



AGRI INFRASTRUCTURE

Attaining self-sufficiency in foodgrain production has been one of the greatest achievements of Indian agriculture since Independence. India has graduated from a food-deficit, foodgrain-importing country in 1950s & 1960s to a surplus-generating and leading exporting country, particularly in case of rice and wheat. This transformation was possible through 'Green Revolution', with the adoption of high-yielding varieties and other inputs and favourable government policies, such as Minimum Support Prices and procurement. Today, India is one of the largest producers of many agricultural commodities in the world, such as cereals, fruits, vegetables, spices, sugarcane and cotton.

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The Covid-19 pandemic during 2020-2021 brought challenges to food security for millions of people worldwide due to supply-chain disruptions and affordability. However, the Government of India had taken necessary measures to protect the vulnerable section of the people of India from the food insecurity concern.

Under the Pradhan Mantri Garib Kalyan Ann Yojana (PMGKAY), the Government of India doubled the food entitlement from 5 kg per person per month to 10 kg per person per month to 80 crore people who are covered under the National Food Security Act (NFSA) - from April 2020 to December 2022. Nearly 104.3 million metric tonnes of food grains were distributed from the central food stock in



addition to the regular NFSA during the mentioned period. India also exported 19.83 million metric tonnes of rice per year on average during the 2020-21 to 2022-23 period. This shows India's capacity today not only to meet the food requirements of its own population but also to contribute substantially to world food security.

This was not the situation in the 1950s and 1960s. Food shortages and deficits were then a great concern, which impacted the food security of India. India met its deficit through regular imports, mainly of wheat. With a continuous drought for three years, from 1964 to 1966, the import of wheat reached its highest level of 7.78 million metric tonnes in 1966. The imported quantity was to the extent of 75% of the domestic wheat production of 10.32

million metric tonnes in 1965-66. This also included wheat imported under PL480 from the United States of America. This was even popularly called a 'ship-to-mouth' situation. At this juncture, India started 'Green Revolution', through the introduction of high-yielding varieties of wheat and rice. With favourable government policies and enabling agricultural research to release new varieties, the farmers responded well in such a short period that wheat production more than doubled to 26.41 million metric tonnes in 1971-72 and rice production went up to 43.07 million metric tonnes from 30.59 million metric tonnes in 1965-66. With this increased production of cereals, India's import of wheat started declining, and it approached its floor from the mid-1980s onwards, except for a few years. Actually, India started exporting rice, particularly from the year 2000 onwards, and became the top exporter in recent years, enjoying around a 40% share of global rice exports. This surplus food production is Independent India's great achievement.

Trends in Agricultural Production

The overall food grain production (cereals plus pulses) rose from 51 MT in 1950-51 to over 330 MT in 2022-23. Since 1950-51, the production of food grains has increased over by 6.5 times and that of fruits and vegetables by 12 times, thus making a visible and salutary impact on national food and nutritional security.

Among cereals, the production of rice and wheat, in particular, increased manifold between 1950-51 and 2022-23. Irrigation and power infrastructure had substantially improved over the period, enabled the timely supply of much-needed

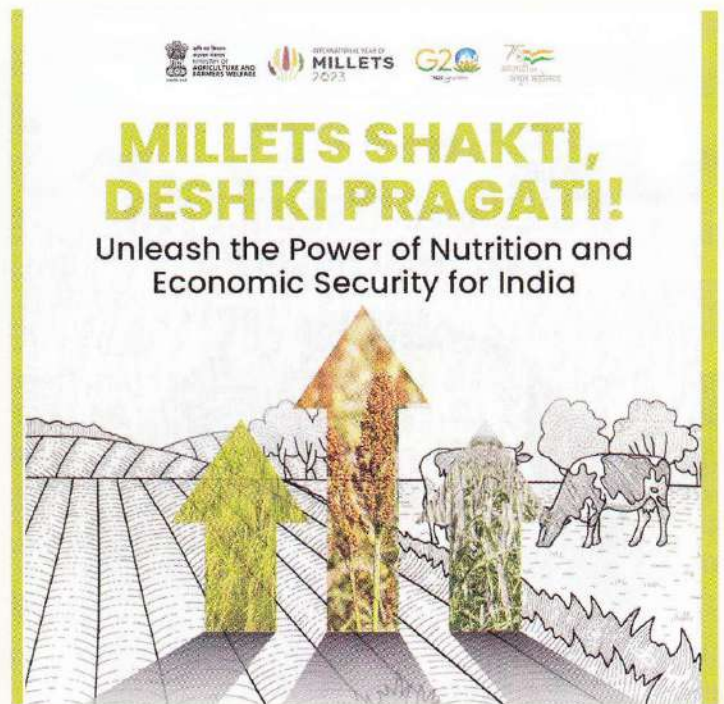
Table 1. Area and production of major crops during 1950-51 and 2022-23

