

Indian Agriculture: A Saga of Success

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Once in your life you need a doctor, a lawyer, a policeman and a preacher, but every day, three times a day, you need a farmer - Anonymous

The Origin, Journey and Future of Indian Agriculture

Around 11,000 years earlier agricultural practices were adopted by Indians as cited in Upanishads, Ramayana, Mahabharata and Vedas. Distinct eco-systems make different agro-climatic zones relative to wide range of soil and vegetation. Pre-independent India was culminated in devil arms of drought (due to monsoon dependence) and unskilled farm workers (due to lack of scientific knowledge) leading to crop failures at multiple locations. So agriculture has to be the most prioritized sectors in Independent India as later became evident by works of Planning Commission following ‘*everything can wait but agriculture*’.

Overcoming all the limitations which restrict agricultural output the Indian agriculture is now far away from the matters of declining soil health, pests and pathogen virulence on crops and climate fluctuations respective to crops, all these due to involvement of scientific temperament being followed. By virtue, patience, hard work and intelligence currently, Indians have ensured the ‘Food Security’ to homeland and worldwide as this was not the case in 1940s when food imports were so high that a memory of ‘*ship to mouth*’ had prevailed. Millions of farmers, enormous planners, thousand of scientists have created the turmoil of making India a net food exporter nation from a food deficit country. The pride reflects in the data which shows that food grain production has reached from 315 million ton in 2022 from 51 million ton during 1950.

Contributing to a major fraction of balanced diet the edibles like milk, pulses, rice, wheat, fruits and vegetables, India is now a giant in production of these food items. Being a home to variety of medicinal plants, India produces and spices in largest amounts than other country in world. When it comes to animal based products beef, poultry birds and fish, India is at top with maximum production and utilization. With all these giant economies, in



upcoming years, India also aims to conserve environment by reducing fertilizer use by 25%, increasing water use efficiency by 20%, employing renewable energy use by 50 % and rehabilitating 26 Million hectares of degraded land for agricultural practices. India is now being recognized by United Nations for transforming carbon dioxide levels, land degradation rate, doing the conservation of biodiversity and achieving sustainable development goals. Incorporating the knowledge, diversifying the field of agriculture, intensifying the use of scientific measures and tools for farmers, adding nutritional values to crops and easing the market access to consumers has placed India at top from export to justifying food security worldwide, from developing sustainable food-agro system to creating entrepreneurship opportunities for young generation. Working tirelessly from last 7 decades Indian Council of Agricultural Research (ICAR) and the National Agricultural Research, Education and Extension System (NAREES), have mediated science and technology to pillars of farming- 'the farmers', who are the pillars on which this day the country stands at top in field of Agriculture.

For a civilization to exist, it has to meet the demand of surviving values like food, air and water. Air and water are available naturally all the time, but it is this food which has to be harnessed from nature to which Indians have mastered in harnessing. According to statistical estimates, whopping 1.40 billion people in India will surpass China by 2027-30 making it a home to highest populous country. Among the world, India holds 7th largest area of land, having 15 different climates with an additional advantage of having 45 fit soils for agricultural practices out of 60 present on earth. 160 million hectare of land is fit for cultivation of edible crops in India, 2nd largest after United States of America.

Institutional bodies of Agriculture in India

Systematic research in the country started with the establishment of Imperial Council of Agricultural Research (1929) in Delhi, known today as Indian Council of Agricultural Research (ICAR). This is the apex body with its headquarters at New Delhi for coordinating, guiding and managing research and education in agriculture including animal sciences and fisheries. The Council is an autonomous organization under the governance of Department of Agricultural Research and Education (DARE), Ministry of Agriculture and Farmers Welfare, Government of India. Established on 16 July 1929 as a registered society under the Societies Registration Act (1860) in pursuance of the report of the Royal Commission on Agriculture,



ICAR now has 113 research institutes, 74 agricultural universities, 4 deemed-to-be-universities, 3 central universities and 731 Krishi Vigyan Kendras spread across the country. With these, ICAR leads one of the largest National Agricultural Research and Education System (NARES) in the world. India has one of the largest agricultural research human resource capitals in the world with approximately 30,000 scientists and more than 100,000 technical & supporting personnel in the NARES. ICAR footprints are also extended to the neighbouring countries and several international, national and regional research organizations and universities are engaged with ICAR in agricultural research and development. Additionally, private and non-Governmental organizations and farmers themselves have done significant agricultural research in their own fields.

