



# INDEPENDENT MARKET REPORT ON SEEDS INDUSTRY IN INDIA

**A Frost & Sullivan Report**

January 2025

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## Disclaimer

The market research process for this study has been undertaken through secondary / desktop research as well as primary research, which involves discussing the status of the market with leading participants and experts. The research methodology used is the Expert Opinion Methodology. Quantitative market information was sourced from interviews by way of primary research as well as from trusted portals, and therefore, the information is subject to fluctuations due to possible changes in the business and market climate. Frost & Sullivan's estimates and assumptions are based on varying levels of quantitative and qualitative analyses, including industry journals, company reports and information in the public domain.

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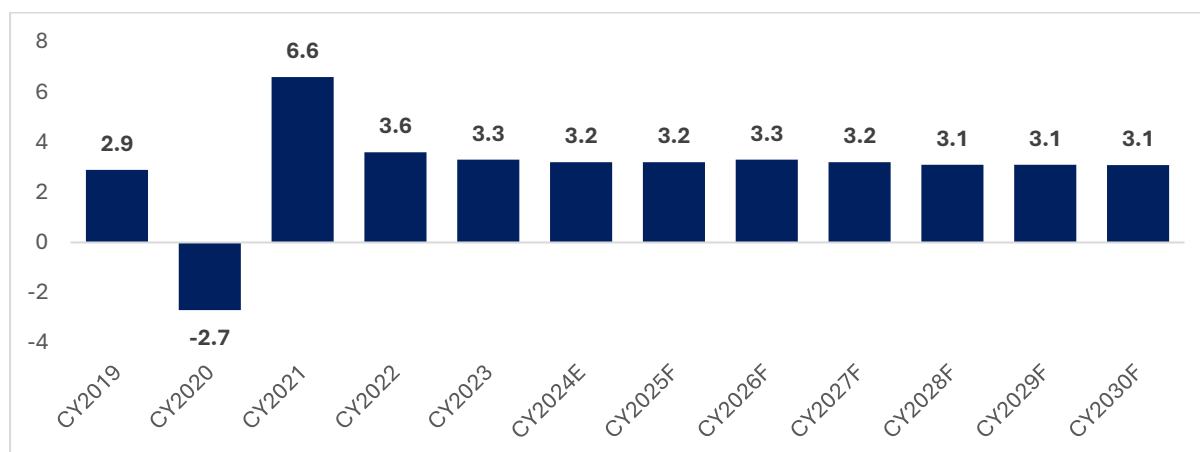
Frost & Sullivan has prepared this study in an independent and objective manner, and it has taken adequate care to ensure its accuracy and completeness. We believe that this study presents a true and fair view of the Global and Indian Seed Industry within the limitations of, among others, secondary statistics, and primary research, and it does not purport to be exhaustive. Our research has been conducted with an "overall industry" perspective, and it will not necessarily reflect the performance of individual companies in the industry. Frost & Sullivan shall not be liable for any loss suffered because of reliance on the information contained in this study. This study should also not be considered as a recommendation to buy or not to buy the shares of any company or companies as mentioned in it or otherwise."

# 1. Global Macro-Economic Overview

## 1.1 Real GDP Growth and Estimates – Global and Key Regions

Global growth moderated from 6.6% in 2021 to 3.3% in 2023, with emerging markets set to lead through 2030, while developed economies grapple with supply chain issues, inflation, and energy transitions.

Exhibit 1: GDP Growth (%), Global, Calendar Year (CY)2019-CY2030F



Note: E: Estimate, F: Forecast, Global Real GDP Growth is represented in calendar years. For e.g. CY2019 is the 12-month period between 1 January 2019 and 31 December 2019

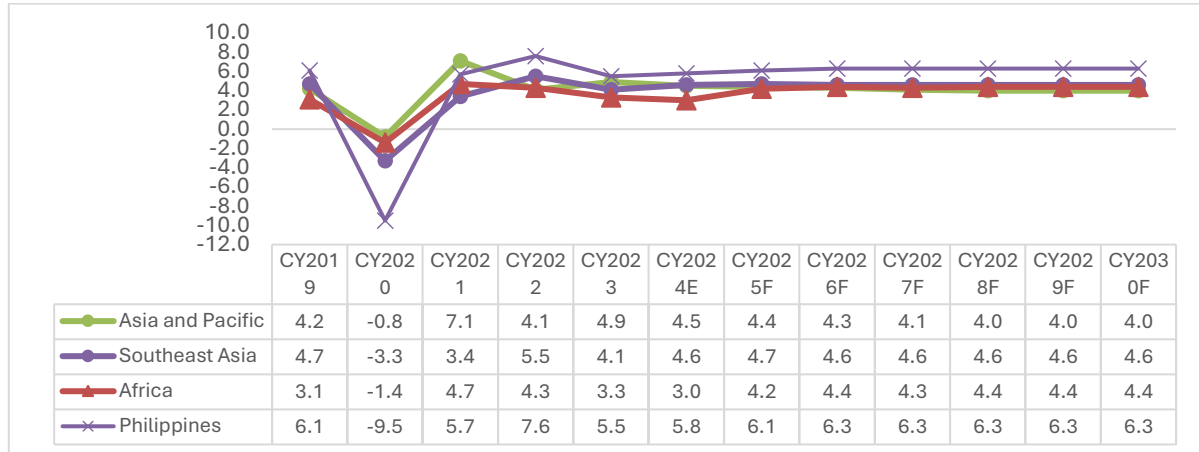
Source: International Monetary Fund (IMF): World Economic Outlook (WEO), October 2024, Frost & Sullivan

Following 6.6% growth in 2021, global expansion slowed to 3.6% in 2022 due to the Russo-Ukrainian conflict, and then to 3.3% in 2023. Inflation stabilization and potential monetary easing are expected to maintain 3.2% growth in 2024. Emerging markets are set to outperform advanced economies through 2030, driven by technological advances and favourable demographics, despite geopolitical risks. Developed economies face challenges from supply chain issues, inflation, and energy transitions, highlighting the need for investors to identify long-term opportunities.

The Asia-Pacific region saw 4.9% growth in 2023, driven by strong consumption and exports, though this is expected to moderate to 4.5% in 2024, with long-term growth hinging on demographics and climate policy. India maintained momentum with 7.0% growth in FY2022-23 and 8.2% growth in FY2023-24 and is forecasted to grow at 6.5% annually until FY2030-31, underscoring its strong economic performance. Southeast Asia grew by 4.1% in 2023, and growth is forecasted to stabilize at 4.6% to 4.7% through 2030, supported by consumption, infrastructure investment, and FDI, though political and environmental challenges remain. Africa's economic potential remains strong, driven by natural resources and a young population, though high debt, climate impact, and conflicts slowed GDP growth to 3.3% in 2023. Many nations are focusing on debt restructuring and resource optimization, with GDP expected to stabilize between 3.0% and 4.4% from 2024 to 2030, aided by infrastructure and

human capital growth. The Philippines, after recovering from a contraction of 9.5% in 2020, achieved a 7.6% GDP growth in 2022, reflecting robust domestic consumption and remittance inflows. Growth is expected to stabilize at 6.3% annually through 2030, supported by sustained consumer demand and expanding service sectors.

**Exhibit 2: GDP Growth (%), Key Regions, CY2019-CY2030F**

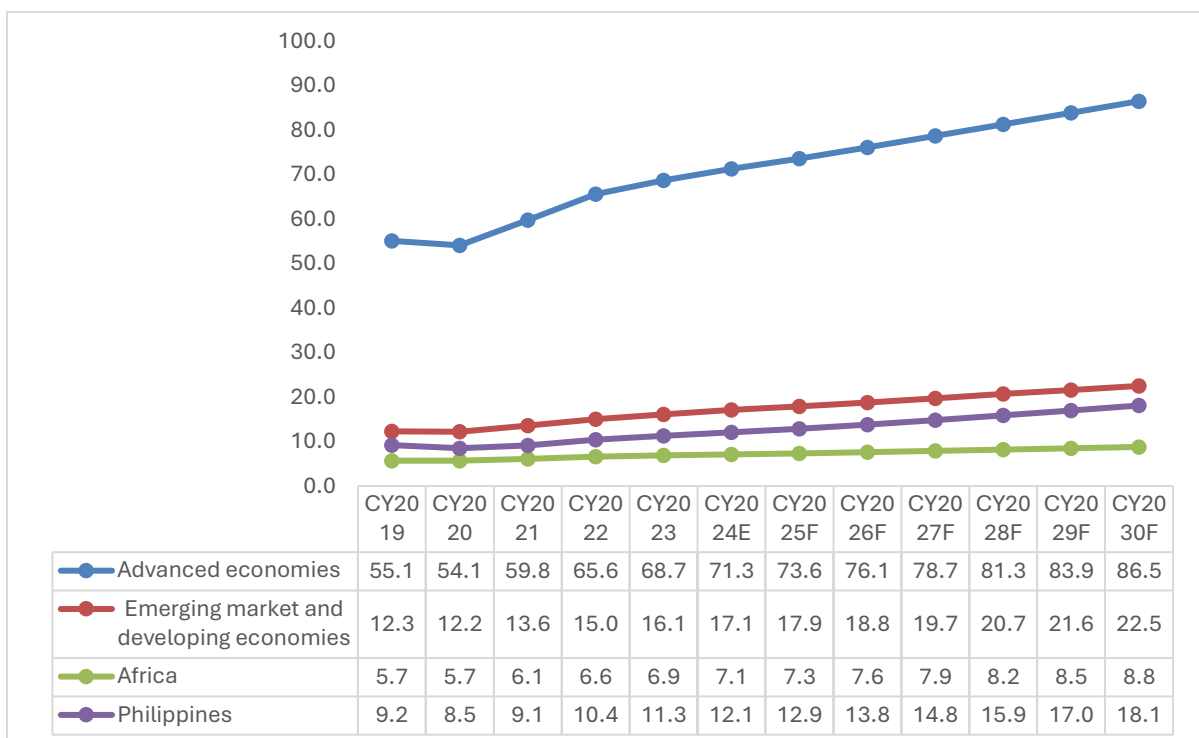


Note: E: Estimate, F: Forecast, GDP Growth is represented in calendar years. For e.g. CY2019 is the 12-month period between 1 January 2019 and 31 December 2019; Source: IMF: WEO, October 2024, Frost & Sullivan

## 1.2 GDP per Capita and Growth Drivers

Advanced economies reached a GDP per capita of \$68,728 in 2023, with the U.S. at \$82,715 and Germany at \$69,532, while emerging markets like China (\$24,503) show variability, driven by FDI and sectoral diversification.

**Exhibit 4: GDP per Capita, Current Prices (Purchasing Power Parity) (PPP) (\$ '000), Advanced & Emerging Economies, Africa & Philippines, CY2019-CY2030F**

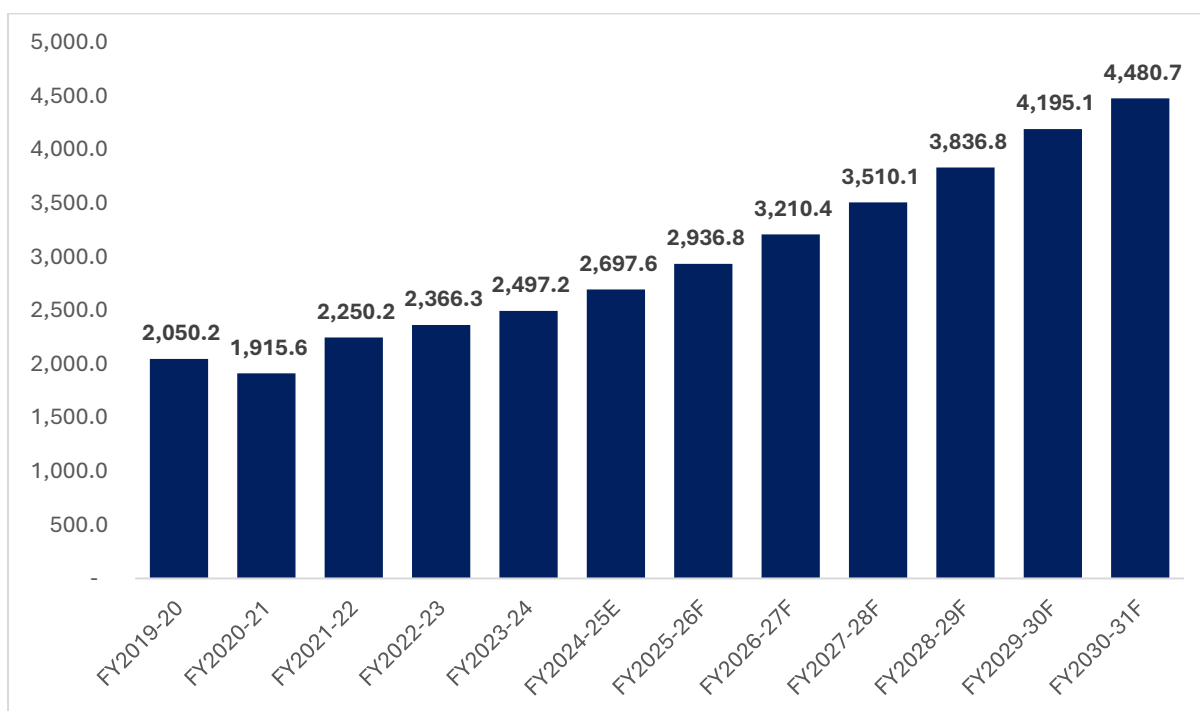




Note: E: Estimate, F: Forecast, GDP per Capita is represented in calendar years. For e.g. CY2019 is the 12-month period between 1 January 2019 and 31 December 2019; Source: IMF: WEO, October 2024, Frost & Sullivan

Advanced economies achieved a GDP per capita of \$68,728 in 2023 (PPP terms), driven by stable markets and productivity gains. The United States reported a GDP per capita of \$82,715, while Germany recorded \$69,532, reflecting growth supported by technology, innovation, and significant investments in physical and human capital. Strong governance and legal frameworks have also contributed to rising per capita GDP. In contrast, emerging markets displayed more variability. China’s per capita GDP stood at \$24,503, while Sub-Saharan African countries averaged only around \$5,110, reflecting modest improvements supported by resource optimization and infrastructure development. Africa as a whole, including North African countries like Egypt and Algeria, recorded a GDP per capita of \$6,900 in 2023, driven by a mix of resource wealth, industrial expansion, and increasing intra-African trade. Growth in these regions is attributed to foreign direct investment (FDI) and diversification from agriculture to broader economic sectors, driving improved GDP per capita and living standards. The Philippines, with a GDP per capita of \$11,300 in 2023, showcased steady growth driven by robust remittance inflows, expanding service sectors, and strong domestic consumption.

**Exhibit 5: GDP per Capita, Current Prices (\$), India, FY 2019-20 to FY 2030-31F**



Note: E: Estimate, F: Forecast, India’s GDP per Capita is represented in fiscal years. For e.g. FY2019-20 is the 12-month period between 1 April 2019 and 31 March 2020

Source: IMF: WEO, October 2024, Frost & Sullivan

India has steadily grown its GDP per capita, reaching \$2,497.2 in FY2023-24 (current prices), with projections to rise to \$4,480.7 by FY2030-31, driven by economic reforms, foreign

investments, and growth in services and manufacturing. Structural changes, including improved infrastructure, urbanization, and digital revolution, along with initiatives like "Make in India" and increasing FDI, have strengthened key industries. Looking ahead, healthcare, education, infrastructure, and the digital economy will continue to support India's growth. Government efforts in formalizing the economy and investing in renewable energy are set to further boost per capita income, positioning India as a growing global economic player despite uncertainties.

### **1.3 Trends in Global Food Security, Global Food Security Index (GFSI), and Country Rank for Key Countries**

**The West Asia conflict has intensified food security risks by disrupting energy and fertilizer supplies, driving inflation and shortages in import-reliant regions, with global food import bills projected to reach record highs by 2024.**

The ongoing conflict in West Asia has exacerbated global food security challenges by disrupting supply chains, particularly for energy and critical agricultural inputs like fertilizers, which are vital for food production. This has severely impacted import-dependent regions such as Africa and South Asia, worsening food shortages and inflation. Pre-existing challenges, including climate change and the lingering effects of the pandemic, have further driven up global food prices.

Looking ahead, rising energy costs and continued supply disruptions are expected to escalate food production costs, increasing risks of inflation and hunger in heavily import-dependent countries. The GFSI 2022 highlights declining food security in low-income nations, with global food import bills projected to hit record highs by 2024.

Staple crops like rice and wheat remain central to food security, providing a significant share of global caloric intake. However, disruptions in fertilizer supplies and rising production costs threaten yields, prompting investments in sustainable farming. Cotton supports rural livelihoods, while oilseeds like mustard and other staples like millet play key roles in enhancing agricultural resilience. Despite these challenges, increasing investments in agricultural technology and sustainable practices offer opportunities for investors as nations seek to reduce their reliance on volatile imports.

**Table 1: GFSI 2022, Country Rankings for Key Countries**

Ranking	Country	Overall Score	Affordability	Availability	Quality and Safety	Sustainability and Adoption
20	Spain	75.7	89	63.1	81.2	66.4
22	Australia	75.4	93.3	61.1	84	58.8
28	Singapore	73.1	93.2	77.8	69.7	44.3
46	Vietnam	67.9	84	60.7	70.2	52.2
59	South Africa	61.7	63.4	60.1	66.1	56.9
67	Philippines	59.3	71.5	55.2	65.3	41.8
68	India	58.9	59.3	62.3	62.1	51.2
82	Kenya	53	41.7	52.5	68.8	52.6
90	Tanzania	49.1	45.8	58.7	50.2	41.7
107	Nigeria	42	25	39.5	55.6	53.7

*Note: GFSI is calculated based on affordability, availability, quality and safety, and sustainability and adaptation. Higher scores indicate better performance of the indicator. Source: UNCCD, Frost & Sullivan*

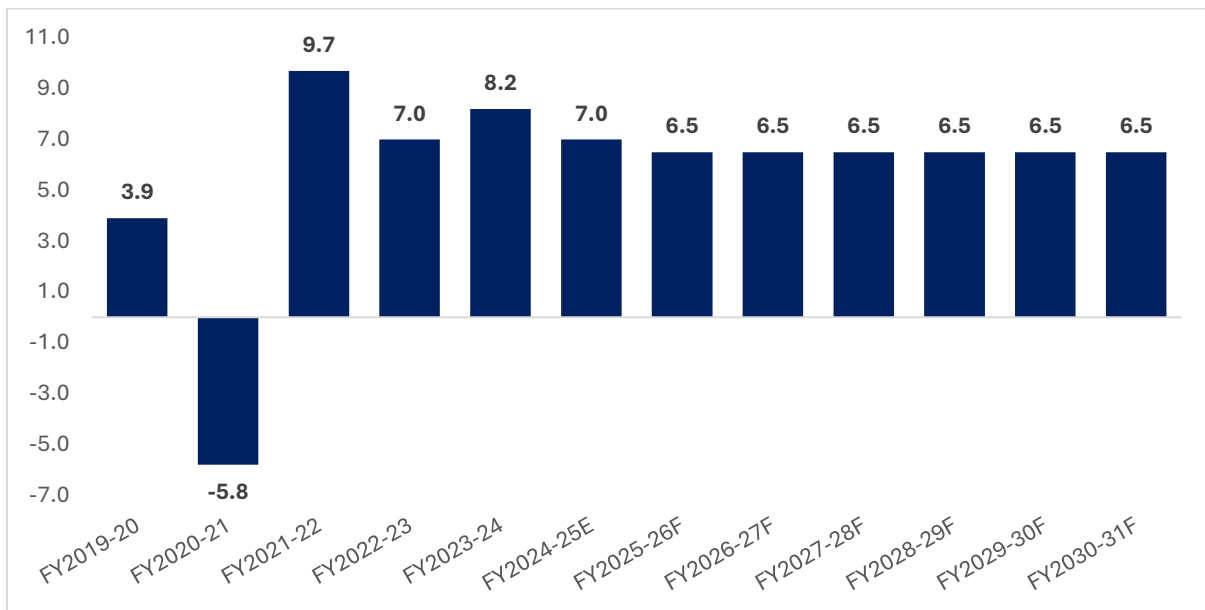
Spain ranks highest with an overall score of 75.7, excelling in Affordability (89.0) and Quality and Safety (81.2). Australia follows closely with a score of 75.4, showing strengths in Affordability (93.3) and Quality and Safety (84.0). Singapore scores 73.1, performing well in Affordability (93.2) and Availability (77.8). Vietnam, with an overall score of 67.9, is strong in Affordability (84.0) but has room for improvement in Quality and Safety (70.2). South Africa scores 61.7, supported by Affordability (63.4) but limited in Sustainability and Adoption (56.9). The Philippines, at 59.3, ranks moderately with solid Affordability (71.5) but lower Sustainability (41.8). India scores 58.9, balanced in Availability (62.3) but less competitive in Sustainability and Adoption (51.2). Kenya's score of 53.0 reflects good Quality and Safety (68.8) but low Affordability (41.7). Tanzania, scoring 49.1, struggles with Affordability (45.8) and Quality (50.2). Nigeria ranks lowest at 42.0, challenged by Affordability (25.0) and Availability (39.5).

## 2. India Macro-Economic Overview

### 2.1 Real GDP and GDP Growth

India's strong 8.2% GDP growth in FY2023-24 positions it as a global economic driver, with nominal GDP set to surpass USD 7 trillion by FY2030-31, making it the world's 3rd largest economy.

Exhibit 8: Real GDP Growth (%), India, FY2019-20 to FY2030-31F



Note: E: Estimate, F: Forecast, India's GDP is represented in fiscal years. For e.g. FY2019-20 is the 12-month period between 1 April 2019 and 31 March 2020

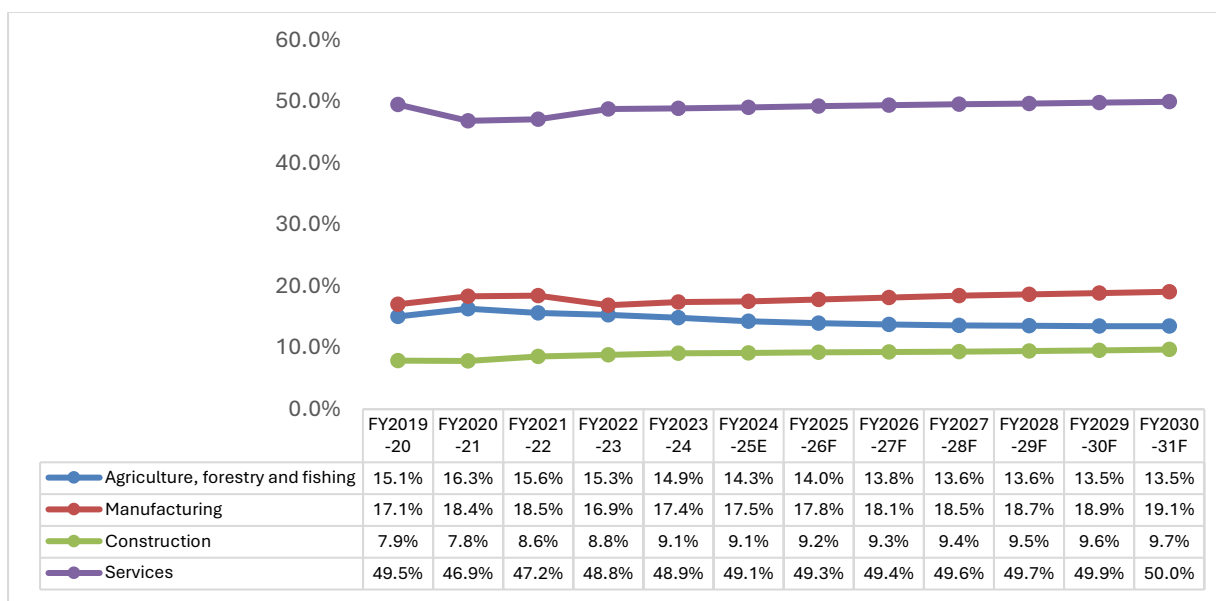
Source: IMF: WEO, MOSPI – India, Frost & Sullivan

Following a robust 8.2% real GDP growth in FY2023-24, India continues to stand out as a major driver of global economic expansion. With a projected average growth rate of 6.5% per year until FY2030-31, the country is on track to surpass both Germany and Japan, positioning itself as the world's 3rd largest economy in terms of nominal GDP. By the close of this decade, India's nominal GDP is expected to exceed USD 7 trillion, fuelled by a combination of factors, including a vast consumer base, a burgeoning middle class, and competitive labour costs. Additionally, the Indian government's strategic focus on enhancing capital expenditure will play a pivotal role in sustaining long-term economic momentum.

### 2.2 Gross-Value Added (GVA), GVA Sectoral Share & Inflation

With a target to become a global investment hub by FY2030-31, India's GVA will see major contributions from services (50%), manufacturing (19.1%), and construction (9.7%), while agriculture gains resilience through agri-tech and export growth.

**Exhibit 9: Sectoral GVA Share (% of Total GVA), India, FY2019-20 to FY2030-31F**



Note: E: Estimate, F: Forecast, India's GVA is represented in fiscal years. For e.g. For e.g. FY2019-20 is the 12-month period between 1 April 2019 and 31 March 2020

Source: MOSPI – India, Frost & Sullivan

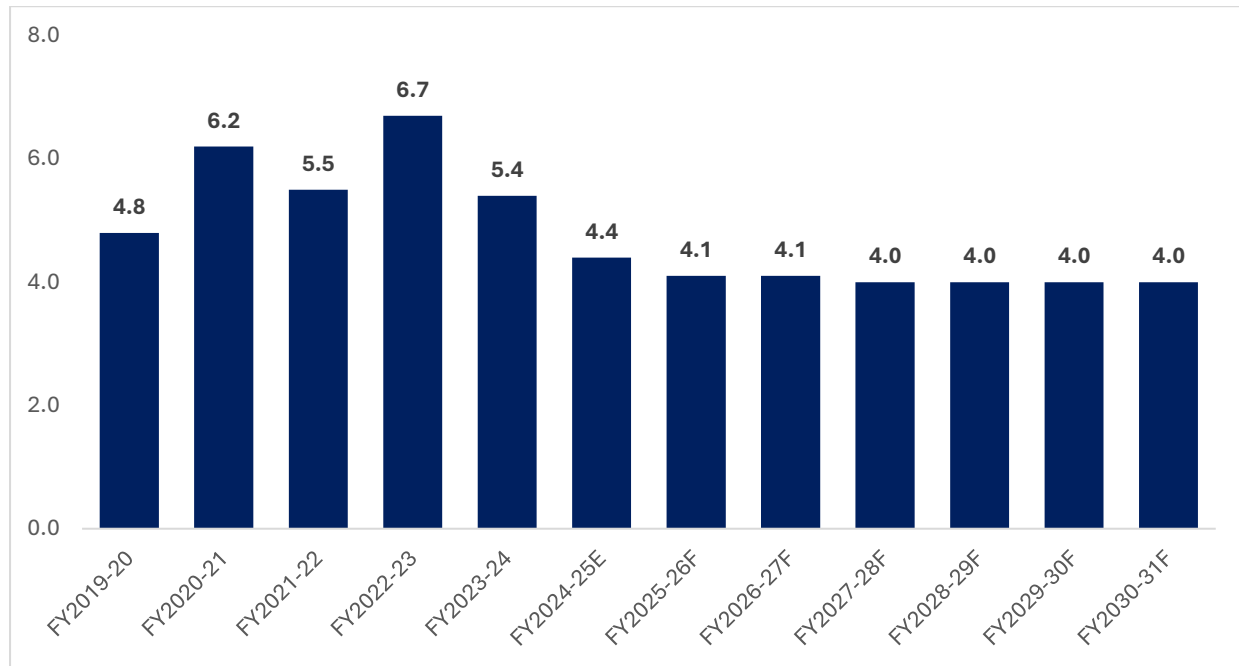
India aims to position itself as a global investment hub by FY 2030-31, with the manufacturing, construction, and services sectors projected to contribute 19.1%, 9.7%, and 50.0% of GVA respectively, reflecting industrial growth and services expansion through digitalization and Industry 5.0 innovations. Though the GVA share of agriculture, forestry, and fishing is set to decline to 13.5%, trends within the sub-sectors vary. Agriculture remains the dominant contributor to the total GVO of Agriculture and allied sectors, though its share has been gradually declining up to FY 2022-23. In recent years, livestock's share surpassed 30% and continues to increase steadily, while shares of forestry and fishing have remained stable in single digits.

Crops such as rice and wheat continue to dominate agricultural output, with production estimated at 137.8 million tons and 113.3 million tons respectively in FY2023-24. Mustard production is estimated to have reached an all-time high of 12 million tonnes in the 2023-24 season, driven by a record sown area of 10 million hectares. Pearl millet, essential for arid regions, maintains steady output, with Rajasthan leading its production. Cotton production, a key cash crop, is projected at 25 million 480-lb bales in FY2024-25, reflecting a slight recovery but still constrained by challenges such as pest infestations and weather fluctuations. Vegetables, primarily cultivated in states like West Bengal and Uttar Pradesh, remain critical to horticulture growth.

Government programs like Paramparagat Krishi Vikas Yojana and Pradhan Mantri Fasal Bima Yojana aim to boost farm incomes and productivity for sustainable growth. With recent advancements in agritech and the promotion of organic farming, the sector is also expected to see improved resilience and efficiency. Additionally, the focus on expanding agri exports

positions India as a key player in the global food supply chain. Manufacturing and construction will be key growth engines, supported by public and private investments, strong domestic consumption, and growing exports. Meanwhile, services will see rapid expansion due to advancements in digital infrastructure and cutting-edge technologies, solidifying its central role in India's economic progress.

**Exhibit 10: Inflation Rate (%), India, FY2019-20 to FY2030-31F**



Note: E: Estimate, F: Forecast, India's inflation is represented in fiscal years. For e.g. For e.g. FY2019-20 is the 12-month period between 1 April 2019 and 31 March 2020

Source: IMF: WEO, MOSPI – India, Frost & Sullivan

India's inflation rate, which peaked at 6.7% in FY2022-23, fell back within the RBI's target range of 2.0% to 6.0% in FY2023-24 due to the central bank's restrictive monetary policy, maintaining a 6.5% repo rate by December 2023. Inflation is expected to stabilize at 4.0% over the forecast period, aligning with the RBI's medium-term target, though food price volatility remains a concern due to monsoon variability. In the near term, inflation management will be critical as global commodity price shifts and supply chain disruptions could cause inflationary spikes. For investors, understanding the relationship between monetary policy and inflationary trends is crucial for assessing India's economic stability and consumer dynamics.

### 2.3 Key Macro Growth Drivers for the Indian Economy

**India's economic momentum is driven by rising capital expenditure, increasing per capita income, a demographic dividend, growing female workforce participation, expanding export targets, and technological advancements for sustainable growth.**

**Increasing capital expenditure:** Government capital expenditure has grown at a CAGR of 18.8%, from \$40.3 billion in FY2017-18 to an estimated \$133.7 billion by FY2024-25, benefiting key sectors like infrastructure, telecommunications, and defence, driving India's economic capacity and industrial growth.

**Rising per capita income levels:** India is expected to lead global per capita income growth with a 5.4% annual increase through 2033, driven by technological advancements, regulatory policies, and rising investment, which will boost consumer spending and economic activity.

**Demographic dividend:** With 68% of India's population in the working-age group, this demographic advantage will drive productivity, attract investment, and enhance India's economic competitiveness.

**Rising female labour force participation:** Female labour force participation reached 37% in FY2022-23, spurred by knowledge-based industries, literacy growth, and supportive policies like Aatmanirbhar Bharat Rojgar Yojana, contributing to economic diversification and growth.

**Growing export potential:** India aims to reach \$2 trillion in exports by 2030, leveraging its skilled labour, cost competitiveness, sectoral strength in areas such as technology and pharmaceuticals, regulatory support, and natural resources base to drive growth.

**Technological Advancements and Sustainable Growth Initiatives:** India's focus on AI, robotics, 5G, and green technologies will transfer industrial growth and make the country an attractive destination for sustainable investments.

## 2.4 Indian Government Initiatives and Policies for the Agriculture Sector

**India's agriculture sector is transforming with a \$339.4 million Digital Agriculture Mission, AgriSURE funding for agri-startups, sustainable horticulture practices, advanced crop science, and ICAR's new climate-resilient seed varieties.**

**Digital Agriculture Mission:** Launched with an investment of \$339.4 million, the Digital Agriculture Mission aims to develop digital infrastructure to improve agriculture productivity and create 250,000 jobs through data-driven services.

**Agri Fund for Startups and Rural Enterprises (AgriSURE):** A \$90.4 million fund supporting agri-entrepreneurs with both equity and debt financing, fostering innovation and public-private partnerships in agriculture.

**Crop Science for Food and Nutritional Security:** Focuses on advancing crop genetics and increasing agricultural productivity to improve food security and climate resilience.

**Sustainable Development of Horticulture:** A \$103.6 million investment to drive sustainable practices and boost both production and quality in India's horticulture sector.

**Indian Council of Agricultural Research (ICAR) New Seed Varieties:** Introduced 109 high-yielding, climate-resilient seed varieties to boost farm productivity, income, and support sustainable agriculture.

**Minimum Support Price (MSP):** The government ensures fair remuneration by setting MSPs for crops like rice, wheat, and cotton. In FY2023-24, MSPs were ₹2,183 for rice, ₹2,275 for wheat, and ₹6,620 for cotton per quintal, encouraging higher production and participation.

**Special Mustard Programme:** Launched in 2020-21, this program boosted mustard production by 40% over three years, with a record 10 million hectares sown in 2023-24 through improved seeds and farming practices.

## **2.5 Private Industry participation in Agriculture**

The agriculture sector contributing 14.9% to India's GVA in FY2023-24 and employing more than 45% of the workforce (as per Periodic Labour Force Survey ), is vital for economic stability and food security. Key players such as Bayer Cropsciences, SeedWorks (US Agriseeds), Syngenta, Crystal Crop Protection, Kaveri Seeds and UPL are key players in seeds and crop protection, demonstrating how private industry plays an instrumental role in advancing agricultural productivity and resilience. Bayer Cropsciences, for instance, has pioneered high-yielding and pest-resistant seed varieties, while UPL has developed innovative crop protection solutions, from insecticides to herbicides. Companies like Nuziveedu Seeds, SeedWorks (US Agriseeds) and Advanta have focused on creating seeds tailored to local climatic conditions. Initiatives like the National Seed Congress (NSC) aim to further strengthen public-private partnerships in the seed industry, uniting stakeholders to foster innovation and growth.

Private industry's commitment to R&D has directly impacted the agriculture sector through substantial investments aimed at both technological advancement and farmer education. For example, Syngenta's "Good Growth Plan" aims to train small-scale farmers in integrated pest management (IPM) techniques, reducing chemical dependency and enhancing sustainable practices. SeedWorks International (US Agriseeds) is a seed research and development company engaged in research, production and marketing of hybrid seeds for rice, cotton, pearl millet, mustard, vegetables and fruits and open-pollinated variety ("OPV") seeds for rice, wheat and mustard. Company is actively developing hybrid & OPV seed varieties across product portfolio supporting resilience and productivity in diverse crop conditions.

## **3. Overall Agriculture Market Overview**

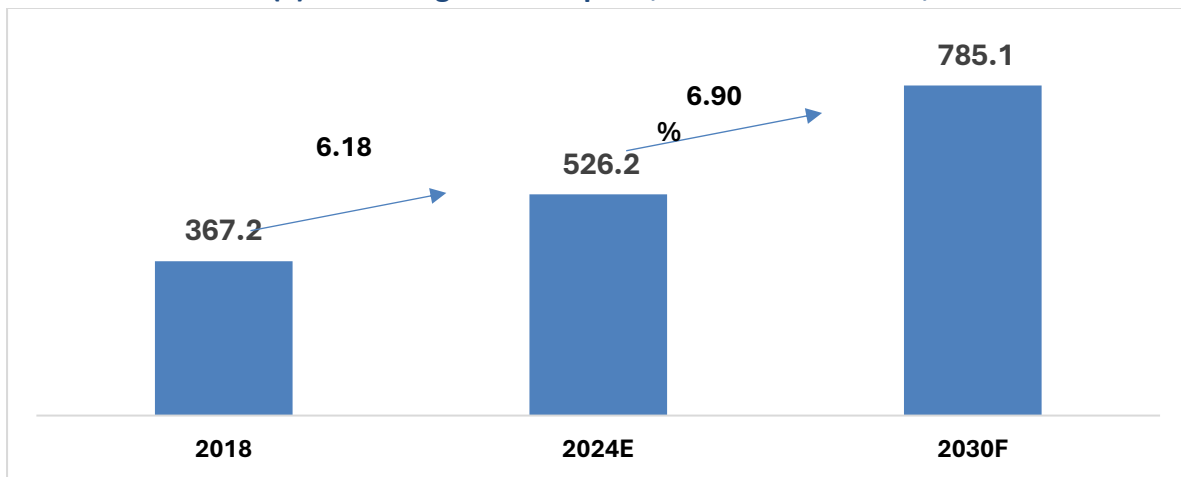


## A} Global

### 3.1 Overview of Global Agriculture Spend

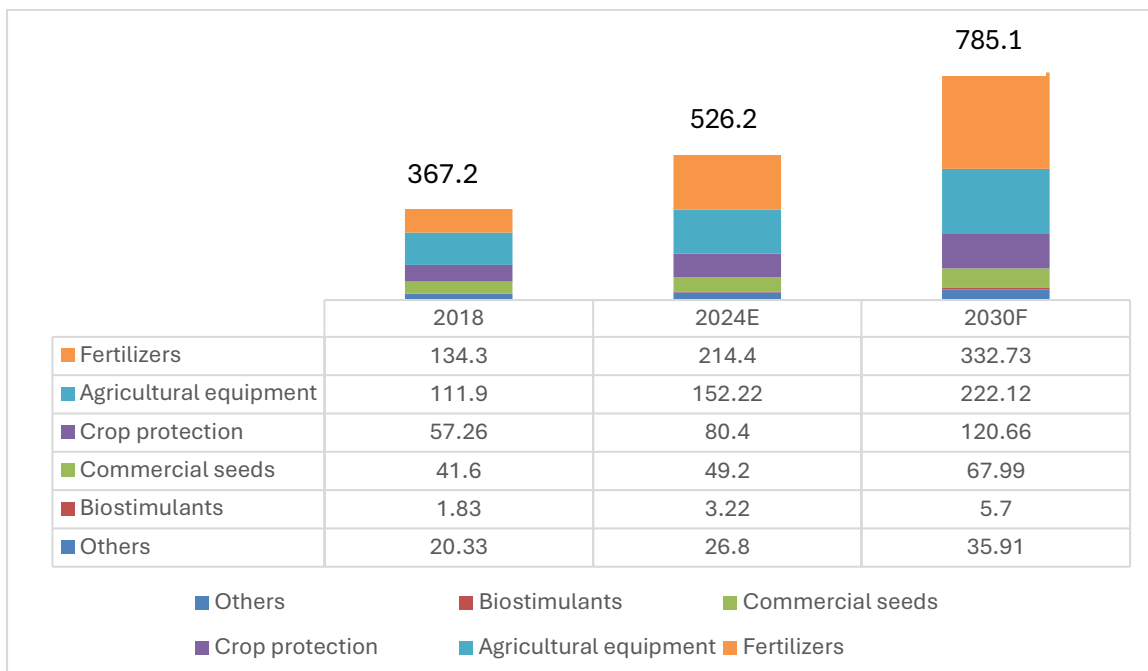
Despite changing global dynamics, the global agricultural spend in the year 2024 is estimated at USD 526.2 Billion which has grown from USD 367.2 Billion in 2018. It is expected to grow at a CAGR of 6.90% to reach USD 785.1 Billion by 2030. This growth is attributed to adoption of improved crop varieties, increased application of fertilizers and crop protection products, and widespread use of mechanization.

**Exhibit 13 (a): Global Agriculture spend, 2018- 2024E- 2030F, USD Billion**



Source: Frost & Sullivan Analysis

**Exhibit 13 (b): Global Agriculture spend by category 2018, 2024E, 2030F (USD Billion)**



Others include irrigation and water management and miscellaneous spends

Source: Frost & Sullivan Research and analysis

### 3.2 Climate Smart Agriculture & Crops

Two of the major development issues we are facing across globe are food and nutrition insecurity and climate change. Nonetheless, a more sustainable food system can guarantee everyone's access to food while also not further degrading the resources.

Currently, one-third of all emissions comes from the global agrifood sector. By 2050, it is predicted that the world's population will have grown to 9.7 billion, increasing the demand for food. Increased food production has always been associated with unsustainable land and resource use and agricultural expansion. This results in a vicious cycle that raises emissions.

An integrated approach to manage crops, livestock, forests, and fisheries, that tackles the issues of food security and climate change is known as climate-smart agriculture (CSA). Climate-smart Agriculture (CSA) has emerged as a holistic approach to tackle food security concerns and promote sustainable development while addressing climate change issues. Climate-Smart Crops (CSCs) are critical in ensuring food security, nutrition, and resource sustainability.

Some of the effective tools for climate smart agriculture include:

- **Integrated pest management (IPM)**- Integrated Pest Management (IPM) is a science-based decision-making process that combines tools and strategies to identify and manage pests. IPM helps in reducing pesticide use, maintaining the national crop ecosystem balance and promotes farmer stewardship by increasing farmer knowledge of ecosystem functioning adapted to their local context.
- **Sustainable soil management** through conservative agriculture- maintaining the soil health to increase soil-related ecosystem services as well as crop nutrition. This includes avoiding excessive tillage, managing pests and nutrients efficiently, selecting adequate crops and rotations, keeping the soil covered, increasing diversity (crops, soil, landscape), managing irrigation efficiently, adding organic matter.
- **Improved water management system**- Efficient use of water by optimizing irrigation scheduling and more efficient irrigation systems, such as drip irrigation.
- **High Quality seed** - Use of quality planting materials and seeds of high-yielding, and well adapted, varieties- seeds with traits such as pest resistance, herbicide resistance, water stress tolerant can be used.
- Agro ecosystem-based cropping system approach which promotes the conservation and enhancement of biodiversity- cultivate a diverse range of species and varieties with associations, rotations, and sequences.

CSA helps in increasing productivity, reducing vulnerability to droughts, pests, diseases and other climate-related risks and shocks; and improving the capacity to adapt and grow in increased seasonal variability and more erratic weather patterns.

