

Report on Pesticides Industry

January 2022

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1. Global Economic Outlook

The world economy contracted by 3.1% in CY2020 owing to the global outbreak of Covid-19. In comparison with the forecasts made by IMF in World Economic Outlook, July 2021, IMF downgraded its projected global economic growth outlook for CY2021 while the estimates remained unchanged for CY2022. The global economy is now forecasted to grow by 5.9% in CY2021 and 4.9% in CY2022. The revision made for CY2021 is due to the downgrades made for advanced economy and low-income developing countries group.

Table 1: Global Growth Outlook Projections (in %)

| Country/Group | 2020 | 2021E | 2022E |
|--|------|-------|-------|
| World Output | -3.1 | 5.9 | 4.9 |
| Advanced Economies | -4.5 | 5.2 | 4.5 |
| United States | -3.4 | 6.0 | 5.2 |
| Euro Area | -6.3 | 5.0 | 4.3 |
| Japan | -4.6 | 2.4 | 3.2 |
| United Kingdom | -9.8 | 6.8 | 5.0 |
| Canada | -5.3 | 5.7 | 4.9 |
| Remaining Advances Economies | -1.9 | 4.6 | 3.7 |
| Emerging Market & Developing Economies | -2.1 | 6.4 | 5.1 |
| Emerging and Developing Asia | -0.8 | 7.2 | 6.3 |
| China | 2.3 | 8.0 | 5.6 |
| India* | -7.3 | 9.5 | 8.5 |
| ASEAN** | -3.4 | 2.9 | 5.8 |
| Emerging and Developing Europe | -2.0 | 6.0 | 3.6 |
| Latin America and the Caribbean | -7.0 | 6.3 | 3.0 |
| Middle East and Central Asia | -2.8 | 4.1 | 4.1 |
| Sub-Saharan Africa | -1.7 | 3.7 | 3.8 |

Notes: E-Estimates

*For India, data and forecasts are presented on a fiscal year basis and GDP from 2011 onward is based on GDP at market prices with fiscal year 2011/12 as a base year.

***Includes Indonesia, Malaysia, Philippines, Thailand and Vietnam*

Source: IMF – World Economic Outlook, October 2021

The growth in global GDP in H1 CY2021 was broadly according to the expectations and outruns for first quarter global GDP were stronger than expected due to continued resumption of economic activities coupled with policy support from the government. However, the momentum weakened in the second quarter due to spike in Covid-19 cases in several emerging and developing economies and consequent disruptions in supply.

Advanced economies group

During the Pandemic, the global economy faced disruption in supply chain due to temporary trade restrictions and shortages of pharmaceuticals, critical medical supplies, and other products. As a consequence of all this, manufacturers worldwide are going to be under greater political and competitive pressures to increase their domestic production, grow employment in their home countries, reduce or even eliminate their dependence on sources.

After a negative growth of 4.5% in CY2020, advanced economies group is projected to grow by 5.2% in CY2021. IMF revised down its forecast from 5.6% made in July 2021 largely due to downgrade made for United States on the back of large inventory drawdowns in Q2 CY2021, in part reflecting supply disruptions and softening consumption in the third quarter of CY2021. The projections for United States subsequently incorporate the infrastructure bill recently passed by the Senate and anticipated legislation to strengthen the social safety net, equivalent to about \$4 trillion in spending over the next 10 years.

Similarly, projections were downgraded for Germany and Japan to 3.1% and 2.4% respectively. For Germany, it was partly due to shortages of key inputs weighing on manufacturing output and for Japan it was attributed to the effect of the fourth State of Emergency imposed from July to September as Covid-19 infections hit a record level in the current wave. Overall, across the advanced economies group, the forecast for CY2022 has been revised upwards from 4.4% to 4.5% in World Economic Outlook – October, 2021 release based on stronger rebound expected in H1 of CY2022 due to higher vaccine rollouts.

In the global economies, the recovery is strengthening due to health protections such as widespread vaccinations which is an effective bulwark against the pandemic. Along with this, monetary policy normalization from central banks has also been as a recovery measure.