The Achievement Phase of Indian Agriculture

135 Mt food items from agriculture and allied sectors was produced in 1950-51. To this day the data reflects 1300 Mt in 2021-22. To call this an achievement is very influential in landmarks of Indian agriculture by the fact that net sown area being constant to 140 million hectare.

Rainbow (specifying colors for foods products) revolution imparted flavors of success to Indian economy by boosting crop production in name of Green revolution, milk production (White revolution), fish rearing (Blue revolution), oil production (Yellow revolution), horticulture based products and honey (Golden revolution), egg production (Silver revolution), coffee production (Brown revolution) and wool production (Grey revolution).

A global home of largest agri-producers is India due to rainbow revolution among top 5 nations. Self-reliant, self-sufficient is tribute to Indian homeland by virtue of which now it has the capacity to export agricultural produce worth US\$ 50 billion. Most of the agricultural commodities production has scaled to a level of 70 times before independence. Transformation levels are justified by the facts that a country which was being hit by various famines became food scarce in 1945, uplifted and somehow faced food shortage till 1956, became food sufficient in 1999, embraced food security by 2010 and is now meeting the global food demand from last more than 10 years, a fundamental example of success at global scale. Food production in India is decorated with inventions of innovation whose light has eliminated the darkness of pandemic situation like Covid-19 whose effect did not hamper the



agricultural commodity production and India retained its global export rate among top 5 countries in the world.

Incorporation of science into technology, delivery to one and all crop producers and effective policies have placed India in worthwhile public figures of eradicating global hunger need.

The Rise and Challenges of Indian Agriculture

In the year of 1947 when we got independence, sequentially speaking, 'Grow more Food' campaign was launched which insisted every Indian to grow food for the social circle they are encircled with. This campaign became success at mass level and people realized its importance, by later making it a business strategy. A year later first University Education Commission of India was formulated to review the higher education in the country imparting agricultural knowledge input also. To do this extension of agricultural knowledge was widespread by projects like Etawah Pilot and Nilokheri. Scientific temperament was employed in developing sugarcane variety co760 (first drought tolerant crop to be generated by breeding methods) in 1949, to overcome drought as it was a major limitation for agricultural produce at that time. With the discovery of hilsa spawning grounds in Hooghly estuary, West Bengal, blue revolution laid its foundation grounds. As the country was facing economic crises also, in 1951 the aid of US \$1.2 million from Ford Foundation was used by Govt. of India to train research personnel. The inauguration of Community Development Project and Nation Extension Service brought awareness to agricultural practices, provided business opportunities, and imparted scientific knowledge all over India to farmers. Meanwhile Indian researchers have developed World's first all rust resistant cultivar of wheat NP 809 and released Jute varieties JRC 212, JRC 321 and JRO 632 which later made India in 2007 the largest exporter of jute till now. The veterinary sector was also transformed scientifically when anthrax vaccine developed saved the lives of millions of cattle and launch of National Rinderpest Eradication Programme (NREP) did the same saving high economic throughput. To solve the drought issues first major irrigation project (Bhavani Sagar Dam, Tamil Nadu) in 1955 was constructed which later increased productivity in that region and today as we know cashew, cocoa, coffee, coconut, rubber, areca nut, betel vine and tea are major economic plantation crops of Tamil Nadu. An example employing scientific knowledge in which apart from natural breeding practices in 1955, induced breeding of



Esomus danricus was achieved using catla pituitary gland extract in order to find a way to meet demands at large global scale. Later on, first All-India Co-ordinated Research Project on Maize started whose success led to various such projects on different crops like mustard, wheat, rice and tea today. The development of crop thresher in 1967 paced the technological advancement.

To bring the consumer based products at a level accessible to all the National Agricultural Co-operative Marketing Federation was established through which several business strategies have been developed. The year of 1960 saw a rise in agricultural education sector as first State Agricultural University on land grant pattern established at Pantnagar, Uttarakhand to impart agricultural education and to develop future agriculturists. Today in India there are more than 63 state agricultural universities in which millions of students are trained every year to ensure food security for upcoming generations. As a result, several new varieties of chickpea, wheat, sorghum were released in upcoming years. Of the notable one is C306 wheat variety with good chapati making quality giving it popularity all over India.

As the production and productivity enhanced, two new bodies were enacted upon by the Indian government, Commission for Agricultural Costs & Prices (CACP) and Food Corporation of India (FCI) which were solely responsible for crop values and their distribution.