Seed companies play a vital role to tackle extreme temperatures, water scarcity, new pests and diseases, and nutritional insecurity by conservation, creation, enhancement, and distribution of crop varieties that are climate resilient. Companies such SeedWorks believe that CSA has strong potential to contribute to the achievement of the 17 Sustainable Development Goals (SDGs). SeedWorks has initiative SRISHTeE (Sharing Responsibilities to Integrate Social, Human, Technological, Environmental & Economic Capital)– in the context of climate variability, climate change and uncertainty about future climate conditions. Key focus

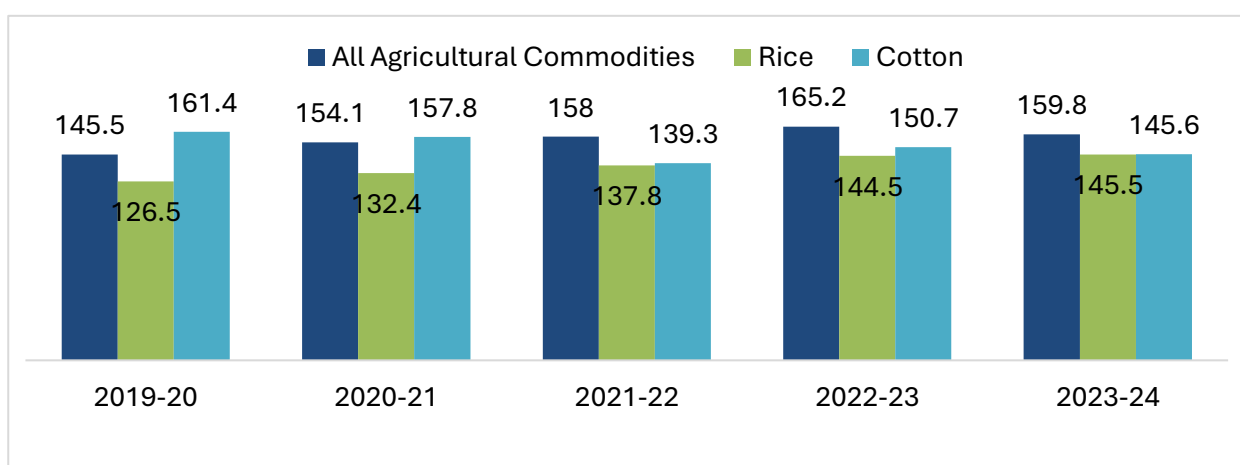
areas as part of SRISHTeE are- Empowering Smallholder Farmers, Effective Water Resources Management, addressing impact of climate change and promoting safe & fair working conditions across the supply chain.

## B} India

### 3.3 Index of Agricultural Production for India

India's Index of Agricultural Production dropped in FY2023-24, mainly due to a decrease in food grain production amid delayed and erratic monsoon caused by El Nino. **El Nino** is a complex weather pattern resulting from variations in ocean temperatures in the Equatorial Pacific, which has been ongoing since 2023.

**Exhibit 17: Index Numbers of Agricultural Production, India, FY2020 - FY2024**



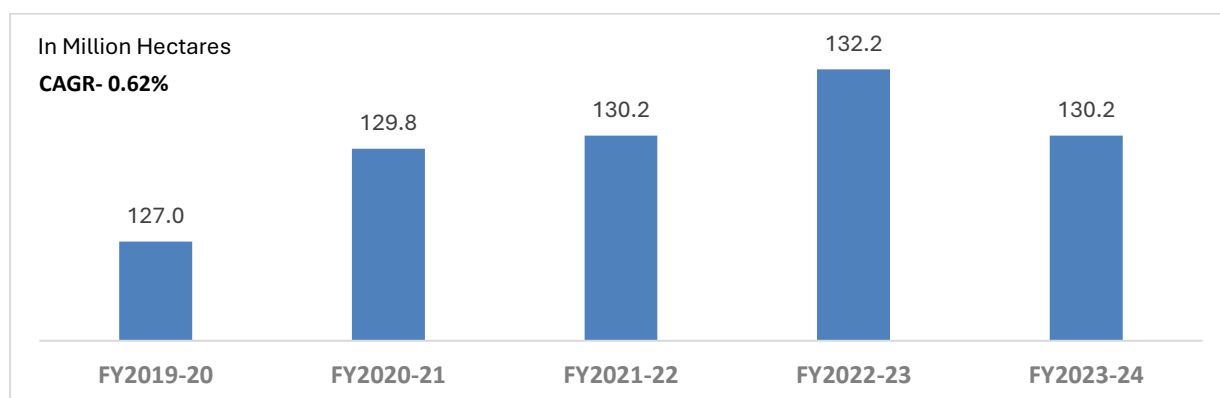
Note: Figures for 2023-24 are sourced from final estimates. Base: Triennium ending 2007-08= 100.

Source: Economic Survey 2023-24; Frost & Sullivan

### 3.4 Area Under Production of major crops in India

In FY 24, gross area under foodgrains is estimates to be 130.2 Mn Ha which is a decline of 1.5% over FY23 area which was 132.2 Mn Ha. This decline is due to decreased rabi acreage from 55.3 Mn Ha in FY 2022-23 to 54.1 Mn Ha in FY 2023-24 majorly from pulses segment. The gross area under foodgrains has grown at CAGR 0.6% from FY 20-24.

**Exhibit 18: Gross Area under Foodgrains, Million Hectares**

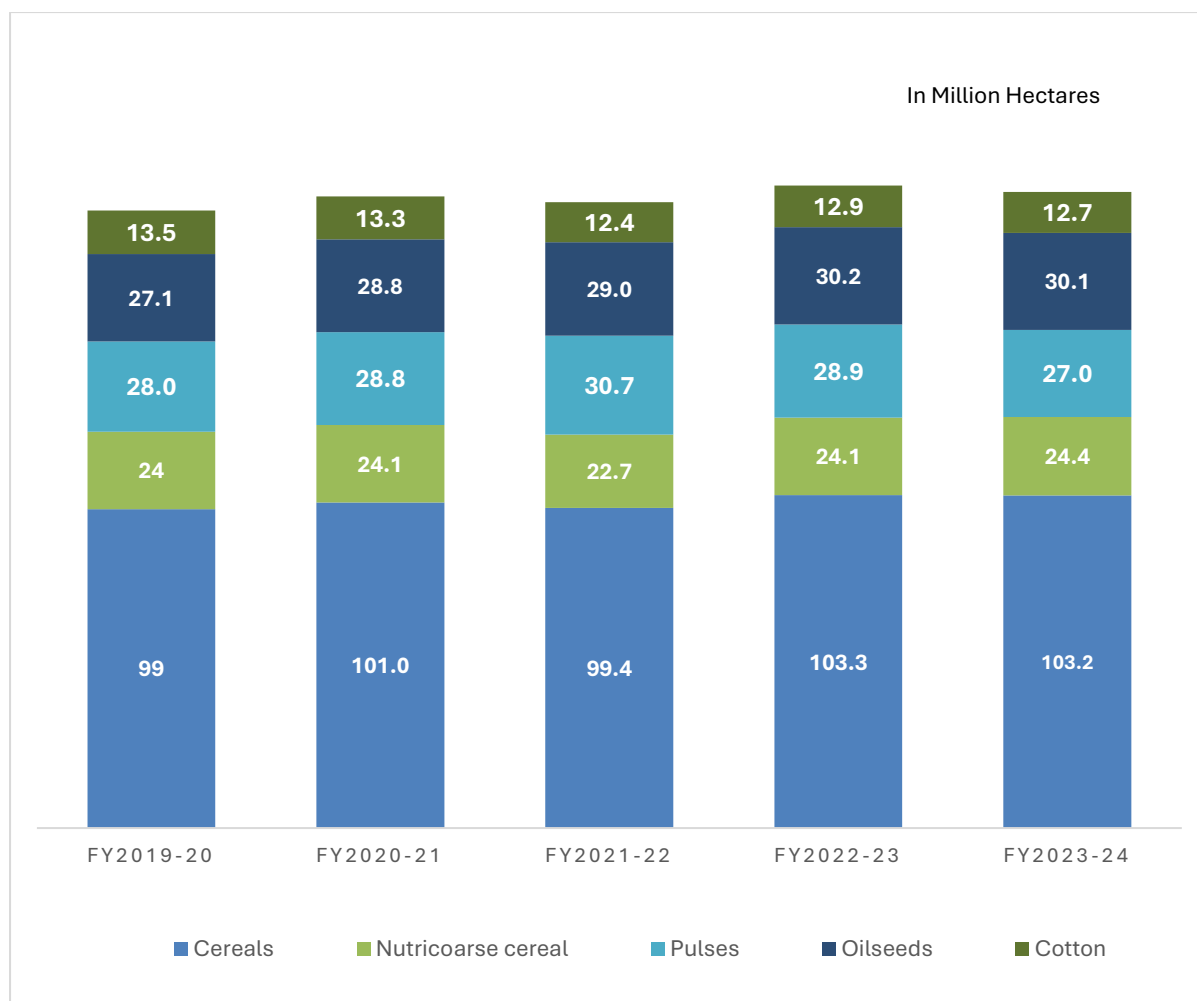


Note: Food grains include cereals and pulses

FY2023-24 data is provisional as indicated by Economic Survey 2023-24

Area under cereals grew by at CAGR 1% from 99 Mn Ha in 2019-20 to 103.2 Mn Ha in 2023-24. Rice & wheat accounted for 61% of the total gross area under foodgrains in FY24. Nutri coarse cereals which include corn, jowar, ragi, pearl millet, small millets and barley accounted for 18.7% of the gross area of foodgrains at 24.2 Mn Ha in FY24. Pulses & Oilseeds accounted for 27 Mn Ha & 30.1 Mn Ha in FY24. Area under cotton in FY 24 is 12.7 Mn Ha which declined by 1.5% from FY20 which was 13.5 Mn Ha.

**Exhibit 19 (a): Gross Area under major crops segments, Million Hectares**



Note: Cereals Includes rice, wheat & Nutri Coarse cereal

Nutri coarse cereal Includes corn, jowar, ragi, pearl millet, small millets and barley

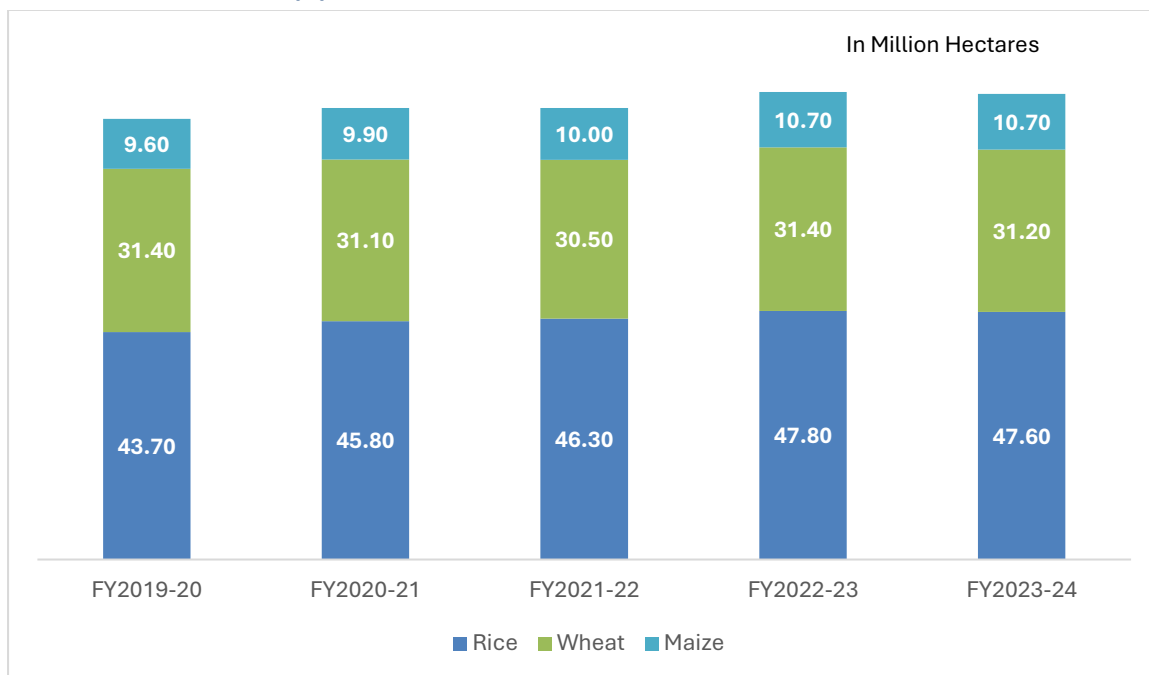
Pulses Includes tur, urad, moong, gram, lentils and other pulses

Oil seeds Includes groundnut, rapeseed & mustard, sesamum, linseed, castor seed, nigerseed, safflower, sunflower and soyabean

Source: AS&E Division, Department of Agriculture and Farmers Welfare, Frost & Sullivan

Crop	Cereals	Nutri coarse Cereals	Pulses	Oilseeds	Cotton
<b>CAGR, % FY20-FY24</b>	1.04%	0.41%	-0.91%	2.66%	-1.52%

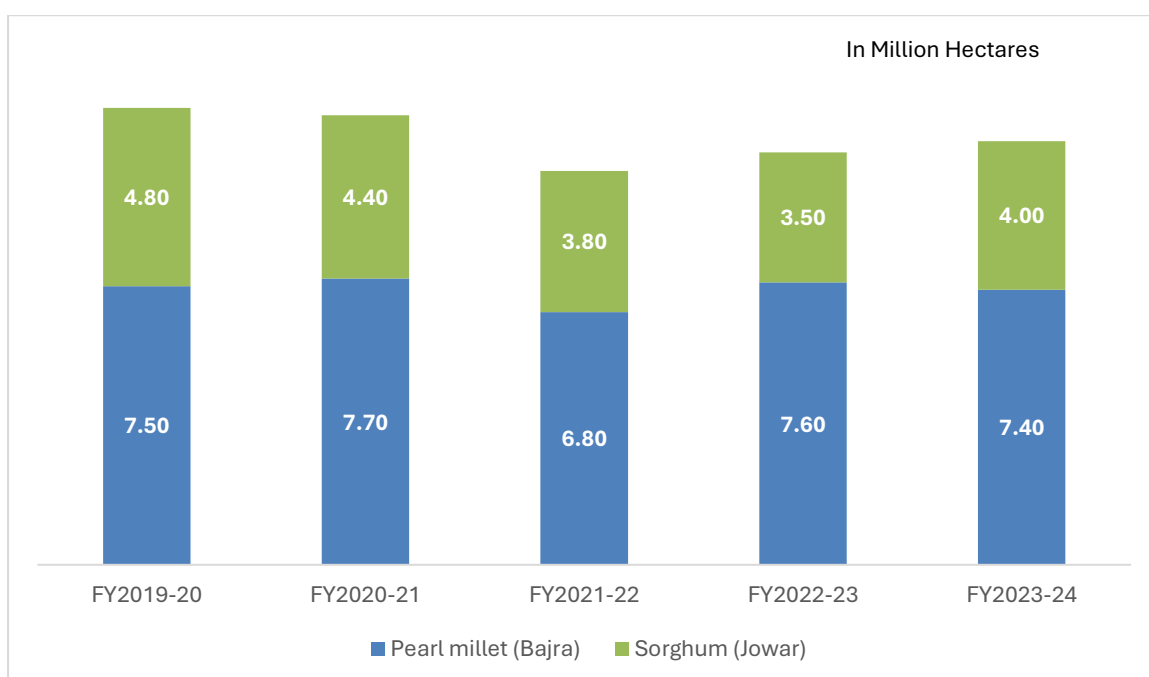
**Exhibit 19(b): Gross Area under Rice, Wheat, and Corn, Million hectares**



Source: AS&E Division, Department of Agriculture and Farmers Welfare, Frost & Sullivan

Crop	Rice	Wheat	Corn
<b>CAGR, % FY20-FY24</b>	2.16%	-0.16%	2.75%

**Exhibit 19 (c): Gross Area under Major Millets, Million hectares**

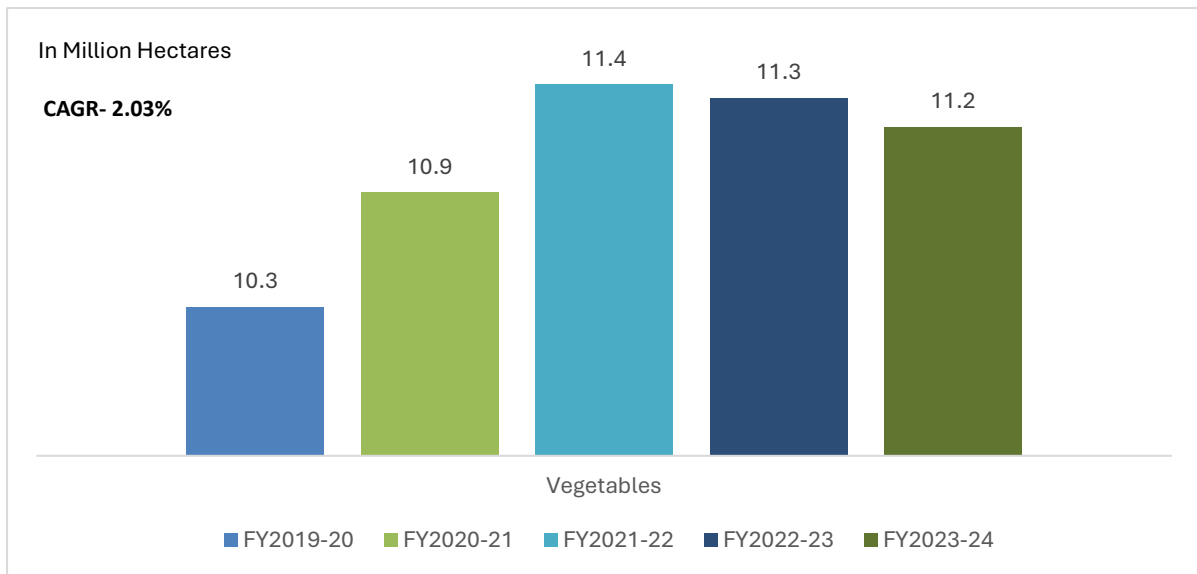


Source: AS&E Division, Department of Agriculture and Farmers Welfare, Frost & Sullivan

<b>Crop</b>	<b>Pearl Millet</b>	<b>Jowar</b>
<b>CAGR % FY20-FY24</b>	-0.34%	-4.46%

Vegetable crop acreages have grown at CAGR 2.0% from FY2019-20 to FY 2023-24 from 10.3 Million Ha in FY 2019-20 to 11.2 Million Ha in FY 2023-24. Potato, Onion, Tomato, Brinjal, Peas, Okra were the major contributors.

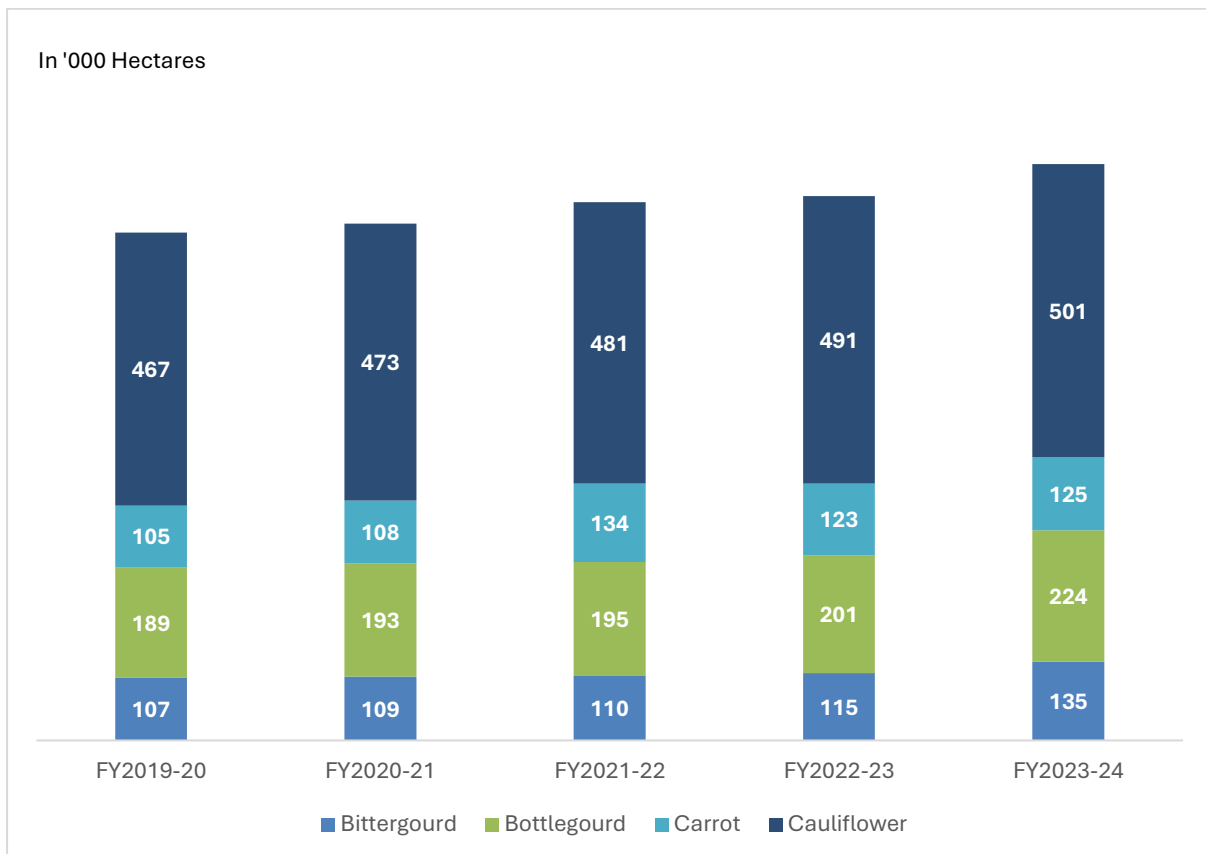
### Exhibit 21: Gross Area under Vegetable Crops, Million hectares



Note : FY 2023-24 data is as per 3<sup>rd</sup> estimates released in Sep 2024.

Source: AS&E Division, Department of Agriculture and Farmers Welfare, Frost & Sullivan

### Exhibit 22 (a): Gross Area under Major Vegetable, '000 Hectares

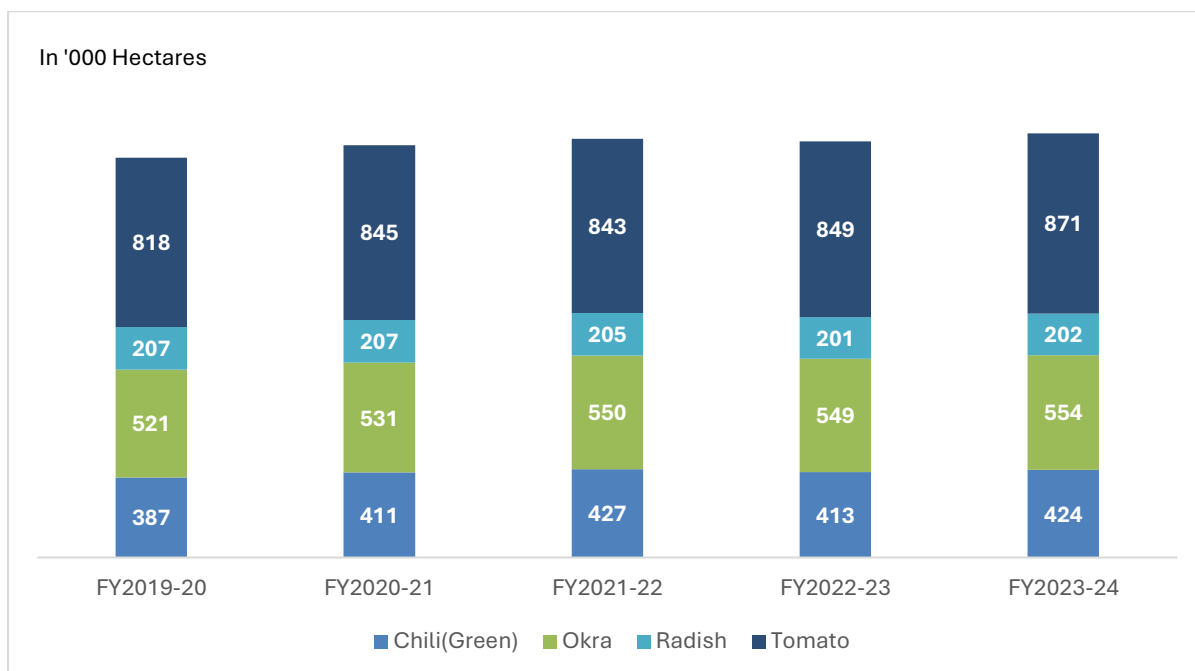


Note : FY 2023-24 data is as per 3<sup>rd</sup> estimates released in Sep 2024.

Source: AS&E Division, Department of Agriculture and Farmers Welfare, Frost & Sullivan

Crop	Bitter gourd	Bottle gourd	Carrot	Cauliflower	Cucumber
<b>CAGR, % FY20-FY24</b>	5.98%	4.34%	4.46%	1.77%	5.36%

**Exhibit 22 (b): Gross Area under Major Vegetables, '000 Hectares**



Note : FY 2023-24 data is as per 3<sup>rd</sup> estimates released in Sep 2024.

Source: AS&E Division, Department of Agriculture and Farmers Welfare, Frost & Sullivan

Crop	Chili (Green)	Okra	Radish	Tomato
<b>CAGR % FY20-FY24</b>	2.31%	1.55%	-0.61%	1.58%

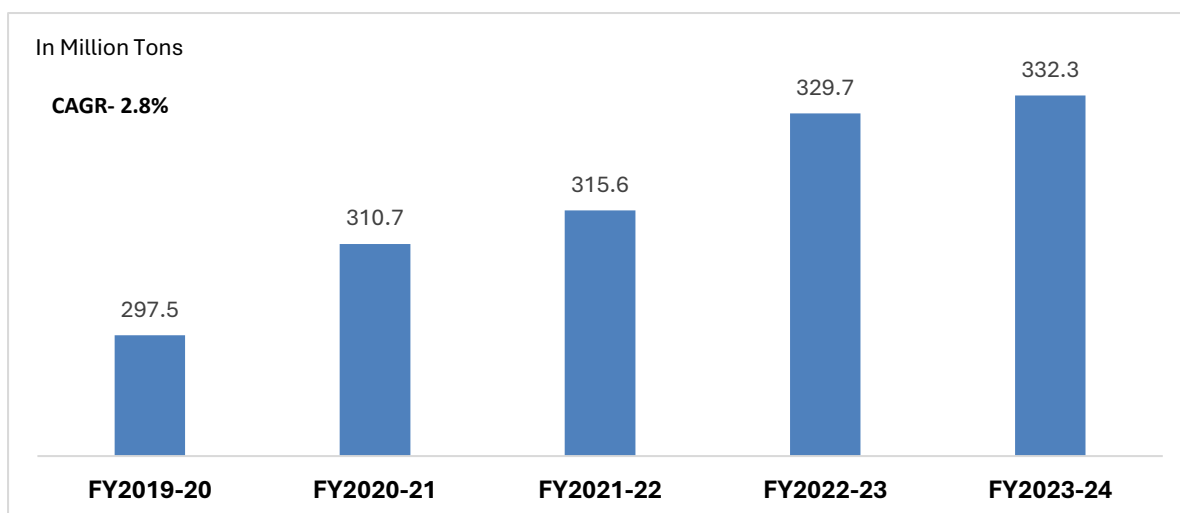
Gross area under Bitter gourd and Cucumber have grown at CAGR 6% & 5.4% respectively. Apart from radish, acreage of crops such as chili, okra, tomato, carrot, cauliflower have grown from FY 2020 to FY 2024. Finance Minister Nirmala Sitharaman also has announced to develop large-scale clusters for vegetable production closer to major consumption centres and steps to strengthen supply chains.

### 3.5 Production of major crops in India

In FY24, 332.3 million tons of food grains were produced, an increase of 2.61 million tons over the year before. The foodgrain production has increased at CAGR 2.8% from FY 2019-20 to FY 2023-24. Food grain production witnessed record increase from FY 20 to FY 24 due to good production of Rice, Wheat and Shree Anna/ Millets. Production of rice, wheat, legumes, oilseeds, and nutri/coarse cereals increased. India ranks second-largest producer of fruits, vegetables, tea, farmed fish, sugarcane, wheat, rice, cotton, and sugar.



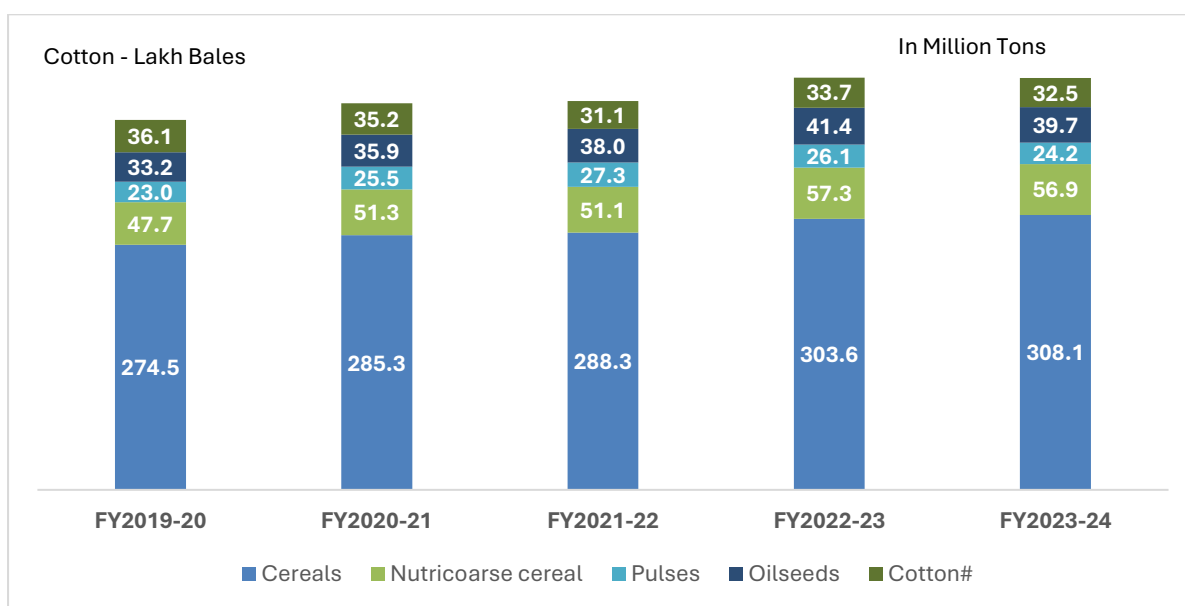
**Exhibit 23: Foodgrains production in India, Mn Tons**



Note: Food grains include cereals and pulses

Source: Final Estimates, Department of Agriculture and Farmers Welfare

**Exhibit 24 (a): Production of major crops segments in India, Mn Tons**



Note: Cereals Includes rice, wheat & Nutri Coarse cereal

Nutri coarse cereal Includes corn, jowar, ragi, pearl millet, small millets and barley

Pulses Includes tur, urad, moong, gram, lentils and other pulses

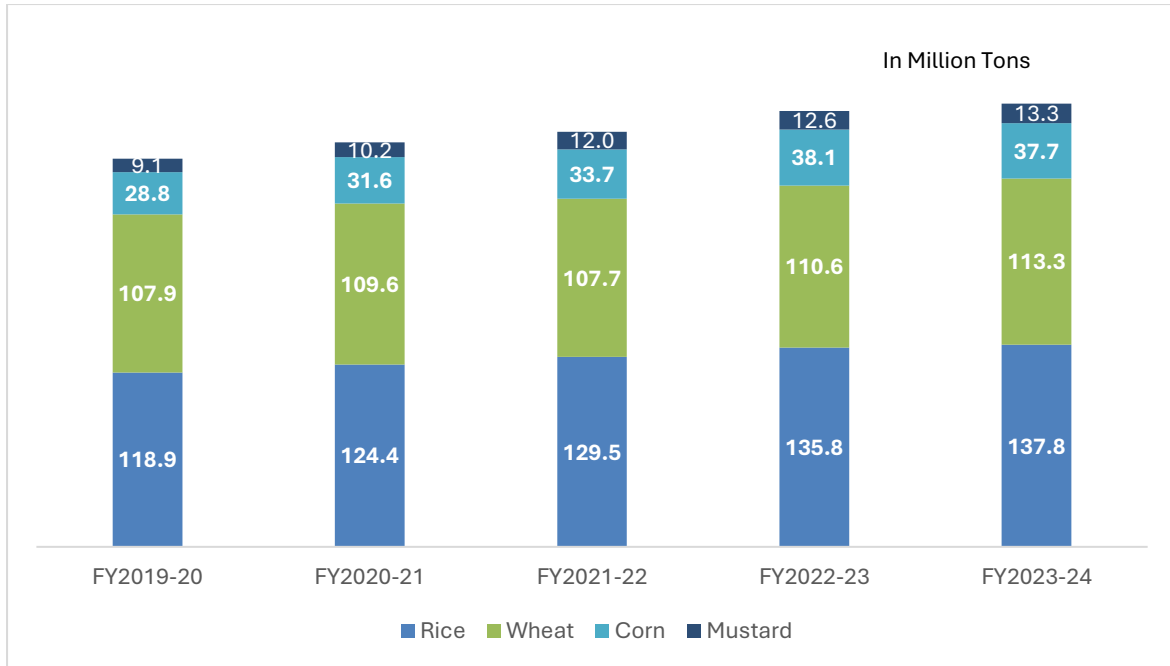
Oil seeds

# Cotton Production in Lakh Bales, 1Bale=170 Kg

Source: AS&E Division, Department of Agriculture and Farmers Welfare, Frost & Sullivan

Crop	Cereals	Nutri coarse Cereals	Pulses	Oilseeds	Cotton
<b>CAGR % FY20-FY24</b>	2.93%	4.50%	1.30%	4.54%	-2.55%

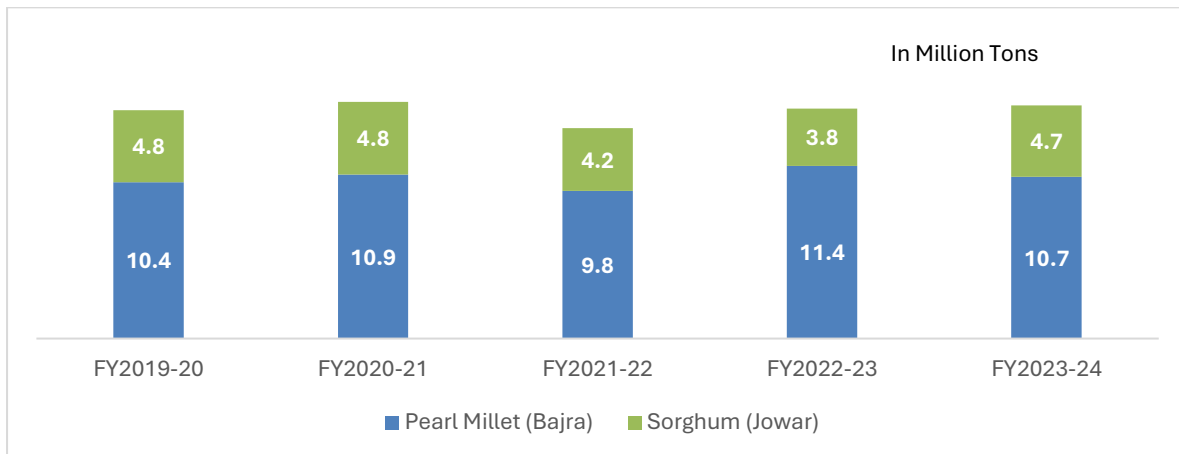
**Exhibit 24(b): Production of Rice, Wheat, Corn and Mustard, Million Tons**



*Source: AS&E Division, Department of Agriculture and Farmers Welfare*

Crop	Rice	Wheat	Corn	Mustard
<b>CAGR % FY20-FY24</b>	3.77%	1.24%	6.97%	9.79%

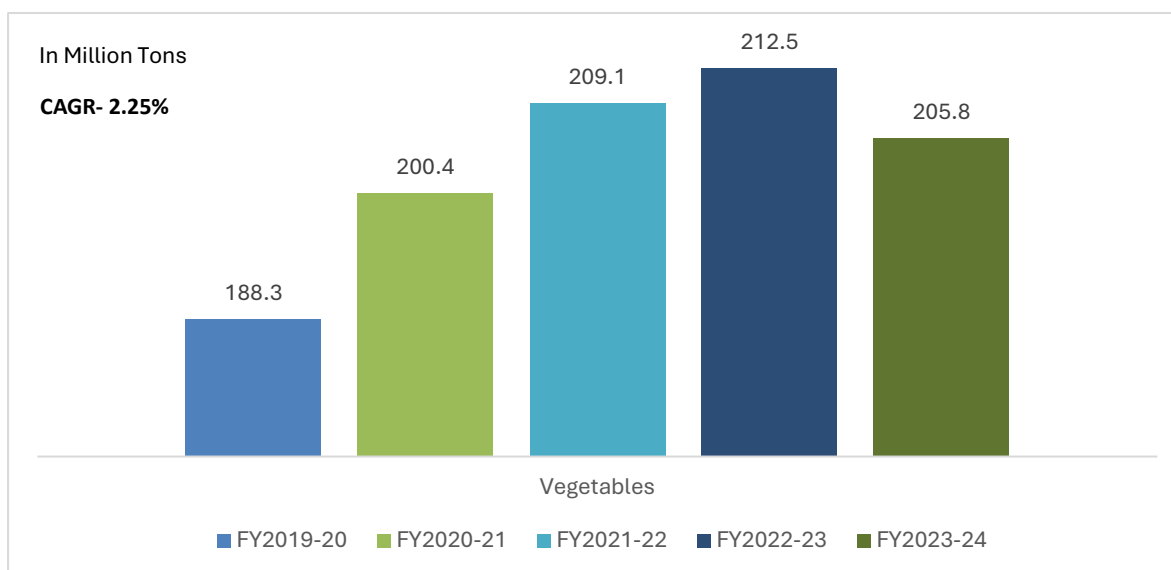
### Exhibit 24(c): Production of Major Millets, Million Tons



*Source: AS&E Division, Department of Agriculture and Farmers Welfare, Frost & Sullivan*

Crop	Pearl Millet	Jowar
<b>CAGR % FY20-FY24</b>	0.84%	-0.18%

**Exhibit 26: Production of Vegetable Crops, Million Tons**



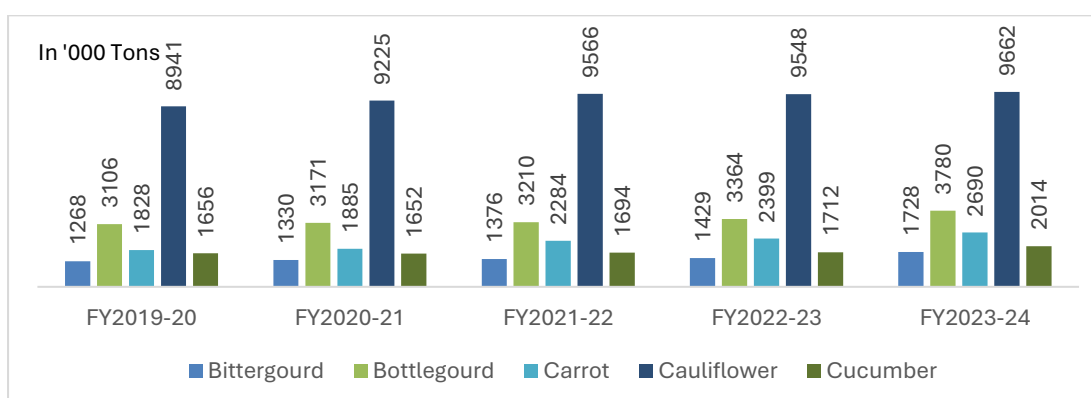
Note : FY 2023-24 data is as per 3<sup>rd</sup> estimates released in Sep 2024.

Source: AS&E Division, Department of Agriculture and Farmers Welfare, Frost & Sullivan

Production of vegetables in India has grown from 188.3 million tons in FY 2019-20 to 205.8 million tons in FY 2023-24. Crop diversification is the one of the major reasons for farmers turning to vegetable farming.

For smallholders farmers in India, growing vegetables offers benefits, particularly when paired with conventional field crops. Many vegetables have a shorter growing cycle, which allows farmers to harvest more than one crop a year and earn income more frequently. It provides a triple win: higher income for farmers and traders, improved nutrition and health for consumers, and economic revitalization. India's consumption patterns are shifting as a result of a growing focus on leading a healthier lifestyle. The demand for nutritious, healthy vegetables has increased as a result of this change. In addition to being an important source of necessary nutrients, vegetables also help to diversify diets.

**Exhibit 27 (a): Production of Major Vegetables, '000 Tons**

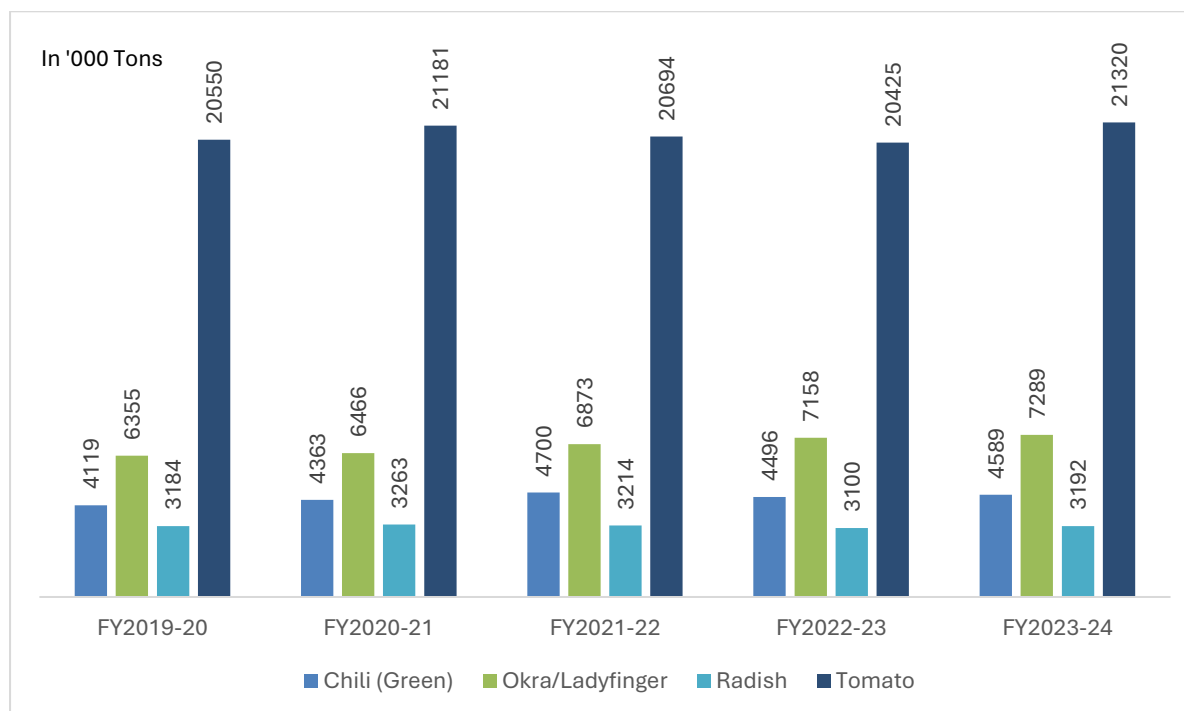


Note : FY 2023-24 data is as per 3<sup>rd</sup> estimates released in Sep 2024.