Emerging market and developing economies group

After contracting by -2.1% in CY2020, the emerging market and developing economies group is estimated to grow by 6.4% in CY2021. This is a revised forecast from 6.3% made in July, 2021 release and is backed by revised upgrades in most of the regions in the group. Projections for China are slightly revised down to 8% in CY2021 due to stronger than expected scaling back of public investment while for India, the projections have remained unchanged at 9.5% growth in CY2021. Apart from China and India, the emerging market and developing economies group is revised down as the Covid-19 cases increased. Meanwhile, projections made in other regions have been slightly revised upwards in CY2021.

IMF highlighted in its report that the economic recovery is highly dependent on vaccine access across regions, hence economies will witness diverging recovery rates which may not remain steady as long as people are exposed to the virus and its emerging variants. Close to 58% of the population is vaccinated in the advanced economies while only around 36% of the population is vaccinated in the emerging economies and less than 5% of population is vaccinated in low income group. In these economies, vaccine supply and distribution remain the primary issue. Hence, speeding up the vaccination of the world population remains the top policy priority, while continuing the push for widespread testing and investing in therapeutics. This would help save millions of lives and also aid in preventing the emergence of new variants thereby hastening the global economic recovery.

2. Indian Economic Outlook¹

GDP growth and Outlook

The Q2 of FY 22 growth rate has propelled India as the World's India's economy grew by 8.4% year-on-year in Q2 of FY 22. On a sequential basis (quarter-on-quarter basis), domestic economic output expanded by 10.4%. The easing/ removal of lockdowns across states along with the steady decline in covid-19 cases and the higher vaccination rate facilitated higher economic activity and output in the latest quarter.

Chart 1: Sequential growth in GDP at constant prices (in %)



Source: MOSPI, CareEdge Ratings Economics Research report

The nominal GDP has grown by 17.6% from Q2 FY22 and is 8.4% higher than the previous quarter. The high growth here is reflective of the price pressures across the various goods and services in the economy. Even though, the elevated growth rates over year ago largely reflects the sharp contraction the country's economy suffered last year, the annual as well as sequential improvement suggests that the domestic economy is on the path to recovery.

Even though the domestic economy the Indian Economy has come off the record decline of last year, it is yet to surpass pre-pandemic level in a meaningful manner.

¹ Source: CareEdge Ratings Economics Research report, "India's Economy in Q2 FY22" dated 30th November 20

When compared with the pre-pandemic period i.e., Q2 FY20, the GDP in Q2 FY22 is only marginally higher by 0.3%.

Table 2: Quarterly GDP growth in % at constant prices (y-o-y)

| | Q2 FY20 | Q2 FY21 | Q2 FY22 | Q2 FY 22 over Q2 FY20 |
|--------------------|---------|---------|---------|-----------------------|
| Real GDP | 4.4 | -7.4 | 8.4 | 0.3 |
| Nominal GDP | 5.9 | -4.0 | 17.6 | 12.4 |

Source: MOSPI, CareEdge Ratings Economics Research report

There are increasing signs of higher level of activity across sectors. This has given rise to optimism that the recovery in the domestic economy is strengthening. Even if the pace of recovery is sustained in the next two quarters, India's GDP for the year is expected to be only marginally higher than that in FY20 (by around 2%).

Demand and investments are yet to see a meaningful and durable pick-up. Improvements in these are expected to be limited and gradual given that even before the pandemic, the domestic economy was grappling with low demand and subdued investment climate. To add to this, domestic and external challenges and uncertainties still abound. The rise in price levels and the underlying threat from new variants of the Covid virus and the associated challenges of on-and-off restrictions and lockdowns could be a set-back / challenge for domestic as well as global recovery.

Given the uncertainties associated with the scale of economic recovery, the RBI is expected to be maintain its growth focus and continue with the accommodative monetary policy stance even as it moves towards gradual normalization of support.

As per CareEdge Ratings Economic Research Report, economic activity is expected to attain and surpass pre-pandemic level from Q3 FY22 onward, hence the GDP growth for the FY 22 made is estimated at 9.1%.

