TRIBUTE

The Final Member of the Extraordinary Triumvirate of Plant Scientists Who Changed the World

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The passing of Dr. M. S. Swaminathan at age 98 on September 28, 2023, marked the end of an epoch. For when the 10,000-year-long story of human agriculture is written, the six-decade time frame from 1963 through 2023 will be seen as the single greatest period of food production and hunger reduction in all human history. In assessing the scientific leadership that brought about that apotheosis of agricultural achievement, there are three names that should be most prominently inscribed on any monument erected to commemorate this transformative era:

Norman E. Borlaug, Nobel Peace Prize recipient from the United States, founder of the World Food Prize, widely known as the "Father of the Green Revolution";
Yuan Longping, the 2004 World Food Prize Laureate from China, referred to as the "Father of Hybrid Rice"; and
M. S. Swaminathan of India, the first World Food Prize Laureate and the leader of India's green revolution, lauded by Time magazine as one of the twenty most influential Asians of the 20th century, and the person who launched this transformative era in Asia, and reached out to international institutions as he perceived a wave of approaching famine and starvation.

From three different cultures and diverse backgrounds, each of these three brilliant individuals whose work impacted millions and millions around the globe, can also lay claim to being the single greatest agricultural scientist in his country's history.

I had the incomparable privilege of working closely with each man while serving for 20 years as President of the World Food Prize Foundation in Des Moines, Iowa, where all three received exalted recognition. Following the deaths of Dr. Borlaug and Professor Yuan, I wrote about the global impact each had effected.

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Now, with the death of Dr. Monkombu Sambasivan Swaminathan, or M. S. as I knew him, I have composed this personal tribute to the final member of that extraordinary triumvirate of plant scientists whose innovations and leadership changed the world.

It was in that role as the inaugural World Food Prize Laureate that I first met M. S. Swaminathan in 1999, when I assumed the role of president of the World Food Prize. I was deeply impressed by his humility, intellectual acumen, kindness and the calm way in which he invariably dealt with emotional issues and controversies.

Over the next two decades, I watched in awe as M. S. provided leadership of a succession of international initiatives, while simultaneously contributing to World Food Prize programmes. He was a source of endless wisdom and insightful guidance to me as I endeavoured to increase awareness of and build the prestige of our Prize, our Borlaug Dialogue symposium, and Global Youth Institute.

The first of those international initiatives I witnessed was his appointment (along with future 2002 World Food Prize Laureate Pedro Sanchez) as Co-Chairs of the U.N. Millennium Project Hunger Task Force created by Secretary General Kofi Annan.

To publicise their efforts and results, both Laureates participated in the Borlaug Dialogue International Symposium in 2003 in a session I organised titled "The Fight Against Hunger: Report from the Millennium Project Task Force on Hunger." During that discussion, Dr. Swaminathan highlighted not only the hunger "hot spots" around the globe, but also what he called food security "bright spots," as a way to encourage similar efforts in the poorest areas.

The Hunger Task Force's final report they wrote was published in 2005 further reflected that optimism with the title "Halving Hunger: It Can Be Done." Recommendations in the report emphasised increasing agricultural production among smallholder farmers and improving nutritional support programmes for vulnerable groups, particularly children, pregnant women, and the elderly, through locally-based efforts to be supported by national-level policy reforms.

A powerful reflection of his leadership and of the effective strategies Swaminathan promoted and institutionalised as co-chair of the Hunger Task Force include the following positive outcomes: that the number of hungry people in the world had declined over the past decade by over 200 million, and more than 70 countries have met or are on track to meet MDG Goal #1, that is, eradicating hunger and poverty.

At the same time, reflecting his role as the Dean of the Laureates, Dr. Swaminathan was a leading figure at the 2001 UN Food and Agriculture Conference in Rome, where he presented a "Declaration by World Food Prize Laureates" on the urgency of fulfilling the international commitment to cut hunger in half.

The Triumvirate Finally Meets

The one and only meeting of the three transformative figures of the greatest period of agricultural production – Dr. Borlaug, Professor Yuan and Dr. Swaminathan – came in 2004 at the World Food Prize in Des Moines.

That year, which was the UN Food and Agricultural Organisation's International Year of Rice, the Prize was awarded to two rice breeders who had worked independently on different continents developing new rice varieties that fed millions of people. Dr. Monty Jones of Sierra Leone was honoured for creating a rice variety specifically bred for the ecological and agricultural conditions in Africa, and Professor Yuan Longping was celebrated for developing the genetic material and technologies essential for breeding high-yielding hybrid rice varieties in China and then the world.

It was Dr. Norman Borlaug who, as Chair of the Laureate Selection Committee, had given final approval for the award, personally presented the Laureate sculpture to Professor Yuan with Dr. Swaminathan looking on.

It was truly a historic moment. The three arguably most impactful plant scientists in history were together, reflecting the power of science and human ingenuity to advance the human condition by increasing the quality, quantity, and availability of food in the world.