Source: AS&E Division, Department of Agriculture and Farmers Welfare, Frost & Sullivan

Crop	Bitter gourd	Bottle gourd	Carrot	Cauliflower	Cucumber
<b>CAGR % FY20-FY24</b>	8.05%	5.03%	10.14%	1.96%	5.01%

**Exhibit 27 (b): Production of Major Vegetable, 000 Tons**



Note : FY 2023-24 data is as per 3<sup>rd</sup> estimates released in Sep 2024.

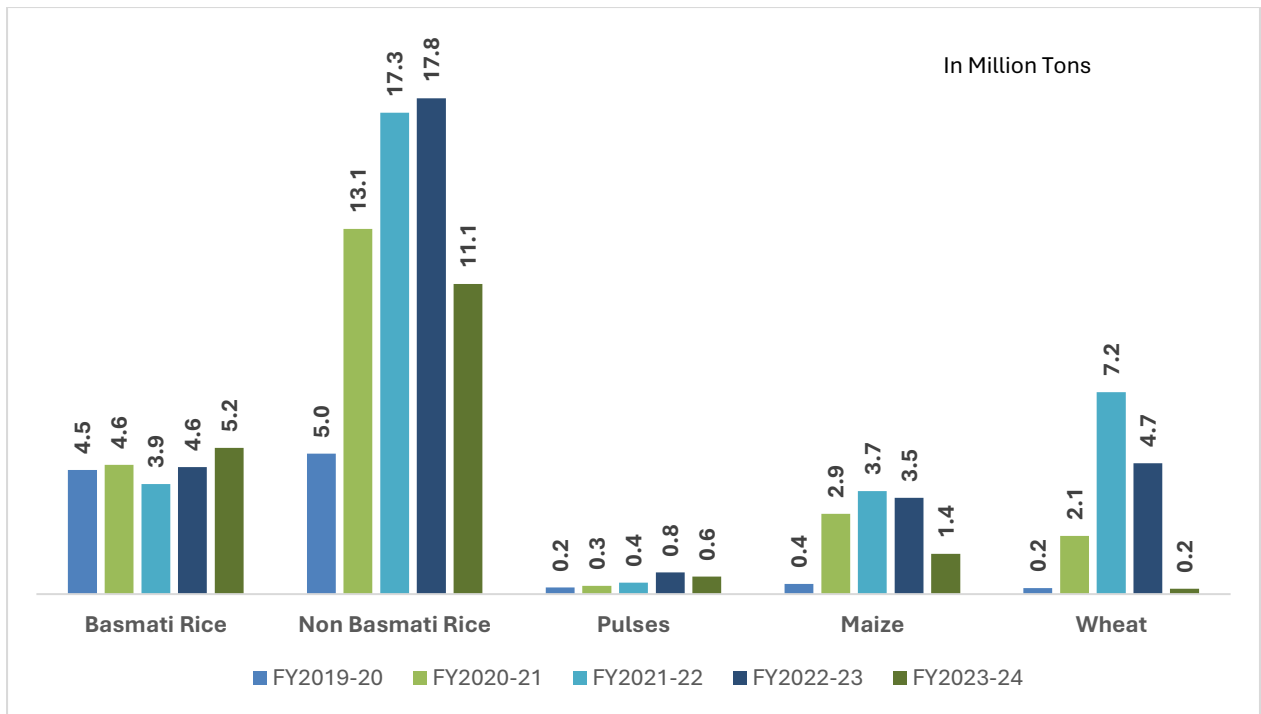
Source: AS&E Division, Department of Agriculture and Farmers Welfare, Frost & Sullivan

Crop	Chili (Green)	Okra	Radish	Tomato
<b>CAGR % FY20-FY24</b>	2.74%	3.49%	0.06%	0.92%

### 3.6 Agriculture Exports Overview Of India – Major Commodities

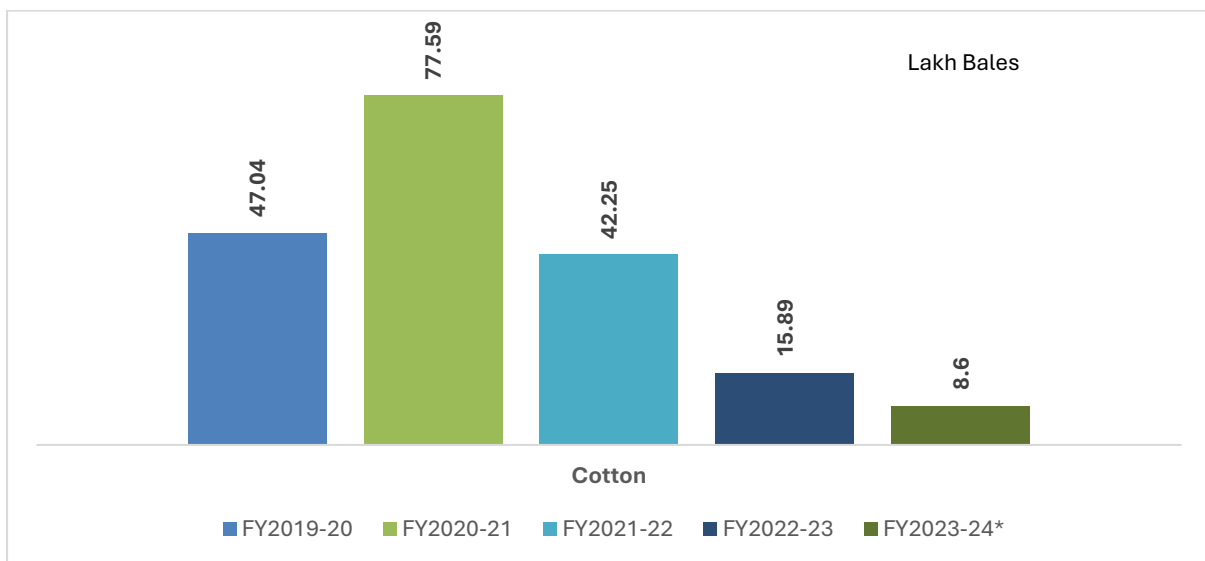
India ranks among the world's top exporters of agricultural products. The total value of agricultural product exports from April to January 2024 was US\$38.65 billion. India's agricultural exports totalled USD 48.15 billion in 2032–24. The main exports from India's agricultural sector include textile and related items, plantation products, marine products, and agri-related products.

**Exhibit 28: Exports of Major Commodities from India, Million Tons**



Source: APEDA

**Exhibit 29: Exports of Cotton from India, Lakh bales**



Note - \* Data for FY2023-24 is upto 31 st January 2024

Source: DGCIS, Kolkata

### 3.7 Key Trends and Growth Drivers of Agriculture sector in India

#### Key trends

**Increasing use of hybrid seeds-** Increasing demand for improved varieties along with hybrids is growing in seed sector. Increased choice & availability of varieties from public and private sectors in all crops, enables wide scale adoption. Increasing seed replacement rate, awareness of farmers is further contributing to increased use of hybrids. ICAR also released varieties that included cereals (23), rice (9) maize (6) and wheat (2), oilseeds (7), pulses (11), sugarcane (4), cotton (5), millets, forage crops, and fiber crops. Among the 40 varieties of horticulture crops

include fruits, vegetables, plantation crops, tubers, spices, flowers, and medicinal plants. Plus, climate change is leading to decreasing yield and diseases across globe. Hybrids with traits such as water stress tolerant, lodging tolerant, herbicide tolerant are being adopted.

**Agricultural Diversification:** In addition to providing food grains, agriculture fulfills other development needs. In couple of decades, the farming industry has expanded to include cashew, areca nut, coconut, millets, mustard, vegetable, spices, flowers, orchids, dairy, and animal husbandry. Similarly, there is an increase in demand for these products India ranks second globally in vegetable production and first globally in fruit production. India's varied climate, geography, and soil types enable it to grow wide range of crops. Exotic Fruits & Vegetables are being grown by many farmers to increase the profitability.

**Investment in Technologies:** According to the Economic Survey 2023-24, food security has been significantly boosted by investments in agricultural research and the support of enabling policies.

Private companies in seeds are also at the forefront on investments in technologies for breeding new plant hybrids. Investments in R &D have significant benefits to company's product portfolio such as new trait's introduction, high yielding varieties, pest & disease resistant varieties and climate smart crops. Few companies invest a significant chunk of their revenues in R&D because of various issues such as lack of proper resource allocation, insufficient skilled workforce, strategic objective of companies and soon.

Seed companies will benefit significantly in the upcoming years from the government's dedication to furthering Indian research and promoting approvals for newly created hybrid and advanced seed varieties that are produced domestically. This will help the companies grow as a whole, and both domestically and in foreign business.

**Increasing use of Agri- inputs:** Owing to rising population & increasing demand of foodgrains, there is a lot of emphasis on increasing the productivity of farms.

There is an increase in demand for quality seeds aligned with the adoption of modern agricultural practices. Given the good monsoon season in 2024, industry experts predicted a 10–11% increase in demand for agrochemicals as a result of the spike in demand for seeds and crop-protection products.

### **Key Growth Drivers**

**Policy Support:** For the benefit of Indian farmers, Government of India introduces various policies and programs for their wellbeing. Dedicated departments, boards, and officials for the agriculture sector, ranging from the central government to state governments, meticulously examine the issues being faced by Agriculture sector.

Indian farmers are assisted by several farmer welfare programs, such as crop insurance and social security. Eligibility requirements, implementation strategies, and related benefits vary between the schemes. It is the duty of the Department of Agriculture and Farmer Welfare to impartially implement the programs. To guarantee access to IT throughout the country, the government has implemented a number of digital initiatives, including the National e-

Governance Plan in Agriculture, the development of digital public infrastructure, digital registers, etc. Multiple schemes such as Pradhan Mantri Kisan Samman Nidhi (PM-KISAN), Pradhan Mantri Kisan Maandhan Yojna, Pradhan Mantri Fasal Bima Yojana, Agriculture Infrastructure Fund, Market Intervention Scheme and Price support Scheme, Sub-Mission on Seed and Planting Material, Mission Organic and so on are rolled out for various stakeholders involved in Agriculture sector.

**Competitive Advantage:** India has a competitive edge in the Agriculture & Food Processing Industry due to its abundance of natural resources. It offers a broad and substantial raw material base suitable for the food processing sectors along with natural resources due to its varied agroclimatic conditions.

According to the Economic Survey 2023–24, the Agriculture sector in India supports the livelihoods of approximately 42.3% of the population and accounts for 18.2% of the nation's GDP at current prices. Over the last five years, the Agriculture industry has grown at an average annual rate of 4.18% percent at constant prices, demonstrating its buoyancy.

### 3.8 Key Govt. Policies & Regulations

Scheme	Description
<b>Central Sector Schemes</b>	
<b>e-NAM Scheme</b>	<p>National Agriculture Market (NAM) is an electronic trading portal operational across India. The implementation was taken up by Small Farmers Agribusiness Consortium (SFAC) in 2016. NAM portal networks the existing APMC (Agriculture Produce Marketing Committee) / Regulated Marketing Committee (RMC) market yards, sub-market yards, private markets and other unregulated markets to unify all the nationwide agricultural markets by creating a central online platform for agricultural commodity price discovery.</p> <p>The scheme brings transparency into online trading with real time price discovery.</p> <p>Producers can expect better and stable price realization and buyers can expect reduced transaction cost. The e-Nam mobile app will enable availability of information on about commodity prices. Quantity and price details of each transaction can be received through SMS along with online payment directly to the bank accounts of the farmers.</p> <p>Thus, resulting in a more efficient supply chain and warehouse-based sale.</p>
<b>Pradhan Mantri Fasal Bima Yojana (PMFBY)</b>	<p>PMFBY was launched in 2016 in order to provide a simple and affordable crop insurance product to ensure comprehensive risk cover for crops to farmers against all non-preventable natural risks from pre-sowing to post-harvest and to provide adequate claim amount. The scheme is demand driven and available for all farmers</p>

Scheme	Description
	A total of 5549.40 lakh farmer applications were insured under the scheme since 2016-17 and INR 150589 crore has been paid as claim.
<b>Modified Interest Subvention Scheme (MISS)</b>	The Interest Subvention Scheme (ISS) provides concessional short term agri-loans to the farmers practicing crop husbandry and other allied activities like animal husbandry, dairying and fisheries. ISS is available to farmers availing short term crop loans up to Rs.3.00 lakh at an interest rate of 7% per annum for one year. Additional 3% subvention is also given to the farmers for prompt and timely repayment of loans thus reducing the effective rate of interest to 4% per annum. The benefit of ISS is also available for post-harvest loans against Negotiable Warehouse Receipts (NWRs) on crop loans for a further period of six months post-harvest to small and marginal farmers having Kisan Credit Cards (KCCs), on occurrence of natural calamities and severe natural calamities. As on 05-01-2024, 465.42 lakh new KCC applications have been sanctioned with a sanctioned credit limit of INR 5,69,974 Crore as part of the drive.
<b>Formation &amp; Promotion of new 10,000 FPOs</b>	The Government of India launched the Central Sector Scheme (CSS) for “Formation and Promotion of 10,000 Farmer Producer Organizations (FPOs)” in the year 2020. The scheme has a total budgetary outlay of INR 6,865 crores. Formation & promotion of FPOs are to be done through Implementing Agencies (IAs), which further engage Cluster Based Business Organizations (CBBOs) to form & provide professional handholding support to FPOs for a period of 5 years.
<b>Centrally Sponsored Schemes</b>	
<b>Rashtriya Krishi Vikas Yojana (RKVY)</b>	The scheme focuses on creation of pre & post-harvest infrastructure in agriculture and allied sectors that help in supply of quality inputs, market facilities, etc to farmers. It provides flexibility and autonomy to states to implement projects as per the local farmers’ needs and priorities from a bouquet of activities in agriculture and allied sectors. The scheme aims to fill the resources gap of agriculture and allied sectors by providing financial support to states for undertaking various activities to increase in overall growth of agriculture and allied sectors and farmers’ income.
<b>Soil Health Card (SHC) Scheme</b>	Soil health card provides information to farmers on nutrient status of their soil along with recommendation on appropriate dosage of nutrients to be applied for improving soil health and its fertility. The indicators are typically based on farmers' practical experience and knowledge of local natural resources. The card lists soil health indicators that can be assessed without the aid of technical or laboratory equipment. The Scheme rolls out a decentralized system



Scheme	Description
	of soil testing which will help in developing a nationwide soil fertility map on a GIS platform that can easily be integrated with the real time decision support systems being developed. In order to develop the soil fertility map, Government of India has decided to conduct 5 Crore Soil Samples across the country during year 2023-24 to 2025-26.
<b>Rainfed Area Development (RAD)</b>	RAD is being implemented since 2014-15. RAD adopts an area based approach in cluster mode for promoting Integrated Farming System (IFS) which focuses on multi-cropping, rotational cropping, inter-cropping, mixed cropping practices with allied activities like horticulture, livestock, fishery, apiculture etc. to enable farmers not only in maximizing the farm returns for sustaining livelihood, but also to mitigate the impacts of drought, flood or other extremes weather events.
<b>Per Drop More Crop (PDMC)</b>	In order to increase water-use efficiency at the farm level through Micro Irrigation technologies i.e. drip and sprinkler irrigation systems, Per Drop More Crop (PDMC) scheme was launched during 2015-16. The Micro Irrigation helps in water saving as well as reduced fertilizer usage through fertigation, labour expenses, other input costs and overall income enhancement of farmers.
<b>Krishonnati Yojana</b>	
<b>National Food Security Mission (NFSM)</b>	The Mission aims at increasing production of rice, wheat, pulses, coarse cereals (Corn and Barley) and Nutri-Cereals through area expansion and productivity enhancement in a sustainable manner in the identified districts of 28 States and 2 UTs (i.e., J&K and Ladakh). Other objectives include restoring Soil fertility and productivity at the individual farm level, enhancing farm level economy to restore confidence amongst the farmers and post-harvest value addition at farm gate.
<b>Sub-Mission on Seed and Planting Material (SMSP)</b>	SMSP covers the entire gamut of seed production chain, from production of nucleus seed to supply of certified seeds to the farmers, to provide support for creation of infrastructure conducive for development of the seed sector, support to the public seed producing organisations for improving their capacity and quality of seed production, create dedicated seed bank to meet unforeseen circumstances of natural calamities, etc.

### 3.9 Key Factors Affecting Demand for Agricultural Inputs

**Increasing Food Demand-** Government of India has set a foodgrains production target of 341 million tons for the 2024–25 crop year (July–June) in anticipation of improved overall crop output from this year's good monsoon rains. This new record level surpasses the output in 2023–2024 by 9 million tons (2.7%). The rapid urbanization, substantial GDP growth, a growing younger population, and increased consumer exposure are the main drivers of this robust expansion. Since both crops are crucial for lowering India's import costs, the target's main focus is on pulses among the foodgrains and oilseeds in the non-foodgrains basket.

It was emphasized that the government wants to boost oilseed output from 39 MT in 2022–2023 to 69 MT in 2030–2031 in order to meet the country's growing need for edible oil and to help India become self-sufficient.

The incremental demand and thereby production has essentially to come from productivity improvements as the potential for area expansion has exhausted. Besides, increasing demand for high-value food commodities like fruits and vegetables, is likely to cause a shift in area from staple food crops.

**Farm income:** In April 2016, the government established an Inter-Ministerial Committee to study the "Doubling of Farmers Income (DFI)" and suggest strategies to accomplish it. Some of the strategies suggested were -

- Increase in crop productivity
- Increase in livestock productivity
- Resource use efficiency – reduction in cost of production
- Increase in cropping intensity
- Diversification to high value agriculture
- Remunerative prices on farmers' produce
- Shift of surplus manpower from farm to non-farm occupations

To improve the welfare of farmers, the Indian government has brought in place a number of policies and initiatives that boost output, provide farmers with income support, and offer remunerative returns.

In the long run, technical advancements, increased resource efficiency, lower production costs, and improved agriculture's resilience to drastic climate change will help in increasing farmers' income. This can be done with high yielding climate smart crop seeds along with other agriculture inputs. In conclusion, if the stakeholders adopt a thorough, multifaceted, and focused strategy that covers income opportunities and their enabling conditions, such as investment in agricultural R&D and infrastructure, as well as the development of institutions and human resources, it may be feasible to double farmers' income.

Increased income will enable farmers to spend more on the high quality agri inputs thereby also boosting the growth of agri inputs sector.

**Weather conditions:** Changing weather conditions is impacting the agriculture sector negatively over last couple of years. Extreme hot summers, delayed/ untimely monsoon and extreme cold are decreasing yield & thereby farmers profitability.

These effects have a wide impact on Indian seed companies also. Seed Companies decisions for investment in R&D is largely impacted by these phenomena. Companies are investing more in research and development of climate resistant crops. Initiatives to improve seed quality and develop climate smart seeds by companies such as SeedWorks (US Agriseeds),

Advanta- UPL, Syngenta, Mahyco, Bayer, Tata Rallis are spearheading the effort to bring down the challenges of weather dependence on agriculture.

**Irrigation facilities:** The importance of irrigation systems is demonstrated in their capacity to alleviate the difficulties caused by irregular monsoon rains, ensuring steady agricultural output and food security. Irrigation played a crucial role in the green revolution in Asia and India. Far larger than the United States of America (27 million ha), India (76 million ha) has the most land equipped for irrigation. Even though India has the world's largest irrigated land, there is a severe water shortage.

Irrigation increases agricultural production through both the expansion of cultivable area beyond that possible under rainfed agriculture and higher crop yields. Thus, leading to increased demand for the other agriculture inputs such as seeds, agrochemicals.

Government is trying to enhance the water use efficiency, particularly through drip and sprinkler irrigation by implementing various schemes such as Per Drop More Crop , Micro Irrigation Fund & Pradhan Mantri Krishi Sinchayee Yojana (PMKSY). These programs, along with developments in technology, are crucial in boosting irrigation's expansion in India. Increased irrigation expansion will ensure water availability for different crops through year and thus enable increased growth of agri input sector.

## 4. Overview of the Seeds Industry

### 4.1 Significance of seeds in agriculture and food production

Seed industry supports overall growth of agriculture sector. It provides access to the best of seed and planting material to farmers across globe along with providing a strong R&D base for seed development, production of high-value hybrids of cereals and vegetables and offering farmers with farmers with multiple choices for different products.

Seed industry also helps in economic growth of country by providing access to high-quality seed there by increases farm productivity. Increased farm productivity leads to higher returns on investments and allows farmers to earn a better living there by uplifting the rural economy.

### 4.2 Key Growth Drivers for Seeds Business

**Technological Advancements** in seed genetics and biotechnology have revolutionized the industry, leading to the development of high-yielding, disease-resistant seed varieties. For instance, genetically modified (GM) crops such as Bt cotton and Roundup Ready soybean have significantly boosted agricultural productivity. As farmers increasingly adopt these high-performing seeds, the market will likely see an acceleration in investment and innovation, promoting sustainable agricultural practices and enhancing the overall productivity of cereal and grain crops worldwide. Trait stacking innovations have provided seed industry opportunity to bundle innovation and deliver superior traits. These advancements address critical agricultural challenges, including pest resistance and climate adaptability, thereby improving crop productivity and food security.

Moreover, innovations in seed treatment technologies, such as seed coating and enhanced nutrient delivery systems, are improving seed performance and fostering growth in the market.

**Rising disposable incomes** in emerging economies are leading to increased consumption of diverse and high-quality food products. This shift is encouraging farmers to invest in high-value seed varieties to meet the growing demand for premium crops.

Additionally, **Government initiatives and subsidies** aimed at promoting agricultural efficiency and sustainability further support market expansion. For example, India's subsidies for hybrid seeds have facilitated increased adoption among farmers.

**Food demand is rising globally** on account to growing population. Food security will continue to be one of the world's most pressing issues in 2024 and the years to follow. As a result, the World Bank has listed food and nutrition security as one of the eight global challenges that need to be addressed at scale.

**Increasing Adoption of Hybrid and Genetically Modified (GM) Seeds along with Climate Change and Resource Constraints (limited land)** are increasing demand for seeds with traits such as drought tolerance, salinity resistance, and heat tolerance.

### 4.3 Factors impacting the Crop yield

**Climate Change** - Climate change can influence the performance of seeds by altering growing conditions such as temperature, rainfall, and soil moisture levels. These changes may affect

germination rates, crop maturity, and overall yields. Developing climate-resilient seed varieties with traits like drought tolerance and heat resistance is crucial to ensuring stable agricultural productivity

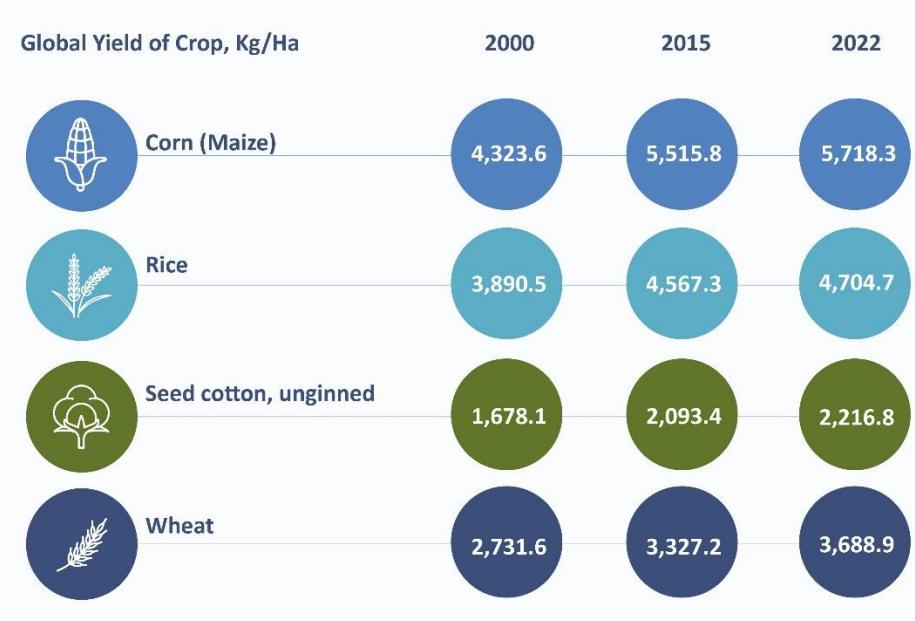
**Increased atmospheric CO2 levels** can be beneficial to plants; this process is known as "carbon fertilization." Crops such as rice and wheat, can benefit from increased CO2. Crops that benefit very little from carbon fertilization — Corn, millet, and sorghum — are much more common in warmer climates. So, they'll see a decline in yields due to increased temperatures without the benefits of carbon fertilization to offset it.

Second, **higher temperatures** have significant impact on crops. Depending on the crop and the region of the world it is cultivated in, this may increase or decrease yields. Moderate climate change could increase average yields for farmers in temperate regions, if temperatures are below what is considered "optimal" for that crop. Higher temperatures will directly lower yields for farmers in the tropics or subtropics where temperatures are already at or above the "optimal."

**Availability of water** has an impact on crops. Yields decline significantly under water stress and the opposite — flood and waterlogging — so crop productivity will decrease if climate change increases the frequency or intensity of these events. The recent floods in Spain – Oct 2024, which have caused massive damage to infrastructure, have affected thousands of hectares of farmland, agricultural groups and farmers.

**Research & Development-** The yield of major crop has increased significantly over the last 70 years globally due to advances in biotechnology made possible by breeders. Plant breeding has improved genetics, and mechanization, fertilizer use, and pest control have all increased crop yields. However, an abundance of data indicates that plant breeding—which includes the use of improved hybrids and varieties—has had the greatest impact on crop yields.

**Exhibit 31: Increase in global yield of major crops**



Source: FAO Stats

Research & Development by private players in climate smart crops such as pearl millet, sorghum also has helped significantly. Companies such as Advanta, Corteva, KWS have portfolio in sorghum whereas companies such as SeedWorks (US Agriseeds), Limagrain, Hytech seeds have extensive pearl millet portfolio as a result of R&D initiatives. In Fiscal 2019-20, SeedWorks (US Agriseeds) launched R&D breeding programs to further expand portfolio of pearl millet (hybrid) and mustards (hybrid and research seeds).

These crops help by providing better productivity & profitability in limited resources for farmers. Thus, improved seed is a major contributor to crop yield & agricultural productivity.

#### 4.4 Entry Barriers

The seed industry is characterized by high entry barriers due to the long development cycles and the need for a substantial and diversified germplasm pool. Developing a critical-scale portfolio can take over a decade, as new product development depends on multiple factors, including the quality of the germplasm pool, availability of adequate infrastructure and investment as well as a strong sales and distribution network for the new products. Incumbents need to continuously innovate to maintain a strong market presence, as farmers exhibit strong brand loyalty and prefer proven products unless a superior alternative is available.

**R&D Costs-** Research and development are essential to the seed industry because of the increased opportunities (such as growing population, increasing food demand, rising incomes, focus on food security and climate smart agriculture) brought about by new technologies, the quicker introduction of traits through these technologies, and the projected demand. Typical cycle for R&D, product development and testing ranges from 6-7 years. Because, of increased competition and technological developments, hybrid life cycles are becoming shorter.

The seed industry creates hybrids with enhanced qualities and nutritional value, as well as features unique to local agroclimatic conditions, increased yields, and resistance to disease and pests. The market viability of a hybrid mostly rests on its enhanced and distinctive

characteristics, which are attained via consistent R&D efforts. Germplasm development, molecular marker technologies, application of biotechnology, assessment of seed quality parameters such as germination, genetic purity, physical purity and vigor take a lot of investments but are crucial for delivering high-quality seeds.

**Regulations-** Although markets require a strong regulatory framework to operate effectively, regulations may often unintentionally result in transaction costs and entry obstacles. Globally, each country has different laws and regulations that govern the development, testing, and sale of seeds. Genetic exclusivity, environmental issues, product viability, performance, and labelling are all subject to these rules. Seed companies need to meet these specific requirements for seed product quality before they are allowed to conduct business. Adherence to the countries different laws and regulations increases the cost of doing business for the industry, which is also dependent on the safeguards provided by the applicable nations' intellectual property laws in order to be able to recover its research expenditure and growth. Robust and efficient intellectual property regulations promote the creation of new products by prohibiting other companies when a seed company has established rights in a particular technology.

Plant breeding is also impacted by regulations. The marketing of conventional seed varieties may be governed by rules in addition to those pertaining to genetically modified organisms; in the European Union, for instance, new varieties may not be marketed until they have successfully completed a test to determine their value for cultivation and use (VCU). The upkeep of public seed banks and regulations controlling access to global genetic resources are two other instances of public policy influencing seed markets.

**Infrastructure-** The primary obstacle in the seed sector is the significant capital outlay in infrastructure across different zone. Experiment stations, land, R&D labs, instrumentations, seed processing facilities and packing unit are among the major investments. In addition, warehouses for storage and handling of seeds are also required. These all infrastructure also need upgradations from time to time.

**Complexities in development & commercialization of products-** Seed companies need to keep on developing new hybrids with increased yields, tolerance to diseases, pest and herbicides. Even with the technological advancements, it is difficult to acquire and create a bank of germplasm which can be used for producing the commercial products. Post the development of product, multiple trails need to be taken in different geographies and climatic zones to ensure the suitability of products. This might take 3-4 seasons and 2-3 years minimum. Post the product finalization, technical requirements in each country for registration of new hybrid needs to be done. Many countries require certain national institutions to test the results of the hybrids which might take further time for commercialization. Thus, time and technical requirements from development of seed to commercialization of the product are huge. The extensive time, technical expertise, and regulatory compliance required for developing and commercializing seeds create a significant entry barrier for new players in the seed industry

**Establishing a Distribution Network-** Post the seed commercialization, marketing and selling of seeds is huge task. Seeds, bio-fertilizers, micronutrients etc. are related products having the same end user i.e. the farmer and are usually sold through dealer networks. In the agri-inputs industry, the difficulty is in distributing the appropriate product at the right time to a

geographically scattered end-user. It also entails making certain that the end-user is aware of the precise raw materials, or agri-inputs, that he needs to meet his demands. Best of R&D and production operations and best of quality manufacturing would not be accomplished if the products did not reach the end customer in a timely way, or if the consumer was not aware of the product, due to the seasonal and timely nature of agriculture business. Because of this, having a robust marketing and distribution network is essential. Retailers, Distributors, Partners are the important stakeholders here and establishing a network with them requires huge manpower & costs.

New entrants often struggle to match the scale, reach, and trust established by incumbents, making this a formidable barrier to entry in the seed industry.

**Brand Building-** Among farmers, brand loyalty is often strong. It's there in almost every facet of their business, from the bags of seed they plant to the colour of the machinery. Multiple players such as Corteva, SeedWorks (US Agriseeds), Bayer, BASF, KWS, East West Seed, Limagrain, Advanta have a diversified product portfolio in terms of crops as well as hybrid/ Research varieties. Crops with strong brand conversion rates include corn, cotton, rice and sunflower. Businesses that create successful hybrids and have cutting edge infrastructure for research and development will stand out from the competition more and more in the current competitive industry. Farmers believe on seeing the results of the product and hence brand building in this industry for a new entrant might take time with already existing competitors.

Farmers are the most discerning customers, seed quality, superior product attributes and brand plays a crucial role as they don't switch if they are happy. Despite being a young company, SeedWorks (US Agriseeds) has managed to scale into the top 10 pure-play seed companies in a fragmented industry on account of being able to create a good brand recognition in the Indian seed market for crops such as cotton, pearl millet and rice.

#### **4.5 Global Supply chain for Seeds**

Seed industry consists of value chain stakeholders, management & biotechnology practices, seed systems, trade, policies and regulatory frameworks.



### Exhibit 32: Global Supply Chain of Seeds



Source: International Seed Federation, Frost & Sullivan Analysis

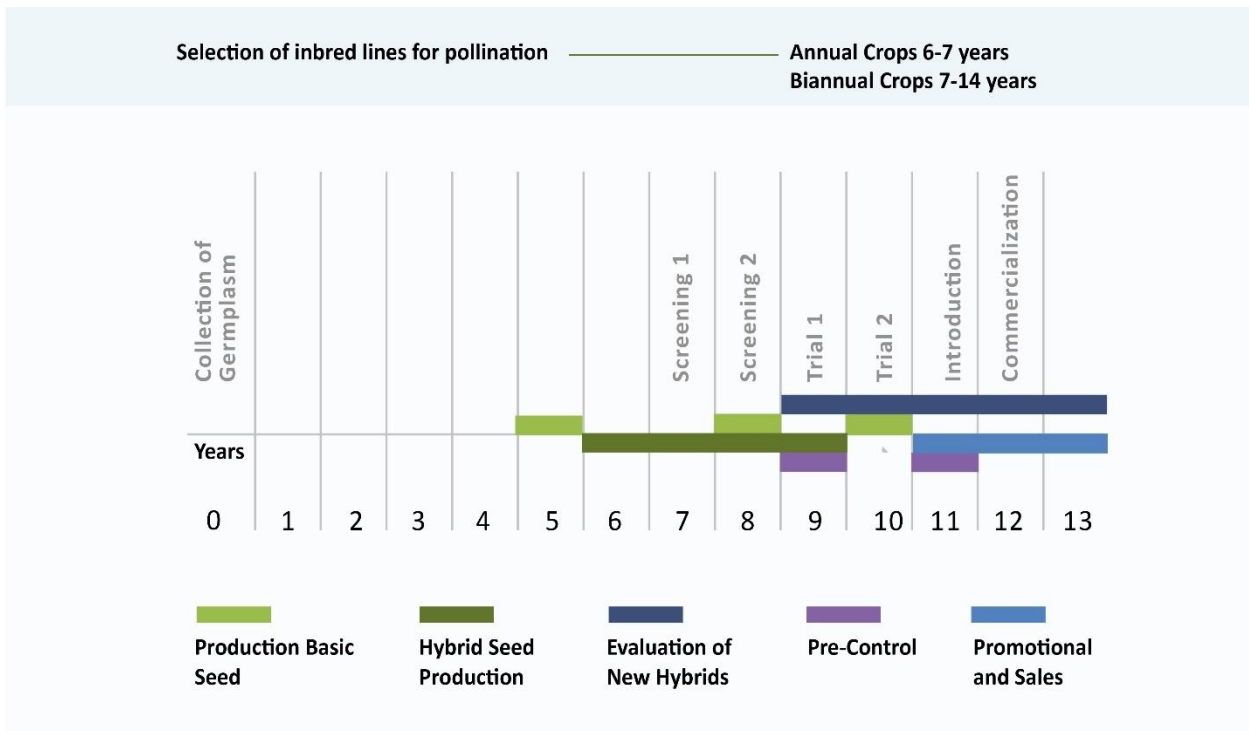
Seed industry supply chain has stakeholders such as Farmers/ Growers, Seed companies, Distributors, Retailers, Public & government seed agencies and end user.

Private seed companies, public & government seed agencies invest in activities such as Breeding, Variety testing (company level; grower’s trials; Official; Distinctness, Uniformity and Stability (DUS) Testing; Value for Cultivation, Use, and Sustainability (VCUS) Testing), Variety registration, Plant Variety Protection – PVP, Production of foundation, breeder & commercial seeds, and Promotion and selling of seeds.

#### 4.6 Seed R&D Process and Funnel from Seed selection to Identification & Commercialization

Seed companies have to go through multiple stages before launching a new product. It starts right from pre-breeding stage. The investments and time involved is huge and companies across globe are trying to optimize in terms of timelines as well as costs by using new breeding technologies. Broad stages from research to selling of seeds are: -

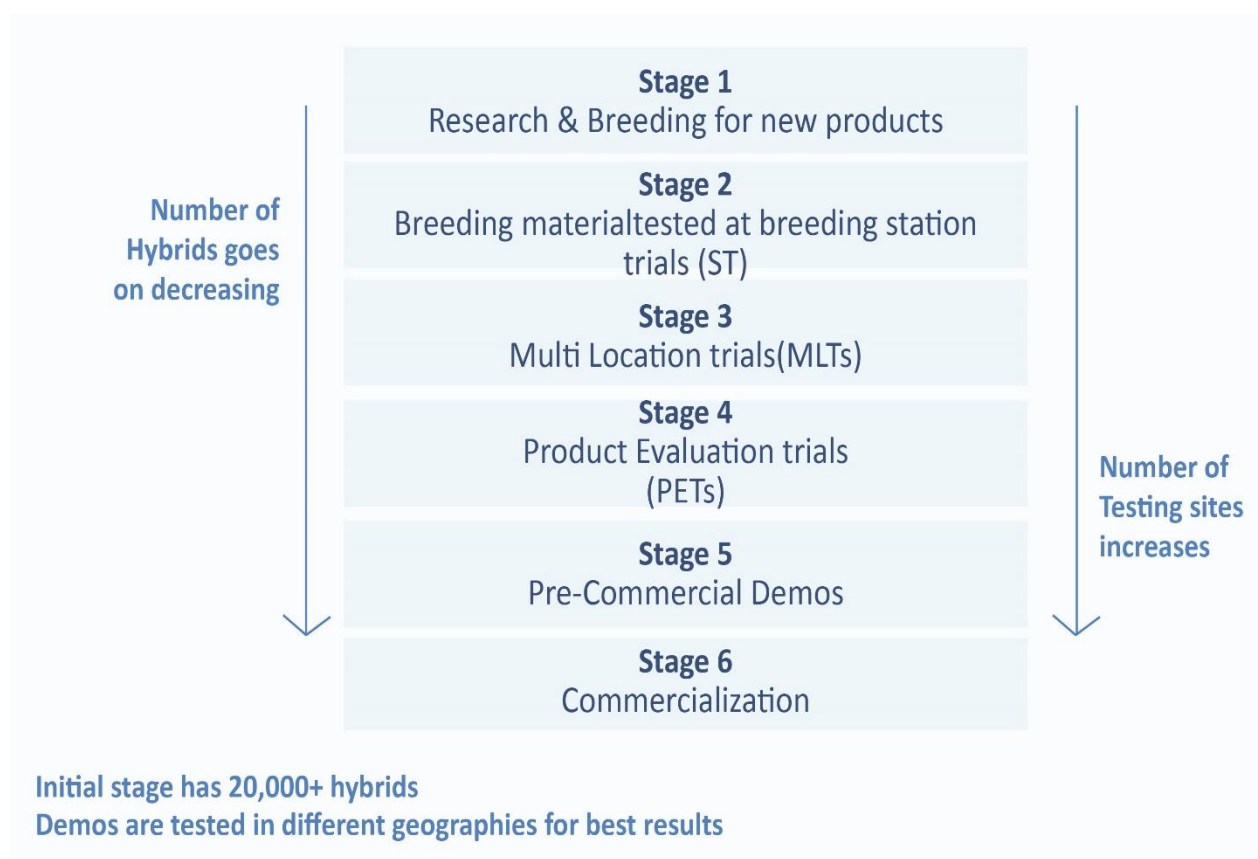
- Pre-breeding
- Breeding
- Variety testing (Company level, Growers trials, Distinctness, Uniformity and Stability-DUS, Value for Cultivation and Use – VCU)
- Variety Registration, Plant Varieties Protection (PVP)
- Production of basic seeds
- Production of Hybrid (commercial seed)
- Promotion and Selling



Source: International Seed Federation

Seed companies have to carry out breeding research at multiple strategic locations. The concerned breeders advance and assess the breeding material generated in these breeding facilities, and promising entries are advanced to the following generation while keeping the intended goal in mind. These breeding stations produce hybrids that must pass rigorous testing phases, such as Multi Location Trials, Product Evaluation Trials, and Pre-Commercial demos. Five primary criteria are used to assess each product: grain yield, milling yield, disease tolerance, grain quality, and lodging tolerance. Prior to the release of the new product(s), farmers and the sales team are involved in the pre-commercial demo stage to register their input, which is mostly regarded as an important component along with the consistency of field data.

### Exhibit 33: Commercialization of Seed



Source: Frost & Sullivan Analysis

SeedWorks (US Agriseeds) has a well-defined process & selection criteria streamlining product pipeline development across various stage gates. Seeds typically go through six to seven stages of testing before they are sent for commercial demonstrations and launched in the market. Each stage of the R&D process, i.e., T1 to T7, involves rigorous testing and evaluation to ensure the development of superior hybrids. Stages T1 and T2 determine the strength of the breeding material where key activities include identification of best breeding lines having preferred traits that should be advanced further for creating new hybrids are identified, where selective preferable genes are introgressed for hybrid creation. After successful evaluation, the T2 lines are encoded and referred to as “parent lines”. The parent lines are crossed with existing hybrids at stages T3 to T6 to create hybrids for trials and further evaluation.

T3, T4 & T5 are the hybrid evaluation stages where each hybrid undergoes systematically managed replicated field trials to benchmark against existing hybrids in advanced stages and peers on defined product characteristics and disease tolerance. Only hybrids performing at par or better than existing hybrids in pipeline are further advanced to next stage. Every hybrid is planted three times per location for three years. Replication reduces error variance caused due to pest, irrigation and disease pressure while multiple locations reduce error variance on account of plot effect and a wider time horizon provides average performance the year effect.

Last stages are T6 & T7 where large-scale testing and evaluation is done through field trials to test adaptability across wider agro-climatic zones at multiple locations. Post successful evaluation, a hybrid is commercialized if it fits business rationale, addresses key gaps / replaces older products in the existing portfolio. However, a successful hybrid post T7 stage may not be commercialized, or commercialization may be delayed if its existing product portfolio already addresses the key gaps or the new product could end up competing with or reducing the sales of existing products.

#### 4.7 Introduction to Conventional seeds

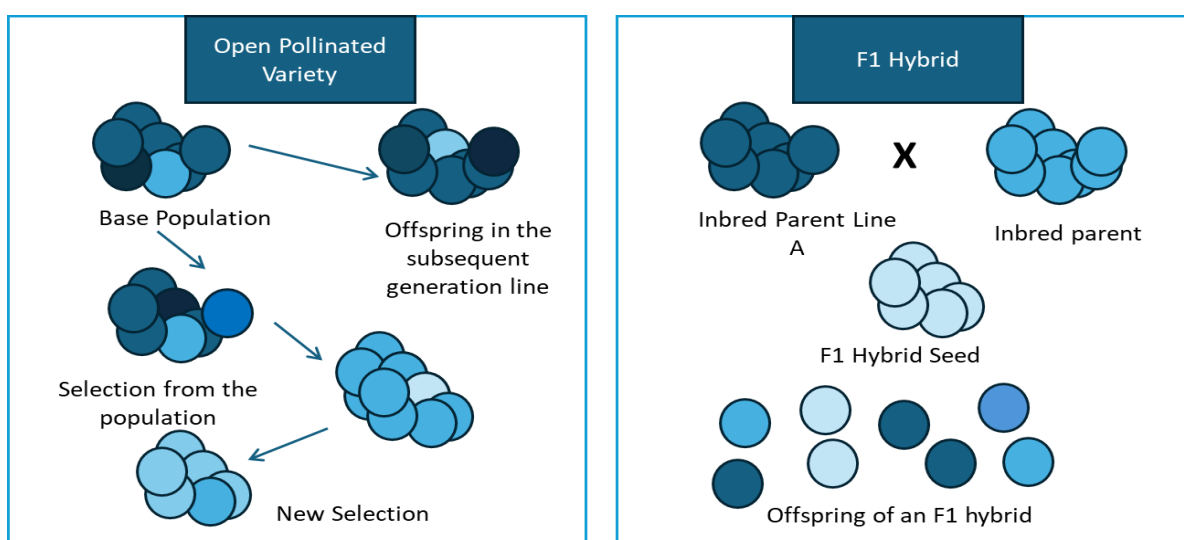
Conventional Seed are the ones which are bred using conventional breeding technologies. Conventional breeding methods include the introduction, selection methods and hybridization. All these methods are categorized further into different types like mass selection, progeny selection, pure-line selection etc.