	Area (million hectares)			Production (million tonnes)		
	1950-51	2022-23*	Times increase	1950-51	2022-23*	Times increase
Foodgrains	97.32	132.2	1.36	50.82	330.53	6.50
Cereals	77.42	103.07	1.33	42.41	303	7.14
Rice	30.81	47.66	1.55	20.58	135.54	6.59
Wheat	9.75	31.82	3.26	6.46	112.74	17.45
Coarse cereals/Millets	37.67	23.58	0.63	15.38	55.95	3.64
Pulses	19.09	29.13	1.53	8.41	27.5	3.27
Oilseeds	10.73	30.09	2.80	5.16	40.99	7.94

Note: * 3rd Advance Estimates

moisture to crops. This reduced crop failure due to the vagaries of the monsoon as compared to the 1950s and 1960s. Further, it facilitated intensive cultivation and the application of modern inputs such as high-yielding varieties, fertilisers, and pesticides. There was enhanced price stability due to Minimum Support Prices and large procurements by government agencies. Coarse cereals and millets production increased to 55 MT in 2022-23, as compared to 15.38 MT in 1950-51. Pearl millet (Bajra) and Sorghum (Jowar) were the two major millets grown in the 1950s. However, the area of cultivation under these crops declined over the same period on account of reduced demand due to a shift in consumers' preferences towards rice and wheat, low yields, and lower profitability. At present, half of the coarse cereal production consists of maize, whose production has increased, thanks to high demand from the poultry industry. Realising environmental and health benefits of millets, the Government of India has given new impetus to millet cultivation. On India's proposal, the United Nations has declared the year 2023 the 'International Year of Millets'.

Pulses are an important source of protein for the Indian population, particularly vegetarians. India is the largest producer and consumer of pulses. Among the many types of pulses grown in India, the major ones are chickpeas (chana), redgram (arhar), green gram (moong), black gram (urad), and lentil (masur). The overall pulse production has gone up from 8.4 MT in 1950-51 to 27 Mt in 2022-23. Chana



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has been the major source of growth in the recent past, and it comprises nearly 50% of the total amount of pulses produced. As pulses production has not increased in step with the population growth, per capita availability has declined from 22.1 kg per person in 1951 to 16.4 kg per person in 2022. Though there is surplus production of chana, the imperfect substitution among pulses and limited international availability to bridge the demand gap through imports put pressure on the prices of some pulses. To attain self-sufficiency, the Government of India continues to adopt various measures to incentivise pulses production under National Food Security Mission, Minimum Support Price programmes, and by increasing procurement.

India is dependent on edible oil imports to meet its domestic demand. The import dependency in FY 2022-23 was around 55% of the total requirement. There was near self-sufficiency in the initial years of the 1970s and import dependence was just 3%. However, this figure had gone up to over 30% from the mid-1970s to 1987-88 due to a shortfall in domestic production. The Government of India implemented the Technology Mission on Oilseeds in 1986 to increase domestic production. As a result, the dependence had declined to just 2% in 1993-94. However, the WTO agreement in 1995 put the edible oils under the Open General Licence, which led to a jump in cheap imports. Though duty was imposed to protect domestic production from cheap imports, it was frequently kept at a low level during years

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witnessing high international prices, particularly during 2007-2013 and from 2020 onwards. Though it had helped to protect consumers from high prices, prolonged cheap imports reduced domestic oilseed prices below MSP and lessened incentives for farmers to grow oilseeds. Sunflower has gone almost out of domestic production, compared to cultivation on 21 lakh hectares in 1992-93. Similarly, the area under groundnut cultivation declined from 87 lakh hectares in 1991-92 to 50 lakh hectares in 2022-23. The area under cultivation of rapeseed and mustard has remained high due to strong domestic preferences, and soyabean production has increased mainly owing to demand for oil meal. To make the country Atmanirbhar in edible oils, domestic oilseed production is being promoted under the scheme National Food Security Mission-Oilseeds(NFSM-OS) from 2018-19. Further, the National Mission on Edible Oil—Oil Palm (NMEO-OP) has been launched in 2021-22 to promote oil palm cultivation (with a special focus on the North Eastern States and Andaman & Nicobar Islands), with a target of increasing the area under palm oil cultivation from 3.70 lakh hectares in 2021-22 to 10.00 lakh hectares in 2025-26.

