express the two genes to produce the enzyme nicotianamin synthase, which mobilizes iron, and the protein ferritin, which stores iron. Their synergistic action allows the rice plant to absorb more iron from the soil and store it in the rice kernel. Together, the expression of the genes has a positive impact on iron accumulation in the rice kernel and increases the iron content more than six-fold compared to the original variety.

The ETH scientists are excited about the new rice variety. The prototypes behave normally in the greenhouse and show no signs of possible negative effects. "Next we will have to test whether the rice plants also perform well in the field under agronomical conditions", says Gruissem. The ETH Professor does not expect the plants to have a negative impact on the environment. It is unlikely that they will deplete the soil of iron, as iron is the most abundant metallic element in it.

The rice plants will have to undergo many greenhouse and field tests for biosafety and agronomic performance before the high-iron rice varieties eventually become available to farmers. The researchers hope that their rice will, in future, offer a glimmer of hope in tackling this far-reaching problem

Monsanto Now Developing New Technologies for Wheat

Monsanto Company is expanding its strong seed and traits portfolio to include wheat. The company has acquired the assets of Westbred, a U.S. based company that specializes in wheat germplasm, the crop's seed genetic material. The investment will bolster the future growth of Monsanto's seeds and traits platform and allow farmers to benefit from the company's experienced in drought, disease and pest-tolerance innovations.

Through its technologies, Monsanto sees an opportunity to bolster the sustainability of wheat by helping wheat farmers improve yields while reducing the use of input resources, such as water, land and energy. The transaction will give WestBred access to Monsanto's technology platforms to provide wheat farmers benefits through both breeding and biotechnology.

Wheat is an important large-acre global crop; it is the largest crop in the world with 550 million acres planted globally. However, it has suffered from the lack of investment in technology and a result its productivity continues to fall behind other major row crops like maize and soybeans.

In the US, it is planted on 59.8million acres but as with the global trend wheat has continued to lag behind gains in other major row crops like maize. The annual growth rate in yield for maize is four times that of wheat.

For the past few years wheat growers in the US have been anxious to have research into biotech wheat, they hope that it will change this competitiveness equation. According to the National Wheat Growers' Association "…Biotechnology's introduction into the wheat crop is necessary for the wheat industry to increase productivity, attract acres back to the crop and feed a growing global population in a sustainable way." The association alongside four other key industry associations released a report "The Case for Biotech Wheat" in September 2009.

According to Carl Casale, executive vice president of global strategy operations for Monsanto, " The U.S. wheat industry has come together to call for new technology investment, and we believe we have game-changing technologies – like our drought-tolerance and improved-yield traits -0 that can meaningfully address major challenges wheat growers face every season."

Monsanto will focus on yield improvement through molecular breeding. In the longer term - about 10 years down the research and development pipeline- Monsanto hopes to introduce some of it biotech traits, particularly those that confer drought tolerance, nitrogen use efficiency, and higher yield.

Food Security; top on Global Seed Forum Agenda

Urgent government measures and increased public and private investment in the seed sector are required for the long term if agriculture is to meet the challenge of food security in the context of population growth and climate change. This was the declaration of the Second World Seed Conference held at the FAO Headquarters in Rome, in early September.

The two-day conference whose theme was, 'Responding to the challenges of the changing world: the role of new plant varieties and high quality seed in agriculture", discussed key issues relating to food security in light of the changing global situation.

Governments were called upon to implement a predictable, reliable, user friendly and affordable regulatory environment to ensure that farmers have access to high quality seed at a fair price.