Conventional Seeds can be classified as **Hybrid seeds & Open Pollinated Seeds.**

**Hybrid:** When two genetically distinct plants of the same species or kind cross, the result is a hybrid seed. The seeds are typically manually cross-pollinated to create a crop with the desired genetic traits of the two plant species, such as bigger boll size in cotton or resistance to disease or lodging in rice plant. For example, pollinating a yellow sweet pepper with a red-hot pepper could produce a hybrid that is red sweet. These seeds can't grow produce that is similar to either of the parent plants which means hybrid seeds are also not capable of passing similar genetic traits from generation to generation. Seed saved from hybrid varieties will not breed true in the next generation and hence cannot be saved after harvest for next season. Cross-pollinated species can be bred via synthetics and family selection, recurrent selection, and mass selection.

Because hybrid seeds are designed to combine the best characteristics of both parent plants, they typically develop more quickly, are more resilient, and yield more.

**Exhibit 34: Open Pollinated Variety Vs Hybrid Process**



Source: Secondary Sources

**Open Pollinated Varieties (OPV):** Open-pollinated varieties are the one which cross-pollinate with other plants of the same variety, to provide seed/offspring that is true to type or similar to the original variety. Their seed won't germinate if they cross with other species varieties. Self-pollinated plants, often known as selfers, typically use their own pollen to reproduce among open-pollinated plants. Typically, crossers reproduce by spreading pollen from one plant of the same species to another. OPV seeds, as opposed to hybrid seeds, will yield plants that primarily share traits with their parent plant or retain the same genetic traits across each generation. OPV seeds are generally produced by open pollination carried out by pollinators like birds, bees and wind. Mass selection, pure line selection, pedigree, bulk population, single seed descent, backcrossing, multiline, and composite are the other breeding techniques for self-pollinated species.

These seeds have been deliberately cultivated over many generations to develop certain specific qualities, such as disease resistance, a distinctive flavour, or a special adaptation to growing conditions. OPV seeds are tried and tested because they have been grown for years.

#### 4.8 Differentiation of Hybrid Seeds vs Open Pollinated Seeds

**Exhibit 35: Open Pollinated Variety seeds Vs Hybrid Seeds**

Parameters	Hybrid Seed	Open Pollinated Variety Seeds (OPVs)
<b>Genetic</b>	Genetic base is from both the parents that are crossed	Broader genetic base and more variability is seen in flowering dates
<b>Yield</b>	High Yielding than OPVs	Lower yield than hybrids
<b>Trait enhancement</b>	Possible with various breeding techniques	Limited scope for trait enhancement
<b>Cost</b>	Higher cost than OPVs	Low or No seed cost
<b>Uniformity</b>	In colour, maturity and other plant characteristics	Limited scope for uniformity in colour & maturity duration

*Source: Frost & Sullivan Analysis*

#### 4.9 Increasing demand for hybrid seeds in India

Indian agro climatic diversity enables multiple types of crops to be grown throughout the country. The traditional way of agriculture is changing throughout the country where farmers are using hybrid seeds, agrochemicals & fertilizers for increased productivity and yield. Hybrid seeds are crucial for increased yield and growth drivers for same are as below:

**Increasing Seed replacement rate (SRR)-** The commercial seed industry is growing as a result of increased Seed Replacement Rates (SRR) for a variety of crops. SRR is the percentage of area sown out of total area of crop planted in the season by using certified/quality seeds other than the farm saved seed. Increasing SRR means that farmers are investing in purchasing and using of seed which are of high quality. In several crops that use Open Pollinated Varieties (OPV) seeds, the SRR has continuously increased throughout time, rising from 20-30% to over 80% in case of vegetables & corn. Whenever hybrid seeds are used for crops, the SRR is 100% since farmers are unable to use the seed again for the next season because it leads to dilution in the genetic purity. According to Ministry of Agriculture & Farmers Welfare, the prescribed

norms of Seed Replacement Rate are 33% for self-pollinated crops, 50% for cross-pollinated crops, and 100% for hybrids. Government intervention to boost SRR in the field crop segment has risen in couple of years

**Higher Hybridization levels-** The hybrid seed sector in India is expanding rapidly. There is huge potential for hybrid Rice market is to expand in the future. According to reports, farmers in states like Bihar, Punjab, Haryana, and Uttar Pradesh are increasingly using hybrid Rice. In situations where there is water stress, hybrid Rice is advantageous as hybrid seeds are tolerant towards water-deficit conditions. Research on the adoption of broad hybridization, or the exchange or alteration of genes as a result of crossing across species from different gene pools, is becoming more popular as a means of increasing crop productivity. Elevated hybridization platforms are a method for better hybridization in crops like sugarcane which significantly reduce labor costs. Government's focus on increasing yield of oilseed and millets will further boost the hybridization for these crops. With almost 90% hybridization penetration, the majority of the vegetable seed crop in India is at saturation.

**Growing Vegetables Seed Market-** India's vegetable seed industry produces a variety of vegetables that are consumed extensively in the nation. Many international nations are seeing a sharp increase in demand for Indian vegetable seeds. There is increased demand for vegetable hybrids across country due to profitability it offers to farmers.

Cucurbits and Solanacius vegetable crops are the most in demand. Along with segments like tomatoes, watermelon, okra, and bitter gourds, the exotic vegetable market is expanding. Companies are entering the vegetable seed market as these products are viewed as high margin products though low in volume. For industry participants, the market for vegetable seeds offers potential as well as challenges due to its extremely fragmented nature.

The industry offers opportunities for companies to create strong positions because there are more than 40 different vegetable crops that cover different categories, species, and families.

#### **4.10 Role of R&D in Seeds along with Role of Private companies in driving innovation in seed industry**

R&D in seed industry is crucial as it enhances the genetic potential of seeds thereby ultimately determining their yield & other essential traits. Seed industry is also one of the most R&D intensive sectors. R&D in seed industry also helps in meeting the challenge faced by farmers by providing them with seed innovations which are sustainable & safe to use. The process of research and development (R&D) has changed over the years, involving the adoption of new technologies as well as a cultural shift toward innovation and data-driven decision-making in all units that contribute to the process (Biotech, Breeding, Product Development (PD), Commercialization). Marker-assisted selection (the process of using morphological, biochemical, or DNA markers as indirect selection criteria for selecting agriculturally important traits in crop breeding), Quantitative trait locus (QTL) analysis (Statistical method that links two types of information—phenotypic data- trait measurements and genotypic data in an attempt to explain the genetic basis of variation in complex trait), and genetic transformation are some of the key techniques that have been used as tools in seed R&D sector.

Presently ~10-15% of nearly 550 companies in the private sector (including indigenous as well as companies of foreign origin or MNCs), are contributing in research and technology

development (R&D), as well as in quality seed production and marketing, out of which nearly <10% companies invest 5-10% of their annual turnover in R&D (A. Rana, National Seed Congress, 2023). The market viability of a hybrid mostly rests on its enhanced and distinctive characteristics, which are attained via consistent R&D efforts.

Domestic companies such as SeedWorks (US Agriseeds), Kaveri Seeds, Nuziveedu, JK Agrigenetics spend ~6-9% of their revenue on R&D. SeedWorks (US Agriseeds) R&D expense was 10.7% of FY24 revenues (fully expensed pre-EBITDA). Company has 20 breeding stations and 95 multi-location trials pan-India.

SeedWorks' (US Agriseeds) emphasis on product development to drive innovation in seeds, demonstrated by being amongst the industry's leading R&D investments, have over the years, led to the commercialization of product offerings with performance traits such as improved yield and disease tolerance.

**Exhibit 36: Summary of prominent breeding techniques used in Seed Industry**

	Conventional breeding	Mutation Breeding	Genetic Engineering	Genome Editing
<b>Description</b>	Donor variety with high grain quality, low yield, and low disease resistance is bred with low grain quality, high yield and high disease resistance properties.	Elite variety with low grain quality is subjected to chemicals or radiation resulting in mutant variants	Desired Q gene from donor variety with high grain quality, low yield, and low disease resistance is genetically cloned with recipient variety with low grain quality, high yield, and high disease resistance.	Targeted variety with low grain quality, yield, and disease resistance is subjected to mutations through genome editing systems such as CRISPR/CAS9
<b>Output</b>	Rigorous selection and backcross resulting in seed with high quality, yield, and disease resistance	Rigorous selection and backcross resulting in seed with high quality, yield, and disease resistance	Results in seed with high quality, yield, and disease resistance	Results in seed with high quality, yield, and disease resistance
<b>Drawbacks</b>	Many other undesired genes also get transferred; cost of registration is high	Many other genes also mutate, cost of registration is high	Only desired isolated gene is transferred	Undesired quality related gene mutated
<b>Timeline</b>	Time consuming	Time consuming	Lesser time required	Less time required for variety development

	Conventional breeding	Mutation Breeding	Genetic Engineering	Genome Editing
<b>Efficiency</b>	Less efficient	Efficient	Efficient	Efficient
<b>Labour Requirement</b>	Laborious	Laborious	Less laborious	Less laborious
<b>Legislature</b>	No Legislature	No legislature	Newly developed varieties come under GMO legislation	Newly developed varieties come under GMO legislation

Source: Frost & Sullivan and secondary sources

Seed companies focus on developing various seed varieties and hybrids in order to help meet the world's increasing demand for food and nutrition as well as to increase the productivity of farmers. The objective is to create new, enhanced hybrids and varieties that have higher yields, the capacity to adapt to changing climatic conditions, and consumer-appealing features.

Modern plant breeding technologies are used by seed companies to develop improved crop seeds. Companies have created some exceptional products throughout the years that have been well received by farmers and customers and have revolutionized the seed industry in many ways. In addition to using modern breeding technologies and having a rapid varietal turnover suitable for target ecologies, private sector R&D has access to abundant worldwide germplasm resources. Companies also invest on infrastructure for processing, storage, seed testing, and quality control.

Research in the private sector focuses on disease & pest resistance, nitrogen use efficiency, herbicide tolerance and on creating hybrids that can withstand harsh weather conditions. Private sector has enabled accessibility of quality seeds across the country along with providing the assurance in terms of quality of the seeds. Companies such as SeedWorks (US Agriseeds) focuses on Conventional breeding, Resistance breeding, Genomics and Phenomics across all its portfolio crops. They have 20 breeding stations and 95 multi-location trials pan-India. In cotton, SeedWorks (US Agriseeds) is doing R&D on resistance to Cotton leaf curl virus (CLCuV) & Sucking pest, high density and synchronous flowering, breeding for staple length, fiber strength, fineness of fiber and increased lint to seed ratio.

#### 4.11 Need for innovation in seeds in context of climate change

Climate change is the biggest issue facing the seed industry. Crop breeding innovations will influence how we address the world's escalating hunger crisis. Resilient crops are of crucial importance as extreme weather events are becoming more frequent due to which new plant diseases are emerging. Heatwaves, Droughts, Floods have become more common.

Thus, the changing climatic scenario is adversely affecting the farmers across the country. In order to tackle and address these escalating issues of climate change, climate-resilient seeds are the need of the hour. Climate resilient seeds are tolerant to drought/ water stress, heat and pests. Sustained investment in seed innovation through public & private sector is crucial. Water-efficient practices like direct-seeded rice needing the herbicide tolerant varieties will offer new opportunities.



Rice varieties such as US 312 of SeedWorks (US Agriseeds), Arize of Bayer have tolerance against drought; Jaladhi of Mahyco has submergence tolerance in case of flood and many players have such different products in wake of climate change.

#### **4.12 Government Regulations and Support**

The National Seed Policy, which attempts to guarantee that farmers have access to high-quality seeds, is one of the policies and programs the Indian government has been implementing to assist the seed sector. Since 2006, 100% FDI in the seed industry was allowed under the automatic route. By eliminating the requirement for prior government clearance, this modification streamlined the investment process and attracted more foreign investors to the market.

Government of India become a member of OECD Seed Scheme from 23rd October 2008 and participates in the five varietal certification schemes viz grass and legume seeds, Crucifer seed and other oil or fiber species seed, Cereal seeds, corn and sorghum seed and vegetable seeds. Seeds OECD Seed Certification facilitates international seed trade. Currently, 61 seed varieties from the public sector, covering 19 crops, are listed in the 2011 OECD. Seed Division has also forwarded list of 35 varieties in 6 crops belonging to private sector for inclusion in the OECD list of varieties. It is hoped that by 2013 more than 150 varieties from India will be listed in OECD list of varieties and to produce the seeds under OECD Seed Scheme for export.

In 2001, law for Protection of Plant Varieties and Farmers Rights'. The law provides the establishment of an efficient system to safeguard plant varieties, farmers' and plant breeders' rights, and to promote the creation of new plant varieties. The Protection of Plant Varieties and Farmers' Rights (PPV & FR) Authority, an independent statutory body corporate created in November 2005 under the PPV & FR Act, 2001, is responsible for implementing the program. The primary goal of the scheme is to provide funding to authorities for its operational expenses and the execution of the Act's provisions, as well as financial support to DUS Centers for the development of guidelines for the Distinctness, Uniformity, and Stability (DUS) test of designated crops.

#### **4.13 Changing Seed Industry Dynamics – New trends**

- Fintech applications are used for Seed production growers farmers/distributors/retailers/end customers- farmers
- Precision agriculture linked seed production for high value seeds
- Use of Artificial intelligence (AI), machine learning (ML), Internet of Things (IoT), Robotics, Drones in entire value chain of seed development & production
- Leveraging technology for policy implementation including Harmonization of Regulatory framework along with traceability
- Promotion of seed treatment & biologicals including microbes in line with microbiome approach
- Regenerative & Sustainable Agriculture Technologies including Direct Seeded Rice (DSR), High Density Planting System (HDPS) and so on.
- Increasing public & private partnerships along with strategic partnerships in private sector to leverage geographical reach as well as enhance the R&D capabilities.
- Focus on speed breeding for development of climate resilient varieties.

## Advantages & Disadvantages of OPV seeds, Hybrid Seeds

### A) OPV Seeds

Advantages	Disadvantages
<b>Low or no seed cost. The producer can keep part of the crop for seed. Even if purchase, the cost of seed is a lot less than hybrid seed.</b>	Yield potential is less than hybrid & GM. Lower profit margins as compared to Hybrid & GM seeds
<b>Seed can be recycled. That is grain from this season can be planted next season.</b>	Uniformity in colour, maturity and other plant characteristics is not observed. Non uniformity could impact the price of the grain, i.e. quality.
<b>OPV has longer flowering period enabling to pollinate during short periods of high stress (for example moisture stress, temperature, etc.) This variation can at times, offer more stable yields.</b>	Poor seed quality can result in poor germination and weak plants that cannot compete well with weeds.
<b>Farmers do not have to worry about quality of seeds as the seeds are saved from farms mostly.</b>	Lack of uniformity may lead to difficulties in carrying out certain operations, such as spraying and harvesting,
	No resistance to insects or Herbicides

### B) Hybrid Seeds

Advantages	Disadvantages
<b>Generally high yielding than open pollinated varieties</b>	Seed is expensive. New seed needs to be purchased every planting season
<b>Have high growth vigour</b>	Yield have to be higher to justify extra cost of seeds compared to OPV seed/ farm saved seed
<b>Exhibit uniform characteristics. The uniformity of the grain harvested can also have marketing advantages when sold to buyers with quality standards</b>	Grain produced from hybrid seed may not be used as seed for the following planting seasons.
<b>A particular hybrid can be selected for a specific pest and disease resistance or drought tolerance</b>	Hybrids are more susceptible to stress conditions (for example tasseling).
<b>Time taken for commercialization is less than GM seeds</b>	Time taken for commercialization is more than OPV seeds

### C) Genetically Modified Seeds

Advantages	Disadvantages
Desirable traits can be added in seeds	Under scrutiny by environmental activists and organizations
Seeds can be made more resilient & resistant to biotic & abiotic stress	Significant investment required to develop & release GM seeds resulting in high cost of seeds
Seeds generally yield more than hybrids	Time for commercialization is more
Lower Pesticide application with GM seeds	Long term effect on safety and biodiversity are not known

#### 4.14 ESG Initiatives Seed Industry

A framework known as ESG helps stakeholders understand how a company is handling opportunities and risks associated with environmental, social, and governance standards (also known as ESG factors).

As part of its larger ESG goals, Kaveri Seeds is actively lowering its carbon footprint and making a beneficial contribution to the environment by implementing eco-friendly projects, resource optimization, and sustainable practices.

SeedWorks (US Agriseeds) is the amongst the few domestic seed company in the private sector in India to undertake a comprehensive green-house gas (“GHG”) emissions baselining and inventory development for scope 1, 2 and 3 GHG emissions and develop emission targets and mitigation plans aligned with Science Based Targets initiative (SBTi).

At Tata Rallis, the Company identifies and prioritises ESG issues material to its business and ecosystem through a structured stakeholder engagement comprising of Community, Employees, Investors, Regulators, Customers, Value chain partners and other stakeholders. Company aims at 30% reduction in absolute CO2 footprint by 2030, sourcing 33% Energy from Renewable sources by FY 28 and 100% Thermal Energy from renewable sources by FY 27.

#### 4.15 Key Threats and Risks in Seed Industry

Risks	Areas of Concerns	Description	Mitigation Measures
<b>Market Risk</b>	Changes in market dynamics/ market and Industry	<ul style="list-style-type: none"> <li>• Changes to the marketing tactics of rivals</li> <li>• Increased pressure from competitors</li> <li>• Emergence of new technologies and marketing strategies, including digitalization, biotechnology, genetically modified/hybrid seeds</li> </ul>	<ul style="list-style-type: none"> <li>• Developing Large and diverse customer base</li> <li>• Constant communication with farmers to understand their changing demands</li> <li>• Consistent gathering of relevant market data</li> <li>• Continuous expenditure on innovative technology &amp; working with partners in cutting-edge technology</li> </ul>
<b>Environmental Risks</b>	Climatic conditions/ Climate Change	<ul style="list-style-type: none"> <li>• Natural disasters like floods, droughts, or unexpected rainfall can affect seed demand.</li> <li>• Significant temperature variations can lead to severe precipitation and other harsh circumstances.</li> </ul>	<ul style="list-style-type: none"> <li>• Develop seeds, that are better suited to combat the environmental challenges.</li> <li>• Flexible and efficient supply chain capabilities will allow for prompt modifications to product supplies in response to current weather conditions.</li> </ul>
<b>Regulatory Risk</b>	Regulatory Challenges	<ul style="list-style-type: none"> <li>• GM crops regulations</li> <li>• Intellectual property rights</li> <li>• Trade restrictions</li> <li>• Front-end (such as product sales bans or decreased usage) and back-end (such as production bans or restrictions)</li> </ul>	<ul style="list-style-type: none"> <li>• Stay informed about planned changes to the regulations</li> <li>• Improve and modify the product portfolio in accordance with anticipated changes</li> <li>• Interacts with industry associations and lawmakers, guaranteeing adherence with a specialized legal team to successfully adjust to the legislative changes.</li> </ul>
<b>Human resource risk</b>	Talent retention	<ul style="list-style-type: none"> <li>• Retaining high-performing employees who can successfully carry out business plans</li> </ul>	<ul style="list-style-type: none"> <li>• Placing competency into practice and preparation for succession in key roles.</li> <li>• Maintaining constant communication with the employees.</li> <li>• Assessing and improving reward systems on a regular basis as needed.</li> <li>• Highlighting the job's objective and company value offer.</li> </ul>
<b>Innovation risk</b>	<b>Research and Development</b>	<ul style="list-style-type: none"> <li>• Failure to launch creative Products might reduce market competitiveness</li> </ul>	<ul style="list-style-type: none"> <li>• In order to provide consistent innovative products, committed R&amp;D</li> </ul>

Risks	Areas of Concerns	Description	Mitigation Measures
		<ul style="list-style-type: none"> <li>• Trailing behind in the use of new technology.</li> <li>• Failure to spot opportunities brought on by new trends.</li> <li>• Introducing products that don't generate enough revenue.</li> </ul>	<p>teams to drive the introduction of unique traits. A yearly "Innovation Rate" to be maintained by a specific strategy to keep up efforts to introduce innovative products.</p> <ul style="list-style-type: none"> <li>• Actively looking at in-licensing possibilities for important crops and broadening focus to include different traits.</li> </ul>

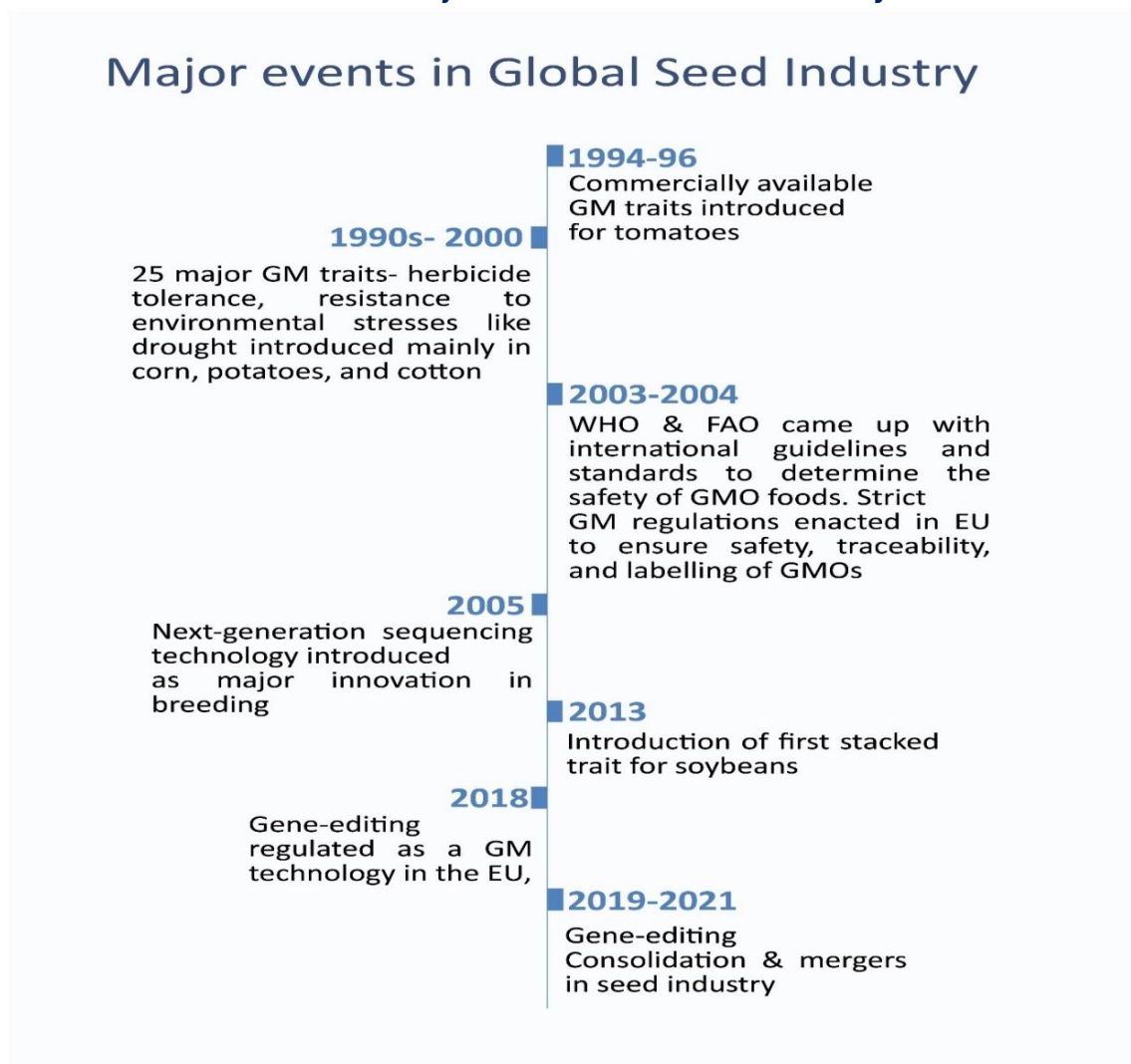
## 5. Global Seeds Market Overview

### 5.1 Overview of the Global Seeds Industry

Over the past couple of decades, the global seed industry has seen tremendous change, with farmers switching from using farm-saved seeds (seeds from the previous harvest are saved to be sown in for next season) to high-value ones, increasing crop production and overall yield. Rapid advancements in trait development, trait convergence, smarter product distribution to growers, and the use of information analytics for strategic business growth are all contributing to the considerable transformation of the global seed sector. Through genetic transformation, marker-assisted breeding, and nanotechnology, advances in seed technology have accelerated. Seed sector witnessed an exponential growth curve due to introduction of genetically modified seeds in Cotton, Corn, Soybean and Canola crops.

Companies in the seed industry are gearing to adapt shifting market dynamics, technological advancements, regulatory changes, and the input industry's strategic convergence in order to provide farmers with comprehensive solutions.

**Exhibit 37: Major events in Global Seed Industry**



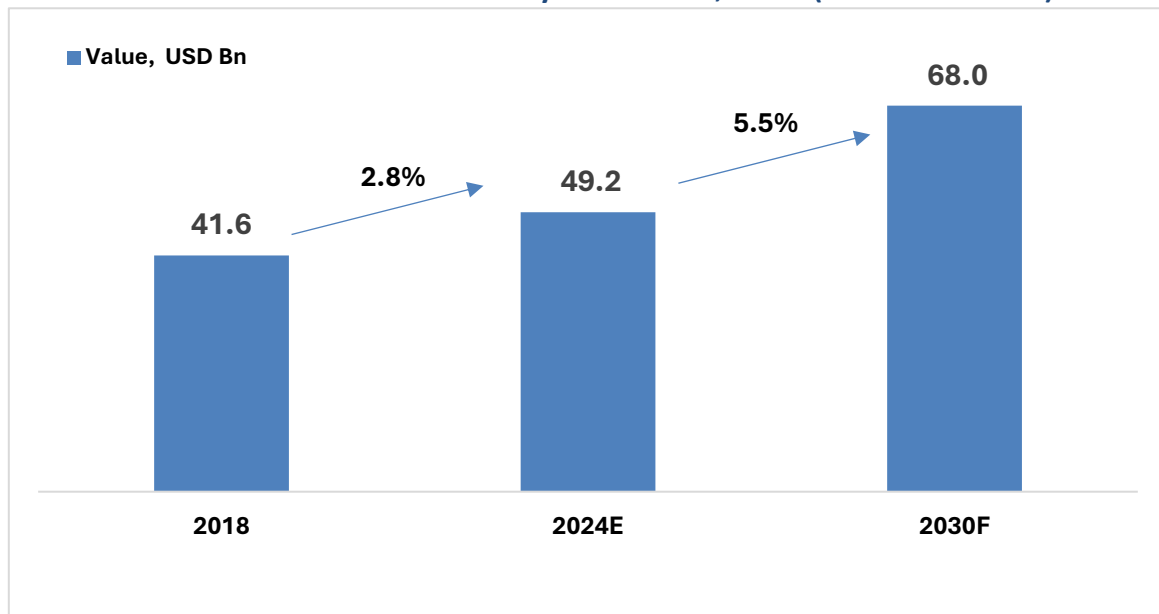
Source: F&S Analysis

## 5.2 Global Seed Industry Market Size

The global seed industry has grown at CAGR of 2.8% from 2018 & is estimated to be valued at USD 49.2 Billion in 2024. The growth in the industry is attributed to increasing demand of food with growing population, trend of using branded seeds over saved seeds, companies expanding their global footprints and innovations in the seed technologies.

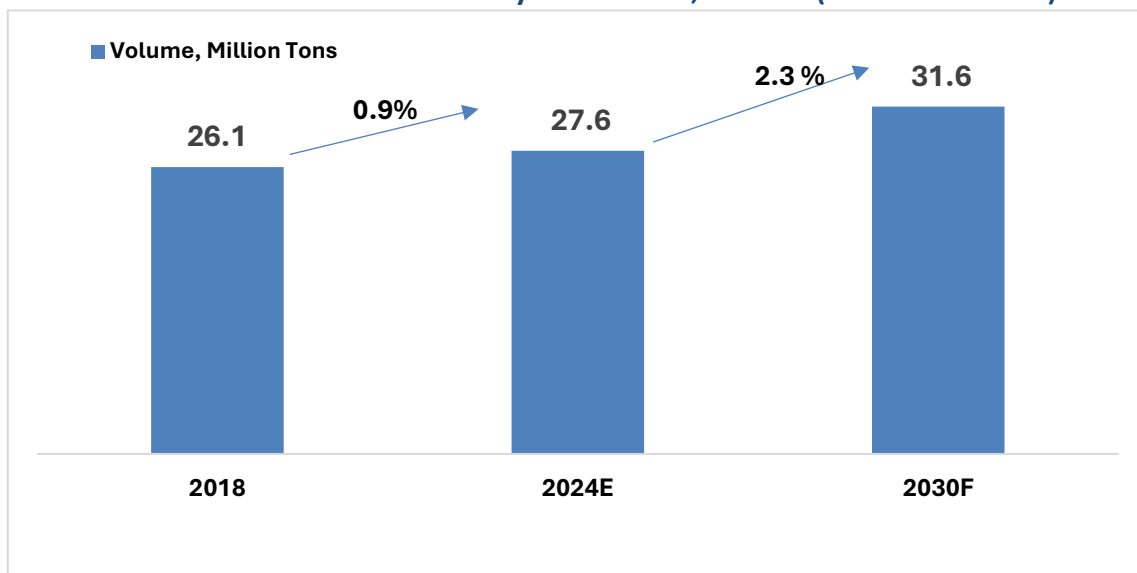
Further the industry is forecasted to reach USD 68.0 Billion by 2030 with a CAGR 5.5%.

**Exhibit 38: Global Seed Industry Market Size, Value (2018-2024- 2030)**



Source: Frost & Sullivan Analysis

**Exhibit 39: Global Seed Industry Market Size, Volume (2018-2024- 2030)**

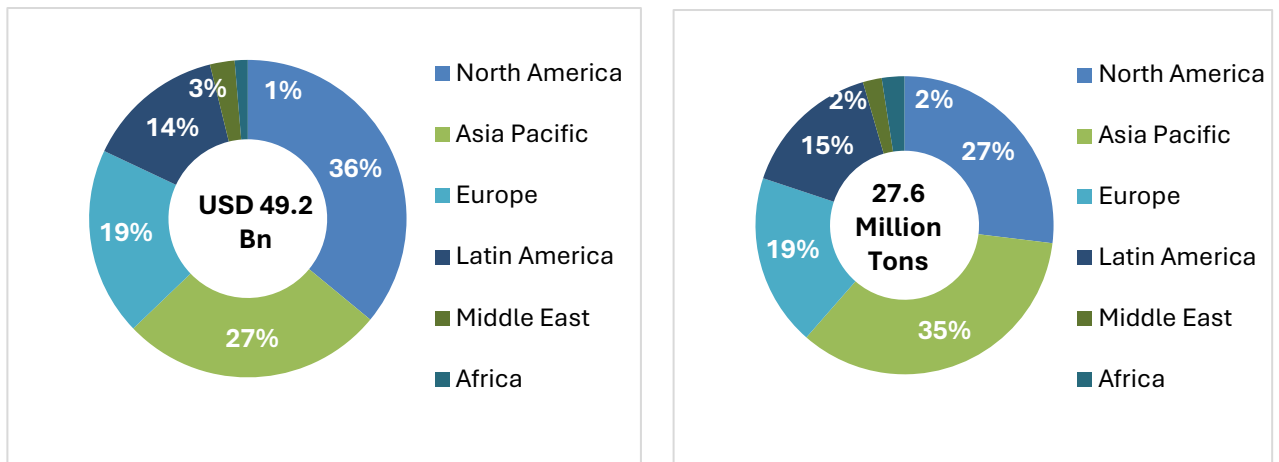


Source: Frost & Sullivan Analysis

In terms of volume, the market is estimated to be 27.6 million tons in 2024 and is anticipated to grow to 31.6 million tons by 2030 with CAGR 2.3%. Players like Bayer, Syngenta, BASF, Corteva are the key players in global seed industry.

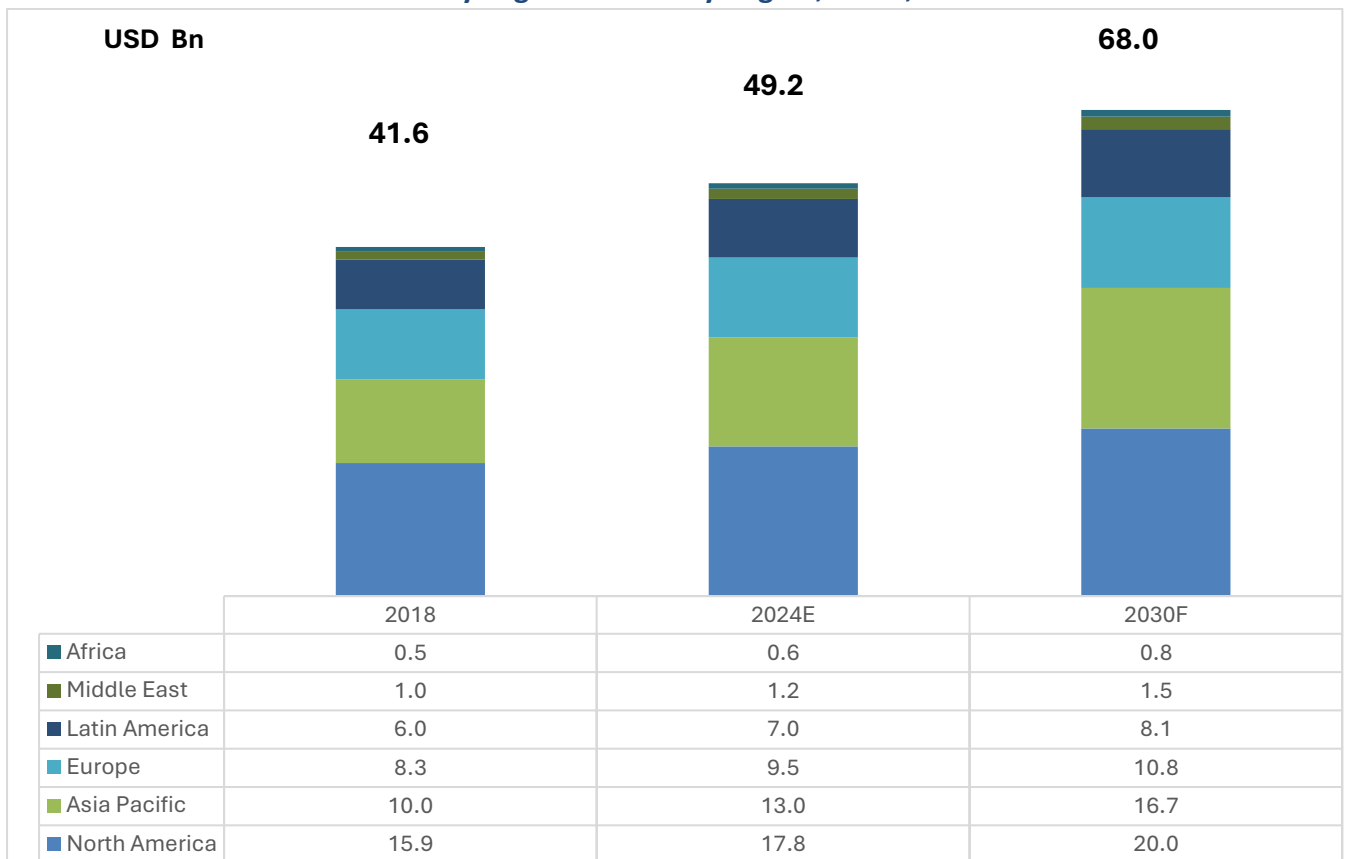
### 5.3 Segmentation of Seed Industry based on Region

**Exhibit 40: Global Seed Industry Segmentation- By Region, 2024E**



Source: Frost & Sullivan Analysis

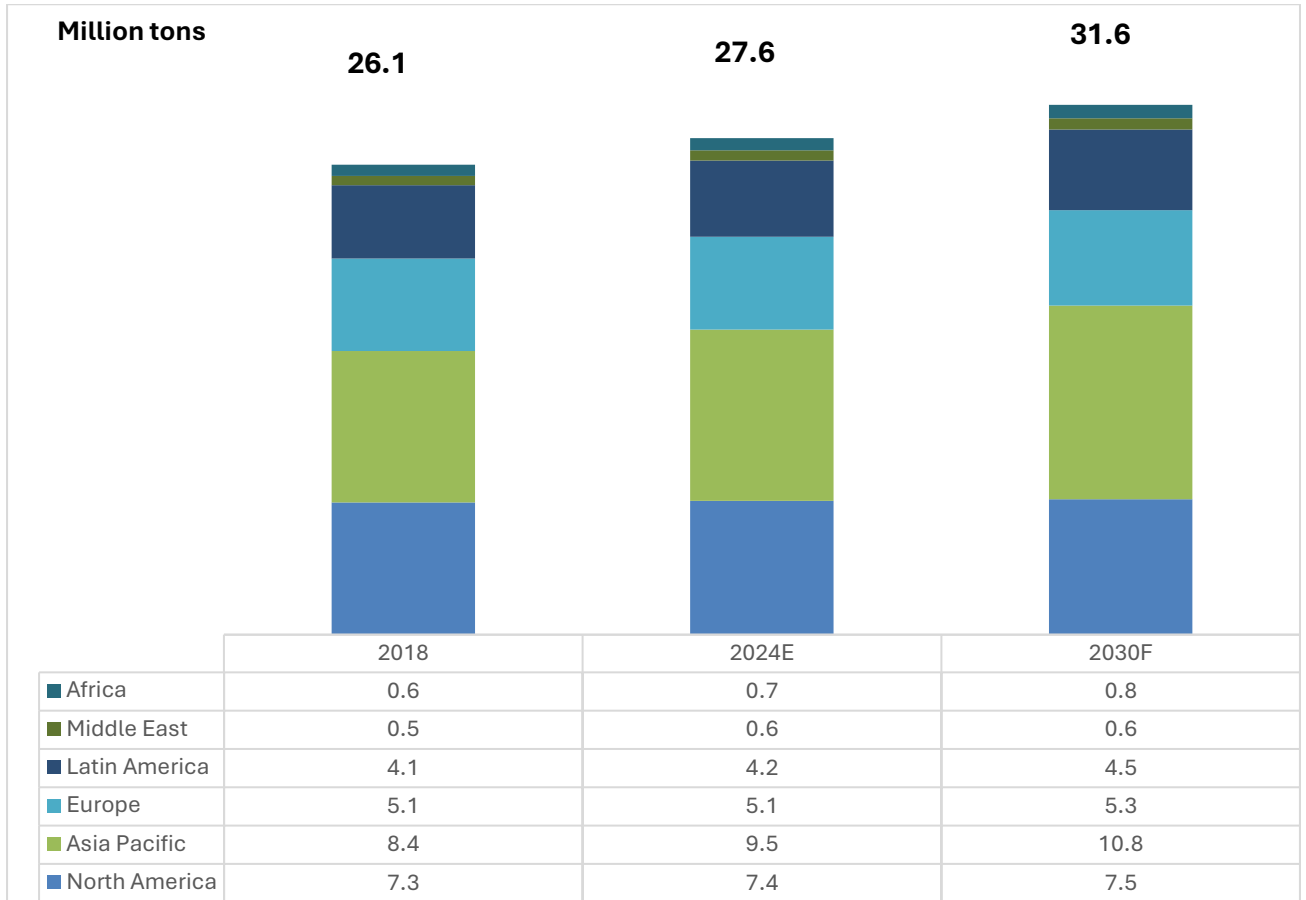
**Exhibit 41: Global Seed Industry Segmentation- By Region, Value, 2018-2024E- 2030F**



Source: Frost & Sullivan Analysis



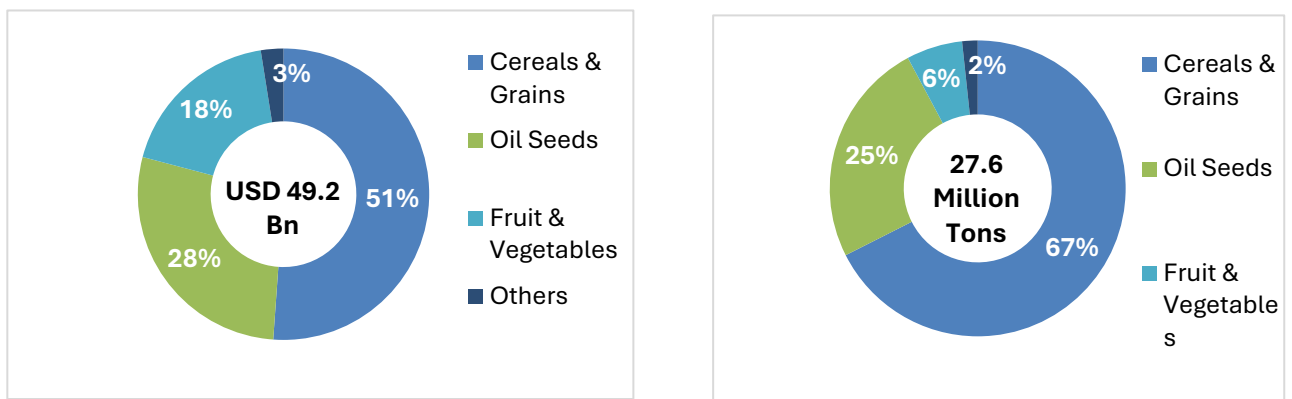
**Exhibit 42: Global Seed Industry Segmentation- By Region, Volume, 2018-2024E- 2030F**



Source: Frost & Sullivan Analysis

### 5.4 Segmentation of Seed Industry based on Crops

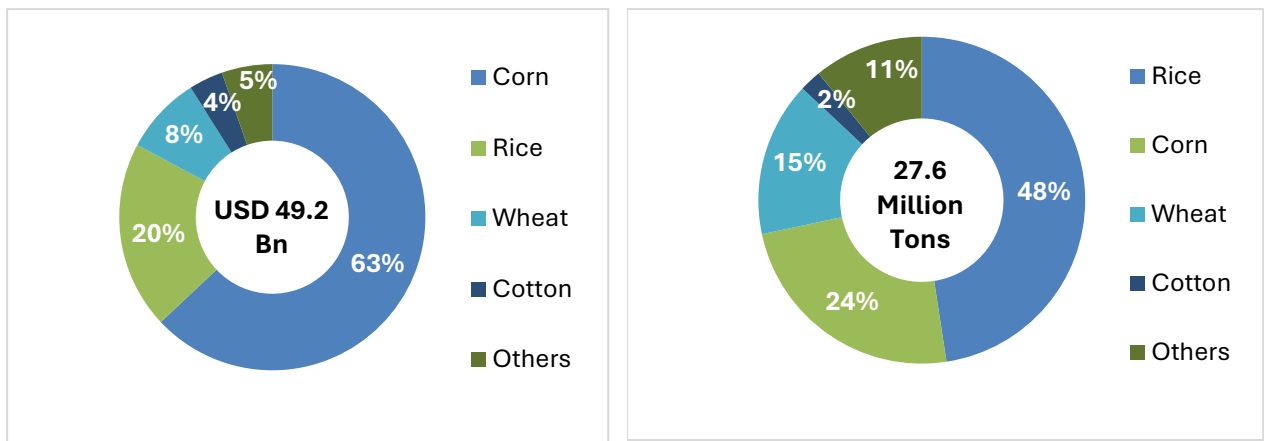
**Exhibit 43: Global Seed Industry Segmentation- By Crops group, 2024E**



Note: - Cereals & Grains include Rice, Wheat, Maize, Millets, Oats, barley, etc.; Oil seeds include- Soybean, Rapeseed/mustard, Canola, Cotton, sunflower, etc.