Fittingly, Dr. Swaminathan gave a presentation at the 2004 Borlaug Dialogue International Symposium highlighting the important role of rice in feeding the world. In it, he observed that "Rice is going to be even more important in future years because of its ample availability as a staple food for billions." He told the symposium audience.

> That is why the International Rice Research Institute gene bank has over one hundred thousand strains of rice varieties grown in a wide array of weather and soil conditions. From uplands to highlands to lowlands, there is enormous opportunity but also great challenge to scientists as they research how to improve the farming systems under diverse ecosystems.

He added that the world needed improved grain quality and nutrition, and that he hoped this would be achieved through science and public policy.

Swaminathan also famously commented upon what he saw as the need for a paradigm shift "from a green to an evergreen revolution":

> All of us must have one basic aim – the prosperity and well-being of farmers, the health and safety of consumers, and the safety of the environment. Working toward these interconnected goals will bring us into a new era of bio-happiness.

In 2006, M. S. delivered a major address at the Borlaug Dialogue entitled "Looking back at the green revolution: how can we replicate the greatest achievement of food production in history?" His short reply to the question was: "We have to be positive on this challenge. We have to replicate the greatest achievement. It cannot be one single achievement, it has to go on."

Dr. Swaminathan emphasised the importance of information technology in ramping up production to feed the growing global population:

> We can produce more because there is an untapped reservoir in the agricultural production bank, and today we can leapfrog in terms of communication by mobilising all the tools, whether the Internet, cable TV, or FM radio, the community radio, or the cell phone – this information technology is opening up enormous opportunities.

He again echoed the urgency to push forward, a call to action frequently and forcefully expressed by Borlaug. Swaminathan said that

> the 21st century challenges of producing more food without expanding agricultural land can be met only by harnessing the best in frontier technologies and blending them with the rich heritage of ecological prudence; eco-technologies for an evergreen revolution should be the bottom line of our strategy to shape agriculture in the future.

Dr. Swaminathan concluded this address with a poignant reference to the correspondence and friendship between George Washington Carver (the enslaved man who, when emancipated, became an Iowan and American agricultural legend) and Mahatma Gandhi, the hero of India's independence movement (who had actually visited Swaminathan's childhood home), and the latter's soliciting advice on nutrition from the former. The great American food scientist – Carver – and the great leader of non-violent civil disobedience – Gandhi – were men for whom universal food security was the key to health, productivity, and freedom.

Dr. Swaminathan noted that Carver believed that his scientific work could only be considered successful if it reached the last person. The lesson, as Swaminathan framed it, was:

> Scientists and politicians are measured by others and by themselves according to whether their work is going to benefit the poorest person in society. That's the way to end all the inequity and the various divides in the world.

In 2009, Swaminathan became the founding chair of the United Nations High Level Panel of Experts on Food Security and Nutrition (HLPE), a position that was subsequently held by another World Food Prize Laureate, Per Pinstrup-Andersen.

Swaminathan would subsequently put forward his vision for an evergreen revolution at the Borlaug Dialogue in Des Moines, and stress the critical importance of biodiversity and nutrition in multiple other fora and conferences. Pinstrup-Andersen wrote of Dr. Swaminathan's role in the HLPE:

> He was instrumental in developing a very effective and influential organisation that has had major impact on policy-making in food security and nutrition by making relevant and timely evidence available to members of the UN Committee on World Food Security.

M. S. Swaminathan was, in effect, using his World Food Prize Laureate status and the Borlaug Dialogue platform in Des Moines to set the global food security agenda for the next two decades.

In 2010, Dr. Swaminathan chaired a panel conversation at the Borlaug Dialogue on biodiversity, with emphasis on the smallholder farmer. He began by pointing out that Borlaug early on recognised the importance of genetic diversity.

> [Borlaug] wanted to have genetic heterogeneity, not homogeneity, in his varieties, so he brought about the pyramiding of genes from diverse sources, whether it was winter wheat or spring wheat, all of them together. And that is one of the reasons why most of the varieties he bred were not only capable of using soil energy, nutrients and water more efficiently, but also were resistant in the broad spectrum of diseases and pests.

> It is now recognised that climate-resilient agriculture has to be built on the foundation of biodiversity . . . Now, in the case of small farmers, it is mostly women who have been the great conservers. From the time, over 12,000 years ago, when the transformation took place from food-gathering to food-growing, a very great contribution – the selection of varieties, the selection of species – was by women.

Swaminathan pointed to the importance of local efforts among the tribal areas of India, where

> enormous work is being done by the smallholder farmers to conserve biodiversity. For example, one group of farmers, mainly women, developed a system of community conservation of biodiversity through their own gene banks. They have always considered biodiversity to be their ally in sustainable agriculture.

> Whenever there is drought, whenever there are floods, the large number of varieties helps them in order to save something, at least, that they have obtained.

Swaminathan concluded this panel conversation with a hope that "the farmers of the world will continue to practice conserving agrobiodiversity through their local, on-farm traditions."

In a major address at the 2014 Borlaug Dialogue, Dr. Swaminathan said he had coined the term "evergreen revolution" to mean increasing agricultural productivity in perpetuity without associated ecological harm. It became clear to him after the successes of the green revolution that vertical growth in productivity – producing more from less land – is the only way to ensure a sustainable and nutritious food supply in the decades to come.