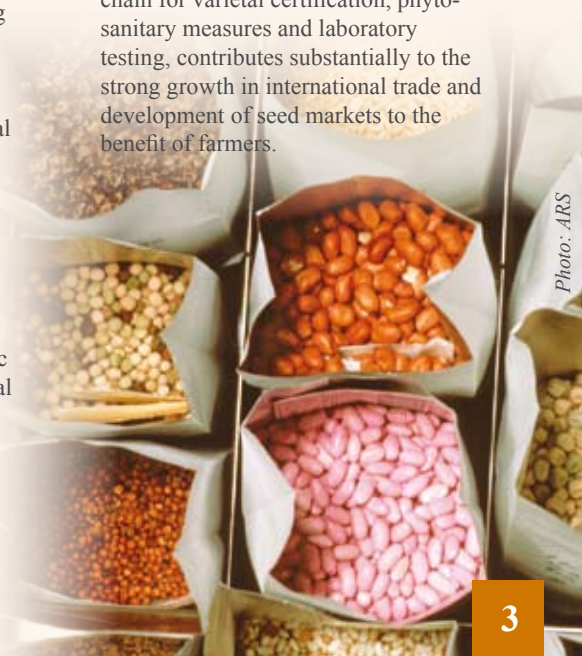
In particular, FAO member countries were urged to participate in the internationally harmonized systems of the Organization for Economic Cooperation and Development (OECD), the International Union for the Protection of New Varieties of Plants (UPOV), the International Treaty on Plant and Genetic Resources for Food and Agriculture (ITPGRFA) and the International Seed Testing Association (ISTA). Recognizing that these systems facilitate the availability of germplasm, new plant varieties and high quality seed for the benefit of their farmers, without which their ability to respond to the challenges ahead will be substantially impaired.

The Conference emphasized the important role of both the public and the private sectors in meeting the challenges ahead and the benefits when the two work together.

The Second World Seed Conference underscored the need for agriculture to provide sustainable food security and economic development in the context of current and future global challenges; highlighting the critical role of new plant varieties and high quality seed in doing so.

Conference conclusions:

- Plant breeding is a major contributor to increased food security whilst reducing input costs, greenhouse gas emissions and deforestation; it significantly mitigates the effects of population growth, climate change and other social and physical challenges.
- ITPGRFA is an innovative instrument that aims at providing food security through conservation, as well as facilitated access to genetic resources under its multilateral system of access and benefit-sharing. The multilateral system represents a reservoir of genetic traits, and therefore constitutes a central element for the achievement of global food security.
- Intellectual property protection is crucial for a sustainable contribution of plant breeding and seed supply. An effective system of plant variety protection is a key enabler for investment in breeding and the development of new varieties of plants; a country's UPOV membership gives breeders the confidence to introduce their new varieties.
- Seed quality determination, as established by ISTA, is an important measure for achieving successful agricultural production. Appropriate infrastructure on the scientific as well as technical level in developed and developing countries is highly recommended.
- The development of reliable and internationally acceptable certificates, through close collaboration between all stakeholders along the supply chain for varietal certification, phyto-sanitary measures and laboratory testing, contributes substantially to the strong growth in international trade and development of seed markets to the benefit of farmers.



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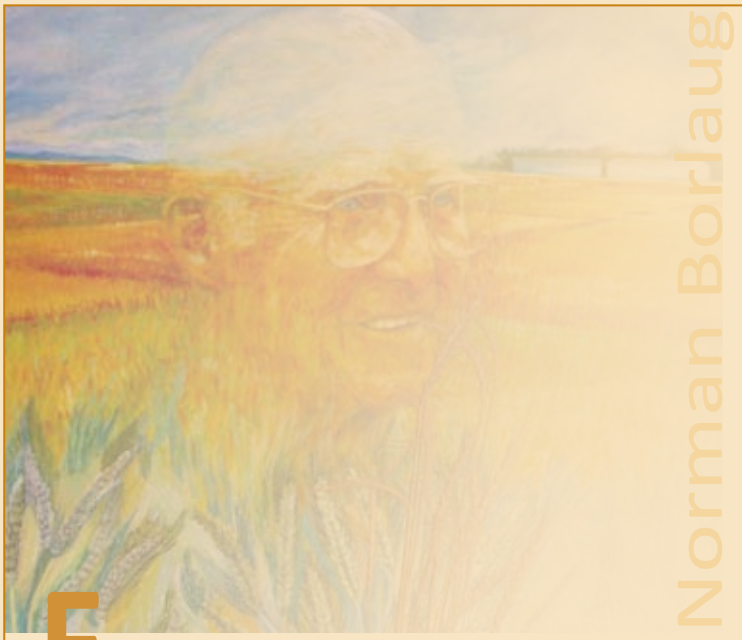

Fight!" Norman Borlaug said at his 95th birthday celebration. "Fight, fight!"