Source: Frost & Sullivan Analysis

**Exhibit 44: Global Seed Industry Segmentation- By Crops, 2024E**



Source: Frost & Sullivan Analysis

### 5.5 Key trends in Global Seed Industry

**Consolidation in Seed Industry & Strategic Partnerships-** From 2015 to 2021, the seed industry saw an era of consolidation. In 2016, Bayer proposed to acquire Monsanto and acquisition was completed by 2018. Corteva combined the seed businesses of Dow Chemical and DuPont, which merged in 2017 to form DowDuPont in 2018-19. Sinochem – ChemChina merger to form new Syngenta Group bringing together Syngenta AG, ADAMA and agricultural activities of Sinochem- Chem China. Thus, Seed industry went through a consolidation during this phase.

SeedWorks (US Agriseeds) has a strong product development track-record evidenced by multiple out-licensing partnerships for field crops with global and Indian companies; several in-licensing partnerships with global and Indian vegetable R&D companies. To improve rice yield, potential cost optimization and sustainable growth via herbicide resistance technology, SeedWorks (US Agriseeds) has partnered with BASF. SeedWorks (US Agriseeds) has established a partnership to gain germplasm access for pearl millet and pigeon pea and potential screening and trait identification with ICRISAT.

#### **Investments in Novel Seed technologies-**

At present, companies in seed industry are focused on enhancing the innovation pipeline across Seeds & Traits along with strengthening digital ecosystem and expanding the global footprint.

- Companies are looking for multitude of partnerships, new, sustainable business models with intelligent and integrated approaches.
- Companies are focused on using genomic, phenotypic and environmental data along with advanced breeding methods and AI to develop novel seed products. Breeding innovations of companies are aimed at improving crop yields, boosting resiliency against pests, disease, herbicides and a changing climate-while also emphasizing drought and salinity tolerance and improving quality.

- Companies are also routinely applying for patents in seed segments to safeguard the developed technologies.

### **Focus on Climate Smart Agriculture & Climate Smart Crops**

By creating seeds that make crops climate smart, salinity - tolerant and drought resilient, companies are weatherproofing farm yields and the happiness of farmers especially in tropical and subtropical regions. The adoption of climate-smart crops is no longer a option but a necessity for Climate-Smart Agriculture. Climate-Smart Crops (CSCs) are critical in ensuring food security, nutrition, and resource sustainability.

**Climate-smart** varieties are bred through the genetic selection and testing of crop lines that survive and yield grain under stress of drought, floods and heat stress. Crops like pearl millet, sorghum are best known for their resilience & yield in adverse climatic conditions. SeedWorks (US Agriseeds) has a specialized R&D program for pearl millet.

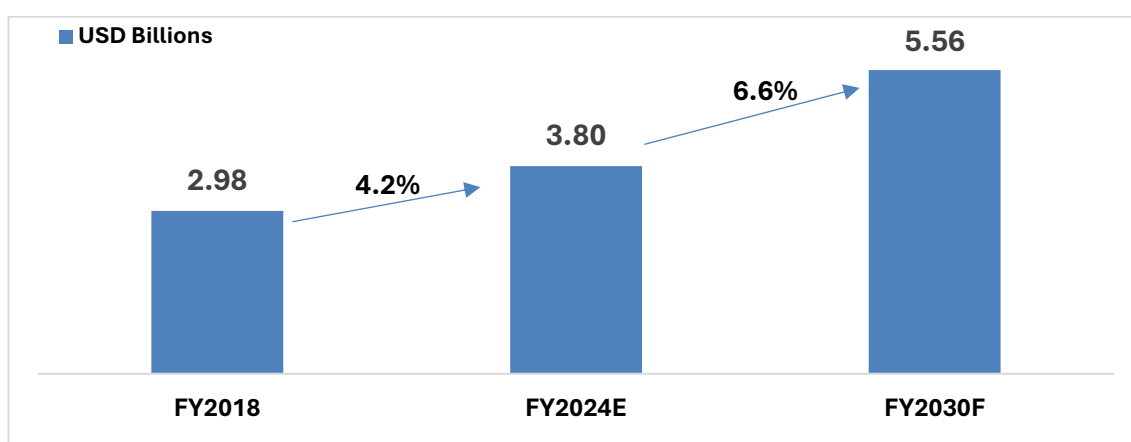
## 6. India Seeds Market Overview

### 6.1 Indian Seed Industry Market Size & Segmentation

India has recently surpassed China as the world's most populated nation. Over the past few decades, it has achieved remarkable accomplishment in becoming food self-sufficient, increasing its production to match the rising demand for food, and importing very little. The Green Revolution played an important part in this success, but it has also been underpinned by the development of the seed industry.

Along with being successful in food self-sufficiency, Indian has been maintaining seed self-sufficiency too, with a relatively low level of seed imports in comparison with the size of the overall market.

**Exhibit 45: Indian Seed Market Size, USD billions**



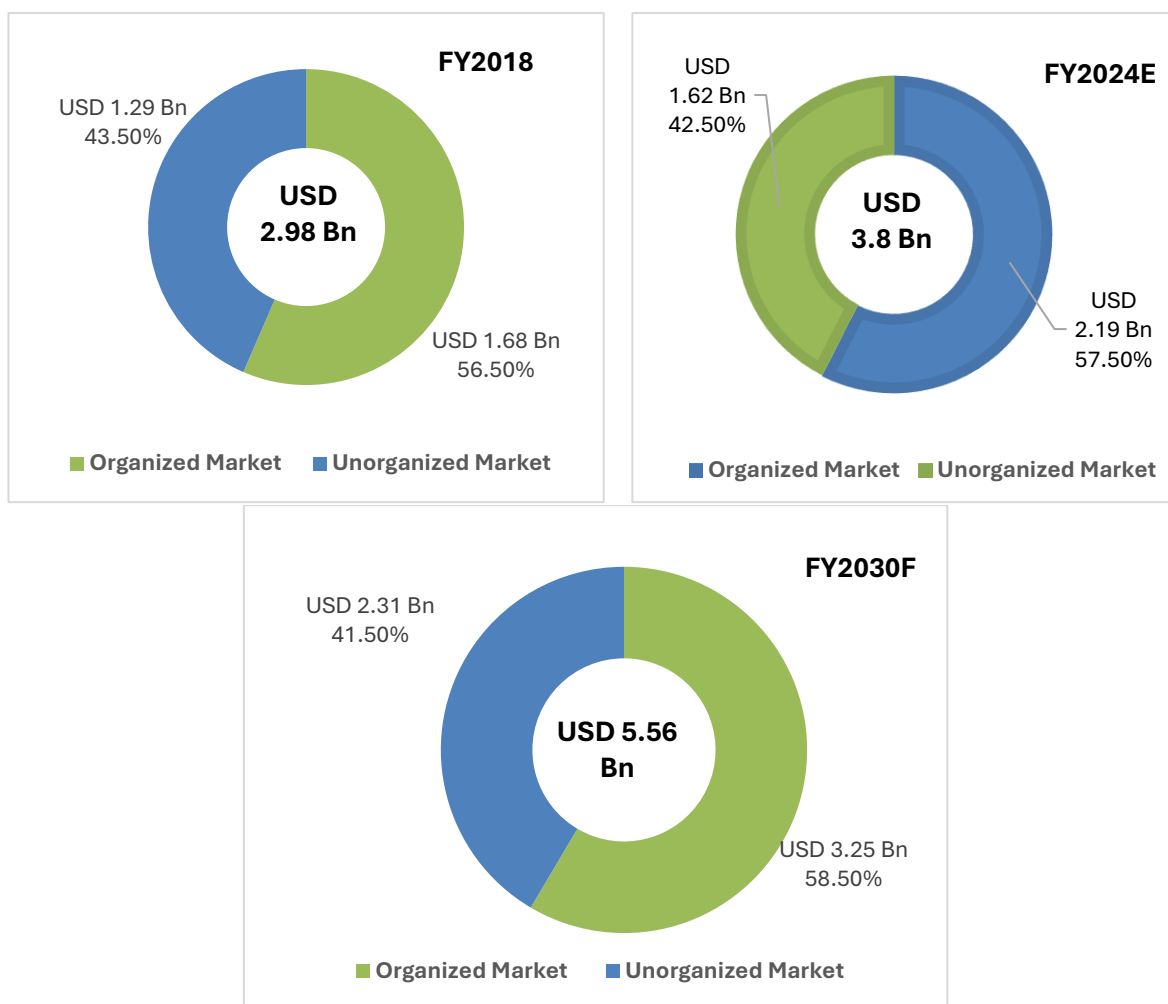
Source: Frost & Sullivan

The Indian seed market is estimated at USD 3.8 Billion in 2024, growing at a CAGR of 6.6% during the period of 2024-2030. It includes hybrid, OPV and GMO seeds. It is expected to grow to a value of USD 5.56 Billion by 2030F. Growth of Indian seed industry is outpacing the growth of global seed industry due to growing demand for food, animal feed and biofuels along with conducive environmental conditions and government policies. India is self-sufficient in fruits, vegetables and field crop seeds and is seeing a potential growth in Rice and corn.

#### **Competition**

Indian seed industry comprises of multinational companies along with domestic companies. Companies such as Bayer, Corteva, Syngenta, East West seeds have presence across globe and are present in crops such as rice, corn, millets, mustard and vegetables. Domestic companies such as SeedWorks (US Agriseeds), Mahyco, Kaveri seeds, Rasi seeds, Nuziveedu seeds, Ajeet seeds, Namdhari seeds, Ankur Seeds, VNR seeds, Tata Rallis, Nath Bio gene are well established and have presence across India. These Companies have products in Cotton, Corn, Wheat, Mustard, Millets, Rice and Vegetables.

**Exhibit 46: India Seed market segmentation in 2018, 2024E & 2030F (USD Billion)**



Source: Frost & Sullivan Analysis

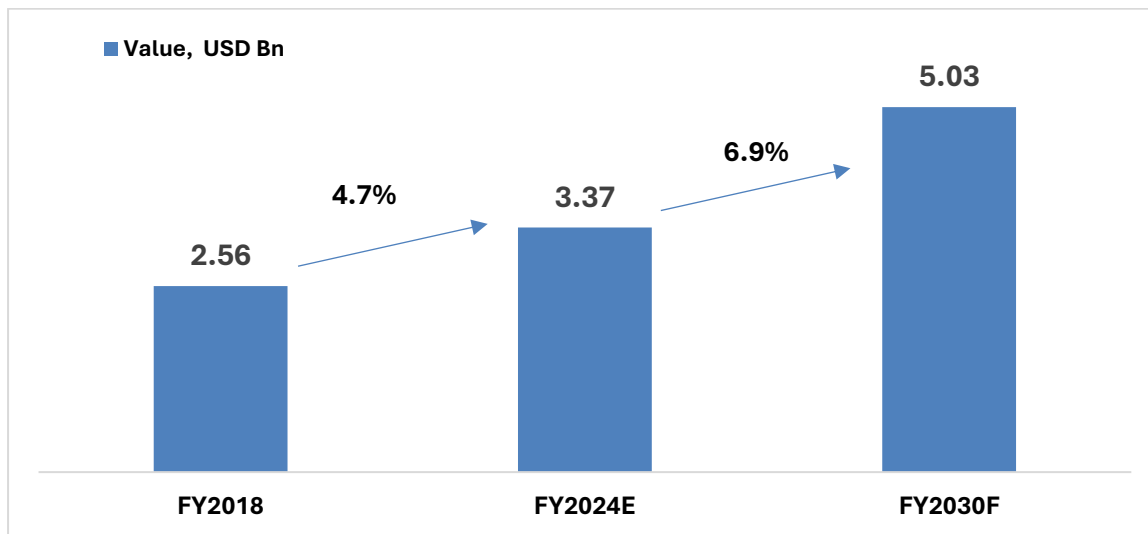
The organized seed market in India in 2024 contributes to ~58% of the entire market with known seed production companies and public entities. Organized sector comprises multinational companies such as Bayer, BASF, Corteva, Advanta seeds, along with Indian companies such as SeedWorks (US Agriseeds), Mahyco, Ankur seeds, Rasi seeds, VNR seeds, Nuziveedu Seeds, Ajeet seeds, Nath Bio gene, Tata Rallis, Kaveri seeds and many others. Nearly all have a very wide product range, selling both vegetable seeds and several field crops. A few companies are engaged in exports of seeds to other countries such as SeedWorks (US Agriseeds) International revenue contributed to about 25.6% (INR 1,340 Mn) in FY24.

The unorganized sector is highly fragmented with multiple local, regional and small companies operating in the seed sector. Unorganized sector also includes the seed barter system that still exists in rural regions of India.

The Indian seed market's composition is evolving quickly in tandem with its growing size, as an increasing number of private companies are expanding their product portfolio and market coverage and strengthening their market presence. Numerous crops that are not commonly grown elsewhere, such different types of gourds and okra, play a significant role in India's

agriculture, which is reflected in the product portfolios of seed companies. In fact, India is the world's largest producer of a number of these crops.

**Exhibit 47: Indian Hybrid & OPV Seed Market Size, Value (2018-2024E-2030F) \***

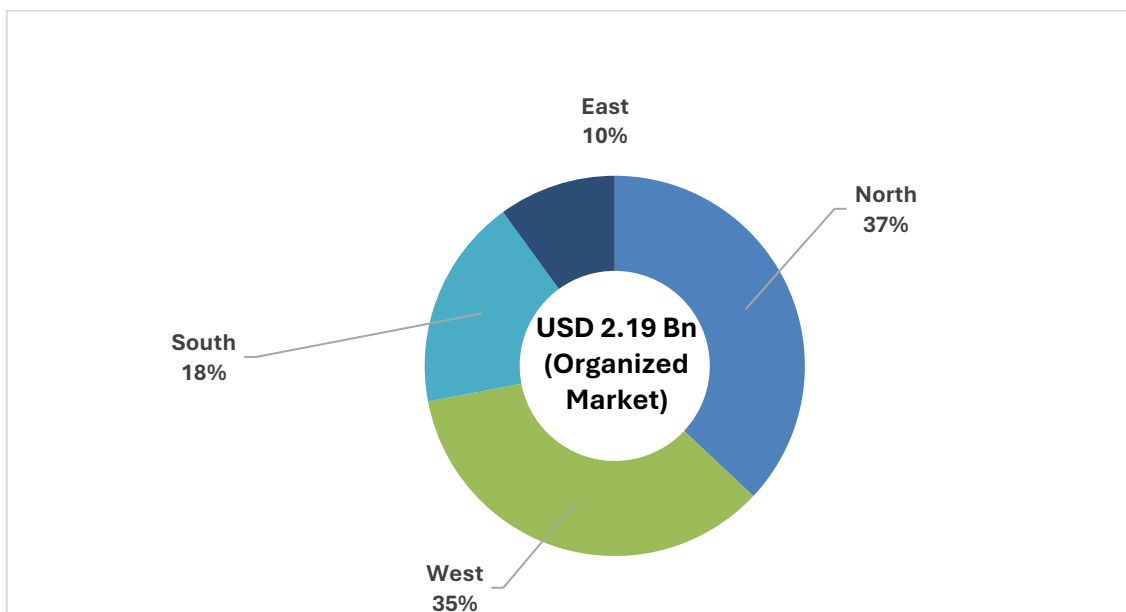


Source: Frost & Sullivan Analysis

**\*Note: The market size excludes GM seeds. Including GM seeds the market size is USD 3.8 Bn**

With an estimated USD 3.37 billion in 2024, the Indian Hybrid & OPV seed market is one of the largest seed industries in the world. The market size for Indian Hybrid plus OPV seeds plus GM seeds is around USD 3.8 billion in 2024. SeedWorks (US Agriseeds), Advanta Seeds, Corteva- Pioneer, Kaveri Seeds, Mahyco, Bayer, Syngenta, Ankur seeds, VNR seeds, Namdhari seeds, Nath Bio gene, Rasi seeds, Tata Rallis and Nuziveedu Seeds are some of the well-known seed companies present in India.

**Exhibit 48: Indian Seed Market Segmentation - Region wise, FY2024E**



Source: Frost & Sullivan, Primary Inputs

## 6.2 Key Trends, Growth Drivers & Opportunities driving the seed market growth in India

- **Increased demand for Oilseed:** Consumption of edible oil has increased dramatically over the previous few decades, reaching 19.7 kilograms annually (kg/year), according to Niti Ayog report for Edible oil published in 2024. Since, this increase has surpassed domestic output, there is significant dependence on imports to meet domestic edible oil demand as well as industrial requirements. Given the multifaceted benefits of achieving “Atmanirbharta” (self-sufficiency) in this sector, a multi-pronged approach is imperative. Production for mustard has increased from 9.1 million tons in FY 2020 to 13.3 million tons in FY 2024.
- **Growing vegetable seed market-** Due to high demand for vegetable, the acreages under vegetable cultivation have also grown at a CAGR of 2% from FY2020 (10.3 Mn Ha) to FY2024 (11.2 Mn Ha). Highest growth has been seen in acreages of beans, pointed gourd, chillies, bitter gourd and cucumber. The hybridization percentage is also higher in vegetable crops. This indicates the need for seed used for these crops has also increased. For FY25, in vegetable segment, across all regions the industry is expected to see further growth driven by increasing acreages under onion, potato, okra and tomato. Exotic vegetable segment is gaining traction along with segments like bitter gourd, watermelon, okra and tomato.
- **New Technologies & agriculture practices** – New technologies are being used in every domain of seed industry. From breeding to sales of seed, multiple technologies such as AI, ML and Digital solutions are being used by seed companies.

Companies are creating new techniques to automatically recognize traits in plants. Plots or fields are photographed, to be utilized to infer traits. Researchers can develop intelligent systems that automate phenotyping, optimize resources in precision agriculture, speed up plant breeding, and enhance crop security tactics by integrating robotics with AI techniques like machine learning and computer vision. Use of drones and remote sensing technologies for precise monitoring of hybrids, as well as assessing crop health and recommending disease prevention strategies is increasing. Recently, Indian Council of Agriculture Research (ICAR) commercially launched two herbicide-tolerant (Ht) basmati rice varieties, which it claimed would control the growth of weeds and promote the water-saving Direct Seeded Rice (DSR) technique. In rice production, weeds are the major biological constraints that could result in 10-30% losses. These varieties are aimed at preventing these losses as well as these varieties will allow farmers to grow the crop directly from seeds sown in the field, bypassing the traditional technique of transplanting seedlings from the nursery. Also, High density planting system (HDPS) for Cotton is emerging for rainfed cotton crop in India. Critical to success of HDPS is early maturing (less than 150 days) compact varieties with synchronous boll bursting habit. This system is also followed in countries such as Brazil, China, Australia, Spain and USA.

- **Increasing use of branded seeds** - Farmers across the regions are shifting towards the branded seeds, simply due to the many benefits offered by these brands. Branded seed

lots go through multiple testing for purity, germination, viability and uniformity before been sold to farmers. In comparison to OPVs, branded hybrids—especially single-crosses—show greater plant and seed uniformity for all traits since all individuals have similar genotypes. Branded seeds are generally uniform when it comes to maturity, height and head inclination which has advantages during harvest. Additionally, the branded hybrids come with multiple advantages of disease resistance, insect resistance & herbicide tolerance. Although cost of seed accounts for 4-6% of production cost, it impacts the productivity of crop for ~30%. Hence, farmers are always on the lookout for seeds that maximize yields and offer better tolerance to pests, diseases, and environmental challenges. Farmers are extremely brand loyal and sticky to seed solutions that solve for their needs.

Plus, farmers are also becoming more aware of the new technologies and innovation that are available for their use. SeedWorks (US Agriseeds) actively engages with farmers, providing them with education and guidance to enhance farm productivity and income. Its initiatives are classified into three phases - pre-season activities (“PSA”) which are conducted before sowing season, product differentiation activities (“PDA”) which are conducted on maturing crops and off-season activities (“OSA”) which are conducted in the period between crop harvest and next sowing cycle. In PSAs, the company conducts various types of above the line and below the line activities that include village level meeting, van campaigns, wall paintings, shop branding and street theatre. In PDAs, the company conducts crop shows on standing crops, where it gathers farmers in the field and shows them the features of its products which differentiate them from competition. SeedWorks (US Agriseeds) has been successful in building trust due to various superior attributes such as high yield, disease tolerant, lodging resistant, bigger boll size etc. The company’s differentiated products with superior attributes have led to strong brand equity with farmers. Thus, seed companies can leverage upon these advantages of farmers shifting towards branded seeds.

- **Increasing exports opportunity** -India has diverse types of agroclimatic conditions, a high degree of technological know-how, experienced and trained labor, adequate land, and plenty of sunshine for farming. As a result, the country has a great chance to become the world's leading supplier of seeds for planting a variety of flowers, vegetables, pasture crops, and field crops.

In order to meet the demands of the world, particularly those of various Asian, African, East European, and South American nations that have comparable agroclimatic conditions to India, the Indian seed business has the potential to develop into a globally competitive, export-focused, and self-sufficient sector. Regarding international trade, the majority of nations allows the importation of seeds, provided that (a) import permits are obtained based on sanitary and phytosanitary certificates and (b) variety evaluation in importing country



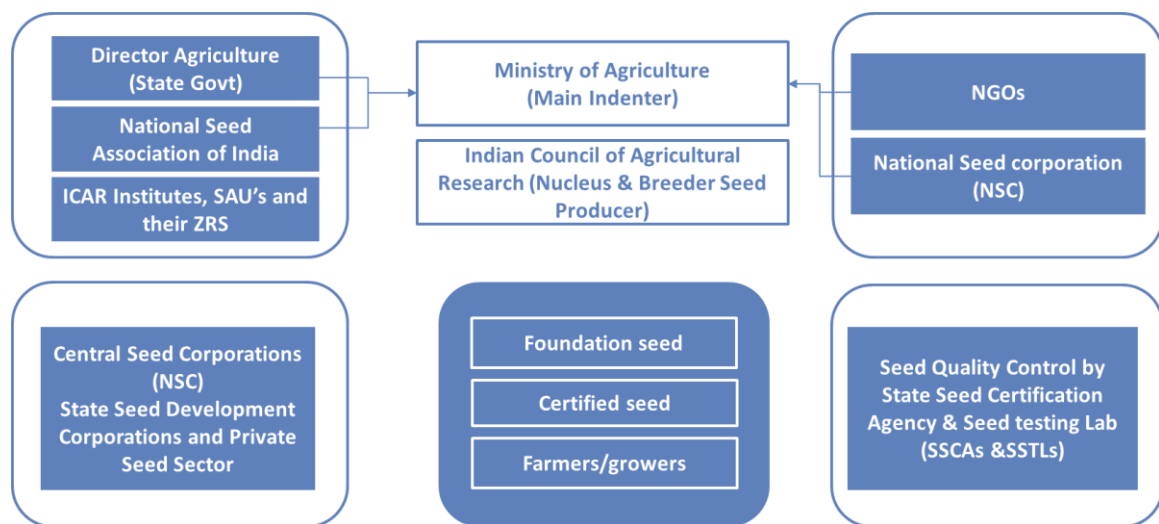
According to National Seed Association of India, the export potential for seeds from India is estimated at more than \$5 billion per year. India can export seeds to many countries with suitable sub-tropical and tropical agro-climatic regions in Asia, Africa, Eastern Europe, etc, at affordable prices, similar to the Indian pharma and agro-chemical sectors. The government must let international and Indian seed corporations to cultivate seeds in designated agro zones for export. These areas might operate similarly to SEZs. They must have facilities for seed testing, dry docks, and efficient shipping which will boost the exports.

### 6.3 Supply chain of seed industry in India

#### A] Public Sector Seed Supply Chain

Public Sector seed supply chain majorly involves the government & public agencies in breeding and distribution of seeds. Nucleus, Breeder, Foundation & Certified seeds are produced by these agencies. Certified seeds are the one that are distributed to farmers.

**Exhibit 49 : Public sector seed supply chain in India**

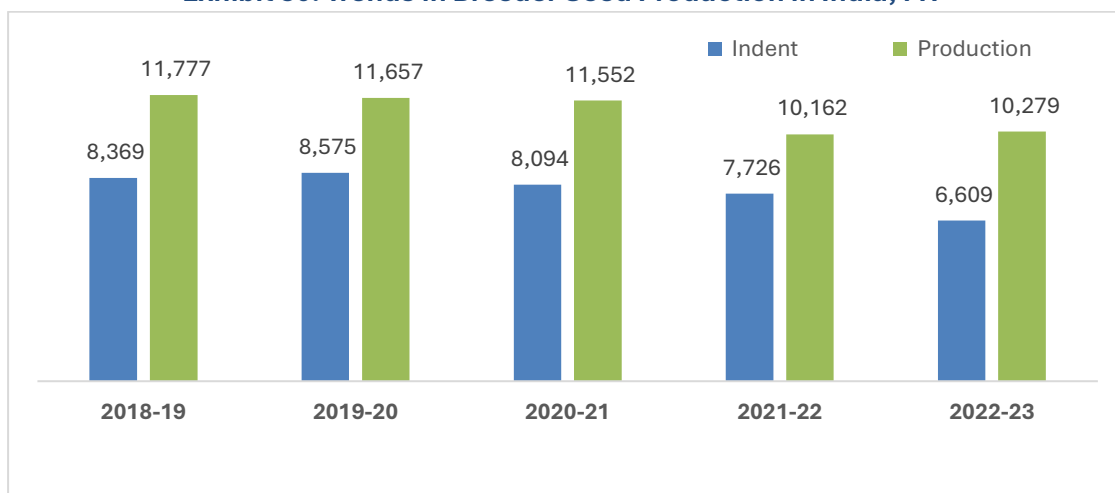


Source: Frost & Sullivan

Produced by the original breeder or a funded breeder, **breeder seed** is the progeny of a variety's nucleus seed and is carried out under the direction of the Indian Council of Agricultural Research (ICAR) with assistance from

- i. ICAR Research Institutions, National Research Centres and All India Coordinated Research Project of different crops.
- ii. State Agricultural Universities (SAUs) with 14 centres established in different states;
- iii. Sponsored breeders recognized by selected State Seed Corporations, and
- iv. Non-Governmental Organizations.

**Exhibit 50: Trends in Breeder Seed Production in India, MT**



*Note: Indent is the an official order or requisition for seed.*

*Source: Indian Seed Congress 2024*

**Foundation seed** is the progeny of breeder seed and is required to be produced from breeder seed or from foundation seed which can be clearly traced to breeder seed. The responsibility for production of foundation seed has been entrusted to the National Seed Corporation, State Farms Corporation of India Ltd (SFCl), State Seeds Corporation, State Departments of Agriculture and private seed producers, who have the necessary infrastructure facilities. Foundation seed is required to meet the standards of seed certification prescribed in the Indian Minimum Seeds Certification Standards, both at the field and laboratory testing.

**Certified seed** is the progeny of foundation seed and must meet the standards of seed certification prescribed in the Indian Minimum Seeds Certification Standards, 1988. The production and distribution of quality/certified seeds is primarily the responsibility of the State Governments.

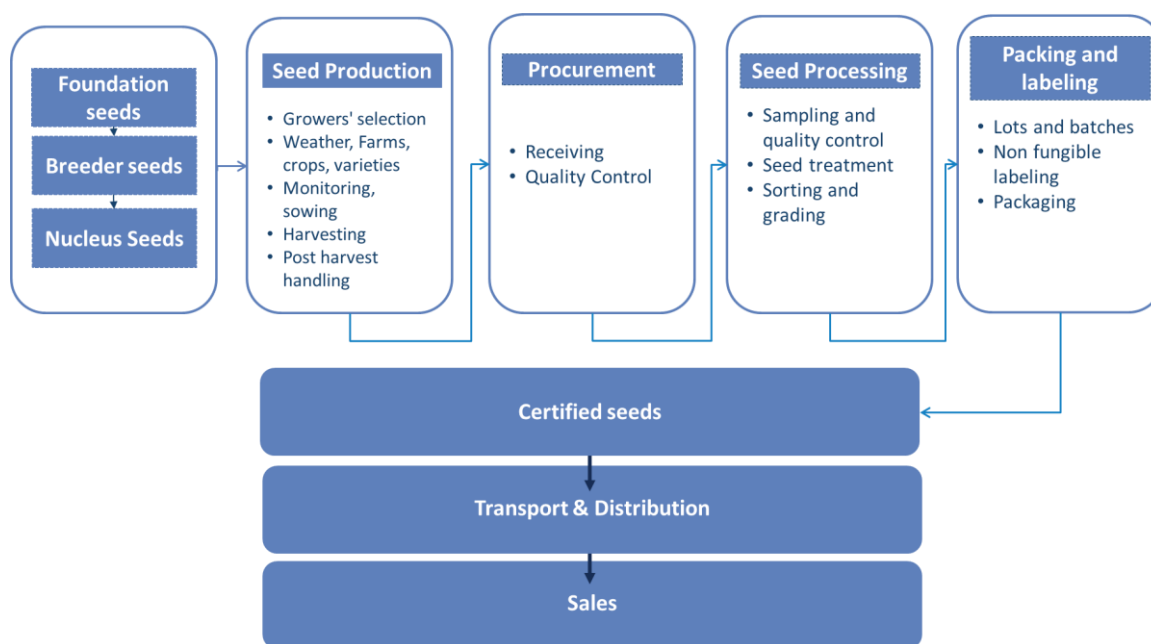
The requirement of certified/quality seeds is assessed by State Governments on the basis of the area sown under different crop varieties, area covered by hybrid and self-pollinated varieties as well as the seed replacement rate achieved.

Private sector companies also collaborate with international as well as government agencies at various stages. For example, SeedWorks (US Agriseeds) has established a partnership to gain germplasm access for pearl millet and pigeon pea and potential screening and trait identification among new hybrids for heat stress and resistance. Company has also partnered to initiate registration for a new parental line for pearl millet with Protection of Plant Varieties and Farmers' Rights Authority (PPVFRA).

## **B] Private Sector Seed Supply Chain**

Private seed sector plays a very important role in food value chain as they add most value to the seed along with developing and breeding superior seed varieties which are vital component of crop production and primary ingredient for food security. Seed industry is one of the highest potential emerging markets and provides new growth opportunities to different players in the value chain.

### Exhibit 51: Private Sector Seed supply chain in India



Source: Frost & Sullivan

The supply chain for seeds in private sector starts right from research and development of new hybrids and varieties for different crops. This stage itself may take 7-10 years as finding desirable germplasm is the key.

Post the seed variety development, selected growers are provided with breeder seeds to multiply them. Growers are important in the seed value chain in India because they contribute to the quality of seeds, which is essential for food production.

Once the seed companies receive the seeds from growers, the seeds are further processed and packed to be sold to the farmers. Processing of seed includes, cleaning, grading, sorting and treating seeds with chemicals for better results. Quality assurance is taken care throughout the process at every stage.





Seeds are sold to end users- farmers through multiple channels which may be offline and online. Offline channels include middlemen such as distributors and retailers which is prominent channel in Indian seed industry. Some of the online e-commerce platforms have been developed specifically for agricultural inputs as well.

From the initial production and distribution stages to the final planting by farmers, various factors contribute to the complexities within the seed supply chain. Maintaining a solid supply chain, managing various areas within it - production planning, logistics transportation, processing plants & distribution is a challenging task for seed companies.

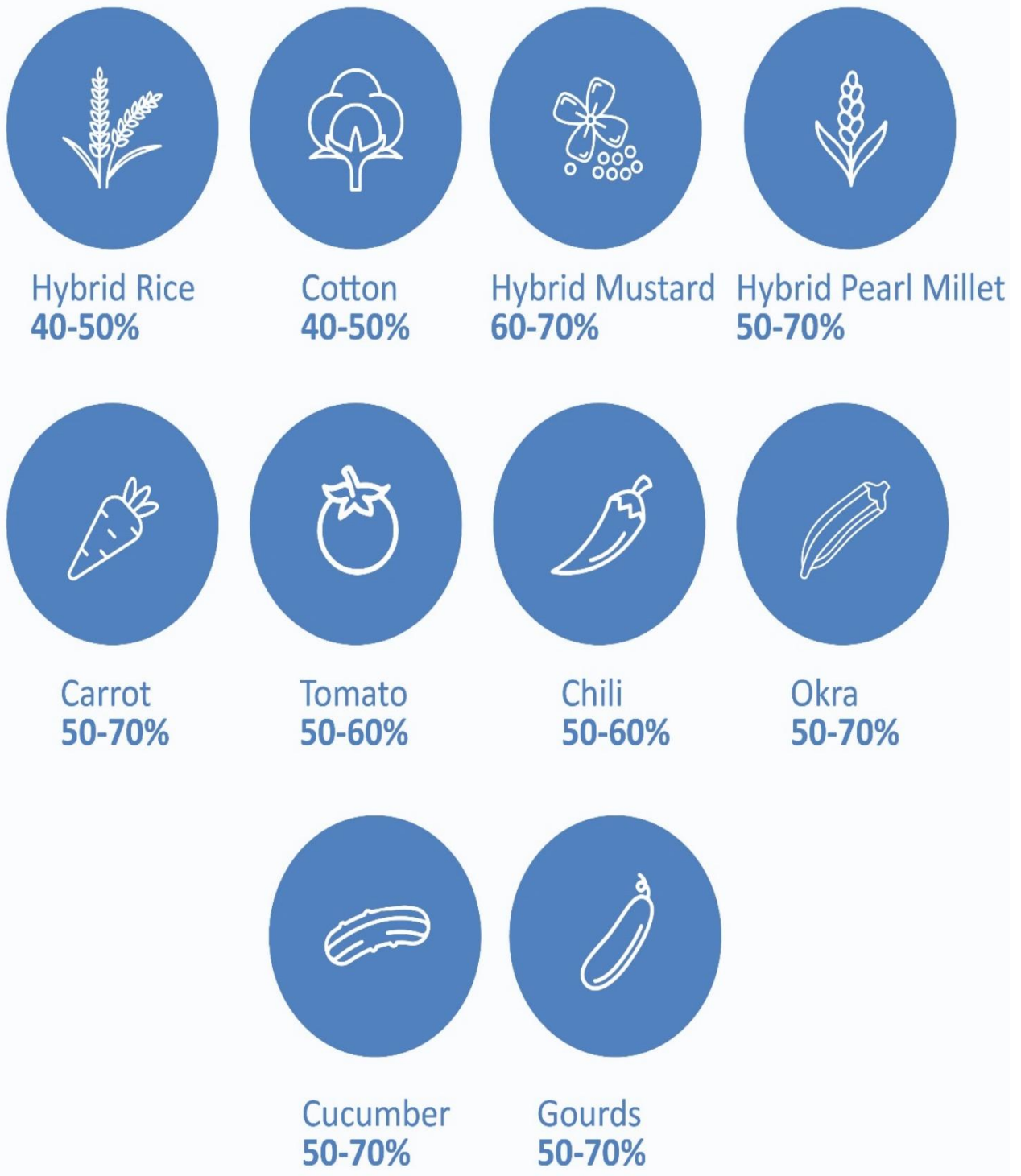
Managing supply-demand dynamics is the backbone of a seed business, making a robust supply chain indispensable. Ensuring optimal inventory levels and timely availability of quality seeds across markets not only drives profitability but also builds trust with farmers. Any misstep—be it shortage or surplus—can disrupt the market and margins, underscoring the need for precision and resilience in operations.

Seed traceability is emerging topics across global industry. Different digital tools are being used for same.

#### 6.4 Key Product Attributes & Gross Margins

Product	Examples of Differentiated attributes
<b>Cotton</b> 	More number of bolls & good boll bursting
	Big Boll Size - 4.5- 6 gms and uniform boll size with high retention
	Good tolerance to Cotton leaf curl virus (CLCuV) & Sucking pest
<b>Rice</b> 	Good cooking and eating quality. Perceived characteristics of premium-quality rice are non-sticky texture, extra-long to long slender grains (i.e., very fine to fine grains), and fragrance
	Resistance to diseases such as Bacterial Blight (BLB), Leaf blast
	Good head rice recovery
	Non lodging along with long and dense panicles (more grains)
	Tolerance to drought as well as flood condition
	Medium to early maturity preferred (95-120 days)
<b>Mustard</b> 	More numbers of branches with high pod and complete pod filling
	Bold and shiny grain
	High oil content (33-46%)
	Low management high yield
<b>Pearl Millet</b> 	Long, bold, compact ear head
	Green fodder
	High tillering- Uniform ear head
	Attractive grain color

### Exhibit 52: Gross Margins for Key Seed crops in India



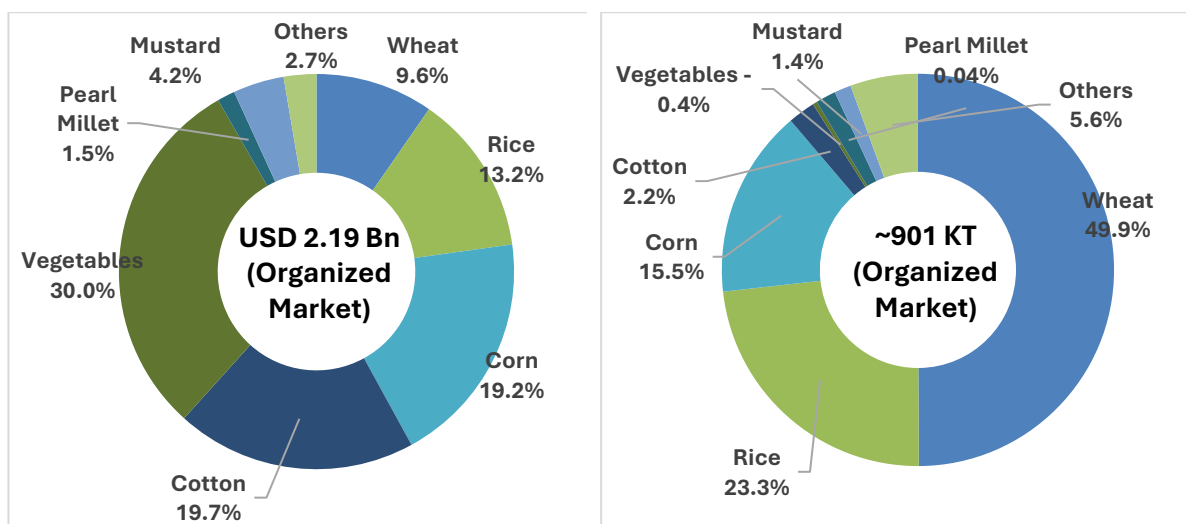
*Note: Percentages are based on the Gross margins*

*Source: Primary Stakeholder, Frost & Sullivan Analysis*

## 6.6 Crop-wise Market Segments & Key Players

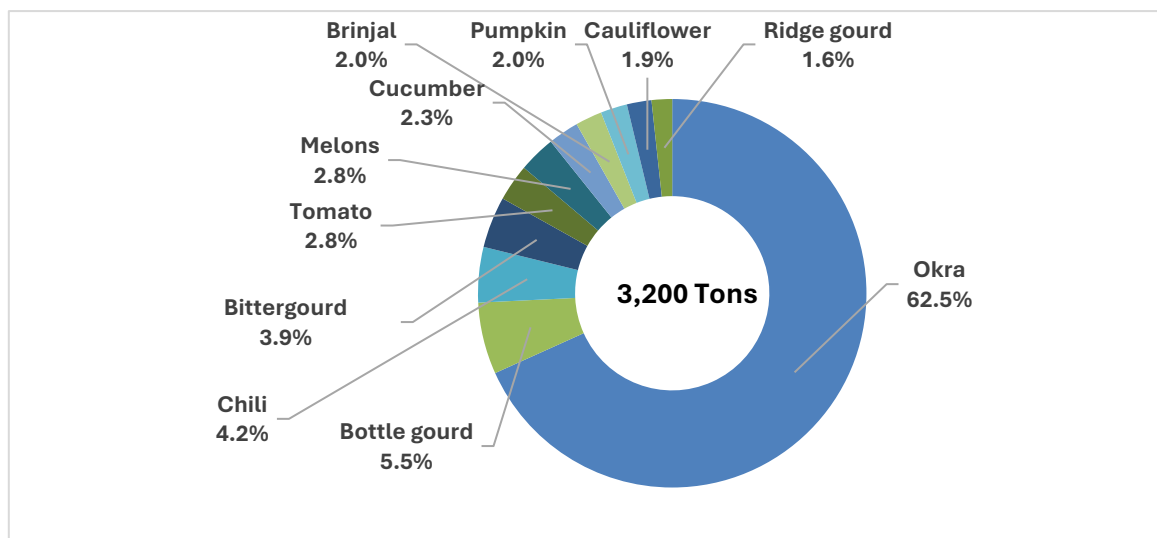
Bayer, Syngenta, BASF & Corteva are the MNCs which have significant market share in seed industry in India. Other companies such as SeedWorks (US Agriseeds), Advanta Seeds, Mahyco, Kaveri Seeds, Nuziveedu Seeds, Rasi Seeds have good presence in the overall seeds market in India with specialized breeding programs in multiple crops. SeedWorks (US Agriseeds) ranks among the top 10 Pure-Play Seed Companies in India in terms of revenue in Fiscal 2024, distinguished by their diversified product portfolio and extensive market coverage. The pure-play seed companies are engaged in seeds business only and include Rasi Seeds, Nuziveedu Seeds, Ajeet Seeds, Namdhari Seeds, Advanta Seeds, Kaveri Seeds, Nath Bio-Genes, VNR Seeds, Mahyco and Ankur Seeds. SeedWorks (US Agriseeds), have over the years established leadership positions in key product segments. SeedWorks (US Agriseeds) hybrid rice and cotton seeds are well-regarded for their performance and resilience contributing to their strong market position. Its Products such as hybrid rice and cotton seeds are known for their high yield, disease tolerance, and adaptability to different climatic conditions.

