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Swaminathan@90

Remembering a revolution that changed India 50 years back — and the man who made it possible

HARISH DAMODARAN

ON AUGUST 7, Monkombu Sambasivan Swaminathan turned 90. For those who know him, it came as no surprise to see the scientific face of India's Green Revolution spend that Friday delivering a lecture on '65 years of Adventure in Agricultural Research & Development' in the morning, followed by a quiet evening with family members. Nor did it surprise that he spoke with perfect clarity, non-stop for almost an hour, while reflecting on "the excitement of doing science, particularly in the field of agriculture".

Many harvests have passed between now and the first two decades of Independence when Swaminathan made the stellar scientific contributions, both on- and off-field, that led to the country's transformation from a 'basket case' to achieving foodgrain self-sufficiency. In the early 1960s, India's wheat and rice production were languishing at 10-12 million tonnes (mt) and 35-36 mt, respectively, forcing massive grain imports that crossed 10 mt in 1966-67. In 2013-14, domestic wheat output was estimated at 95.85 mt, while at 106.65 mt for rice.

It is true that the people who did the actual breeding or selection of the blockbuster varieties in wheat (Kalyan Sona, Sonalika, Arjun, Janak, HD-2285 and HD-2329) and rice (IR-8, Jaya and Padma) that farmers planted in a big way aren't as well known in popular imagination — the likes of VS Mathur, SP Kohli, DS Athwal and, of course, the legendary G.S. Khush. But there isn't any doubt that the basic strategic vision underpinning the Green Revolution in India — introducing a new genetic strain or 'plant type' responsive to increased fertiliser and water application — came from Swaminathan.

The traditional wheat and rice cultivars were tall and slender. These 'lodged' - fell flat on the ground — when they grew and their earheads were heavy with well-filled grains produced in response to high fertiliser doses.

In 1954, while at the Central Rice Research Institute at Cuttack after doing a PhD from Cambridge University and a post-doctoral research associateship at the University of Wisconsin, Swaminathan worked on a programme for transferring genes from the relatively non-lodging and fertiliser-responsive 'Japonica' rice varieties to indigenous 'indica' races. This approach of breeding for enhanced fertiliser response he extended to wheat after joining the Indian Agriculture Research Institute (IARI) at New Delhi later that year. Swaminathan essentially sought a reduction in plant height making it less lodging-prone. His strategy of developing semi-dwarf wheat varieties using mutagenesis — exposing plants to chemicals or radiation to introduce desirable modifications in their DNA — did not, however, work: The lowering of plant heights led to a simultaneous reduction in the size of the grain-bearing panicles or earheads!

But around this time, Swaminathan — who kept abreast of the latest crop research — had learnt of 'Norin-10', a semi-dwarf wheat with large panicles originally bred in Japan and collected by Samuel Cecil Salmon, an agronomist with the post-World War II American occupation administration under General Douglas MacArthur. This variety was used by Orville Vogel at Washington State University to breed a winter wheat, 'Gaines', containing the Norin-10 dwarfing genes and giving very high yields. Swaminathan, in 1960, wrote to Vogel, requesting for the seeds of Gaines. Vogel readily obliged, while also warning that, being a winter wheat, it may not flower in India. He further advised Swaminathan to approach Norman Borlaug, who had incorporated the same dwarfing genes through Vogel's lines into his spring wheat varieties in Mexico that were better suited for India. This was precisely what Swaminathan was looking at: A new plant type that was short and yet with normal spikes, which could use more fertiliser and water to give higher grain yields per acre.

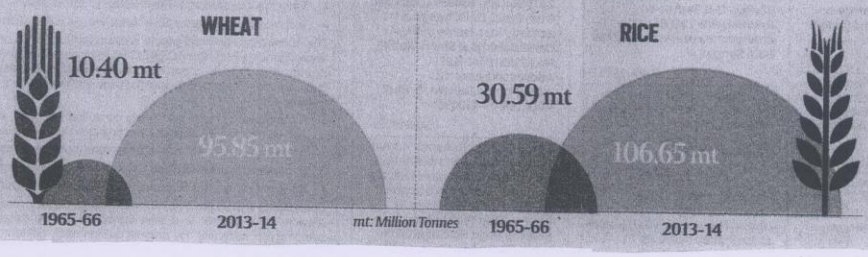
In April 1962, Swaminathan sent a detailed proposal to the then IARI Director, B.P. Pal, seeking to invite Borlaug to India and initiate a wheat breeding programme with dwarf spring wheat material from Mexico. The rest is history. Borlaug visited IARI in March 1963 and later on sent the seeds from the best of his semi-dwarf Mexican wheat strains, Sonora 64 and Lerma Rojo 64. The selections and varieties developed from those launched the Green Revolution. By the end of the decade, India's wheat production had crossed 20 mt. The catalyst here was clearly Swaminathan. As Borlaug put it, he deserved "a great deal of the credit ... for first recognising the potential value of the Mexican wheat dwarfs. Had this not occurred, it is quite possible that there would not have been a Green Revolution in Asia". The same strategy of changing plant architecture to confer lodging-resistance and enable higher fertiliser application was followed for rice — in this case, using Taichung Native 1, an Indica variety developed in Taiwan carrying the semi-dwarf 'Dee-Gee-Woo-Gen' genes.

Swaminathan, all through this, wasn't ignorant of the side effects of the Green Revolution. As early as January 1968, addressing Indian Science Congress at Varanasi, he spoke of the dangers of "the rapid replacement of numerous locally adapted varieties with one or two high yielding strains in large contiguous areas", "intensive cultivation of land without conservation of soil fertility (that could) ... lead ultimately to the springing up of deserts", "indiscriminate use of pesticides, fungicides and herbicides", and "unscientific tapping of underground water". Could anyone have been more prophetic and still clear that there was no alternative to raising yields? It was the prelude to his subsequent focus on converting the Green Revolution into an 'evergreen revolution' — "improvement of productivity in perpetuity without ecological harm", as he reiterated in his Friday address.

That same passion and genuine concern has extended to championing the cause of crop producers. When National Commission on Farmers that he headed in 2004-06 recommended that MSP for crops be at least 50 per cent more than the weighted average cost of production, it caught on like wild fire. Even Narendra Modi made this part of his poll campaign; his promise to fix MSPs by adding 50 per cent profits to farmers' input costs won many votes, though it is waiting to be implemented.

"Someday, I am sure the formula of cost-plus-50 per cent will be adopted. There is no other way", believes Swaminathan, who radiates the same youthful optimism even at 90.

MS Swaminathan with Norman Borlaug inspecting a wheat field in India



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Sumita Gupta
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