In that speech, he especially urged the World Food Prize Global Youth Institute students in the audience – and the next generation of aspiring Borlaugs everywhere – to work

hard toward achieving a world where nutrition security becomes the common denominator. He emphasised that an important element in achieving the United Nations Zero Hunger Challenge, a global call to action by Secretary General Ban Ki-moon to eliminate hunger by 2025, is to focus scientific and policy efforts on nutrition security for all.

> Anticipate future problems, anticipate climate change, and do not forget the fact that the human population is growing. Producing more food with less land and less water can only be done with new technology. That is our human challenge, and it is a challenge that can be met, provided that everyone comes together, like a symphony.

In a *Science* magazine editorial published in August 2014, he wrote:

> the drive to reduce hunger in the world has largely relied on crops such as wheat and rice that provide calories. But an increase in calories alone is not good enough. Improved diets and good health require bolstering nutrition . . . Without mainstreaming nutritional criteria in large-scale agricultural cropping and farming systems, the prospect for meeting the UN's Zero Hunger Challenge will be dim.

Leading the World Food Prize Laureate Selection Committee

When Norman Borlaug, sensing his own mortality, felt he could no longer continue as chair of the Laureate Selection Committee, he and I met to discuss his successor. Dr. Borlaug felt that the annual choice of the Laureate was the most important function of the World Food Prize Foundation. It was the one that he most cared about and for that reason he had held the leadership position of the Committee since the Foundation was created in 1986. He felt and I agreed that M. S. Swaminathan, who was already serving as an anonymous member of the Selection Committee, was the only choice.

Dr. Swaminathan immediately stepped forward to assume that responsibility, choosing Dr. Gebisa Ejeta of Ethiopia and Purdue University as the 2009 recipient. Ejeta would in turn assume the leadership of the Selection Committee when age began to limit M. S. in carrying out the duties of the Chair. But the appointment of Dr. Swaminathan to be the visible symbol of the Prize had the desired impact of maintaining the reputation of the Prize for probity and an influence-free selection process.

Reflecting his own focus on building peace through agriculture, the Swaminathan-led Laureate Selection Committee created a succession of recipients of significant impact. In 2012, his Committee chose Dr. Daniel Hillel of Israel, an irrigation pioneer who had been nominated by scientists from three Arab and Muslim countries as the World Food Prize Laureate, for his work in Palestinian and Arab villages. United Nations Secretary General Ban Ki-moon came to Des Moines to join in the presentation of the World Food Prize to Dr. Hillel.

The following year, the Committee chose three individuals who were pioneers of biotechnology. Among them was Dr. Robb Fraley, the chief science officer of the Monsanto Company. Given the controversy surrounding the issue of genetically modified organisms or GMOs, this selection created significant controversy. To respond to the questions raised, Dr. Swaminathan issued this statement about the decision:

> The year 2013 marks the 60th anniversary of the discovery of the double helix structure of the DNA molecule by James Watson, Francis Crick and Maurice Wilkins. During the last 60 years, the science of molecular genetics, also referred to as New Genetics, has opened up uncommon opportunities for shaping the future of agriculture, industry, medicine, and environment protection. It is therefore appropriate that the World Food Prize is being awarded this year to some of the pioneers of the New Genetics who have opened up opportunities for achieving a balance between human numbers and the human capacity to produce adequate food.

Inspiring the Next Generation

Like Dr. Borlaug, Dr. Swaminathan's favourite part of the World Food Prize was interacting with young high school age students at the Global Youth Institute in Des Moines and hosting a Borlaug-Ruan International Intern each year at his MSSRF Research Facility in Chennai, India. The high school age American students that we sent each summer for eight-week internships unfailingly brought back two distinct impressions: of the acute intellectual environment that permeated the research being conducted; and of the warm personal welcome extended by M. S. Swaminathan and his wife Mina, who would host a family dinner for the intern in their home.

Perhaps the event involving Dr. Swaminathan that is most deeply etched in my memory came in 2007 when Norman Borlaug received the United States Congressional Gold Medal – America's highest civilian honour – from the President of the United States in the Rotunda of the U. S. Capitol in Washington. M. S. Swaminathan was invited to speak about Dr. Borlaug. At the conclusion of his remarks, Swaminathan read out lines from Rainer Maria Rilke that he felt captured Norman Borlaug's contributions. It reads as follows:

> Again and again someone in the crowd wakes up, he has no ground in the crowd, and he emerges according to much broader laws. He carries strange customs with him and demands room for bold gestures. The future speaks ruthlessly through him.

In August 2019, when I came to Chennai for what would be my last time to see him, I quoted the same lines to the large gathering saying it equally applies to Dr. Swaminathan himself.

M. S. Swaminathan, a son of India and a bold visionary, inspired by Gandhi, truly did "change the world." As such, he will always have a place in the pantheon of our planet's most distinguished agricultural scientists and humanitarian heroes.