It was the rallying cry of that March day in Dallas, where Norm was surrounded by dozens of friends, relatives, colleagues and dignitaries. It also was the dominant theme of his life. He was a tireless warrior against global hunger, challenging others to continue his work. It is no small request. Borlaug, plant breeder and Nobel Peace Prize winner, saved millions of lives by bringing hybrid seeds and modern farming practices to famine-plagued India, Pakistan and Mexico in the 1960s and '70s.

Borlaug's work in wheat, and that of the late Henry Beachell in rice, brought about a Green Revolution that made folly of dire predictions that the world's population would outstrip its capacity to produce enough food. With the hardy dwarf varieties that Borlaug created, farmers across Asia and Latin America were able to grow more wheat on every acre – feeding their neighbors and having a surplus for export. The world largely thought the problem was solved and Borlaug was a hero, though his name and great works remained unknown by many people.

Borlaug never rested, however. He pushed throughout his life for further advances in science and education. He knew then, as the world learned during last year's food crisis, that his work was not done.

The United Nations predicts that the world's population will top 9 billion by 2050, up from 6.8 billion this year. If wide-scale famine is to be averted, that means food production must double in that timeframe. But there are few new acres that can be brought into production without encroaching upon rainforests and other precious ecosystems. Climate change, soil erosion and water scarcity are challenging farmers' ability to produce abundant crops on the land they already plant. In Sub-Saharan Africa, which never was reached by the Green Revolution, crop yields per acre already have been falling – and that continent will be most affected by adverse land, water and temperature changes to come.

Last year, at conferences and in headlines, I began hearing the dire concerns of 18th Century economist Thomas Malthus raised anew: How can the world grow enough crops to feed all who are hungry?

But Borlaug had hope. He had faith in human ingenuity, collaboration and determination – in our ability to fight – to once again avert crisis.

I, with many others, share his optimism. In the labs, fields and greenhouses of public research institutions and private companies, the brightest minds are focused on creating tools to help farmers produce more food and fiber per acre with plants that consume less water and energy. Non-governmental organizations, universities and philanthropies are devising ways to get these tools into farmers' hands and to help them bring more abundant crops to market. Farmers around the world, whether planting half an acre or thousands of acres, are hungry for innovation. It's what they do best.

Though saddened by the loss of this great man, I am heartened to know the next generation of scientists and warriors against hunger already is marching in his footsteps. In March, at Norm's birthday celebration, my company named in his honor the $10 million Beachell-Borlaug International Scholars program to fund the doctoral education of rice and wheat plant breeders from around the globe. The first of these students just began their studies – providing one answer to his rallying cry.

I, like the man I so admired, believe that when we all work together we can break the cycle of global poverty and starvation. In his memory, let's fight on!

-- *By Hugh Grant, Chairman, President and Chief Executive, Monsanto Company*

India: Bt Brinjal gets Regulator's Go-ahead

The Genetic Engineering Approval Committee (GEAC), India's biotechnology regulator, has approved biotech brinjal for commercial cultivation. If also approved by the government, it will become the first biotech food crop in India and the first GM brinjal approved anywhere in the world.

Minister of State for Environment and Forests Jairam Ramesh confirmed that the GEAC had given its approval for the environmental release of the Bt Brinjal, but said the government was yet to take a decision on the recommendations of the committee.

Work on the pest-resistant eggplant began in 2002. The improved eggplant expresses a protein derived from the bacteria *Bacillus thuringiensis* (*Bt*) which gives it resistance to the fruit and shoot borer (FSB), a very destructive pest. All the safety tests for the Bt eggplant were conducted in India, they included agronomic and field trials for Bt brinjal to check its effectiveness against pests; these have been carried out at 11 sites. Before the approval,Bt cotton was the only commercially approved biotech crop in India.

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When Norman Borlaug was born in 1914, world population was about 1.75 billion. When he was awarded the Nobel Peace Prize in 1970, 3.7 billion people lived on this planet. Today world population stands at 6 billion. His work has helped expand global food production faster than the population, but we must not become complacent, with projections of a further 3 billion people by 2050, work needs to be done now more than ever before.

Echoing Borlaug's words "… You'll never get the star … but if you stretch yourself enough, you'll get some stardust on your hands. And if that happens you'll be surprised what happens in your ability to do something for yourself, your family, the community, the state, the nation, and the world.

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