Production of fruits and vegetables has increased manifold in the recent decades - from 87 million tonnes in 1991-92 to 320 million tonnes in 2022-23 (First Advance estimate). The yield is also very high - at 17 tonnes/ha, compared to that of food grains (at 2.5 tonnes/ha). There is a major shift

towards consumption of fruits and vegetables due to rising per capita income. Therefore, production of fruits and vegetables has a high potential to grow. However, perishability, seasonality, and price volatility pose challenges. Therefore, there is a need for enabling infrastructure, such as processing centres and cold chains, to reduce wastage and maintain regular supply at a reasonable price. The National Agriculture Infra Financing Facility of Rs 1 lakh crore, announced in the year 2020, is a welcome initiative to address the agricultural infrastructure issues holistically.

India is a leading producer of cotton and sugarcane. Adoption of Bt cotton in 2000s enabled significant increase in cotton production - from 100 lakh bales in 2001-02 to 343 lakh bales in 2022-23 (Third Advance estimate). However, development of resistance in pests such as Pink Boll Worm, to Bt cotton, has posed a challenge to the sustenance of cotton production. There is a requirement of evolving technologies to tackle the emerging challenges in cotton cultivation. India is the second largest producer of sugarcane and the largest consumer of sugar in the world. The production has steadily increased over the decades. Sugarcane production fluctuates mainly because of deficit monsoon and because mills, not being able to generate sufficient revenue owing to depressed prices, defer payment to farmers. The Government's ethanol-blending programme and recent initiative of direct conversion of sugar juice to ethanol may ensure adequate price recovery and timely payment to farmers. As a water-intensive crop, its cultivation in semi-arid regions, particularly in Maharashtra, Karnataka and Tamil Nadu, leads to groundwater depletions. Further, lack of mechanisation, particularly for harvesting, is another challenge. The Government's promotion of custom hiring centres for agricultural machinery may benefit adoption of mechanisation.

Agricultural resources and inputs

The net area sown for crops in 2019-20 was 139.90 million hectares compared to 118.75 million hectares in 1950-51, thus growing by just 1.17 times. However, population growth was 3.8 times higher in the same period. The challenge of meeting the rising demand for food of the rapidly growing population with a limited increase in net area sown was possible through more intensive cultivation and a higher yield. Cultivation of High-Yielding Varieties (HYV)

Table 2. Irrigation and Fertiliser trend

	1950-51	2019-20	Increase by times
Net sown area (Million hectares)	118.75	139.90	1.17
% of net irrigated area	17.55	53.39	3.04
gross area sown (Million hectares)	131.89	211.36	1.6
Fertiliser consumption (Million tonnes)	0.698	29.796	42.68
per ha fertiliser in kg	0.53	140.97	265.98

with more area under irrigation and the application of more inputs such as fertilisers and pesticides played a great role in enhancing agricultural production.

Since 1950, the Indian Council of Agricultural Research has released more than 6000 varieties of crops. Application of fertilisers (Nitrogenous, Phosphatic, and Potassic, or NPK) has increased from 0.5 kg per ha in 1950-51 to 140 kg per ha in 2019-20, while net irrigated area, as a percentage of net sown area, has gone up from 17.55 to 53.39 in the same period (ref table 2).

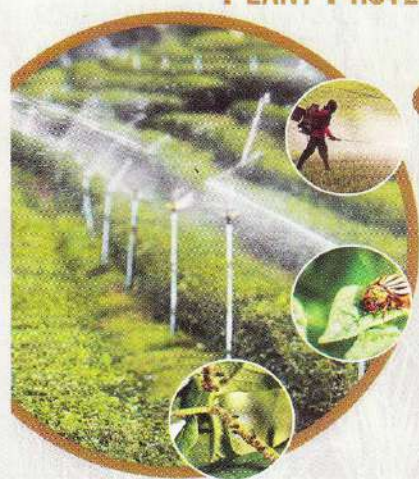
Fertiliser subsidies by the Government of India have incentivised farmers to apply larger amounts of fertilisers. The recommended ratio of fertiliser application (N:P:K) is 3:2:1. However, farmers apply more nitrogenous fertilisers than the ratio warrants. One of the reasons may be that nitrogenous fertilisers are highly subsidised. To incentivise farmers to go for application of fertilisers more in keeping with recommended proportions, a nutrient-based subsidy scheme was introduced in 2010 and further revised in May 2023. Neem-coated urea