**Exhibit 53: India Seed Market Segmentation - By Crops, Value & Volume, FY2024E**



Source: Frost & Sullivan Analysis, Primary Inputs

**Exhibit 54: Indian Seed Market Segmentation - Vegetable Seeds category, FY2024E**



Source: Frost & Sullivan, Primary Inputs

## Cotton

Cotton is often referred to as white gold due to its significance for rural economic growth. Collectively, India stands at ~ 325.22 Lakh bales, each weighing 170 kg (5.5 Million Metric Tons) in 2023-24 by being the second largest producer of cotton with ~23% market share globally. States of Gujarat (89.65 Lakh Bales), Maharashtra (82.43 lakh bales) & Telangana (48.1 Lakh Bales) are the top 3 states producing cotton in FY 2024. Area harvested for cotton in India in FY 2023-24 was 12.70 million hectares (~40.9% of global area). For cotton, commercial sales season in India is from April to July. Global cotton market stands at 24.3 million Metric Tons. India also happens to be one of the largest consumers of cotton in the world with about ~5.3 million Metric Tons.

Currently cotton is the only Genetically Modified crop in India. Receptivity of farmers to new technology was amply demonstrated by the rapid and widespread adoption (reaching 95% of the crop area) of Bt cotton when it became available in the early 2000s. In 2024, it is estimated that 4.5- 4.8 Crore cotton seed packets were sold in Indian seed market. The Indian cotton market accounted for INR 35,000- 35,500 Mn in 2021. The market size is anticipated to increase from INR 36,500-37,000 Mn in 2024E to ₹ 44,000-45,000 Mn by 2030F. The Indian cotton segment is expected to grow at a CAGR of 3-4% between 2024E and 2030F. The market is segmented on the basis of maturity duration as following:

Segment	Maturity Duration	Industry size
Early Maturity	<140- 150 days	25-30%
Medium Maturity	150-170 days	40-45%
Late Maturity	170- 180+ days	20-25%

India is the only country globally, which grows all four species of cotton: -

- Arboreum
- Herbaceum (Asian cotton),
- Barbadense (Egyptian cotton)
- Hirsutum (American Upland cotton).

G. Hirsutum represents 90% of the hybrid cotton production in India and all the current Bt cotton hybrids are G. Hirsutum. In India, majority of cotton production comes from 9 major cotton growing states, which are grouped into three diverse agro-ecological zones, as under:

- Northern Zone – (Punjab, Haryana and Rajasthan)
- Central Zone - (Gujarat, Maharashtra and Madhya Pradesh)
- Southern Zone - (Telangana, Andhra Pradesh, Tamil Nadu and Karnataka)

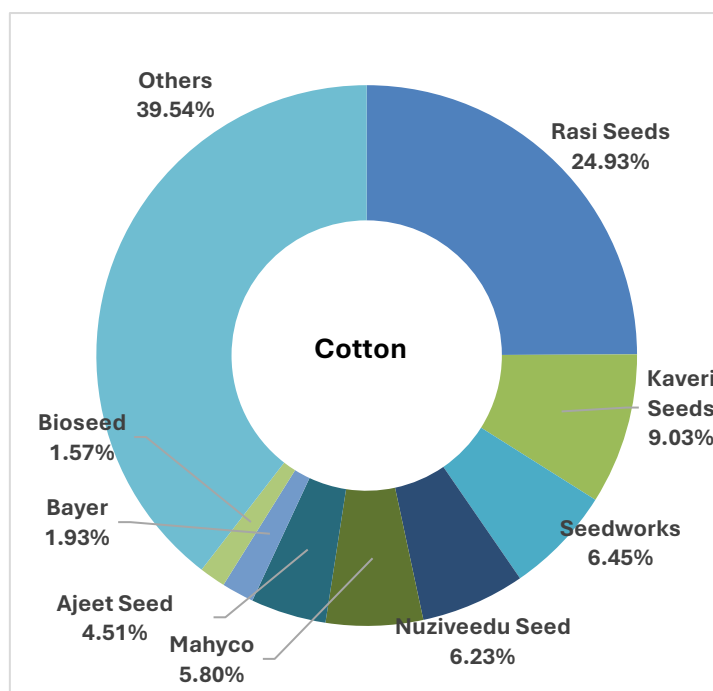
Cotton Seed market in India is highly regulated and competitive market. The Indian cotton seed industry is focusing on areas such as pest and disease-resistant seeds, drought-tolerant varieties, and more yield to address the challenges of climate change while maintaining farmer profitability. Precision breeding techniques, along with data-driven approach and biotechnology innovations to develop new seed varieties that are resistant to pests, diseases, drought, and heat etc., are gaining ground.

Growing issue with cotton seed production is declining seed productivity brought on due to lack of newer technologies. The industry and government institutions are actively working to bring in new tech to solve problem of pest, diseases and other required attributes in cotton. Cotton hybrid technology is required to tackle the issue of pink bollworm particularly in northern states.

In India, High Density Planting System (HDPS) has attractive market opportunity in cotton which involves sowing plants at higher densities to optimize crop standability and yield. Seed industry is expected to grow at a fast pace due to high seed rate in High Density Planting System (HDPS) which is getting widely adopted across country. This has the potential to bring a paradigm shift in the way in which cotton is cultivated in India. HDPS is ideally suited to rainfed regions than irrigated. Critical to the success of HDPS is availability of early maturing compact varieties (<150 days) with synchronous boll bursting as harvesting is done mechanically in HDPS system. Companies are investing in research of these kind of varieties, and it is expected to drive volume growth in India. According to industry stakeholders, currently 12-15 lakhs packets of same are sold in Indian market with Maharashtra and Telangana leading the segment.



**Exhibit 55: Market shares of prominent players in Cotton segment, FY2024E**



SeedWorks (US Agriseeds) ranks 3<sup>rd</sup> in cotton seeds in terms of volume of seed sold in India in year 2024.

*Note: Above market shares are based on volume trends*

*Source: Primary stakeholders, Frost & Sullivan Research and Analysis*

Some of the major companies in cotton seed market are Rasi seeds, Kaveri Seeds, Mahyco, Ankur seeds, SeedWorks (US Agriseeds) , Nuziveedu Seeds, Ajeet seeds and Bayer.

As of September 30, 2024, SeedWorks (US Agriseeds) offered 12 varieties of cotton seeds in the South and Central region (which account for 80-85% cotton acreages), in early, medium and mid late maturity segments. The company’s technological innovations include research on cotton varieties suitable for HDPS and its product offerings in cotton include genetics suitable for the evolving segment of HDPS.



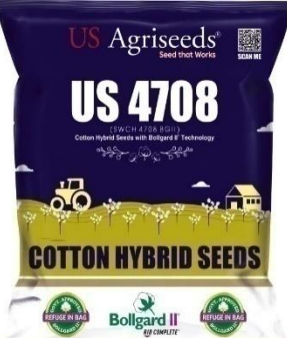
To qualify for approval in India, cotton seed varieties must meet or exceed stringent benchmarks during ICAR-supervised multi-location trials. These include demonstrating superior yield potential vs checks (benchmarks), resistance to major pests and diseases, and stable performance across diverse agro-climatic zones while also adhering to fibre quality standards such as length, strength, and fineness.

New Cotton Hybrids of SeedWorks (US Agriseeds) approved in August 2024 are US 707 BGII (SZ IR) and US 711 BGII (CZIR n SZ IR) and SWCH 4754 BGII was approved for sales in Maharashtra. For North zone, three of SeedWorks (US Agriseeds) hybrids- SWCH 4735 BGII (US 4141 BGII), SWCH 4750 BGII (SU 51 Super Plus) and SWCH 4768 BGII were approved for 2024 season. These hybrids demonstrated a yield advantage over checks (benchmarks) during ICAR-supervised multi-location trials., along with strong pest resistance, ensuring reliable performance across diverse agro-climatic zones. These approvals validate the quality and reliability of its products, providing confidence to farmers in their agronomic benefits and commercial viability.

Market share of SeedWorks (US Agriseeds) for cotton crop was 5.6% in FY2021 & has increased to 6.4% in FY2024E.

Chain boll bearing, tolerance to sucking pest, good boll bursting, tolerance to water stress and high yield are some of the features farmers look for while buying the cotton seeds.

**Exhibit 57: Key Products and Variants of SeedWorks (US Agriseeds) in Cotton**

Product and Variants	Principal Features	Product Image
US 51 Super	<ul style="list-style-type: none"> <li>• Big boll</li> <li>• Tolerant to water stress conditions</li> <li>• Easy picking</li> <li>• Suitable for northern zones</li> </ul>	
US 7067	<ul style="list-style-type: none"> <li>• Early hybrid as it provides a 75% yield in 155 days to 165 days</li> <li>• Big boll</li> <li>• Easy picking</li> <li>• Suitable for south and central zones</li> </ul>	
US 4708	<ul style="list-style-type: none"> <li>• Chain boll bearing and high yield</li> <li>• Tolerance to sucking pests</li> <li>• Suitable for south and central zones</li> </ul>	

Source: Company sources, F&S Analysis

## Rice

For a sizable portion of India's population, rice is a basic staple food that contributes significantly to food security by offering significant calories intake. Production of rice provides livelihoods for an enormous number of farmers and labourers. It contributes to rural development and poverty alleviation by providing rural households with a vital source of income. Indian's rice production has grown from 118.9 million tons in FY 2019-20 to 137.8 million tons in FY 2023-24. For rice (hybrid rice and OPV rice), commercial sales season in India is from April to July. Top three rice producing states in India for FY 2023-24 were Telangana (12.17%), Uttar Pradesh (11.50%) and West Bengal (11.06%).

**Rice seed market** is hybridised to a certain extent with research and open pollinated varieties still dominating the market.

The OPV rice segment in India has transitioned from farm-saved/ bulk seeds to quality packed seeds, along with seed treatment solutions. OPV or Research rice accounts for 85-90% of the rice market volume in India and is still the dominant segment in Indian rice seed industry.

The Indian Hybrid Rice seed market accounted for INR 12,000- 13,500 Mn in 2021. The segment is estimated to amount for INR 14,700-15,500 Mn in 2024E and is expected to grow at CAGR 5.5-6% to reach INR 20,500- 21,000 Mn in 2030. The current hybridization level in rice is around 8-10%, with an estimated 4- 4.2 million hectares under hybrid rice cultivation in 2023- 24.

Gains in rice segment are realised in the export segment varieties. Inter segmental shift in rice seed market can be observed in the near term owing to unpredictable rain. The seed segment for hybrid rice in Indian seed market are basis days of maturity and grain type as following:

Segment	Maturity Duration, days	Industry size
<b>EM- Early Maturity</b>	90-105	12-15%
<b>ME- Medium Early Maturity</b>	110-125	33-40%
<b>MM- Medium Maturity</b>	125-140	40-43%
<b>LM- Long/Late/Full Maturity</b>	140+	5-8%

In volume terms, hybrid rice segment in India is estimated to account for 55,000- 60,000 tons in 2024. Medium maturity segment accounts for 40-43%, medium early segment accounts for 33-40%, early maturity segment accounts for 12-15% and the late maturity account for 5-8% of market for hybrid paddy. SeedWorks (US Agriseeds) has a differentiated hybrid rice product offerings are spread across medium and full maturity segments aiming to address specific market gaps.

Currently 125-140 days segment i.e., the MMMS & MMLG segment dominates the market. There could be a shift in the segment from 135 day to 125 day due to climate changes.

In India, herbicide tolerant (HT) technology in hybrid rice is expected to drive margin expansion in industry. HT technology reduces the economic/ yield loss caused due to weeds and broadens the compatible herbicide spectrum in rice as it controls the growth of weed. Herbicide-tolerant (HT) rice could be an effective and long-term solution for weed management in Direct Seeded Rice method (DSR). DSR refers to the process of establishing a rice crop from seeds sown in the field rather than by transplanting seedlings from the nursery. IRRI with ICAR released two varieties for herbicide non-transgenic HT rice varieties such as PB 1979 and PB 1985 in India. Other hybrids available in Indian market are Sava 127 FP and Sava 134 FP. These varieties are suitable for Direct Seeded Rice (DSR) method. Herbicide-tolerant (HT) coupled with DSR and hybrid seeds is expected to grow the hybrid seed market in India.

For Rice seed in India, historical growth in the industry has been muted due to production challenges in the medium maturity segment, partially offset by strong traction in the full maturity segment. SeedWorks (US Agriseeds) is one of the key players in Rice market with product portfolio consisting of both hybrid & OPV Rice. SeedWorks (US Agriseeds) is

addressing this challenge by launching next-generation hybrids and streamline R&D pipeline. Growth in the full maturity segment will continue to be driven by US 362, with increasing out-licensing revenues evidencing its strong genetic profile.

SeedWorks (US Agriseeds) has developed and commercialized OPV rice seeds based on extensive market feedback and in-house R&D initiatives. The Company's foray into the OPV segment, has been supported by their distribution infrastructure and brand equity. SeedWorks (US Agriseeds) technological innovations include research on varieties suitable for Direct Seeded Rice (“DSR”). The Company have an established foothold in the rice seeds market in India, which is characterized by a 10% hybrid and 90% OPV composition.

In Hybrid Rice portfolio varieties such as – US305, US 312 & US 312 Gold, US 362 are some of the prominent products. No lodging, high head rice recovery, good cooking quality and early to medium maturity are some of the notable features of these products. Share of Seedworks in hybrid rice market in FY2021 was 7.1% which has increased to 7.3% in FY2024E.


#### Exhibit 58: Performance of pipeline product of SeedWorks in SAUs

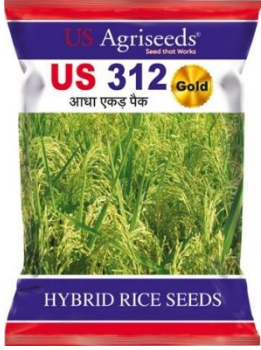


Product	Mean Yield, Kg/ha	Test Weight, gms
US 3537	5,757	25.5
Hybrid check	5,591	23.9

Source: Indira Gandhi Krishi Vishwavidyalaya (IGKV) Raipur, Company sources

Pipeline product of SeedWorks (US Agriseeds) in rice hybrid- US 3537 ranked 7th (in terms of mean yield- kg/ha) amongst 55 entries and benchmarks used in Kharif 2023 trials in Indira Gandhi Krishi Vishwavidyalaya (IGKV) Raipur, Chhattisgarh. The product also recorded 2.9% yield increase over check hybrid check conducted in 6 trials locations and was among the 2 products that showed superiority over best check and hybrid check.

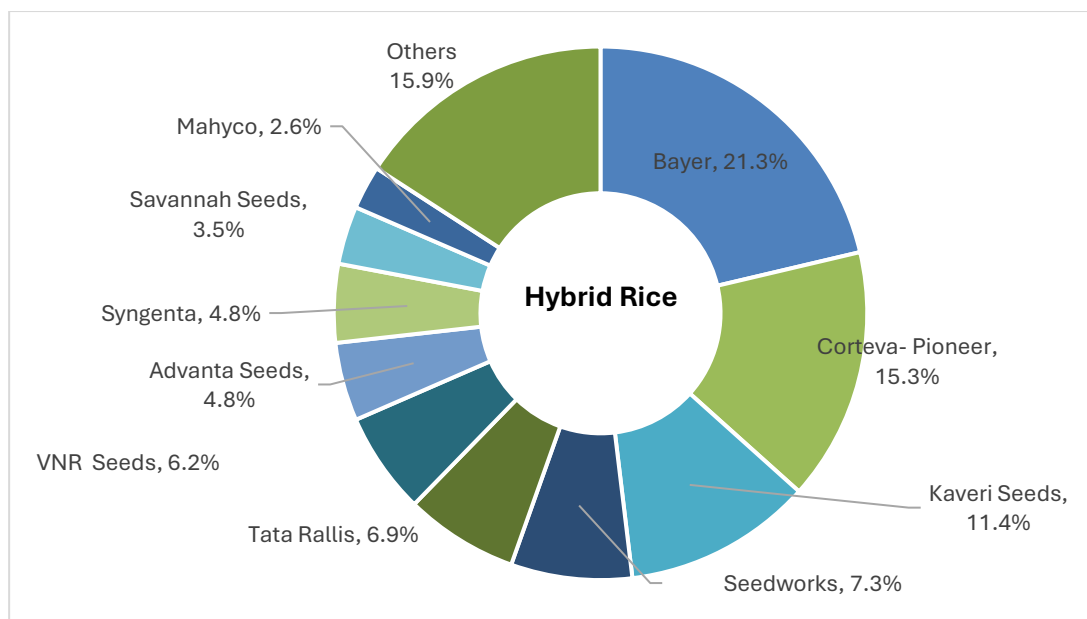
#### Exhibit 59: Key Products and Variants of SeedWorks (US Agriseeds) in Rice

Product and Variants	Principal Features	Product Image
<b>Hybrid Rice</b>		
US 362	<ul style="list-style-type: none"> <li>• Matures in 130 days to 135 days</li> <li>• Good standability</li> <li>• Long and dense panicle with more grains</li> </ul>	

Product and Variants	Principal Features	Product Image
US 312 Gold	<ul style="list-style-type: none"> <li>• Matures in 120 days to 125 days</li> <li>• Healthy nursery and robust plants</li> <li>• Good cooking quality and taste</li> <li>• Tolerant to neck blast</li> </ul>	
<b>OPV Rice</b>		
US 6101	<ul style="list-style-type: none"> <li>• Matures in 140 days to 145 days</li> <li>• Attractive, solid, and heavy bold grains</li> <li>• Good standability and vigor</li> <li>•</li> </ul>	
US 6201	<ul style="list-style-type: none"> <li>• Matures in 130 days to 135 days</li> <li>• Long panicle, with attractive and fine grain</li> <li>• Good standability and vigor</li> <li>•</li> </ul>	

Source: Company sources, F&S Analysis

**Exhibit 60: Market shares of prominent players in Hybrid Rice segment, FY2024E**



**SeedWorks (US Agriseeds) ranks 4<sup>th</sup> in Hybrid rice, in terms of volume of seed sold in India in FY2024.**

*Note: Above market shares are based on volume trends*

*Source: Primary stakeholders, Frost & Sullivan Research and Analysis*

Bayer with its brand “Arize” is the market leader in hybrid Rice segment. In India, Bayer sells 14 different Arize types, which yields 20–35% more than regular varieties. Six of these Arize varieties are naturally resistant to bacterial leaf blight (BLB).

Other notable companies include Corteva- Pioneer seeds, Kaveri seeds, Advanta, Syngenta, Mahyco, VNR Seeds and Tata Rallis- Dhanya in the hybrid Rice segment. Companies are offering hybrid as well as research varieties with maturity durations from 110- 145 days along with lodging tolerance and disease resistance. As the crop is impacted by biotic stresses and several pests like Tryporyza incertulas and Gundhi bugs, conventional hybrids are being substituted with hybrids having improved features. In order to boost yield, companies are providing farmers with hybrid seeds that are resistant to herbicides. Depending on their severity, a major biotic constraint to rice diseases can reduce yields by 20–100%. Significant damage is caused by major diseases like blast, brown spot, bacterial blight, sheath blight, and tungro virus disease. New minor diseases such false smut, grain discolouration, early seedling blight, narrow brown spot, and sheath rot have also become major issues.

**Pearl Millet**

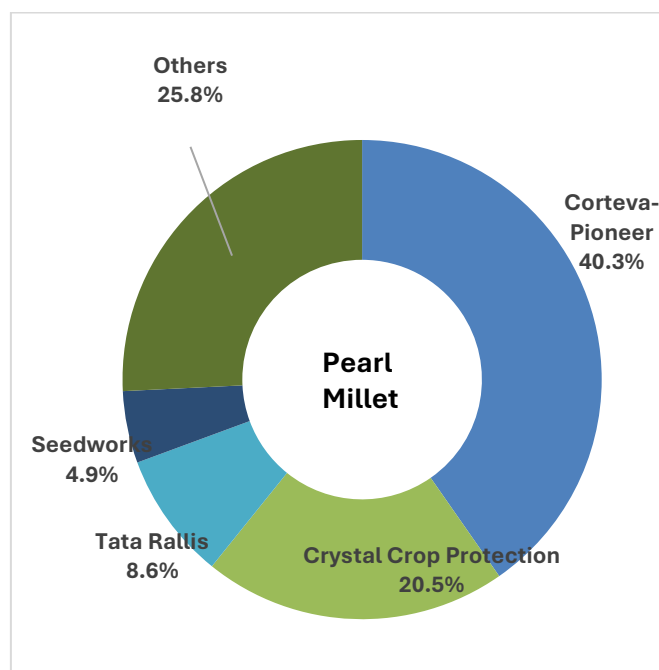
A climate-resilient Nutri cereal known for its quick growth and low input needs, pearl millet is the fourth most commonly grown food crop in India, after rice, wheat, and maize. Because of its balanced nutritional profile and excellent photosynthetic efficiency, it can withstand biotic stress and unfavourable weather conditions. Pearl millet flourishes in harsh agroclimatic conditions. Low soil fertility, high pH, aluminium saturation, low moisture, high temperatures, salt, and little rainfall are among difficult conditions in which it can thrive.

As the agrarian focus shifted to increased food grain production & productivity using high-yielding varieties of wheat & rice in the identified green revolution geographies, millets, which had been India's staples for centuries, slowly drifted to the background and were marginalized after the green revolution.

In the 2023-24 period, pearl millet was grown on 7.40 million hectares in India, yielding an average production of 10.7 million tons. For pearl millet, commercial sales season in India is from May to July and January to March. Most pearl millet in India is cultivated during the rainy (Kharif) season (June/July to September/ October), with some cultivation during the summer (February-May) in parts of Gujarat, Rajasthan and Uttar Pradesh and during the post-rainy (rabi) season (November-February) on a smaller scale in Maharashtra and Gujarat. Rajasthan (42.81 Lakh Tons), Uttar Pradesh (21.95 Lakh Tons) & Haryana (11.95 Lakh Tons) are the top 3 pearl millet producing state sin India for FY 2024.

Pearl millet market in India in 2021 was around INR 2,700-2,900 Mn and is expected to grow at CAGR 6-8% from INR 3,750-4,200 Mn in 2024E to 2030F reaching INR 5,500-6,200 Mn. Compared to most other cereals, pearl millet grain has a higher nutritional value. Pearl millet is used to make a wide variety of traditional dishes, drinks, and specialty items. Pearl millet is increasingly being employed in small-scale commercial food production. Pear millet is also used as in excellent green fodder for livestock. Early to medium duration (80-90 days) pearl millet are more popular amongst in the Indian states – Rajasthan, UP, Haryana, Maharashtra, & Gujarat. Long & compact earhead, medium bold grain in attractive colour & high tillering are some of the desirable traits in Pearl Millet crop. Private players effort in R&D of hybrid pearl millet has been a boon for seed industry. It has helped farmers boost grain yield and fodder yield along with green foliage.

**Exhibit 61: Market shares of prominent players in Pearl Millet segments, FY2024E**



**SeedWorks (US Agriseeds) ranks 4<sup>th</sup> in Pearl millet seeds in terms of volume of seed sold in India in FY2024.**

*Note: Above market shares are based on volume trends*

Source: Primary Stakeholders, Frost & Sullivan Research and Analysis

Pearl millet seed is offered by players such as Corteva- Pioneer seeds, Crystal Crop Protection Limited, Tata Rallis- Dhanya, SeedWorks (US Agriseeds), Kaveri seeds, Nath seeds and Mahyco.

As of September 30, 2024, SeedWorks (US Agriseeds) offered 5 pearl millet seed varieties for both rainy and summer segments. These varieties offer consistent performance across environments and high grain and fodder yield. Company's recent foray into pearl millet seeds have witnessed traction and fast ramp-up, supported by a pipeline of next-generation products offering superior attributes for both wider markets and select niche markets. In-house R&D capabilities have helped develop a differentiated product portfolio in the pearl millet segment, which comprises 70- 85% hybrid and is poised for high growth.

### Exhibit 62: Performance of pipeline product of SeedWorks

#### (a) Performance of US7773 in AHT -Late Trial, Kharif-2023 (Zone A):-

Variety	Grain Yield (kg/ha)	Days to Maturity	DM (%) 60 DAS	Blast (Score)	Ergot%	Smut (%)	Rust (%)	Fe (ppm)	Zn (ppm)
<b>US7773</b>	<b>4181</b>	<b>83</b>	<b>0.5</b>	<b>1.7</b>	<b>0.4</b>	<b>0</b>	<b>1.1</b>	<b>49</b>	<b>33</b>
Check 1	3833	85	0.4	1.7	0.4	0	1	62	44
Check 2	3548	85	1	2.5	0.4	0.3	1	47	27
Check 3	3311	82	0.5	1.3	0.4	2.5	1	64	35
Check 4	2784	79	2.1	2.6	0.4	0.4	0.7	81	38

#### (b) Performance of US7773 in AHT -Late Trial, Kharif-2023 (Zone B):-

Variety	Grain Yield (kg/ha)	Days to Maturity	DM (%) 60 DAS	Blast (Score)	Ergot%	Smut (%)	Rust (%)	Fe (ppm)	Zn (ppm)
<b>US7773</b>	<b>4049</b>	<b>88</b>	<b>0.9</b>	<b>2.7</b>	<b>1</b>	<b>0</b>	<b>15.4</b>	<b>52</b>	<b>37</b>
Check 1	3934	88	1.6	3.7	1.6	0	7.8	49	37
Check 2	3923	89	0.8	2.4	1	0	10.3	53	34
Check 3	3448	86	0.8	2.1	1	0.3	9.8	71	37
Check 4	3290	85	2.8	3.4	1.4	0	11.6	75	41

Source: Summary of Research Experiments 2023-24 Report

#### (c) Performance of US7722 in AHT -Late Trial, Kharif-2023 (Zone A):-

Variety	Grain Yield (kg/ha)	Days to Maturity	DM (%) 60 DAS	Blast (Score)	Ergot%	Smut (%)	Rust (%)	Fe (ppm)	Zn (ppm)
<b>US7722</b>	<b>4499</b>	<b>83</b>	<b>1.7</b>	<b>1</b>	<b>0.4</b>	<b>0</b>	<b>0.5</b>	<b>46</b>	<b>35</b>
Check 1	3703	82	1.3	1.5	0.4	0	0.5	53	37
Check 2	3623	83	1.3	1.4	0.5	0.3	0	60	36
Check 3	3391	85	1.8	1.6	0.4	0.4	0	46	29
Check 4	2566	77	1.4	2.5	0.4	2.1	1.5	79	39

Source: Summary of Research Experiments 2023-24 Report by ICAR, AICRP



### Performance of US7722 in AHT -Late Trial, Kharif-2023 (Zone B):-

Variety	Grain Yield (kg/ha)	Days to Maturity	DM (%) 60 DAS	Blast (Score)	Ergot%	Smut (%)	Rust (%)	Fe (ppm)	Zn (ppm)
<b>US7722</b>	<b>3999</b>	<b>87</b>	<b>0.8</b>	<b>1.8</b>	<b>1.8</b>	<b>0</b>	<b>7.4</b>	<b>57</b>	<b>37</b>
<b>Check 1</b>	3893	87	1.1	2.1	1.8	0	5.9	57	34
<b>Check 2</b>	3518	87	1.6	2.1	1.4	0	9.9	51	36
<b>Check 3</b>	3441	86	2.2	2.1	1.5	0	11.4	72	42
<b>Check 4</b>	2823	83	1.4	2.9	0.8	0	10.1	89	42

Source: Summary of Research Experiments 2023-24 Report by ICAR, AICRP


### (d) Performance of US7307 in SHT - Trial, Summer-2023:-

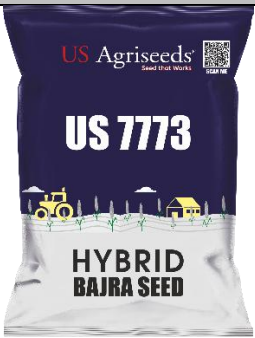
Variety	Grain Yield (kg/ha)	Days to Maturity	DM (%) 60 DAS	Blast (Score)	Ergot%	Smut (%)	Rust (%)	Fe (ppm)	Zn (ppm)
<b>US7307</b>	<b>5299</b>	<b>86</b>	<b>0.5</b>	<b>0.5</b>	<b>0</b>	<b>0</b>	<b>0.5</b>	<b>47</b>	<b>36</b>
<b>Check 1</b>	5276	86	0	1.3	0.5	0	3.7	63	40
<b>Check 2</b>	4960	85	0	0.3	0	0	2.2	41	27
<b>Check 3</b>	4727	85	0	0.3	0	0	6.3	46	35
<b>Check 4</b>	4691	86	0.7	2	0.5	0	1.7	56	37

Source: Summary of Research Experiments 2023-24 Report by ICAR, AICRP

SeedWorks (US Agriseeds) product for Millet - US7773, US7722, US7307 ranked 1st, 2nd and 3rd respectively in Kharif 2023 & Summer 2023 trials. These products also performed well on various metrics considering disease resistance (Blast score, Ergot %, Smut %, Rust %) & days to maturity.

### Exhibit 63: Key Products and Variants of SeedWorks (US Agriseeds) in Pearl Millet

Product and Variants	Principal Features	Product Image
US 7306	<ul style="list-style-type: none"> <li>• Good seed setting in high temperatures</li> <li>• More tillering and staying green until the end</li> <li>• Good standability</li> <li>• Suitable for the summer season</li> </ul>	

Product and Variants	Principal Features	Product Image
US 7773	<ul style="list-style-type: none"> <li>• Long compact earheads</li> <li>• High yield</li> <li>• [Staying green until the end]</li> <li>• Good standability</li> <li>• Suitable for the rainy season</li> </ul>	

Source: Company sources, F&S Analysis

## Mustard

An essential oilseed crop in India, rapeseed-mustard is essential for reducing the demand-supply gap for edible oil in the country. Since long ago, all parts of the rapeseed-mustard plant have been used for flavoring, medicine, and preservation, making them important to human livelihood.

The second-largest oilseed crop in India, rapeseed-mustard is grown in a variety of agroclimatic conditions, including both rainfed and irrigated systems, in a range of soil types, and in hills and hills in the northeast to northwest. Rapeseed-Mustard acreages in India have grown from 6.9 Million hectares in FY 2019-20 to 9.10 Million hectares in FY 2023-24 growing at CAGR 7.2% for the stated period. For mustard (hybrid mustard and OPV mustard), commercial sales season in India is from September to November. The production of rapeseed- mustard was 13.25 million tons for FY 2023-24. Rajasthan (5.18 Mn Tons), Uttar Pradesh (1.87 Mn Tons) & Madhya Pradesh (1.75 Mn Tons) are the top 3 rapeseed- mustard growing states in FY 2024.

Mustard seed market in India is both OPV/research and hybrid based. Market for research mustard is ~INR 750-850 Million in 2024 which is estimated to grow at CAR 4-5% till 2030 to reach INR 970-1,200 Million.

In 2021, the hybrid mustard market was around INR 5,000-5,600 Mn. The hybrid seeds accounted INR 6,800-7,000 Mn in 2024E and further expected to grow at CAGR 5.5-6% till 2030F to reach INR 9,700-9,800 Mn. Segmentation for hybrid mustard is as follows: -

Segment	Maturity Duration, days
<b>EM- Early Maturity</b>	<100
<b>ME- Medium Early Maturity</b>	100-120
<b>MM- Medium Maturity</b>	120-130

Herbicide tolerance trait will drive the market for mustard seed. Hybridization levels in Mustard are 9-10% with rest market been catered by research/OPV varieties. Companies such as Mahyco & Shriram Bioseed offer products in research mustard segment.

The production and productivity of rapeseed-mustard in India have been substantially raised, and the quality of the produce has also improved, thanks to the introduction of high-yielding types and hybrids as well as improved production and protection technology. The market is dominated by Corteva- Pioneer seeds with about ~60-65% market share. Other significant companies include Crystal Crop Protection, SeedWorks (US Agriseeds), Shriram Bioseed, Tata Rallis, Mahyco and Hytech Seeds. Companies have mustard products which are tolerant to stem rot & white rust along with bold grains with good oil content and different maturity periods.

#### Exhibit 64: Performance of pipeline product of SeedWorks in SAUs

##### (a) Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior - Trials Rabi 2023:

Variety	Seed Yield (kg/ha)
KMH 721	3410
Check 1	3230
Check 2	3318
Check 3	2058
Check 4	2570

##### (b) Chaudhary Charan Singh Haryana Agricultural University, Hissar Trials Rabi 2023:



Variety	Seed Yield (kg/ha)
KMH 721	3560
Check 1	3391
Check 2	3259
Check 3	3419

Source: SAU reports, company sources

As of September 30, 2024, SeedWorks (US Agriseeds) offered two varieties of mustard seeds in the fast-growing hybrid seeds and OPV market. SeedWorks (US Agriseeds) pipeline products in mustard - KMH-721 ranked 1st in the trials conducted at CCS Agriculture University, Hissar and was found superior to all check varieties in terms of seed yield

#### Exhibit 65: Key Products and Variants of SeedWorks (US Agriseeds) in Mustard

Product and Variants	Principal Features	Product Image
<b>Hybrid Mustard</b>		
KM H721	<ul style="list-style-type: none"> <li>Bold grain size</li> <li>More pods per branch</li> <li>More branches</li> <li>Matures in 125 days to 130 days</li> </ul>	

Product and Variants	Principal Features	Product Image
<b>OPV Mustard</b>		
Lafar Kranti	<ul style="list-style-type: none"> <li>• High number of branches with appressed pods</li> <li>• Long main branch</li> <li>• High yield</li> <li>• Matures in 120 days to 130 days</li> </ul>	
Krishna Kranti	<ul style="list-style-type: none"> <li>• Matures in 100 days to 105 days</li> <li>• More number of pods per plant</li> <li>• Longer branches</li> </ul>	

Source: Company sources, F&S Analysis

## Wheat



Over the past five years, India's wheat production has surged, from 107.9 million tons in FY 2019-20 to 113.3 million tons in 2023-24. In 2023-24, wheat was planted on 31.30 million Hectares. For OPV wheat, commercial sales season in India is from October to December. Uttar Pradesh (35.43 Mn Tons), Madhya Pradesh (21.28 Mn Tons) & Punjab (17.78 Mn Tons) are the top 3 wheat producing states for India in FY 2024.

The OPV wheat market is estimated to be valued at INR 17,900-19,000 million in 2024E and is expected to grow at CAGR 5.5-6% till 2030 to be valued at ~INR 25,000 million. It has grown at CAGR 6% from INR 15,000 million in 2018.

Wheat seed market in India is predominantly in the variety/ research / open pollinated segment with little to no hybridization. Private players have continued efforts in this direction where hybrid wheat occupies a niche segment in commercial wheat seed production compared to other cereals. Duration for research wheat varieties in Indian seed market varies from 125 – 135 days. Farmers demand for excellent medium bold & shiny grains which have tolerance to yellow rust, sucking pest and leaf rust. Wheat varieties in Indian market are suitable for early as well as late sowing.

Major player in Wheat seed market in India is Shriram Bioseed with varieties such as Ganga gold, Vasudha and Annapurna. Mahyco, Ankur seeds, Ajit seeds, Eagle seeds JK Agri seeds are some of the other players in the wheat seed market. **SeedWorks (US Agriseeds) has recently entered the OPV seed market of wheat seeds business targeting a large and growing 100% OPV market.**

### Exhibit 66: Key Products and Variants of SeedWorks (US Agriseeds) in OPV Wheat

Product and Variants	Principal Features	Product Image
US 5210	<ul style="list-style-type: none"> <li>• Matures in 135 days to 140 days</li> <li>• Average height of the crop is between 100 centimeters to 105 centimeters</li> <li>• Attractive bold grain</li> <li>• Good yield and good taste</li> </ul>	
US 5310	<ul style="list-style-type: none"> <li>• Matures in 135 days to 140 days</li> <li>• Average height of the crop is between 95 centimeters to 100 centimeters</li> <li>• Long and attractive panicle with shiny grain</li> <li>• Good yield</li> </ul>	

Source: Company sources, F&S Analysis

Recently, a few contract research firms have emerged to conduct specialized wheat breeding for larger corporations. The increased demand for trait-focused wheat seeds by farmers to fulfil the needs of the processing industry and exports, coupled with the reduction in the reach of public seed businesses due to limited resource, is driving the private sector's investment in wheat research.

### Vegetables

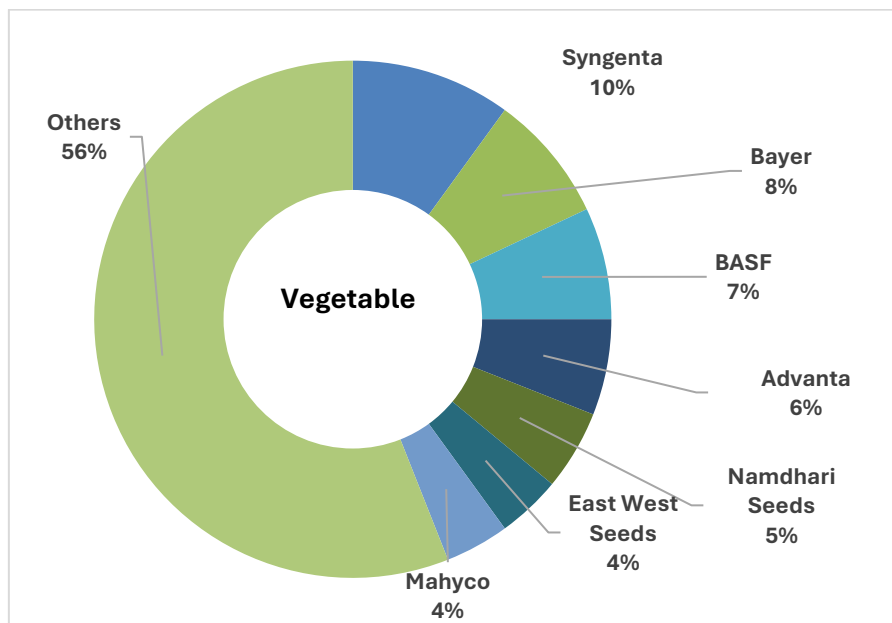
Because of its varied climate, India has the opportunity to grow a wide range of fresh fruits and vegetables. After China, it is the world's second-largest producer of fruits and vegetables. According to the National Horticulture Board's National Horticulture Database (3rd Advance Estimates), India produced 205.8 million metric tons of vegetables in 11.2 million hectares in FY 2023-24. For vegetables, commercial sales season in India is primarily from January to March. Onion, Potato, Tomato, Okra, Gourd, and Green Chilly Contribute largely to the vegetable market as well as export basket.

The vegetable seeds market is expected to grow at a CAGR of 9-10% between 2024E to 2030, reaching INR 98,000- 99,000 million driven by increasing consumer demand, evolving taste

preferences, and rising hybrid penetration. The market was valued at ~ INR 47,500 Million in 2018.

Vegetable seed market in India is highly competitive with multiple players leading in different crop segments as well as existence of unorganized players. Hybridization in vegetables is high as compared to the cereals and oilseed market.




**Exhibit 67: Market shares of prominent players in Vegetable segment, FY2024E**






Note: Above market shares are based on volume trends

Source: Primary stakeholders, Frost & Sullivan Research and Analysis

**Exhibit 68: India Vegetable Market Seeds Snapshot for Key Categories**

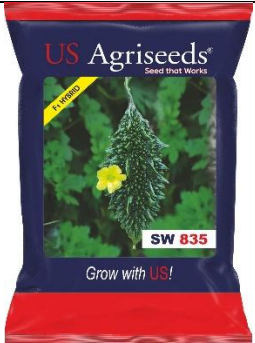
Vegetable category	Market size in 2024E (Tons)	Hybridization	Key players along with Market shares
Okra 	2,000	>80%	Advanta ~25% Bayer 19-20% Rasi 5-6% <b>SeedWorks (US Agriseeds) 2-3%</b>
Chilli 	135-145	>80%	Mahyco Seminis Syngenta HM Clause
Cauliflower 	60	~50-60%	Syngenta, Seminis and Advanta occupy ~50% of the market share

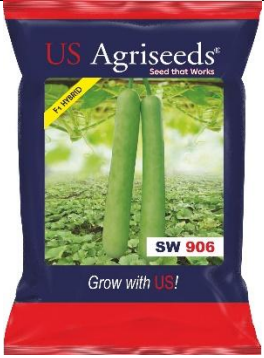



Vegetable category	Market size in 2024E (Tons)	Hybridization	Key players along with Market shares
Brinjal 	60-65	~60%	Mahyco, Ankur, Seminis, and VNR seeds collectively hold 50% market share
Tomato 	70-90	>80%	Syngenta (Sahoo variety) Bayer Namdhari Indo- American
Gourds* (Bottle Gourd, Bitter Gourd, Ridge Gourd, cucumber) 	425	>90%	Bottle gourd - Mayhco, East west, and VNR seeds. Bitter gourd - East West, VNR Seeds, HM Clause and Rasi Seeds Cucumber - East West and Rasi Seeds

Source: Primary inputs, Frost & Sullivan Analysis

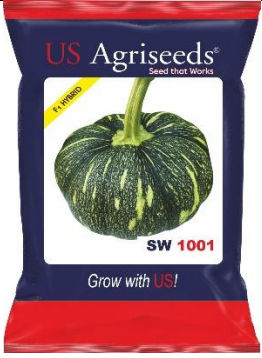
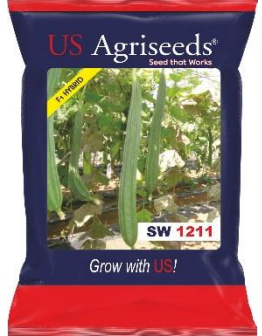
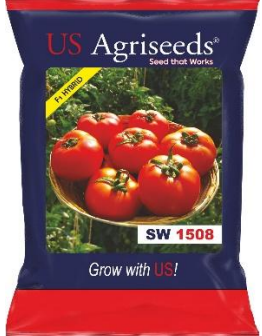

As of September 30, 2024, SeedWorks (US Agriseeds) offered 89+ varieties of vegetable seeds in key categories including tomato, okra, chillies, gourds, melons, marigold, and cucumber, etc. The company's portfolio includes a well-balanced mix of in-house developed seeds and third-party sourced seeds, making it one of the few companies capable of sourcing foundation seeds from innovators. Presently, the company is directing its research efforts into core crops such as tomato, hot pepper, okra and cucurbits




#### Exhibit 69: Key Products and Variants of SeedWorks (US Agriseeds) in Vegetables

Product and Variants	Principal Features	Product Image
<i>Vegetable Crops</i>		
<b>Bitter Gourd</b>		
SW 835	<ul style="list-style-type: none"> <li>Average fruit length of 10 centimeters to 12 centimeters</li> <li>Mid-early maturity</li> <li>Average fruit weight of 60 grams to 80 grams</li> </ul>	
<b>Bottle Gourd</b>		

Product and Variants	Principal Features	Product Image
SW 906	<ul style="list-style-type: none"> <li>• Cylindrical, long and glossy green fruits</li> <li>• Medium maturity</li> </ul>	 <p>The image shows a seed packet for US Agriseeds SW 906. The packet is dark blue with a red top and bottom. It features a photograph of two long, green, cylindrical cucumbers. The text on the packet includes 'US Agriseeds® Seed that Works', 'F1 Hybrid', 'SW 906', and 'Grow with US!'.</p>
<b>Cucumber</b>		
SW 216	<ul style="list-style-type: none"> <li>• Average fruit length of 20 centimeters to 24 centimeters</li> <li>• Average fruit weight of 250 grams to 300 grams</li> <li>• Medium maturity</li> </ul>	 <p>The image shows a seed packet for US Agriseeds SW 216. The packet is dark blue with a red top and bottom. It features a photograph of three green cucumbers. The text on the packet includes 'US Agriseeds® Seed that Works', 'F1 Hybrid', 'SW 216', and 'Grow with US!'.</p>
<b>Hot Pepper</b>		
SW 413	<ul style="list-style-type: none"> <li>• Dual segment hybrid</li> <li>• Strong and bushy plant habit</li> <li>• Average fruit length of 9 centimeters to 11 centimeters</li> <li>• Average fruit girth of 0.8 centimeters to 1 centimeters</li> <li>• Mid-late maturity</li> </ul>	 <p>The image shows a seed packet for US Agriseeds SW 413. The packet is dark blue with a red top and bottom. It features a photograph of a basket containing several red and green hot peppers. The text on the packet includes 'US Agriseeds® Seed that Works', 'F1 Hybrid', 'SW 413', and 'Grow with US!'.</p>
<b>Okra</b>		
SW 017	<ul style="list-style-type: none"> <li>• Attractive dark green and slender fruits with five ridges</li> <li>• Dwarf plant habit with short internode distance and effective branching</li> <li>• Average fruit length of 15 centimeters to 17 centimeters</li> </ul>	 <p>The image shows a seed packet for US Agriseeds SW 017. The packet is dark blue with a red top and bottom. It features a photograph of an okra plant with several green, ridged fruits. The text on the packet includes 'US Agriseeds® Seed that Works', 'F1 Hybrid', 'SW 017', and 'Grow with US!'.</p>
<b>Pumpkin</b>		



Product and Variants	Principal Features	Product Image
SW 1001	<ul style="list-style-type: none"> <li>• Early maturity</li> <li>• Average fruit weight of 2.5 kilograms to 3 kilograms</li> <li>• Attractive fruits</li> </ul>	
<b>Ridge Gourd</b>		
SW 1211	<ul style="list-style-type: none"> <li>• Average fruit length of 30 centimeters to 35 centimeters</li> <li>• Average fruit weight of 180 grams to 200 grams</li> <li>• Mid-late maturity</li> </ul>	
<b>Tomato</b>		
SW 1508	<ul style="list-style-type: none"> <li>• Attractive red flat round fruits</li> <li>• Medium maturity</li> </ul>	
<b>Watermelon</b>		
SW 2208	<ul style="list-style-type: none"> <li>• Icebox segment, indicating small size and ability to fit iceboxes</li> <li>• Potential to provide four to five fruits per plant</li> <li>• Average fruit weight of 4 kilograms to 5 kilograms</li> </ul>	
<b>Radish</b>		

Product and Variants	Principal Features	Product Image
SW 603	<ul style="list-style-type: none"> <li>• Attractive milky-white root</li> <li>• Mid-early maturity</li> <li>• Tropical segment</li> </ul>	
<b>Marigold</b>		
SW 507	<ul style="list-style-type: none"> <li>• Attractive orange flowers</li> <li>• Tall plant habit</li> <li>• Good plant vigor</li> <li>• Average flower size of 7 centimeters to 8 centimeters</li> </ul>	
<b>Muskmelon</b>		
SW 303	<ul style="list-style-type: none"> <li>• Strong wine vigor</li> <li>• Average fruit weight of 1 kilogram to 1.5 kilograms</li> <li>• Mid-early maturity</li> <li>• High in sweetness</li> </ul>	

## 6.7 Seed -Replacement Rate in India

The percentage of the total crop area planted during a season that is sown using certified or high-quality seeds other than farm-saved seed is known as the seed replacement rate. The seed replacement rate (SRR) is a crucial metric for assessing the degree of utilization of high-quality, certified seeds. The Seed Replacement Ratio also indicates the quality of the seed that farmers receive in comparison to the actual seed needed for crop cultivation. Better use of the Certified/Quality Seeds is shown by a higher seed replacement rate. Seed Replacement Rate is also strongly correlated with production since certified seeds are more productive. Therefore, a higher seed replacement ratio increases productivity and production, as well as the likelihood of attaining food security, nutritional security, and restraining the inflation of food prices.