Worldwide Recognition of Indian Agriculture and Green revolution

The advent of year 1966 brought such achievements that designated India at world level for food production. The contribution of one man named Dr. Monkombu Sambasivan Swaminathan deserves a special place when it comes to Green Revolution in Indian Agriculture.

He worked in collaboration with colleagues and students on a wide range of problems in basic and applied plant genetics, agricultural research and development and the conservation and enhancement of natural resources over a period of 60 years. Among various contributions of his some notable ones are elucidation of the origin and differentiation of potato species (1952), Improving the yield potential of indica rice through crosses between indica and joponica varieties (1954), standardization of techniques for the induction of polyploidy (i.e., doubling the number of chromosomes) in several economic plants, including tuber-bearing solanum species (1950), accomplishment of difficult crosses in potato species,

resulting in alien gene transfer for frost resistance (1953), elucidation of the factors influencing the induction and recovery of mutations in wheat and rice and elaboration of the relationships between the secondary effects of food irradiation and the assessment of the wholesomeness of irradiated food, understanding of genetic relationships among wheat species (1960), identification of the barriers to high yields in wheat and the initiation of the wheat breeding programme involving the "Norin" dwarfing genes obtained from Mexico(1963) (owing to green revolution), initiation of a rice breeding programme designed to transfer the non-lodging plant type to basmati strains (this led ultimately to the release of Pusa Basmati) (1965), development of the concept of "crop cafeterias", "mid-season corrections in crop scheduling", risk distribution agronomy and alternative cropping strategies for different weather conditions(1966), purposeful manipulation of genes in improving the yield, quality and stability of performance of wheat, rice and potato(1949 – 1989).

Since soil is the fundamental surface on which crop grows and study of which will definitely change the crop production scenario. Year 1970 saw transformation as soil fertility maps were prepared and gypsum technology was incorporated for reclamation of sodic soils. This in all affected the productivity of the areas concerned.

Year 1971 and 1972 were embraced mango years as mango production pioneering developed from later on. Amrapalli and Mallika two famous varieties saw their arousal after independence in this time. Today we have more than 1500 varieties of mango in India

As much time for production in field is necessary the same time of time should be given to the planning and imparting of scientific data. Department of Agricultural Research and Education (DARE) was set up in 1973 which still operates to look after all aspects of the agricultural research and Education (including horticulture, natural resources management, agriculture engineering, agricultural extension, animal science, economic statistics and marketing and fisheries) involving coordination between the central and state agencies in India.

To work as Knowledge and Resource Centre of agricultural technologies for supporting initiatives of public, private and voluntary sectors in improving the agricultural economy of the district first Krishi Vigyan Kendra was set up in Puducherry in 1975. Today



we have 731 KVKs functional all over India functioning along with T & V (Training and Visit) system enabled for distant farmers of the country.

For the fulfilment of nationwide research and extension of education brilliant minds with extraordinary knowledge are required. Opportunity of serving the Indian agriculture made available to students by the advent of year 1975 when the establishment of Agricultural Research Service (ARS) and Agricultural Scientists' Recruitment Board (ASRB) took place. On other side, arise and release of new varieties was at pace both in terms of quality as well as quantity. Notable ones are pigeon pea 'UPAS 120', chickpea 'L 144', first oat variety "Kent", Forage sorghum variety "MP Chari", Lok 1- mega wheat variety with superior grain quality, HD 2329,-a high yielding mega wheat variety, development of first semi-dwarf basmati variety 'Pusa Basmati 1' and first hybrid rice (APHR 1).

As per the data suggests 65% of India is still rural by 2022. Its percentage mark was around 80 % before independence. In 1980s this concept was realized by economists of the country and hence to maintain the stability of rural economy, National Bank for Agriculture and Rural Development (NABARD) was established that partakes in development of institutions which help the rural economy. While agriculture was flourishing, the economic benefits from horticulture were in need of that time, so National Horticulture Board (NHB) was setup with a mandate to promote integrated development in horticulture, to help in coordinating, stimulating and sustaining the production and processing of fruits and vegetables and to establish a sound infrastructure in the field of production, processing and marketing with a focus on post harvest management to reduce losses. Several programmes and schemes came into action by that time like launch of SAFAL – organized retail network for fruits and vegetables, issuing of Fertilizer Control Order (FCO), introduction of Comprehensive Crop Insurance Scheme (CCIS), adoption of 'Integrated Pest Management' (IPM) as national policy and development of Zero-till drill by the end of 1991. Key establishments were National Academy of Agricultural Sciences (NAAS) for publication responsibility of scientific data, initiation of Institution-Village Linkage Programme (IVLP) to help village people understand the modern agriculture practices, opening of National Gene Bank at New Delhi for conservation of germplasm and possible insights into evolution, development of Accreditation Board for Higher Agricultural Education for maintaining accuracy in organizations, for distribution of agricultural scientific data insights to general



public Agricultural Technology Information Centre (ATIC) was initiated. Meanwhile, Intellectual Property Rights are maintained by Protection of Plant Variety and Farmers Right Act (PPVFR Act), to generate interest and involvement of young farmers National Agricultural Innovation Project (NAIP) has been. All these events involving preparation of first greenhouse gas emission inventory from Indian agriculture to study effects on climate change were set up by end of 2006.