was introduced to reduce wastage and diversion of the subsidised product to non-agricultural sectors. Further, the Soil Health Card will help farmers apply the required quantity of fertilisers. The Government is also encouraging farmers to use nano urea for a more sustainable and judicious application of fertilisers.

A vast irrigation potential has been created since Independence. Programmes such as the Command Area Development Programme (started in 1974-75) and the Accelerated Irrigation Benefit Programme (1997) have played a great role in providing water to the parched fields of India. As a result, the net irrigated area reached 53% in 2019-20 from 17.55% in 1950-51. As per the 2010 census, groundwater irrigation has a share of 63% in total irrigation in terms of area. However, groundwater provided water security for agricultural growth where canal irrigation was not possible; overexploitation has an adverse impact on sustainability, particularly in the case of water-intensive crops like paddy and sugarcane in Punjab, Haryana, Karnataka, Maharashtra, and Tamil Nadu. To promote more sustainable and judicious use of water for irrigation, the Government of India is implementing a drip and sprinkler irrigation programme called 'More Crop Per Drop' under the Pradhan Mantri Krishi Sinchayee Yojana from 2015-16. Further, crop diversification is also being promoted.



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Price policy and Market

The Government of India fixes Minimum Support Prices (MSP) for 23 commodities in accordance with the recommendations of the Commission for Agricultural Costs and Prices (which came into existence in January 1965) each year, before the sowing season. Assurance of a remunerative and stable price environment is considered very important for increasing agricultural production and productivity since prices often fluctuate in the market. The food grain procurement at MSP, particularly

rice and wheat has provided protection to farmers against price volatility. Pulses and Oilseeds are also being procured at MSP under the Price Support Scheme. To provide more flexibility, Price-Deficient Payment method is also being implemented.

Under the Agricultural Produce Market Committee Act, in most of the States, the agricultural markets have long been regulated, and traders are allowed to buy from the farmers at the market yard. With the availability of IT technology, the National Agricultural Market (e-NAM) was launched on 14 April 2016. e-NAM is a digital platform integrating 1260 APMC mandis across 22 States and 3 UTs to facilitate online trading of 203 agricultural and horticultural commodities to enable farmers to realise more remunerative prices for their produce. e-NAM is catalysing the digital transformation of mandi operations and the e- trading of agricultural commodities.

Digital Public Infrastructure (i.e., Agristack and Krishi Decision Support System) is being built by using space technology and other modern technologies, such as Artificial Intelligence and Machine Learning, to provide inclusive and farmer-centric solutions. This will help farmers and other stakeholders in the areas of crop planning and health, improved access to farm inputs, credit and insurance, crop estimation, market intelligence, and support for the growth of Agri-Tech industry and startups.

As agriculture is highly dependent on weather, there are challenges to sustain food production and make agriculture more resilient to climate

change, particularly in rainfed areas. Anticipating the challenges, the Government has been implementing schemes such as the National Mission for Sustainable Agriculture (NMSA) and National Innovations in Climate Resilient Agriculture (NICRA) to cope with biotic and abiotic stress.

Decades of backbreaking work by farmers have transformed Indian agriculture since Independence from a traditional low-production food-deficit sector to a modern surplus food-producing sector. However, domestic production of certain commodities such as pulses and oilseeds cannot meet the growing demand and, as a result, there have been significant imports to meet the shortfall.

The success of Indian agriculture has also invited new challenges. Over-reliance on groundwater irrigation for water intensive crops has depleted groundwater resources in certain regions. As Indian agriculture is still highly dependent on monsoon, climate change may pose many challenges for sustaining future agricultural production. Therefore, India needs to adopt technological solutions, including digital technology, to sustain farm production and overcome the challenges it faces. India needs to brace itself for the challenges ahead, particularly sustaining the level of production in the traditional areas and adapting to climate change. With the application of technology that is more advanced and favourable government policy, the agricultural sector bids fair to surge ahead, vastly strengthened, modern, and more resilient to the vagaries of nature. □

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