## 6.8 Exports vs Imports Trend in seeds

The export/import of seeds and planting material is governed by the Export and Import (EXIM) Policy 2002-07 and amendment made therein. Restrictions on export of all cultivated varieties of seeds have been removed w.e.f. 01.04.2002, except the following:

- i. Breeder or foundation or wild varieties
- ii. Onion, berseem, cashew, nux vomica, rubber, pepper cuttings, sandalwood, saffron, neem, forestry species and wild ornamental plants
- iii. Export of Niger, which is canalized through TRIFED, NAFED, etc.
- iv. Groundnuts, exports of which is subject to compulsory registration of contract with APEDA.

The export of these seeds is restricted and is only allowed on case-to-case basis under licence issued by Director General Foreign Trade on the basis of the recommendations of Department of Agriculture and Cooperation

All imports of seeds and planting materials are subjected to the Plant Quarantine Order 2003, as the EXIM Policy reiterates. Directorate General of Foreign Trade (DGFT) issues import licenses in response to Department of Agriculture and Cooperation's (DAC) recommendations. ICAR or ICAR-accredited farms will get a modest amount of the desired imported seeds for trial and evaluation for a single crop season. An EXIM Committee was constituted in the Seeds Division to deal with application for exports/imports of seeds and planting materials in accordance with the New Policy on Seed Development and EXIM Regulations. According to World Seed Trade Statistics, India's share in global trade in seeds (import & export) is very less and to give boost to seed export, India has decided to participate in OECD Seed Schemes for the following categories of crops:

- Grasses and legumes
- Crucifers and other oil or fiber species
- Cereals
- Maize and sorghum
- Vegetables

Along with these efforts from government, private sector is also expanding its reach by exporting seeds across globe. Companies such as SeedWorks (US Agriseeds), Advanta, Mahyco are some of the leading companies who export seed to different countries.

## 6.9 Key Regulations Impacting the Indian Seeds

The following policy initiatives have been taken by the Government of India in seed sector: -

- Enactment of the Seeds Act, 1966
- Seed Review Team-SRT (1968)
- National Commission on Agriculture's Seed Group (1972)




- Launching of the World Bank aided National Seeds Programme (1975-85) in three phases leading to the creation of State Seeds Corporations, State Seed Certification Agencies, State Seed Testing Laboratories, Breeder Seed Programmes etc.
- Seed Control Order (1983)
- Creation of the Technology Mission on Oilseeds & Pulses (TMOP) in 1986 now called The Integrated Scheme of Oilseeds, Pulses, Oil Palm and Maize (ISOPOM).
- Production and Distribution Subsidy
- Distribution of Seed Mini kits
- Seed Transport Subsidy Scheme (1987)
- New Policy on Seed Development (1988)
- Seed Bank Scheme (2000)
- National Seeds Policy (2002)
- The Seed Bill (2004)
- Formulation of National Seed Plan (2005)
- National Food Security Mission (2007)
- Rashtriya Krishi Vikas Yojna (2007)
- Biotechnology Regulatory Authority of India (BRAI) BILL, 2013

#### 6.10 Cost of seeds to overall cost of farm production

Seed is an extremely important input for farmers and they look for best quality products while making their purchase decision which makes it important for the seed companies to invest in R&D and launch right products.

The details of projected Cost of Production of various grains per quintal for 2023-24 is given in exhibit below.

**Exhibit 74: Cost of Seed to overall cost of Production**

Crop	Cost of Production, Rs /Quintal	Seed cost as percentage of Production cost	MSP. Rs/Quintal	% Return over Cost
 Rice	1,455	4.30%	2,183	50.0%
 Pearl millet	1,371	2.90%	2,500	82.3%
 Wheat	1,128	6.60%	2,275	101.7%

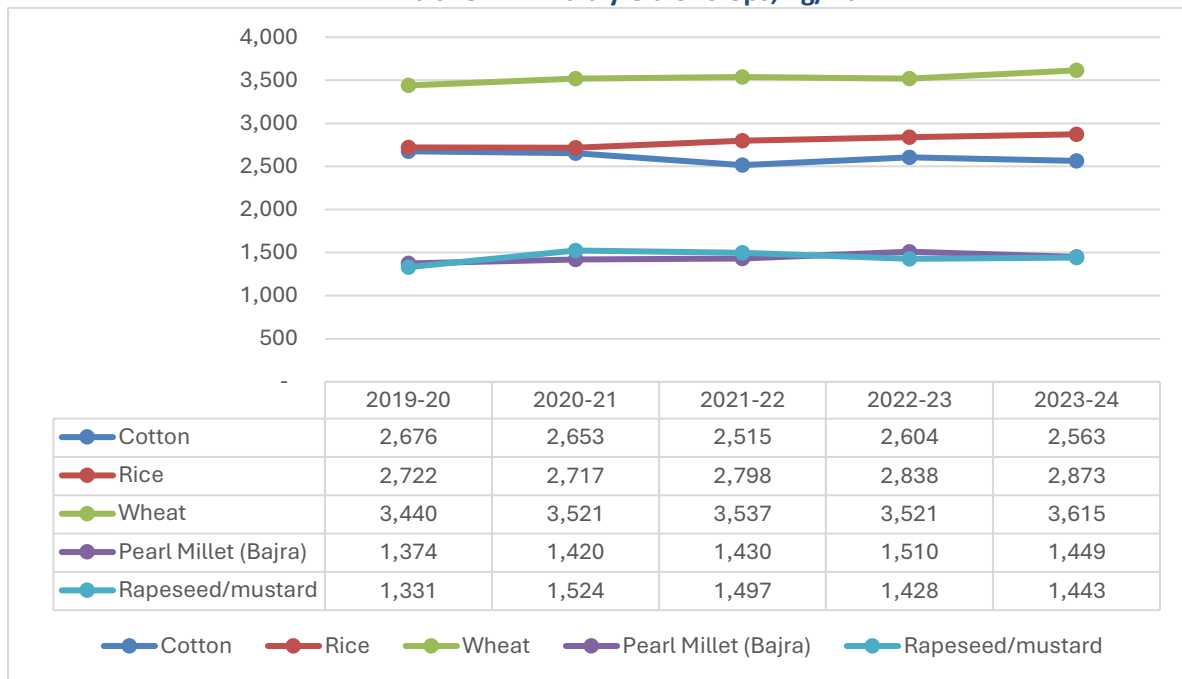
Note: Data is for 2023-24

Government fixes minimum support prices (MSPs) for 22 mandated crops, on the basis of the recommendations of the Commission for Agricultural Costs & Prices (CACP), after considering the views of State Governments, Central Ministries/ Departments other stakeholders, concerned.

### 6.11 Improvement in farm productivity on account of hybrid seeds

Growing seed replacement rate along with availability of new generation hybrids for different crops have boosted the productivity of major crops in India.

**Exhibit 75: All India yield of crops, Kg/Ha**



Source: Department of Agriculture & Farmers Welfare

Productivity /yield of maize grew by 10.5% in 2023-24 at 3,321 kg/ha from 3,006 in 2019-20. Mustard’s yield grew by 8.4% in same duration. Yield of Rice crop has grown by 2,722 kg/ha in 2019-20 to 2,873 kg/ha which is growth of 5.5% over 2019-20. Pearl millet’s productivity grew at 5.5% in 2023-24 over 2019-20.

Private sector seed companies have a significant role to play in making quality, high yielding seeds accessible to the farmers. Most of the seed companies have R&D programs focused on rice, cotton and corn. **SeedWorks** (US Agriseeds) not only focuses on rice and cotton but also has specialized programs for **pearl millet & mustard** as well. Company has strong focus on developing tools for breeding crosses and analytics to target specific traits. Key technological processes/ tools are Genotyping (molecular breeding and markers for defensive traits), Generation turnaround (speed breeding, shuttle breeding) & Precision phenotyping for data collection for predictive breeding.

In addition, **SeedWorks** (US Agriseeds) R&D capabilities are backed by advanced infrastructure that includes 20 breeding facilities, 95 trial locations across India, a pathology laboratory, a

R&D entomology laboratory and two biotechnology laboratories as of September 30, 2024, driving their R&D pipeline. Company's pathology lab located in Bengaluru, Karnataka, R&D entomology lab in Hyderabad, Telangana and two biotech labs located in Singapore and Hyderabad support the plant breeders in accelerating the development of the latest seed varieties. It also operates multiple breeding stations in India and undertake multi-location trials across India, Nepal and the Philippines. In Fiscal 2024, **SeedWorks** (US Agriseeds) field crop hybrids were tested at over 752 agro-climatic locations while Company's vegetable crop hybrids were tested at over 591 agro-climatic locations in India.

## 7. Regional Seeds Market Overview

### A} Philippines

#### 7.1 Agriculture overview of Philippines

The Philippines is predominantly an agricultural nation, with a sizable population residing in rural areas and relying on farming for their livelihood. According to latest data of 2022, over 23.7% of Filipinos in employment are involved in the agricultural industry, which is divided into four subsectors: forestry, farming, fisheries, and livestock. The agriculture, forestry, and fishing industry in the Philippines generated a gross value added of approximately 1.8 trillion Philippine pesos in 2023, equivalent to about 8.6% of the country's GDP.

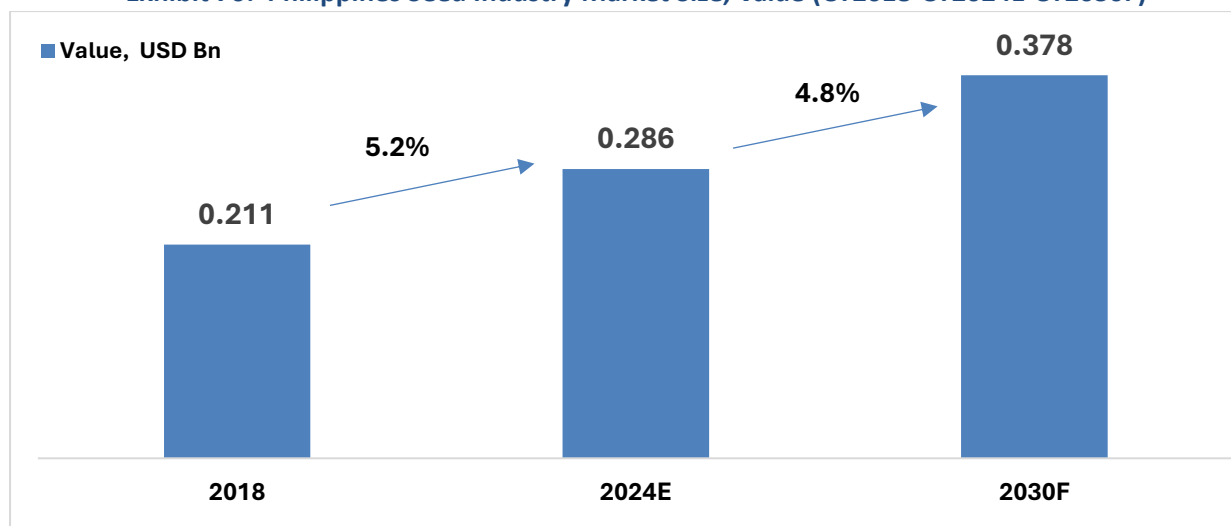
#### 7.2 Philippines Seed industry Market size

The Philippines Seed Market size is estimated at USD 0.28 billion USD in 2024, and it is expected to reach USD 0.37 billion by 2030, growing at a CAGR of 4.8% during the forecast period (2024E-2030F).

The Philippine seed market is dominated by open-pollinated varieties and hybrids. The higher percentage of OPVs & hybrids is due to Rice cultivation. Hybrids seeds are also being adopted by farmers because of their increased production, greater adaptability & other advantages over the OPVs.

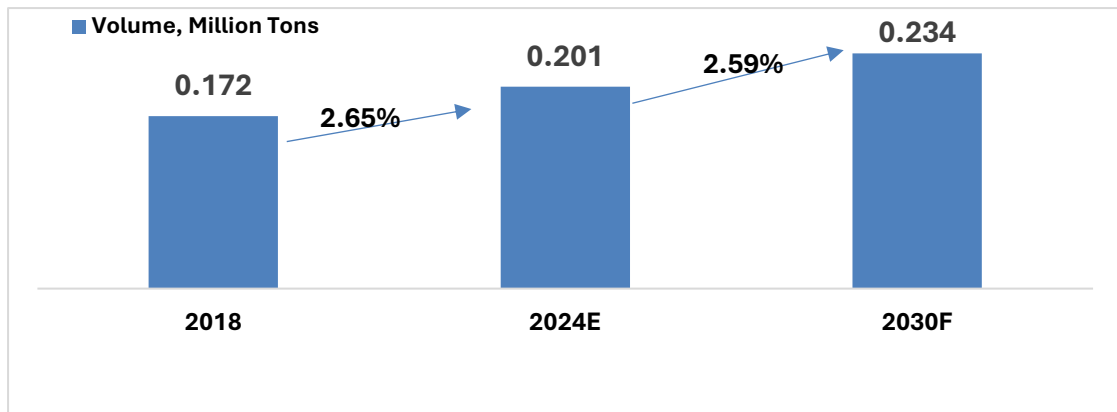
Philippines will continue to have rice deficit in coming years and hence government is pushing to increase rice production which will lead to increase in hybrid rice seed market in the country

**Exhibit 76: Philippines Seed Industry Market Size, Value (CY2018-CY2024E-CY2030F)**



Source: Frost & Sullivan Analysis

**Exhibit 77: Philippines Seed Industry Market Size, Volume (CY2018-CY2024E-CY2030F)**

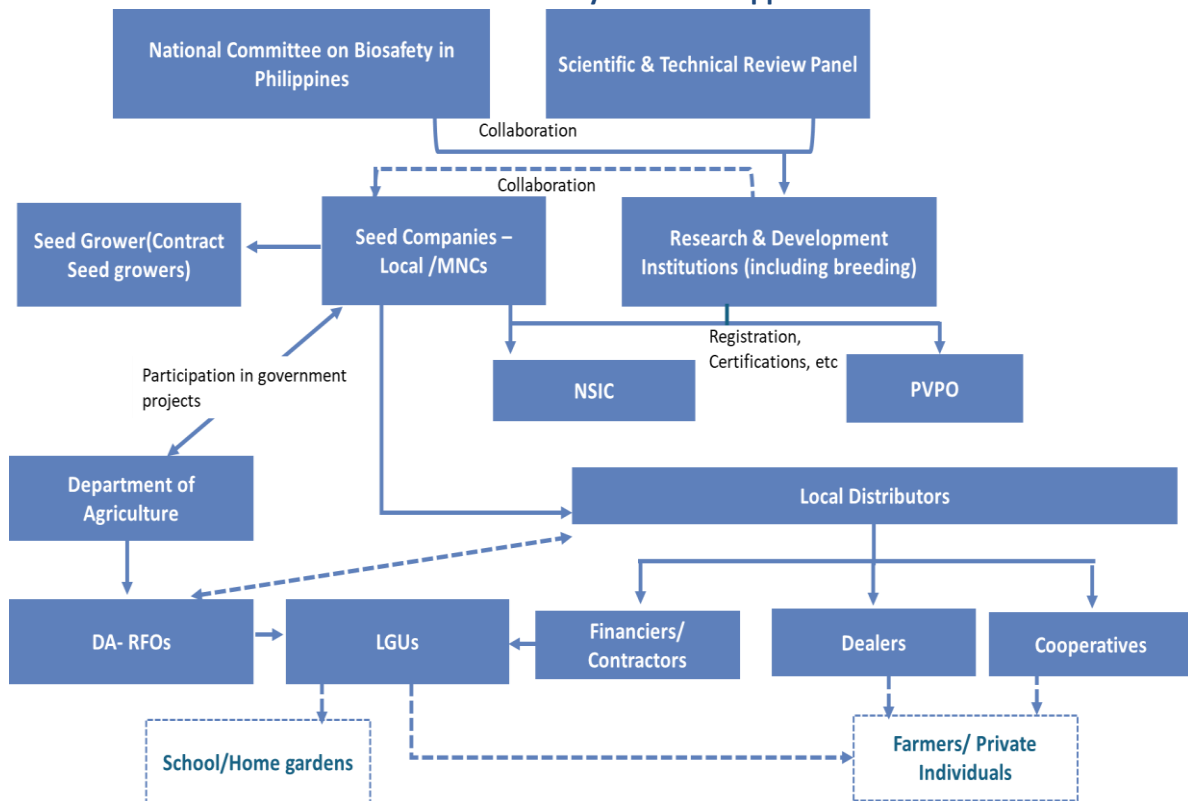


Source: Frost & Sullivan Analysis

In terms of volume, the Philippines seed industry is estimated to be around 0.20 million tons growing at CAGR 2.65 % from 2018-2024E. It is further expected to reach 0.23 million tons by 2030F expanding at CAGR 2.59%. While rice and corn are the main field crops cultivated, huge scope lies in the development of the vegetable seed sector.

The seed industry is vital to agricultural sector of Philippines. Major constraints faced by farmers in Philippines is access to high quality & affordable seeds along with climate change which is affecting the crop yield. A further strong local formal seed system is required to address these challenges which will ensure the availability of seeds along with enhancing the crop yields.

**Exhibit 78: Seed System in Philippines**



Note: NSIC- National Seed Industry Council; PVPO- Philippine Plant Variety Protection Office; DA- Department of Agriculture; RFO- Regional Field Office; LGUs- Local Government units

Source: National Seed Industry Council, Seed Summit 2023



Above exhibit shows the seed system in Philippines. National Committee on Biosafety & Scientific & Technical Review Panel are the apex bodies who collaborate to take decisions on matters related to seed in country. NSIC & PVPO are responsible for R&D activities at public level through different institutions. Private companies also collaborate with these institutions along with carrying out their R&D activities independently. Private companies participate in government run programs for subsidies in seed. **SeedWorks (US Agriseeds) also participates in this program.** For e.g. In hybrid rice segment, 95% of hybrid rice seed goes to subsidy program. Govt procures the seed from companies & supplies the rice seed to small & marginal farmers.

### 7.3 Philippines Seed Industry Market Segmentation


With 32.5% of the total seed market, grains and cereals make up the largest part. Due to the increase in demand for cereals from both domestic and foreign markets, which was fueled by both export potential and domestic consumption, the area planted under grains and cereals grew by 0.8% between 2017 and 2022. Being a staple food in the Philippines, rice is the main cereal/row crop cultivated there. The growth in rice cultivation is driven by the ongoing need for rice to meet daily nutritional needs. Potential market opportunity in rice is due to herbicide technology which is expected to drive margin expansion in industry.



Currently, in 2024 the hybrid rice is grown on 1.2-1.3 Mn hectares in Philippines with hybridization rate of 25-27%.

The hybrid rice market accounted for USD 84-86 Mn in 2023 and is expected to grow at CAGR 5-6% to reach USD 140-145 Mn in 2030. In volume terms, the size of hybrid rice segment is accounted for 19,500- 21,000 Tons. Some of the key players in hybrid rice segment are SL Agritech Corporation (SLAC), Longping Tropical Rice Development Inc., Bayer, SeedWorks Philippines (US Agriseeds) and Leads Agri.

SeedWorks is the fourth largest hybrid rice seed company in the Philippines in terms of volumes in CY 2023. In the Philippines, Seedworks commanded a volume market share of 12% in the hybrid rice segment in CY 2023 after SL Agritech, Longping Tropical Rice Development Inc & Bayer.

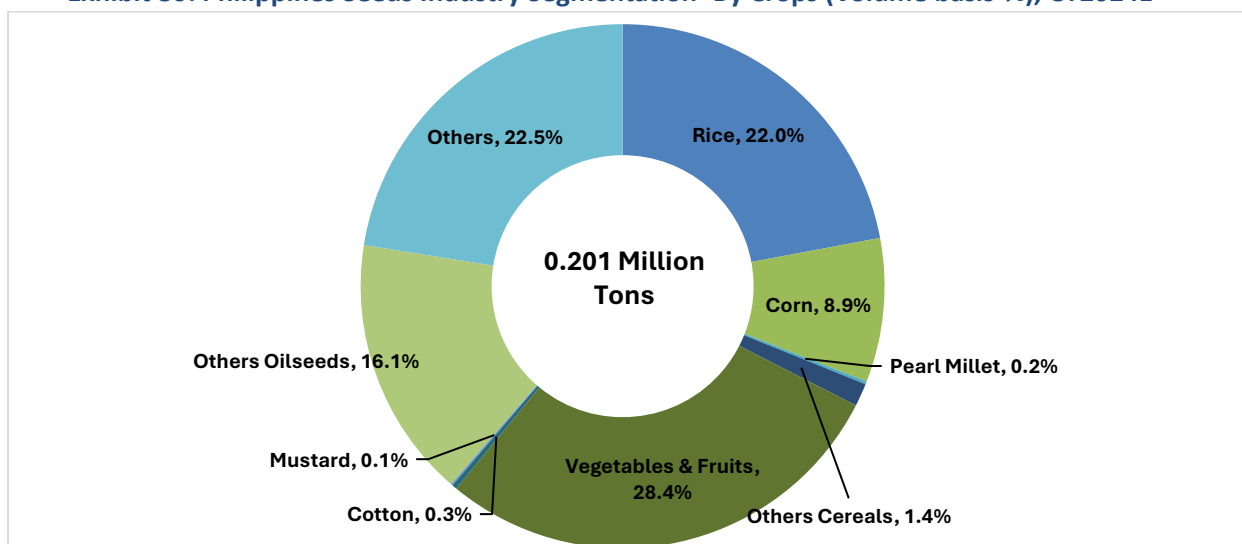
#### Exhibit 79: Key Products and Variants of SeedWorks (US Agriseeds) in Philippines

Product and Variants	Key Traits	Product Image
<b>Hybrid Rice</b>		
US 88	<ul style="list-style-type: none"> <li>• Long grain</li> <li>• Tolerant to bacterial leaf blight and blast</li> <li>• High tillering and erect flag leaf</li> <li>• Medium maturing variety</li> <li>• High milling recovery</li> <li>• Recommended for dry season</li> <li>• Soft when cooked and a good option for brown rice</li> </ul>	

Product and Variants	Key Traits	Product Image
Quadro Alas	<ul style="list-style-type: none"> <li>• Early maturing (105 DAS)</li> <li>• Tolerant to bacterial leaf blight and blast</li> <li>• High-yielding variety</li> <li>• Recommended for wet and dry seasons</li> <li>• Long slender grain of approximately 6.90 mm</li> </ul>	
TH 82	<ul style="list-style-type: none"> <li>• Tolerant to intermittent drought</li> <li>• Tolerant to bacterial leaf blight</li> <li>• Non-lodging and non-shattering</li> <li>• Applicable for direct and dry seeding</li> <li>• High head rice recovery</li> <li>• Recommended for wet and dry seasons</li> <li>• Shiny white grain</li> </ul>	

Cereals & grains are followed by vegetables seeds. Tomato, pumpkin, and gourds are the major vegetable crops grown in the Philippines, with the increasing demand for disease resistance, pest resistance, quality, and quantitative traits.

**Exhibit 80: Philippines Seeds Industry Segmentation- By Crops (Volume basis-%), CY2024E**



\*Other cereals- Barley, Millets, Buckwheat, Wheat; Others include- Spices, etc

Source: Frost & Sullivan Analysis

## 7.4 Philippines Seed industry Key trends

**Technological Advancements with public & private partnerships-** In order to maximize resource utilization and efficient land usage, the Philippine agriculture industry has been advocating the use of precision agriculture, hydroponics, and vertical farming, particularly in urban areas. The seed industry is undergoing transformation with government & public partnership in various technological adoption of modern agricultural techniques, such as better irrigation systems, the use of high-yield seed varieties, and the application of better pest and disease management techniques is growing in Philippines.

High yields, resistance to disease & lodging, ability to adapt to broader soil types and water stress/excess are some of the sought-after seed traits. Institutions such as IRRI are leading research strategies & innovations in sustainable production, low-carbon emissions, and value addition for rice markets.

In 2022, BASF Agricultural Solutions & SeedWorks Philippines Inc. entered into licensing agreements for Herbicide Tolerant (HT) Rice which will solve the weedy rice problem. The trait introgression in SeedWorks (US Agriseeds) hybrids is in progress. In April 2023, Syngenta Seeds and Ginkgo Bioworks collaborated to develop new traits for the next generation of seed technology to produce healthier and more resilient crops.

**Increasing demand for Vegetable seed-** According to USDA, Filipinos often consume fewer than 25% of the recommended daily intake of vegetables as advised by the World Health Organization. Availability, cost, dietary and cultural considerations, and a negative perception of vegetable safety and quality are some of the causes. The Philippine government has encouraged the adoption of PhilGAP, a national standard for good agricultural practices. This certification program outlines on-farm and postharvest practices required to produce vegetables that are safe to eat, of good quality, and produced with consideration of worker health and safety and the environment. However, farmers have been sluggish to adopt PhilGAP. Seed companies including SeedWorks (US Agriseeds), East West Seeds, Allied Botanical Corporation, Syngenta, Corteva are some of the major companies offering high quality vegetable seeds in the market.

**Climate Change Resilience -** The production of crops is significantly impacted by climate change, which put global food security at risk. Philippines is dealing with more severe climate-related hazards as it gets ready to switch from the El Niño weather pattern to La Niña in mid-2024. Philippines has been struck by a series of tropical cyclones in 2024 that have brought widespread impacts across the archipelago.

## 7.5 Philippines Seed Industry Key Opportunities & Drivers

- The Philippines, home to the International Rice Research Institute (IRRI), is a **leading adopter of hybrid rice seed** in the region, with key players such as SL Agritech and Syngenta driving production. SeedWorks (US Agriseeds) is also a prominent player in hybrid rice market in Philippines.
- While rice and corn remain the primary field crops, there is significant growth **potential in the vegetable seed sector**. East-West Seed has strategically partnered with the Department of Agriculture to bolster the vegetable seed market. SeedWorks (US Agriseeds) vegetables business is also growing and is profitable in country.
- The country's **robust regulatory framework** for plant breeding, coupled with the **cost-effective variety registration process**, positions the Philippines as an attractive destination for seed business investments.
- The advantages of growing crops in the Philippines extend beyond its natural resources, supported by a **robust infrastructure network**. With improvements in rural roads, irrigation systems, and transport facilities, the country has seen better accessibility to markets, reducing post-harvest losses.
- Additionally, the **government's emphasis on developing agricultural programs and partnerships with the private sector** fosters an environment conducive to sustainable crop production. The nation's diverse geography also allows for the cultivation of a wide range of crops, such as rice, corn, sugarcane, and coconut, as well as oilseeds like soybean and canola.
- The Philippines is particularly known for its production of both food and cash crops. In the cereal and grain category, rice and corn are staples, with the country being one of the largest rice producers in Southeast Asia.
- **Vegetables such as eggplant, tomatoes, and onions** thrive in the cool highland areas of the Cordillera region, while tropical fruits like mangoes, bananas, and pineapples are grown throughout various provinces. Mindanao, in particular, is recognized for its large-scale production of oilseeds, including coconuts, which are vital for the global market.
- The Philippines' **agricultural strengths, combined with favorable climatic conditions and infrastructure**, make it an ideal location for seed production and crop cultivation.

## 7.6 Regulatory Landscape for seeds in Philippines

The Department of Agriculture governs the activities of the National Seed Industry Council. The Philippines, home to the International Rice Research Institute (IRRI), is one of the most prolific users of hybrid rice seed in the region.

The strong regulatory framework for plant breeding and low cost involved in the variety registration process make the country attractive for seed business investments. The National Plant Quarantine Services Division (NPQSD) of the Bureau of Plant Industry is the regulatory

arm of the Philippine Department of Agriculture when it comes to matters of import, export, domestic movement, as well as market access of plants and plant products.

Seed Industry Development Act of 1992 was developed to promote and develop the seed industry in the Philippines and create a national seed industry council.

### 7.7 Key players in the Philippines Seed industry

Sr. No.	Company Name	Headquarters	Key Focus on Seeds	Product Portfolio
1	Bayer	Germany	Cereals and Vegetable Seeds	Corn, Rice, Vegetable
2	Syngenta	Switzerland	Cereals & Vegetable Seeds	Corn, Rice
3	Corteva	United States of America	Cereals & Oilseeds	Corn, Pearl millet, Sorghum, Sunflower, Cotton, Mustard, Rice, Soybean, Wheat
4	Allied Botanical Corporation	Philippines	Vegetable seeds	Corn, Cucurbits, Cauliflower, Cabbage, Broccoli, Radish Legumes, Tomato, Onion, Eggplant, Okra, Pepper, Herbs, Carrot
5	East-West Seed	Thailand	Vegetable Seeds	Tomato, Bitter gourd, Cucumber, Onion, Pepper, Watermelon
6	SeedWorks Philippines	India	Cereals & vegetables	Rice, Cabbage, Watermelon, Cucumber, Squash, Ridge gourd, sweet corn, bitter gourd, beans, pepper
7	SL Agritech Corporation	Philippines	Cereals	Rice

## B} Nepal

### 7.8 Agricultural Overview of Nepal

Even in a limited geographic area, Nepal's climate diversity—which ranges from subtropical to arctic in high mountains—is distinctive. Ecological zoning, such as Terai, Hill, and Mountain, affects farming practices and production potential. Despite the fact that agriculture has been practiced in Nepal for ages, crop output appears to be inadequate.

Rice, maize, wheat, millets, and barley are among Nepal's most important food crops. The most significant of this is rice, which makes about 55% of all land used for food crops.

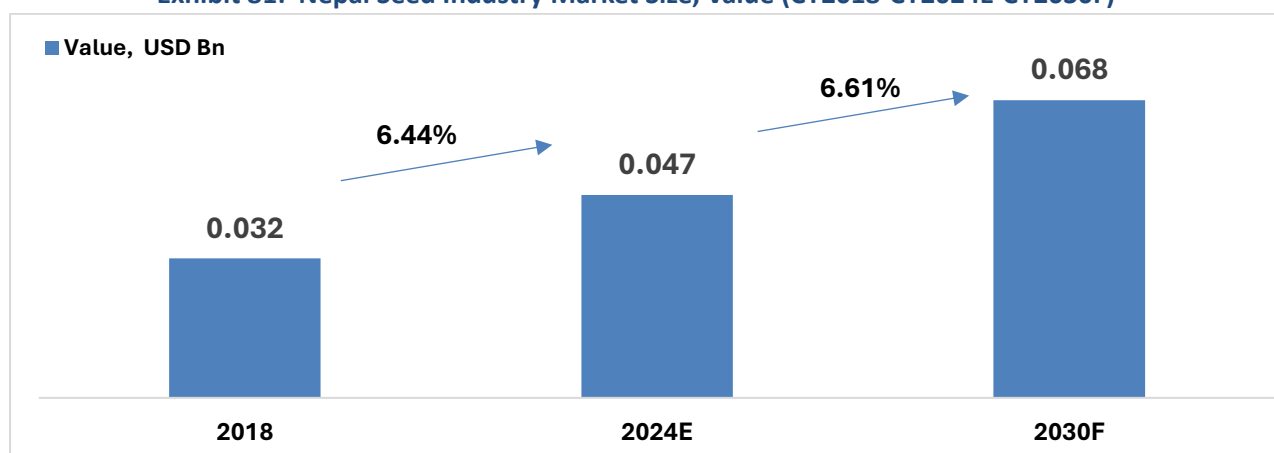
About 15% of the country's consumption demands are met by cereal imports, primarily rice. According to FAO updates, about 1.4 million tons of cereal are expected to be imported in the 2024–2025 marketing year (July–June), which is 7% less than the five-year average. It is anticipated that 630,000 tons of rice will be imported in 2024. On average, 550 000 tons of maize and 225 000 tons of wheat are expected to be imported.

### 7.9 Nepal Seed industry Market size

The Nepal Seed Market size is estimated at USD 0.047 billion USD in 2024, and is expected to reach USD 0.068 billion by 2030, growing at a CAGR of 6.61 % during the forecast period (2024-2030).

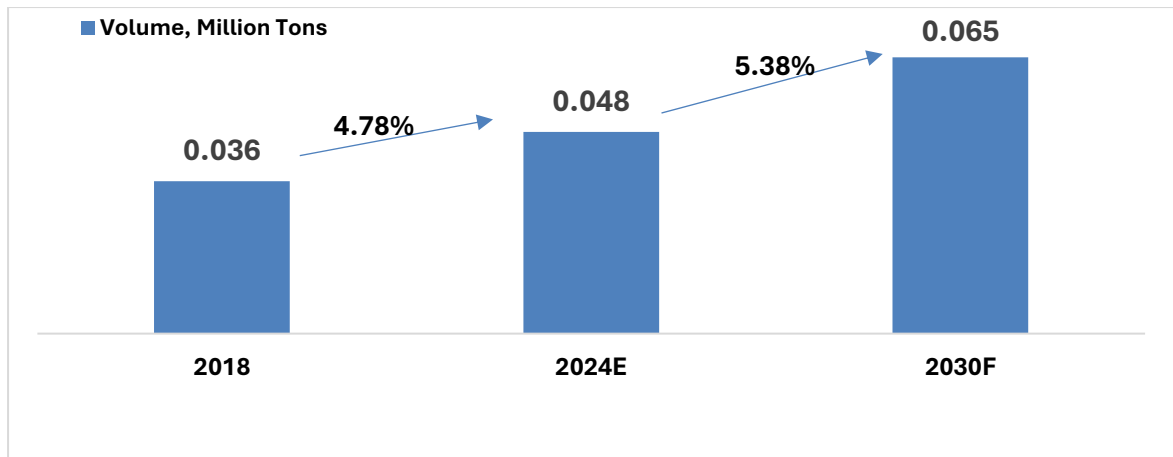
The varied agroecology of Nepal, which includes temperate, tropical, and subtropical zones, makes it the perfect place to grow cereal, fruit, and vegetable seeds. However, because of limitations in the nation's formal seed industry, this potential remains unrealized. Due to the prevalence of the informal system, farmers do not have adequate access to high-quality seeds. Just 25% of total grain seeds needed in 2023 were supplied by the formal sector. As a result, Nepal imports a lot of seeds, especially hybrid rice and maize, which add up to about half a billion dollars a year when cereal seeds and grain imports are taken into consideration.

**Exhibit 81: Nepal Seed Industry Market Size, Value (CY2018-CY2024E-CY2030F)**



Source: Frost & Sullivan Analysis

**Exhibit 82: Nepal Seeds Industry Market Size, Volume (CY2018-CY2024E-CY2030F)**



Source: Frost & Sullivan Analysis

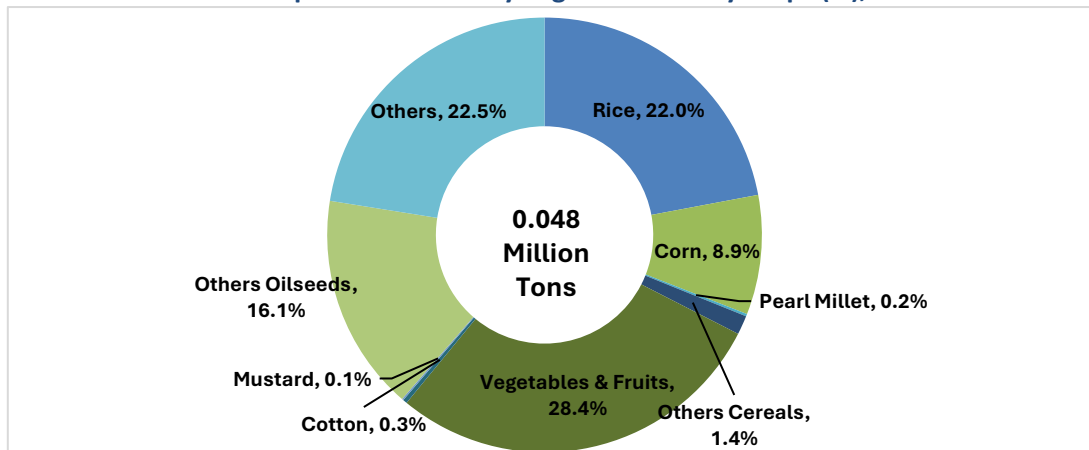
The development of Nepal's seed industry has long way to go. Private sector seed companies have opportunities for selling high-yielding varieties that are resistant to significant biotic and abiotic stresses, educating farmers about modern technologies and quality-certified seeds and developing institutional and human capacity throughout the seed value chain.

Country's infrastructure needs to be developed for better storage and road access along with providing incentives for private sector investment.

### 7.10 Nepal Seed Industry Market Segmentation

Nepal seed industry is dominated by rice with an estimated 22% of the market in volume terms. Cereals & grain market account for 44.7% in the entire seed industry.

**Exhibit 83: Nepal Seeds Industry Segmentation- By Crops (%), CY2024E**



\*Other cereals- Barley, Millets, Buckwheat, Wheat; Others include- Spices, etc

Source: Frost & Sullivan Analysis

Being a staple food in the Nepal, rice is the main cereal/row crop cultivated there. The growth in rice cultivation is driven by the ongoing need for rice to meet daily nutritional needs.

The hybrid rice market in Nepal is estimated to account for 1,500-1,700 metric tons in 2024E. SeedWorks (US Agriseeds), Nath seeds, Mahyco, VNR seeds, Advanta seeds are some of the key players from India who export hybrid paddy seeds to Nepal. SeedWorks (US Agriseeds) is

amongst the top 4 companies in hybrid rice in Nepal with ~26-29% market share in hybrid rice market in CY 2024.

Cereals & grains are followed by vegetables seeds. Potato, Okra, gourds and Chillis are the major vegetable crops grown in Nepal.

### 7.11 Nepal Seed Industry Key Opportunities & Drivers

- The National Seed Vision (NSV) 2025 and the ten-year Agriculture Development Strategy (ADS) have been taken into implementation in Nepal. In order to become self-sufficient, explore market potential, and boost the nation's economy, these programs place a strong emphasis on several facets of research and seed production. Hybrid seed production is expected to be driven by these initiatives.
- Annual Area Harvested for Rice is increasing in Nepal. In 2019-20, rice was harvested from 1,459,000 Hectares compared to estimated 1,550,000 Hectares in 2024-25. This growing rice acreages will further increase the demand for seeds in the country.
- Nepal's seed industry is driven by new investments in seed company operations and infrastructure. Currently, there are 20 locally registered seed companies supplying approximately 50% of the country's formal seed system. The growth is particularly evident in Nepal's emerging cereal seed sector, which consists mainly of small- to medium-sized enterprises. These companies, while making progress, often face challenges such as a lack of comprehensive business plans, limited working capital, and insufficient processing and storage capabilities. They primarily produce open-pollinated crop varieties, which are subsequently registered and released by Nepal's National Seed Board.
- The infrastructure supporting Nepal's agriculture is gradually advancing, with efforts to improve irrigation systems, transportation, and market access in rural areas.. Furthermore, the growth of agricultural cooperatives and farmer training programs is helping optimize crop yield and promote sustainable farming practices. As a result, Nepal is progressively strengthening its agricultural sector, allowing for a wider range of crops to flourish.