As per RBI's fifth bi-monthly monetary policy for 2021-22, The RBI highlighted downside risks to the growth outlook – on account of the emergence of Omicron Variant and consequent renewed surge in Covid-19 infections across countries globally.

To add to this there are headwinds from elevated global commodity prices, potential volatility in global financial markets with faster normalization of monetary policy in advanced economies and prolonged global supply bottlenecks.

In terms of quarterly growth, it has revised downward the GDP growth projections for Q3 and Q4 of FY22 from its earlier estimates of October'21 (by 0.2% and 0.1% respectively). The Q1 FY22 growth estimate too has been left unchanged at 17.2% and it has pegged Q2 FY23 GDP growth at 7.8%

Table 3: RBI's GDP Growth Outlook as on December'21

| | Q3 FY 22 | Q4 FY 22 | FY 22 | Q1 FY 23 | Q2 FY 23 |
|------------|----------|----------|-------|----------|----------|
| GDP Growth | 6.6 | 6 | 9.5 | 17.2 | 7.8 |

Source: RBI press release dated December 8, 2021

Gross Value Added (GVA)

Gross value added (GVA) is the measure of the value of goods and services produced in an economy. GVA gives a picture of supply side whereas GDP represents consumption.

- There has been a broad-based year-on-year growth across all the sectors in Q2 FY22 driven by the low base of year ago.
- Barring agriculture and mining all the other key sectors have in the latest quarter witnessed growth over Q1 FY22.
- When compared with the pre-pandemic period i.e., Q2 FY20, the output of the service sector viz., trade, hotel, transport & communication and finance, real estate & professional services have been lower
- GVA in Q2 FY22 grew by 7.9% on a sequential basis, following the contraction of 13% in the preceding quarter.
 - Industry (30% of GVA) as well as the services (58% of GVA) sector were the drivers of economic output during the quarter.
 - The industrial sector grew 6% on a sequential basis and by 7% on an annual basis. Manufacturing followed by construction were the driver for growth in industry. Manufacturing output grew by 8% while construction GVA was 9% higher than Q1 FY22. The higher manufacturing output can be linked to the festive period demand for

manufactured goods that prompted higher levels of production during August-September. The pick-up in construction can be linked to the easing of restrictions and the focus on infrastructure by the government.

- The contraction in the agriculture sector on a quarterly basis (by 16% in Q2 FY22) is reflective of the impact the unfavourable weather conditions prevalent during the quarter that led to loss of output.
- The service sector output in the latest quarter was 16% higher than Q1 FY22 and 10% more than a year ago. All the sub-segments of the service sector witnessed strong growth in Q2 FY22 following the contraction of the preceding quarter. The easing of restriction has led to a fast rebound in this sector. The output of the sector however is yet to attain pre-pandemic levels.

Table 4: Sectoral Growth – Quarterly (Y-o-Y % Growth) at Constant Prices

| At Constant Prices | Q2 FY20 | Q2FY21 | Q2 FY22 | Q2 FY22 v/s Q2 FY20 | Q-o-Q % growth Q2 FY22 |
|---|-------------|--------------|-------------|---------------------|------------------------|
| Agriculture, forestry & fishing | 3.5 | 3.0 | 4.5 | 7.7 | -16.2 |
| Industry | -1.8 | -3.0 | 6.9 | 3.7 | 5.9 |
| Mining & quarrying | -5.2 | -6.5 | 15.4 | 7.9 | -14.0 |
| Manufacturing | -3.0 | -1.5 | 5.5 | 5.5 | 7.9 |
| Electricity, gas, water supply & other utility services | 1.7 | 2.3 | 8.9 | 8.9 | 5.2 |
| Construction | 1.0 | -7.2 | 7.5 | -0.3 | 8.7 |
| Services | 8.2 | -11.4 | 10.2 | -2.4 | 16.2 |
| Trade, hotels, transport, communication & broadcasting | 6.8 | -16.1 | 8.2 | -9.2 | 24.9 |
| Financial, real estate & professional services | 8.9 | -9.1 | 7.8 | -2.0 | 7.0 |
| Public administration, defence and other services | 8.8 | -9.2 | 17.4 | 6.6 | 24.7 |
| GVA at Basic Price | 4.6 | -7.3 | 8.5 | 0.5 | 7.9 |

