Dr. Verghese Kurien Memorial Lecture

What can we learn from the Green, White and Rainbow Revolutions to Plan for a Sustainable Dairy Industry?

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*** Dr. Verghese Kurien Memorial Lecture was delivered by Dr. R.P. Aneja during 51st DIC in Patna, Bihar.**

This is a great honour for me to make this presentation at the 51st Dairy Industry Conference organized by the Indian Dairy Association in Patna. I am most grateful to Dr. R.S. Sodhi, the President of the Indian Dairy Association and the organizers of this conference for this honour. Thank You, IDA.

Today, we gather to delve into the profound lessons we can learn from the history of the Green Revolution, the White Revolution, and the Rainbow Revolution. These pivotal movements have not only shaped the agricultural landscape of India but have also had far-reaching impacts on our society, economy, and the environment.

Let's begin with the Green Revolution, a term synonymous with the remarkable achievements of Dr. Norman Borlaug. In 1944, Borlaug embarked on a journey of agricultural research in Mexico, sponsored by the Rockefeller Foundation. At that time, Mexico was heavily reliant on wheat imports, with 60% of its wheat requirements being met through imports. However, by 1963, a staggering 95% of Mexico's wheat was Borlaughian, and the country's wheat production had surged by an astonishing 600%.

Borlaug's breeding programs were primarily about increasing yields; they aimed at developing disease-resistant varieties and shorter plants that could withstand the weight of heavily fertilized wheat ears. This breakthrough laid the foundation for the Green Revolution all over the world. In India, Agriculture Minister Shri C. Subramaniam, a Visionary Leader, ordered ten plane loads of these seeds to kickstart the Green Revolution rather than wait for the indigenous varieties that were taking time to start trials. This was a risk that he took, and it paid off in terms of speeding up the green revolution and saving India from the embarrassment of living from ship-to-mouth existence. He also played a crucial role in establishing the National Dairy Development Board (NDDB) as desired by Prime Minister Lal Bahadur Shastri in 1966 after his historical visit to the Amul Dairy. Dr. Kurien was appointed as the Chairman of the National Dairy Development Board and he ensured that its headquarters remained at Anand, close to Amul Dairy. Its charter was to replicate the Amul Pattern of dairy cooperatives run by the farmers themselves and a Professional Manager managed its affairs for the benefit of milk producers. It was a blessing for me to have worked with the visionary for 24 years.

The success of the Green Revolution was not just about producing more food; it was also about ensuring that the increased production reached the market.

The Food Corporation of India (FCI) was set up to procure cereals from farmers at Minimum Support Prices (MSP). The NDDB, on the other hand, helped the Anand Pattern cooperative to ensure a guaranteed market for all the milk produced. This intervention extended to vegetable oils, making the country self-sufficient in edible oils by 1992.

However, the marketing support for fruits and vegetables has been minimal, yet these sectors have grown at the same rate as milk. This raises a pertinent question: Why are grain farmers agitating while milk producers are not? The answer lies in the market dynamics. Grain farmers all over the world get a small fraction of the consumer money spent on grain products like wheat flour, bread, etc. This is because the farmers do not own the entire supply chain and the industry walks away with the bulk of the consumer rupee. In the case of milk and milk products, the producers get a much higher proportion. Milk producers have a commanding share of the market and can decide on the purchase and sale price of milk. They get 60-70% of the consumers' rupee which is the highest share of the consumer rupees going back to the milk producer anywhere in the World. This was further helped by ensuring that market surplus milk in the flush season was conserved as milk powder, minimizing the impact of seasonal surpluses on farmer prices. If the grain producers in India were to get a similar proportion of the consumer rupee spent on packaged atta, rice, millet flour, etc., they would not be out on the streets creating political unrest (**Fig. 1**).