### 7.12 Key players in the Nepal Seed industry

Sr. No.	Company Name	Headquarters	Key Focus on Seeds	Product Portfolio
1	Bayer	Germany	Cereals and Vegetable Seeds	Corn, Rice, Vegetable
2	Corteva	United States of America	Cereals	Rice, Wheat, Corn
3	Anamolbiu Private Limited.	Nepal	Cereals, Pulses & Vegetable seeds	Corn, Tomato, Potatoes, Radish



Sr. No.	Company Name	Headquarters	Key Focus on Seeds	Product Portfolio
4	East-West Seed	Thailand	Vegetable Seeds	Tomato, Bitter gourd, Cucumber, Onion, Pepper, Watermelon
5	Lumbini Seed Company	Nepal	Cereals	Rice, Wheat, Corn, Pulses
6	National Seed Company	Nepal	Cereals	NA

## C} Africa

### 7.13 Agriculture overview of Africa

Africa has 60% of the world's uncultivated arable land. The agriculture sector accounts for 35% of Africa's GDP and employs more Africans than any other sector. The typical African farm barely produces at around 40-50% of its maximum potential. Furthermore, by 2050, the continent will only produce 13% of its food needs if current trends continue. However, with a rising population, thriving markets, and half of the world's uncultivated arable land, African agriculture also has immense potential.

Africa's most commonly cultivated cereal is corn. Corn is the main staple grain in East and Southern Africa. It is eaten as porridge, meal, and flour, among other forms. Although corn is a staple grain in West Africa, it is also frequently eaten as a snack in the form of boiled or roasted corn cobs.

Another crop that is commonly grown throughout Africa, especially in the Sahel region, is millet, which is used to feed both humans and cattle. In Africa, especially in West Africa, rice is a common crop. Although it is not as commonly consumed as other grains, wheat is also grown in Africa. Animal feed is made from wheat straw. While it is not as popular as other cereals, barley is another grain that is cultivated in Africa.

Tomatoes and onions are the most important vegetables.

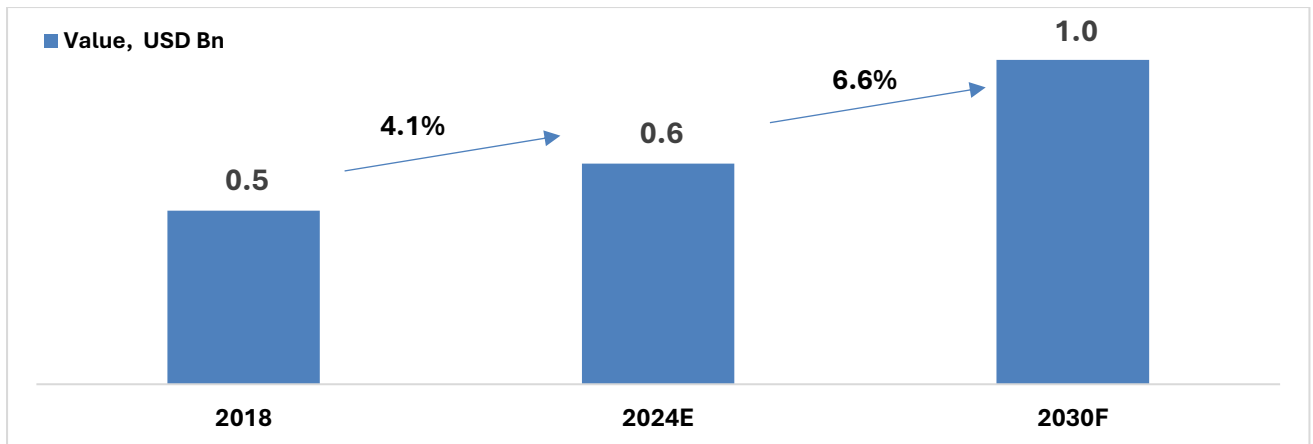
Onions and tomatoes are grown all over Africa, but the Mediterranean region is where most of them are produced. In the same region, vegetables like cauliflower and cabbage are cultivated, and some of these products are exported to southern Europe. In tropical Africa regions, peppers, okra, eggplants, cucumbers, and watermelons are important vegetables.

### 7.14 Africa Seed industry Market size

In Africa, where agricultural production is still very low and the utilization of improved varieties is very limited, seed systems are crucial. Many countries in the region have a vast agricultural land and potential to produce to increase yield at the farm level. Operating in Africa presents several challenges. These include finding skilled labor, as many countries face labor shortages and lack skilled professionals. Supply chain disruptions, regulatory hurdles, and political instability can also impact business operations. Despite these challenges, the potential for growth in Africa's agricultural sector presents a substantial opportunity.

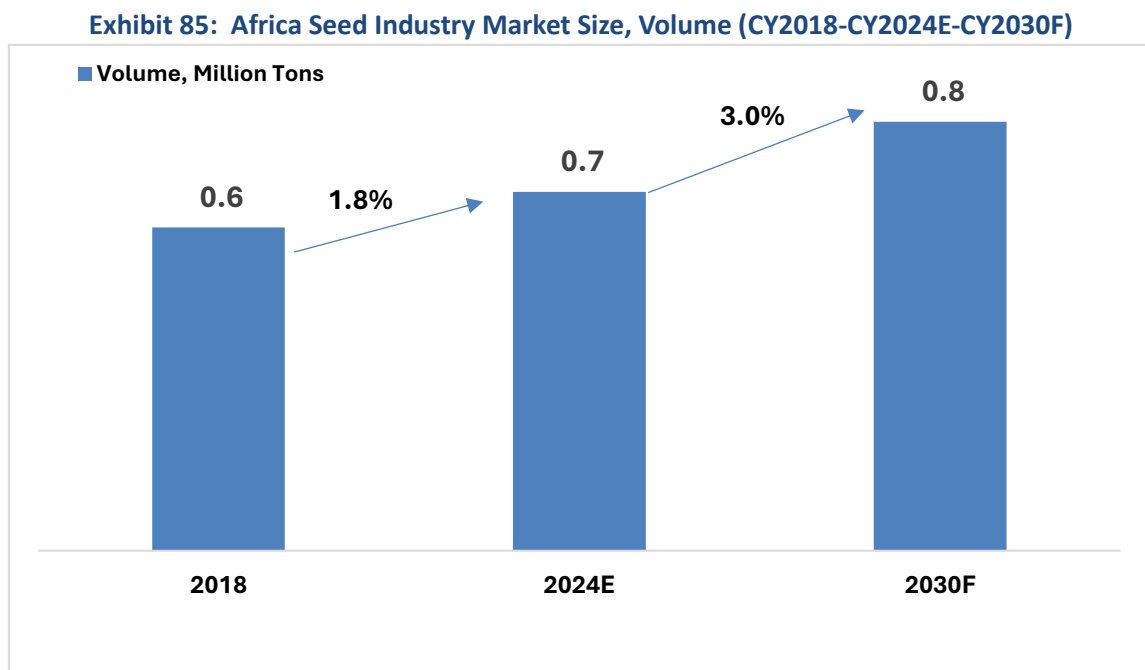
Rapid population growth in Africa is significantly increasing the demand for food, necessitating the adoption of high-yield and fast-growing seed varieties, fertilizers, and other inputs to ensure adequate food supply. The demographic surge is pressuring the agricultural sector to enhance productivity and efficiency. Concurrently, there is a critical focus on improving nutritional security by promoting the cultivation of nutrient-rich crops.

#### **Exhibit 84: Africa Seed Industry Market Size, Value (CY2018-CY2024E-CY2030F)**



Source: Frost & Sullivan Analysis

In 2024, it is estimated that African seed industry will account for ~1.3% of the worldwide seeds market, with a valuation of USD 0.6 billion for the same period. The market has grown at a 4.1% CAGR between 2018 to 2024 because of the surge in the adoption of innovative technologies & awareness regarding the advantages of hybrid seeds. The market is forecasted to grow at 6.6 % till 2030.



Source: Frost & Sullivan Analysis

Seed Sector in Africa can be broadly classified as Formal & Informal. Formal seed sector in Africa consists of formally recognized and regulated seed companies, both public and private, that fall under the jurisdiction of legislative quality assurance systems, seed certification systems, and that use modern equipment, machinery, and varieties along with business and technological approaches. About 10% to 15% of seeds, mostly from cereals and legumes, are supplied by this industry. Maintaining variety identity and purity as well as producing seeds with the best possible physical, physiological, and hygienic qualities are the sector's guiding principles

Informal seed sector is based on how farmers grow, distribute, and purchase seeds through on-farm saving, trade with other farmers, or purchases from nearby grain markets. Although it is mostly based on regional landraces and variations, there are also chances to include some modern varieties. The informal sector, which primarily operates outside of regulatory frameworks, effectively addresses local demands in terms of type, accessibility, and quality. Unregulated seed businesses that are just a few steps away from becoming part of the formal sector are also included in this sector. Africa’s seed sector is still predominantly informal. Millions of small-scale farmers supply majority of the seeds planted in Africa. Thus, the formal sector with multiple seed companies has huge potential to grow in Africa.

**Exhibit 86: Seed Industry market size in Key counties in Africa**

Country	Value, CY2024, USD Mn	Value, CY2030, USD Mn
<b>Malawi</b>	16.1	17.0
<b>Burkina Faso</b>	6.2	6.4
<b>Nigeria</b>	253.9	264.4
<b>Kenya</b>	23.7	25.3

*Source: Frost & Sullivan Analysis*

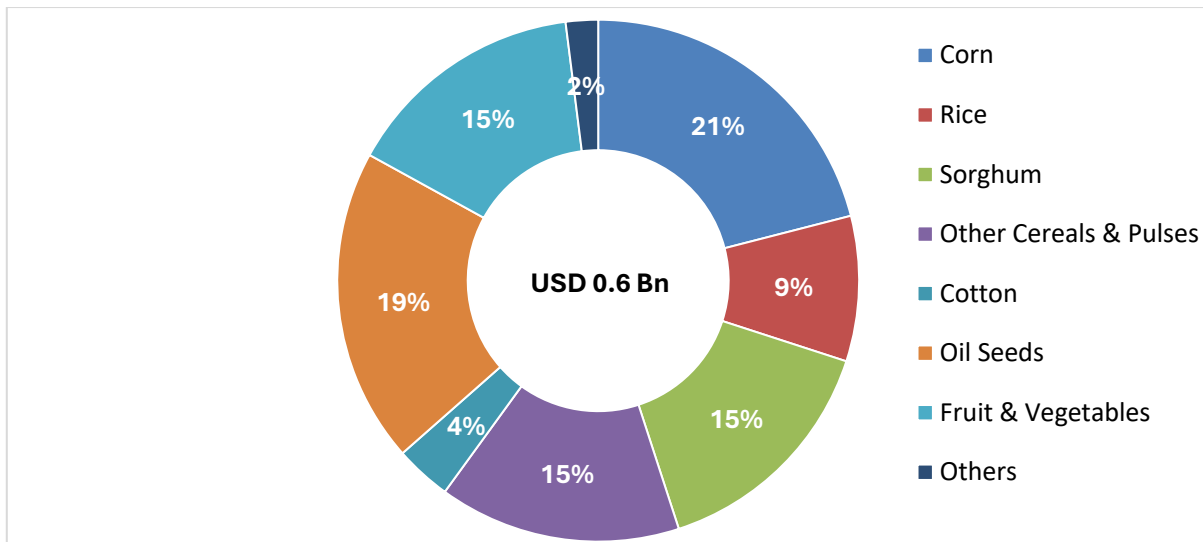
The above-mentioned countries present a huge scope for export of seeds from India as the demand for seeds is not fulfilled by the domestic seed sector. The government along with global organizations such as WHO, FAO are also focused on improving the food security in Africa. A number of Indian seed companies have been expanding into these markets in recent years. As Indian companies gain access to these markets; by focusing on exports of seed, African farmers/ distributors will also have access to locally adapted certified quality crop seeds and planting materials for increasing their productivity and income.

The seed industry is expected to witness growth owing to increasing adoption of cotton seeds and increased cultivation of quality vegetable seeds across these countries.

### **7.15 African Seed Industry Market Segmentation**

In 2023-24, cereals & grains dominated the total cultivated acreage in Africa region, apart for cocoa and coffee. Corn, Sorghum, Rice, Millets are the main cereals grown in the region with significant consumption levels as well.

**Exhibit 87: Africa Seeds Industry Segmentation- By Crops (%), CY2024E**



up

\*Other cereals- Barley, Millets, Buckwheat, Wheat; Others include- Spices, etc

Source: Frost & Sullivan Analysis

Sorghum is one of the staple cereals in the region which is used in beverage industry.

Rice is another major crop in Africa with the African rice, whose scientific name is *Oryza glaberrima*, is unique to Africa and is an integral part of the culture of some communities.

Cotton is one of strategic crops in Africa, especially for countries in Eastern and Southern Africa (ESA). It generates export revenues, as well as employment and income for families in rural areas in Africa. The market share of Cottonseed is around 4-5% i.e. about USD 24-30 Mn and growing at a CAGR of 3-5% in the region. Market is driven by increase in acreages for faster adoption of 'Bt cotton.

The area under cultivation for field crops is growing due to increasing regional and global demand for biofuel production and the higher demand for grains and cereals as staple crops.

Vegetable seed market is estimated to account for ~15% i.e. around USD 90-100 Mn in 2024. The market is growing at around 5-7% within vegetable seeds in the region. The majority of companies in Africa have focused on trading and distributing vegetable seeds, with a very few companies investing in R&D to create their own locally adapted varieties. Despite the presence of numerous international seed companies, there is still a shortage of vegetable or other crop breeding for the domestic market in Africa. The majority of vegetable seed is still imported from outside the continent, and local businesses still only make open-pollinated seed instead of hybrids. Some of the major vegetable in Africa include peppers, okra, beans, onions, potatoes, cucumbers, and watermelons. Kenya, and Ethiopia are the largest markets in terms of vegetable seeds followed by Nigeria, Uganda and Tanzania.

## 7.16 Africa Seed industry Key trends

**New traits** -As seed sector in Africa is shifting towards more formalized system, newer traits are being introduced by local as well as MNCs in the market. Public sector is also playing a major role in disseminating new technologies. Farmers across the region are being educated to use new, high yielding varieties for boosting the food security in region. Disease resistance is a popular emerging trait in African seed market due to the impact of insects and diseases on crop productivity and agricultural sustainability in the region.

**Climate change** – African nations are losing between 2 – 5% of their GDP on average, and several are spending up to 9 percent of their budgets to combat climatic extremes.

The African agribusiness is being significantly impacted by climate change, and farmers across the continent will need to implement strategies and technology that can adapt to the new weather patterns and changing consumer needs. This requires a thriving seed industry capable of utilizing both cutting-edge new technologies and the potential of regionally adapted breeds. To address the continuously shifting needs of African customers as well as those of the global market, there is tremendous potential to formalize and improve seed systems.

### **Bringing back neglected crops-**

In one of the worst-hit regions of the globe, Africa, one underappreciated solution—neglected crops—could be a potent instrument to ease the food and climate problems that continue to inflict suffering. Often referred to as "indigenous," "lost," "native," "orphan," "traditional," or "underutilized," neglected crops include vegetables like kale, eggplant, and amaranth as well as grains like sorghum and millet. They are native to specific region and have historically served as the foundation for incredibly nutrient-dense foods, but over time, many people lost or forgot about them. they are now underutilized by farmers and producers and, likewise, neglected by consumers, plant breeders, policymakers, and donors. Seed companies are leveraging this opportunity and launching products in sorghum, pearl millet and many others which are suitable to local conditions.

Along with above trends, African seed industry is also shifting towards being more organised and farmers are willing to purchase the branded seeds which has quality assurance.

## 7.17 Africa Seed industry Key opportunities & Drivers-

- **Food Security Issues:** According to the FAO - Food Security and Nutrition in the World (SOFI) Report – 2024, the prevalence of moderate or severe food insecurity in Africa (58.0 percent) was nearly double the global average where at least 298.4 million people may have faced hunger in 2023. Africa also remains the region with the largest estimated population (20.4%) which is facing hunger. Governments across the region along with FAO and other international organizations are trying to mitigate this food security issue. Various aids, imports, development funds are deployed to increase the agriculture production. Public as well as private sector players have been trying to make good quality high yielding seeds available across the region. These initiatives have also been helped by increased arable land.

Over the past 20 years (2000-2019), Africa's agricultural area has grown by more than a third, or 102 million hectares, or 52% of the global expansion.

- **Emerging Public & Private Sector Research:** In the majority of nations, corn dominates public breeding initiatives in terms of R&D expenditures. At least half of the active breeders for the top four priority food crops. Some private seed companies have started their own breeding programs, with their breeders often collaborating closely with National Agricultural Research Institute (NARIs) and Consortium of International Agricultural Research Centres (CGIAR) institutions.
- **Increasing GM Crops adoption:** With over 90% of the GM planted area, South Africa is the region's leading GM agriculture country. Other nations in the region have started growing genetically modified crops since 2012.

### 7.18 Key players in African Seed Industry

Some of the key players in African seed industry include Bayer, Syngenta, Corteva, Groupe Limagrain, BASF, Enza Zaden, Rijk Zwaan and Advanta seeds. These companies are focusing on cereals, oilseeds and vegetable seeds majorly.

In addition to consolidating its position in the Philippines and Nepal, SeedWorks (US Agriseeds) is actively pursuing opportunities to enter new geographies such as Africa. In Africa, the company plans to introduce their high-performing cotton and vegetable seed portfolios. The company's strategy includes developing hybrids, particularly HT rice hybrid, that are specifically adapted to the local agro-climatic conditions, ensuring high yield and resilience. SeedWorks (US Agriseeds) will also establish strategic partnerships with local distributors and agricultural organizations to facilitate market entry and growth. By building relationships with local stakeholders and investing in farmer education and support programs, the company aims to achieve significant market penetration in these regions.

Despite the presence of several international seed companies in Africa, there is still a shortage of vegetable seeds for the domestic market; as a result of which a majority of vegetable seeds are imported from outside the continent. This creates a significant opportunity for **SeedWorks (US Agriseeds)** to establish their presence in the crop segment, as the increasing demand for hybrid seeds with yield improvements will drive market growth. The Company is currently in the process of conducting field trials and registrations for its Cotton hybrids in these countries, and we aim to commence commercial operations by the end of Fiscal 2026. We are one of the few companies to receive a BG2 trait license from Bayer in Nigeria, Malawi and Kenya for the development and production of Bt cotton.

## 8. Competitor Benchmarking

### Revenue, INR Million

Company	Consolidated / Standalone	Revenue, INR million				Growth in Revenue
		FY 2021	FY 2022	FY 2023	FY 2024	CAGR, FY 21-FY 24
<b>SeedWorks (US Agriseeds)</b>	Consolidated	3,722.3	4,571.6	4,883.0	5,226.9	11.98%
<b>Advanta Seeds</b>	Consolidated	NA	28,680.0	36,030.0	42,240.0	-
<b>Ajeet Seeds</b>	Standalone	3,048.8	3,296.2	5,127.8	NA	-
<b>Ankur Seeds</b>	Standalone	5,396.0	5,924.4	6,475.0	7,273.1	10.46%
<b>Bayer India (Seed Revenues)</b>	Standalone	NA	NA	6,681.6	7,654.8	-
<b>Corteva Agriscience Seeds</b>	Standalone	15,069.3	16,787.4	20,406.6	NA	-
<b>JK Agri Genetics</b>	Standalone	2,237.8	2,458.5	2,009.2	1,481.0	-12.85%
<b>Kaveri Seeds</b>	Consolidated	10,363.1	9,699.8	10,703.6	11,484.1	3.48%
<b>Mahyco (Seeds &amp; Horticulture revenues)</b>	Consolidated	8,068.1	10,525.9	12,125.5	11,663.6	13.07%
<b>Namdhari Seeds</b>	Standalone	3,649.7	3,988.0	4,216.9	NA	-
<b>Nath Bio-Genes</b>	Consolidated (FY22 to FY24); Standalone FY21	3,075.6	2,783.6	3,013.6	3,326.2	2.65%
<b>Nuziveedu Seeds</b>	Standalone	7,429.1	6,506.3	7,236.0	7,354.2	-0.34%
<b>Rasi Seeds</b>	Standalone	15,392.2	12,963.5	12,525.4	12,297.6	-7.21%
<b>Tata Rallis India (Seed Revenues)</b>	Standalone	3,989.0	3,491.3	3,395.1	4,116.8	1.06%
<b>VNR Seeds</b>	Standalone	3,648.2	3,859.2	3,959.8	4,806.5	9.63%

Note: Revenues mentioned are from seed business for all mapped companies, and 3 Year CAGR (%) has been calculated considering revenue from seeds business for all companies. FY24 Financials for Ajeet Seeds, Corteva Agriscience Seeds & Namdhari Seeds were not available as on Jan 31<sup>st</sup>, 2025 which was taken as the cutoff date for this report and hence, 3 Year CAGR (%) couldn't be calculated. Seed business revenues for Bayer India were not publicly disclosed for FY21 and FY22, and consequently, 3 Year CAGR (%) couldn't be calculated. Source: Company annual reports, Tofler.

- SeedWorks (US Agriseeds) is the second fastest growing Indian seed company in terms of revenue from FY21 to FY24 with CAGR 11.98%, amongst the companies mapped above.



## R & D Expense, INR Million

Company name	R&D expense, INR million	R&D expense as % of Revenue
<b>SeedWorks (US Agriseeds)</b>	561.8	10.7%
<b>Advanta Seeds</b>	2,490.0	5.9%
<b>Ajeet Seeds</b>	NA	NA
<b>Ankur Seeds</b>	335.4	4.6%
<b>Bayer India</b>	NA	NA
<b>Corteva Agriscience Seeds</b>	NA	NA
<b>JK Agri Genetics</b>	112.7	7.6%
<b>Kaveri Seeds</b>	589.6	5.1%
<b>Mahyco</b>	703.5	8.5%
<b>Namdhari Seeds</b>	NA	NA
<b>Nath Bio-Genes</b>	112.8	3.4%
<b>Nuziveedu Seeds</b>	423.1	5.2%
<b>Rasi Seeds</b>	426.7	3.4%
<b>Tata Rallis India (Seeds business)</b>	NA	NA
<b>VNR Seeds</b>	570.9	11.9%

Note: \*Data available for FY 2023. Rest of the company's data is for FY 2024.

Data for capital expenditure has not been considered in R&D expenses.

Source: Company annual reports, Tofler.

Investment in R&D boosts the product offering of the companies. It also increases profitability and help businesses stay ahead of their peers. VNR seeds, SeedWorks (US Agriseeds) and Mahyco are among the top 3 players in pure-play seed companies spending maximum on R&D in FY 24 amongst the compared peers. These companies have also spent more than industry's average (6.4%) on R&D which emphasise the company's agility to adapt to changing requirements of the farmers. SeedWorks' (US Agriseeds) emphasis on product development to drive innovation in seeds, is demonstrated by being amongst the industry's leading players in R&D investments, which has over the years, led to the commercialization of product offerings with performance traits such as improved yield and disease tolerance. The strategic expansion of their product portfolio has enabled SeedWorks' (US Agriseeds) to maintain a strong foothold in the seed industry and in the markets where it operates.

## Exports Revenue, INR Million

Company name	Exports Revenue, FY 2024, INR million	Exports Revenue as % of Revenue
<b>SeedWorks (US Agriseeds)</b>	1,339.9	25.6%
<b>Advanta Seeds</b>	NA	NA
<b>Ajeet Seeds</b>	NA	NA
<b>Ankur Seeds</b>	1.4	0.02%
<b>Bayer India</b>	NA	NA
<b>Corteva Agriscience Seeds</b>	NA	NA
<b>JK Agri Genetics</b>	NA	NA
<b>Kaveri Seeds</b>	657.1	5.7%
<b>Mahyco</b>	NA	NA

Company name	Exports Revenue, FY 2024, INR million	Exports Revenue as % of Revenue
Namdhari Seeds	NA	NA
Nath Bio-Genes	43.8	1.3%
Nuziveedu Seeds	NA	NA
Rasi Seeds	NA	NA
Tata Rallis India	NA	NA
VNR Seeds	97.6	2%

Source: Company annual reports, Tofler.

### Earnings Before Interest, Taxes, Depreciation, and Amortization (EBITDA), INR Million

Company name	FY 2022	FY 2023	FY 2024
SeedWorks (US Agriseeds)	503.5	292.7	353.4
Ajeet Seeds	97.4	364.2	NA
Ankur Seeds	1,073.0	904.7	960.2
Corteva Agriscience Seeds	5,466.5	10,111.5	NA
JK Agri Genetics	152.0	-83.7	-254.8
Kaveri Seeds	2,025.3	2,517.2	2,858.2
Mahyco (Seeds and Horticulture)*	414.6	966.3	-504.3
Namdhari Seeds	480.2	476.0	NA
Nath Bio-Genes	371.9	488.9	498.6
Nuziveedu Seeds	791.8	1,327.1	1,195.5
Rasi Seeds	4,282.5	3,168.1	3,311.2
VNR Seeds	362.3	433.1	596.9

Note: EBITDA is calculated as profit before tax and exceptional items plus depreciation expense plus finance costs less other non-operating income. For Mahyco\*, EBITDA for seeds and horticulture is considered i.e. segment result before interest and tax + segment depreciation. Source: Company annual reports, Tofler.

### Profit before Tax & exceptional items (PBT), INR Million

Company name	FY 2022	FY 2023	FY 2024
SeedWorks (US Agriseeds)	344.3	124.8	146.7
Ajeet Seeds	84.2	352.3	NA
Ankur Seeds	1,209.8	1,282.2	1,407.9
Corteva Agriscience Seeds	5,497.0	10,334.4	NA
JK Agri Genetics	102.6	-152.8	-296.1
Kaveri Seeds	2,227.5	2,858.9	3,207.7
Mahyco (seeds and horticulture)	346.3	1,330.7	431.9
Namdhari Seeds	400.8	267.0	NA
Nath Bio-Genes	253.5	361.6	381.2
Nuziveedu Seeds	858.7	1,393.6	1,204.7
Rasi Seeds	4,449.9	3,395.7	3,735.4
VNR Seeds	292.1	355.4	472.8

Source: Company annual reports, Tofler.

### Profit After Tax Margins (PAT Margins), %

Company name	FY 2022	FY 2023	FY 2024
<b>SeedWorks (US Agriseeds)</b>	5.3%	1.1%	0.9%
<b>Ajeet Seeds</b>	3.2%	5.7%	NA
<b>Ankur Seeds</b>	17.3%	16.5%	15.8%
<b>Corteva Agriscience Seeds</b>	32.6%	52.2%	NA
<b>JK Agri Genetics</b>	3.1%	-5.4%	-14.1%
<b>Kaveri Seeds</b>	21.9%	25.5%	26.1%
<b>Mahyco (Seeds and horticulture)</b>	3.9%	9.6%	5.6%
<b>Namdhari Seeds</b>	10.1%	6.4%	NA
<b>Nath Bio-Genes</b>	-24.2%	11.6%	11.9%
<b>Nuziveedu Seeds</b>	12.7%	27.4%	18.3%
<b>Rasi Seeds</b>	25.5%	21.2%	21.3%
<b>VNR Seeds</b>	5.6%	6.7%	7.3%

Note: PAT Margin (%) = Profit / (loss) for the year / Revenue from Operations. For Mahyco\*, PAT margin is calculated as Seeds and horticulture segment profit (loss) for the year/Revenue from Seeds and Horticulture segment. Source: Company annual reports, Tofler.

### Return on capital employed (ROCE), %

Company name	FY 2022	FY 2023	FY 2024
<b>SeedWorks (US Agriseeds)</b>	23.6%	9.7%	10.3%
<b>Ajeet Seeds</b>	-0.3%	3.0%	NA
<b>Ankur Seeds</b>	9.2%	7.0%	7.1%
<b>Corteva Agriscience Seeds</b>	18.9%	41.4%	NA
<b>JK Agri Genetics</b>	7.1%	-6.3%	-18.8%
<b>Kaveri Seeds</b>	14.4%	17.4%	19.8%
<b>Mahyco (Seeds and horticulture)</b>	NA	NA	NA
<b>Namdhari Seeds</b>	8.9%	6.6%	NA
<b>Nath Bio-Genes</b>	5.1%	7.0%	6.7%
<b>Nuziveedu Seeds</b>	9.3%	13.9%	10.1%
<b>Rasi Seeds</b>	33.8%	21.1%	22.9%
<b>VNR Seeds</b>	18.1%	16.3%	20.5%

Note: Return on Capital Employed is calculated as EBIT divided by Average Capital Employed. EBIT is calculated as profit before tax and exceptional items plus finance costs less other non-operating income. Average Capital Employed is the average of total equity and total debt, including both non-current and current borrowings. Source: Company annual reports, Tofler.

### Return on Equity (ROE), %

Company name	FY 2022	FY 2023	FY 2024
<b>SeedWorks (US Agriseeds)</b>	31.2%	6.7%	5.7%
<b>Ajeet Seeds</b>	1.7%	4.7%	NA
<b>Ankur Seeds</b>	12.0%	11.7%	11.7%
<b>Corteva Agriscience Seeds</b>	22.7%	50.5%	NA
<b>JK Agri Genetics</b>	5.6%	-7.9%	-17.3%

Company name	FY 2022	FY 2023	FY 2024
<b>Kaveri Seeds</b>	16.8%	20.6%	23.0%
<b>Mahyco (Seeds and horticulture) *</b>	5.3%	12.0%	6.1%
<b>Namdhari Seeds</b>	12.9%	6.9%	NA
<b>Nath Bio-Genes</b>	-11.7%	6.3%	6.7%
<b>Nuziveedu Seeds</b>	11.7%	24.3%	14%
<b>Rasi Seeds</b>	29.9%	19.7%	19.5%
<b>VNR Seeds</b>	15.8%	16.3%	18.2%

*Note: Return on Equity is calculated as profit for the period divided by average total equity. For Mahyco\*, ROE is calculated as Seed & Horticulture Segment Profit after tax/Average Segment Equity i.e (Segment Assets-Segment Liabilities). Source: Company annual reports, Tofler.*

### Operational Benchmarking

Companies	Product Portfolio										
	Cotton	Rice/ Paddy		Mustard		Pearl millet		Wheat		Vegetables	
	GM	Hybrid	OPV/ Research	Hybrid	OPV/ Research	Hybrid	OPV/ Research	Hybrid	OPV/ Research	Hybrid	OPV/ Research
SeedWorks (US Agriseeds)	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓	✗
Mahyco	✓	✓	✓	✓	✓	✓	✗	✗	✓	✓	✓
Ankur Seeds	✓	✓	✓	✗	✗	✓	✗	✗	✓	✓	✓
Kaveri Seeds	✓	✓	✓	✓	✗	✓	✗	✗	✓	✓	✗
Nuziveedu Seeds	✓	✓	✓	✓	✗	✓	✗	✗	✓	✓	✗
Rasi Seeds	✓	✓	✓	✓	✓	✓	✗	✗	✓	✗	✗
Advanta Seed	✗	✓	✗	✓	✗	✓	✗	✗	✗	✓	✗
Namdhari Seeds	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗
Nath Bio Genes Ltd	✓	✓	✓	✓	✗	✓	✗	✗	✓	✓	✗
Ajeet seeds	✓	✓	✓	✓	✗	✓	✗	✗	✓	✓	✓
VNR seeds	✗	✓	✓	✗	✓	✓	✗	✗	✓	✓	✓
Tata Rallis	✓	✓	✗	✓	✗	✓	✗	✗	✗	✓	✗
Corteva- India	✗	✓	✗	✓	✗	✓	✗	✗	✗	✗	✗

Companies	Product Portfolio										
	Cotton	Rice/ Paddy		Mustard		Pearl millet		Wheat		Vegetables	
	GM	Hybrid	OPV/ Research	Hybrid	OPV/ Research	Hybrid	OPV/ Research	Hybrid	OPV/ Research	Hybrid	OPV/ Research
Syngenta- India	✗	✓	✗	✗	✗	✗	✗	✓	✓	✓	✗
Bayer- India	✗	✓	✗	✗	✗	✗	✗	✗	✗	✓	✗
Crystal Crop Protection	✓	✓	✓	✓	✗	✓	✗	✗	✗	✓	✗
BASF- India	✗	✗	✗	✗	✗	✗	✗	✗	✗	✓	✗
Sriram Bioseed	✓	✓	✗	✗	✗	✓	✗	✗	✓	✓	✗

Source: Company websites, Secondary research

Companies	YOE	Operational Benchmarking			
		Product Diversification			Exports presence
		No of Crops	No of field crops	No of vegetable crops	
SeedWorks (US Agriseeds)	1998	21	7	14	Philippines, Nepal
Mahyco	1964	22	11	11	Asia, Africa, USA, Middle East and Europe (more than 20 countries).
Ankur Seeds	1976	34	12	22	NA
Kaveri Seeds	1976	15	9	6	Bangladesh, Tanzania, Algeria, UAE, Vietnam, Ivory Coast, Thailand, Laos, Cambodia, Philippines, Egypt
Nuziveedu Seeds	1973	15	9	6	NA
Rasi Seeds	1973	7	7	0	
Advanta Seed	1989	30	7	23	80+ countries including Ukraine, Romania, Brazil, Thailand, USA, Australia, Argentina, Indonesia, Kenya

Companies	YOE	Operational Benchmarking			
		Product Diversification			Exports presence
		No of Crops	No of field crops	No of vegetable crops	
<b>Namdhari Seeds</b>	1985	24	0	14	Bangladesh, Pakistan, Nepal, Turkey, Egypt, Jordan, Bulgaria, Spain, Tanzania, Kenya, Myanmar, Thailand, Vietnam, Indonesia,
<b>Nath Bio Genes Ltd</b>	1979	27	8	17	Africa, Bangladesh, Philippines, Nepal, Nigeria, China, Myanmar, Pakistan, Indonesia, Vietnam, Sudan
<b>Ajeet seeds</b>	1986	34	8	26	NA
<b>VNR seeds</b>	2005	25	5	20	NA
<b>Tata Rallis</b>	-	6	5	0	39 countries
<b>Corteva- India</b>	-	NA	NA	NA	NA
<b>Syngenta- India</b>	-	26	2	24	90 countries worldwide
<b>Bayer- India</b>	-	21	3	18	12 countries
<b>Crystal Crop Protection (Seeds)</b>	1994	30	8	22	United States, Egypt, Bangladesh, Thailand, and Sri Lanka
<b>BASF- India</b>	-	10	0	10	10 countries
<b>Sriram Bioseed Ventures</b>	1992	24	7	17	9 Countries (India, Vietnam, Philippines, Thailand, Indonesia, Bangladesh, Laos, Cambodia, Nepal and China.

Source: Company websites, Secondary research

SeedWorks has emerged as the youngest pure-play seed company to secure a position among the top 10 pure-play seed companies in India, demonstrating market acceptance amongst farmers for their products across key crops and their ability to scale efficiently and achieve significant milestones within a short timeframe.

Companies	Operational Benchmarking				
	No of distributors	No of States present	Farmer Network	Grower Network	No of employees
<b>SeedWorks (US Agriseeds)</b>	4,000+ distributors	Present in 22 states	4 million farmers	43,393 grower farmers	451
<b>Mahyco</b>	1800 distributors of field crop seeds and 2500 distributors of vegetable seeds	Andhra Pradesh, Bihar, Gujarat, Haryana, Himachal Pradesh, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh (13+)	10 Million Farmers	Over one lakh registered contract growers spread all over India.	944
<b>Ankur Seeds</b>	NA	Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Madhya Pradesh, Maharashtra, Punjab, Rajasthan, Tamil Nadu, Telangana, Uttar Pradesh (12+) with 18 Regional Offices across India.	NA	100,000	1,052
<b>Kaveri Seeds</b>	Direct distributor network- 3785	18+ states, 400+Districts	55 million	1,000,000	1,342
<b>Nuziveedu Seeds</b>	3,300+	28 states and 2 UTs	100,000	75,000+	1,700+
<b>Rasi Seeds</b>	40K distribution points, 200 sales offices	17+ states	400,000	35,000	NA
<b>Advanta Seed</b>	789 (Distributors for UPL)	NA	NA	NA	NA
<b>Namdhari Seeds</b>	800 (15,000 dealer points and availability across the country.)	Himachal Pradesh, Punjab, Haryana, Uttar Pradesh, Maharashtra, Andhra Pradesh, Karnataka, Tamil Nadu, Bihar, Chhattisgarh, Gujarat,	5,00,000+ farmers	12,145 farmers globally	481



Companies	Operational Benchmarking				
	No of distributors	No of States present	Farmer Network	Grower Network	No of employees
		Jharkhand, Madhya Pradesh, Odisha (14+)			
<b>Nath Bio Genes Ltd</b>	20,000	Pan India presence with 16 business centers across 131 regions in India across 23 states of India	NA	15,000+	423
<b>Ajeet seeds</b>	400	10+	Maharashtra and other western states including South	50,000 (Gujrat, Rajasthan, Maharashtra, Tamil Nadu, Andhra Pradesh, Telangana, and Karnataka.	1,705
<b>VNR seeds</b>	1,100+	21+states PAN India	11,00,000+	NA	1,364
<b>Tata Rallis</b>	2,765 (Dealers)	26+	40,00,000+	12000 (1400+Seed Production Villages)	1657* (Total)
<b>Corteva- India</b>	NA	NA	40,00,000 farmers	NA	NA
<b>Syngenta- India</b>	Available data only for flowers	28 states & 8 UTs	More than 20 Million smallholder farmers across India were supported by Bayer's agri-inputs		1,800+
<b>Bayer- India</b>	4,157	28 states & 8 UTs	NA	NA	1,317 (india)

Companies	Operational Benchmarking				
	No of distributors	No of States present	Farmer Network	Grower Network	No of employees
<b>Crystal Seeds</b>	600+ dealers (7000+ for Crystal Crop)	Pan India	NA	NA	500+
<b>BASF- India</b>	300+	24			112
<b>Sriram Bioseed Ventures</b>	NA	28	NA	NA	6,067

Companies	ESG Initiatives
<b>SeedWorks (US Agriseeds)</b>	<p>Company prioritizes environmental, social and governance (“ESG”) initiatives, with a focus on environmental sustainability and promoting social responsibility. ESG initiatives are guided by the SRISHTeE framework, which addresses six smart pillars: Carbon, Water, Energy, Nitrogen, Knowledge, and Weather. Through this framework, it empowers smallholder farmers, promote effective water resource management, and address the impact of climate change.</p> <p>SeedWorks (US Agriseeds) has been recognized as amongst 40 ‘business’ members of Global Alliance for Climate Smart Agriculture (GACSA) in 2022. The company is one of the few domestic seed company in the private sector in India to undertake a comprehensive green-house gas (“GHG”) emissions baselining and inventory development for scope 1, 2 and 3 GHG emissions and develop emission targets and mitigation plans aligned with Science Based Targets initiative (SBTi). Company have implemented several measures to reduce their carbon footprint including piloting methane chambers, installing solar panels and solar sprayers, and converting seed waste into bio-fertilizer. These efforts have resulted in a reduction of over 820 metric tons of carbon dioxide and the production of 14 metric tons of organic fertilizer in Fiscal 2024. At Company’s vegetable seed processing plant, 50% of energy requirement was met from renewable energy in Fiscal 2024. Additionally, over the last three Fiscals, Company have saved over 14 billion litres of water annually through various initiatives across India. Company has adopted smart irrigation practices to reduce water consumption for DSR. This resulted in water savings and reduced crop cycle time. They have also generated power via conversion of discarded seed into energy.</p> <p>Company’s commitment to sustainability is further demonstrated by its 'Extended Producer Responsibility' fulfilment for post-consumption plastic waste, which is a policy that holds producers responsible for their products' lifecycle, including disposal, recycling and reuse. In Fiscal 2024, Company collected and disposed of 222 metric tons of plastic waste.</p> <p>Company has been recognized for efforts in sustainability including award for Best Performance in Soil and Water Conservation and award for Climate Resilient Agriculture and Sustainable Carbon Management Practice by Transformance in 2023. Company has received multiple awards from FICCI at the Sustainable Agri Summit for its efforts in soil and water conservation and enhancing farmers’ income through better cotton initiatives, and the bronze rating from EcoVadis, a globally recognized business sustainability ratings platform.</p>
<b>Mahyco</b>	<p>Company has contributions in the field of education &amp; has built most modern eye care Centre at Jalna. Health, nutrition, Education, livelihood Environment / Water, Technology dissemination are key focus areas. Company encourages diversity in respect of age, colour, gender, language, disability, ethnicity, religious beliefs, nationality, family status, and sexual orientation.</p>
<b>Ankur Seeds</b>	<p>Corporate Social Responsibility Committee is constituted by the Board of Directors of Ankur Seeds Private Limited which involves participating, contributing and marking presence in social, economic, infrastructural, educational, cultural</p>

Companies	ESG Initiatives
	developments etc. Hunger, Poverty, Malnutrition and Health, Promoting education and Gender Equality and Empowerment of Women are focus areas.
<b>Kaveri Seeds</b>	Focus Area- Education, Rural Infrastructure, Skill Development. Offered scholarships to students across Warangal Urban, Medak and Hyderabad districts in Telangana. Constructed 'Rythu Vedikas' in Gnpur and Kothulanaduma Village and provided computers to Rythu Vedikas in Kannapur, Molungur and Thadikal villages. Constructed a check dam at Bollonipally Village. Other infra projects include- septic tank, sewage lines, and a water tank at Pamulaparthi Village, Wargal Mandal, Siddipet District, construction of 2 BHK houses in GNpoor Village in Bheemadevarapally Mandal, Warangal Urban District Bheemadevarapally Mandal in Warangal Urban District, Telangana
<b>Nuziveedu Seeds</b>	Extension works on Biochar & Carbon Credits, Direct Seeded Rice, Standard Package Practices for Maize/ Silage
<b>Rasi Seeds</b>	Conducts free annual Eye Camp at Attur, Provides educational assistance to economically backward students
<b>Advanta Seed</b>	NA
<b>Namdhari Seeds</b>	NA
<b>Nath Bio Genes Ltd</b>	CSR initiatives in rural development. Need-based training programs are conducted to further enhance the skills and knowledge of small and marginal farmers. Trainings on sustainable agricultural practices, soil and water conservation, pest management, use of fertilizers, are imparted.
<b>Ajeet seeds</b>	NA
<b>VNR seeds</b>	NA
<b>Tata Rallis</b>	Rallis has undertaken an ambitious initiative of 30 by 30, targeting 30% absolute reduction of carbon emission by the year 2030. Further, as a part of its social focus area, the Company undertakes various CSR projects around its manufacturing units with specific focus on education, skill development and employability/entrepreneurship.
<b>Corteva- India</b>	NA
<b>Syngenta- India</b>	Syngenta India initiated a 10,000 km Drone Yatra to educate farmers on drone spraying technology, covering 13 states. Also launched Syngenta Foundation India
<b>Bayer- India</b>	In September 2024, Bayer launched the 'Bayer Forward Farming' initiative in India, establishing a network of farms that demonstrate sustainable agricultural practices. The program focuses on regenerative agriculture, particularly sustainable rice cultivation, and aims to support smallholder farmers in adopting innovative farming techniques to enhance productivity while preserving environmental resources
<b>Crystal Crop Protection</b>	NA
<b>BASF- India</b>	NA
<b>Sriram Bioseed Ventures</b>	The company is making advances in climate resilient crop development, environmental stewardship. Community engagement.