The Commencement of Modern age Agriculture

Modern age agriculture results are satisfactory in terms of release of new varieties, climate resilient changes to Indian agriculture, use of indigenously developed vaccines against potent pathogens of farm animals. Some notable vaccines developed from 2006 to 2021 are inactivated vaccine for H9N2 virus, Canine Distemper indigenous vaccine, *Brucella abortus* S19Δ per vaccine, buffalo pox vaccine and indigenous sheep pox vaccine (SRIN-38/00 strain).

Period of 2014 started with groundbreaking advancement in agriculture as Atlas of vulnerability of Indian agriculture to climate change prepared which attracted scientists from all over the world from distant disciplines over the concept of climate change. 100 climate resilient villages were developed under National Innovations on Climate Resilient Agriculture (NICRA) whose aim is to enhance the resilience of Indian agriculture to climate change and climate vulnerability through strategic research and technology demonstration.

As a matter of fact India got freedom from African Horse Sickness. Notable developments are development of Jalkund, low-cost rainwater harvesting structure in hills, development of citrus rejuvenation technology and Mobile Mini Soil Lab- Mridaparikshak came into action. In 2017 National Agricultural Higher Education Project (NAHEP) was established whose mandate is to develop resources and mechanism for supporting infrastructure, faculty and student advancement, and providing means for better governance and management of agricultural universities, so that a holistic model can be developed to raise the standard of current agricultural education system of India. Year 2018 saw the launch of PM-KISAN scheme in which all landholding farmer families are provided a financial benefit of Rs 6,000 per year per family, payable in three equal instalments of Rs 2,000 every four months. For the first time ever money from government has been credited directly in accounts of beneficiaries and for first time ever in 2019, ICAR Tableau with the theme



'Kisan Gandhi' in 26th January Republic day parade won the best tableau prize. Ministry of Fisheries, Animal Husbandry and Dairying (MoFAH&D) formed in 2019 which is responsible for matters relating to livestock production, preservation, protection from diseases and improvement of stocks and dairy development, and also for matters relating to Delhi Milk Scheme (DMS) and National Dairy Development Board (NDDB). Development of BHOOMI Geo-portal, a gateway to soil geospatial database, quantification of erosion induced carbon loss of India, development of micro and secondary nutrients deficiency maps of the country along with the introduction of pesticide management bill are remarkable achievements of Indian agriculture by end of 2020. Captive breeding and seed production of grey mullet and mangrove red snapper has been developed in last year, 2021.

What a country needs most after food – Education

Scientific agricultural-education system is prerequisite for sustainable agricultural development. The pioneering establishment of State Agricultural Universities (SAUs) from the start of 1960 was meant to give rise to human resources with hands on training of quality agriculture setup which thereby led to fruitful gains known by names of Green Revolution, followed by White, Yellow and Blue Revolutions. It started in 1949, when Dr. S. Radhakrishnan, a great educationist and first Vice President of India envisioned the establishment of autonomous holistic rural universities to teach agricultural sciences along with humanities, mathematics and natural sciences. This was followed by the recommendations of the Indo-American teams of 1955 and 1959 for establishing agricultural universities on the line of Land Grant University (LGU) of USA. In 1958, the Indian Agricultural Research Institute (IARI), New Delhi was declared as a Deemed University (DU) by the University Grants Commission.

Gobind Ballabh Pant University of Agriculture & Technology located in Pantnagar, Uttarakhand was first established SAU based on LGU pattern in India. Currently, with 113 ICAR Institutes, 74 State Agricultural Universities (SAUs), 4 Deemed to be Universities (DUs), 3 Central Agricultural Universities (CAUs) and 4 Central Universities (CUs) with Agriculture Faculty; the NARES is one of the largest in the world. These Agricultural Universities and DUs are providing advanced degrees in over 30 disciplines of agriculture and allied sectors.