Fig. 1: Farmers Share of the Consumer Rupee

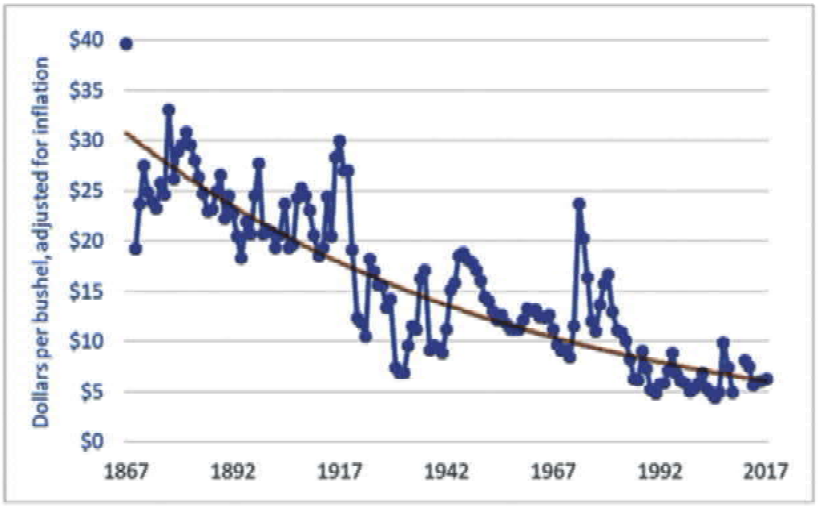
Cereals	70-80%
Milk	60-70%
Fruits and Vegetables	20-30%
Packaged Atta and Rice	50-60%
Milk Based Sweets	30-40%

Green revolution technologies are keeping farmer prices at a low level and have adversely impacted the terms of trade between agriculture and industry.

The price of a car a hundred years ago was about 1000 US $ and a ton of wheat gave the farmers 100 US $. While wheat prices have hardly tripled, car prices have gone up are about 30-40 times The present-day

Fig. 2: Historical Prices for Wheat 1867-2017

(**Source: Through the mill: 150 years of wheat price data, Darrin Qualman**)



Wheat price, western Canada (Sask. or Man.), farmgate, dollars per bushel, 1867–2017

green revolution technologies, if fully adopted, can feed ten times the population of the world. This is a testament to the enduring legacy of Borlaug's technology (**Fig. 2**).

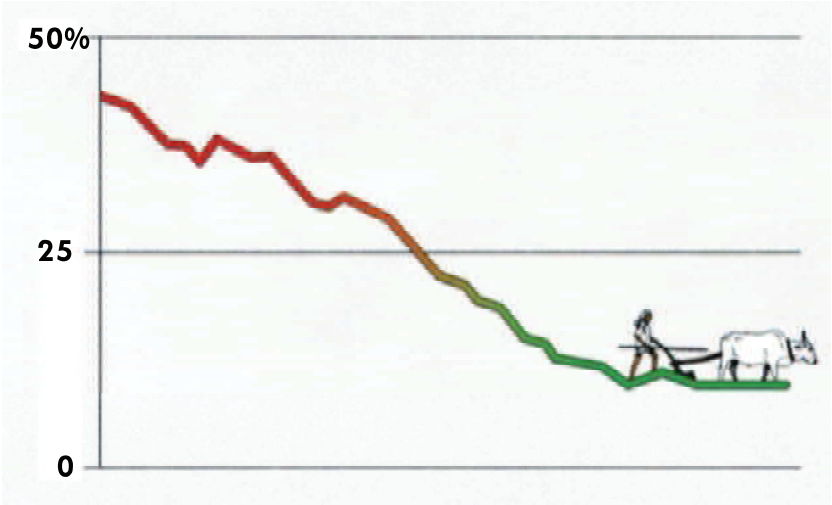
The horizon now holds AI-based Heritable Agriculture, a technology spun out of Alphabet's Labs. This technology aims to speed up the process by predicting which genetic changes will improve yields, taste, nutritional content, and photosynthetic capacity for a given environment. With data from 14,000 field trials, they have determined the quickest breeding path to develop new varieties. The new Green Revolution is almost upon us.

The terms of trade for farmers have also been a point of contention. While the prices of industrial and consumer goods have risen globally, agricultural produce prices have remained stagnant. This disparity is the root cause of poverty in countries that rely heavily on agriculture. India, for instance, became poor as it depended on agricultural incomes for the bulk of its population. The Green Revolution, while increasing production, also contributed to this phenomenon by exacerbating the terms of trade against farmers.

Efficiency in agriculture is another critical aspect. Milk accounts for 30% of the agricultural GDP, and fruits and vegetables account for another 30%. Remarkably, these sectors use only 10% of the land and water. This indicates that farmers have moved towards higher-value crops. However, newer technologies will first aim at increasing the productivity of these higher-value crops, which could have serious consequences on farmer incomes.

So, what have we learned so far? The Green, White, and Rainbow Revolutions have had a profound impact on each other. Farmers have optimized their returns on land, water, and human resources. However, farmer prices have stagnated, and the terms of trade have gone against them. Efficient marketing of farmers' produce holds the key to their prosperity. While MSP has protected farmers' interests, it does not provide incentives to produce more high-value crops like oilseeds. The Market Intervention Operation (MIO) demonstrated that India could become self-sufficient in vegetable oils by providing incentive prices to grow more. Unfortunately, Indian farmers are losing out on the benefits they could derive from producing more oilseeds. Fruit and vegetable farmers continue to be exploited by middlemen.

Fig. 3: Reduction of Poverty in India over the past 30 Years (**Source: The Economist- February 27, 2025**)



Looking ahead, the future of the agricultural sector holds both promise and challenges. Indian farming will continue to make more optimal use of sunshine, land, water, and human resources. However, agricultural incomes will come under pressure as new AI-based crop breeding technologies unfold, promising higher photosynthesis, better resistance to pests, and more. To overcome the pressure on commodity prices, newer markets will need to be explored, including the market for fuels like ethanol. Crop production will need to stop polluting the environment and adjust to higher global temperatures. For India, it is crucial to move towards labour-intensive, high-value crops.

In conclusion, the history of the Green, White, and Rainbow Revolutions offers invaluable lessons for the future. As we embrace new technologies and market dynamics, it is essential to ensure that the benefits reach the farmers who are the backbone of our agricultural economy. By addressing the challenges and leveraging the opportunities, we can pave the way for a sustainable and prosperous agricultural future.

There is great hope for milk producers in India as they continue to produce milk out of crop residues with minimal feeding costs, family labour and love for the cows. You will emerge as a competitive producer of milk against the capital-intensive dairy sector in the West. And you are serving milk milk-loving population that finds milk as the cheapest protective food even in terms of calories per rupee. This is a win-win situation for both the producers and the consumers. This has significantly contributed to the reduction of poverty in India (**Fig. 3**).

The Economist has just reported from the most recent survey" that only 1%of India's households fell below the international poverty line which now stands at $ 2.15 a day at purchasing power parity. It quotes an analysis of data by Surjit Bhalla et al, that India all but eliminated the most extreme form of poverty. Surely the White revolution has contributed significantly to this massive improvement.

This morning the IDA did me the honour of presenting me with **Dr. V. Kurien award**. I wish to take this opportunity to express my gratitude to all those who helped me in making significant contributions to serve the dairy sector, particularly the milk producers and in alleviating rural poverty. I wish to, recognize the values inculcated by my loving parents that have sustained the spirit of selfless service to society with integrity and honesty. I must acknowledge the role our Guru Dr. N.N. Dastur played in moulding his students to become dedicated professionals. Today we have two other students of Dr. Dastur being awarded a **Lifetime Achievement Award** by The IDA to Dr. Jagjit Singh Punjrath and the **M.R. Srinivasan oration award** to Dr. Bhupendra Mathur. Kudos to NDRI and the Dairy Science College Karnal.

Thank you to all my colleagues for their dedication to the mission of NDDB, to selflessly serve the poor rural milk producers, who made India into a dairy giant from being pygmies in the field. You are the best.