Source: MOSPI, CARE Ratings Economics Research report

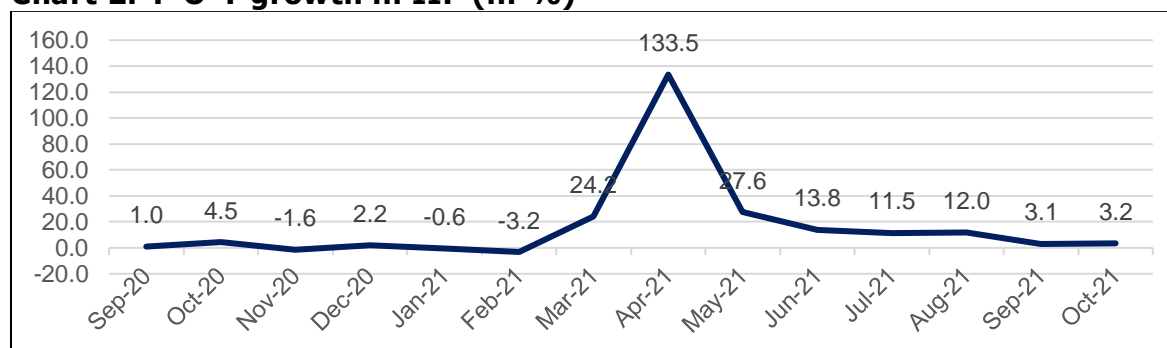
i. Industrial Growth

Growth in industrial output remained unchanged at 3.2% in October'21 compared with 3.1% in the previous month. Negative growth in the capital and consumer goods segment has restricted the growth in overall industrial output. Weakening of the base has contributed to slowing momentum in industrial activity from the double-digit growth witnessed during the first five months of FY22. Sequential momentum in industrial activity accelerated by 4.3% during the month. Output in all sectors witnessed an improvement over the previous month except electricity, capital goods and consumer goods segment.

The IIP growth has witnessed a moderation over the past two months on account of base normalisation.

Companies are expected to ramp up output amid strengthening demand scenario which is expected to support manufacturing growth in the near term. Performance of the mining sector is expected to pick-up with resumption of mining activities that were impacted by extended monsoons. Thus, we could expect industrial output to gather momentum in the coming months, however, it would continue to be subdued with the waning of base-effect.

Chart 2: Y-O-Y growth in IIP (in %)



Source: MOSPI, CareEdge Ratings Economics Research report

1.2.4 Concluding Remarks

The Reserve Bank of India (RBI) at its fifth bi-monthly monetary policy meeting for FY22 concluded on 8th December 2021, maintained the repo rate at a record low of 4% and continued with its accommodative policy stance. RBI reiterated its emphasis on growth and economic revival.

The central bank's focus on supporting economic growth prevailed at the just announced policy review, as in its assessment even though economic recovery is gaining traction it is not yet strong enough to be self-sustaining and durable. It has reiterated that the accommodative monetary policy stance would be maintained for as long as necessary for reviving and sustaining economic growth. At the same time the RBI continues to move towards gradual normalization of policy support. It did not announce any fresh liquidity infusion measures and indicated that it would keep rebalancing and fine-tuning the liquidity surplus in the banking system.

In its latest monetary policy meet, the RBI has kept CPI inflation target unchanged at 5.3% for the financial year 2022. However, the upward revision of CPI estimate for Q3 FY22 to 5.1% from 4.5% earlier is indicative of price pressures build up in the near term. Soaring vegetable prices, hike in telecom tariffs along with lower statistical base are expected to push retail inflation print closer to the upper limit of the RBI's target band. Also, any plausible supply chain disruptions from Covid-19 latest variant could dilute the impact of reduced fuel duties on CPI. Against this backdrop, Care Edge Ratings Economic Research estimates the retail inflation for the year to average around 5.5% with an upward bias.

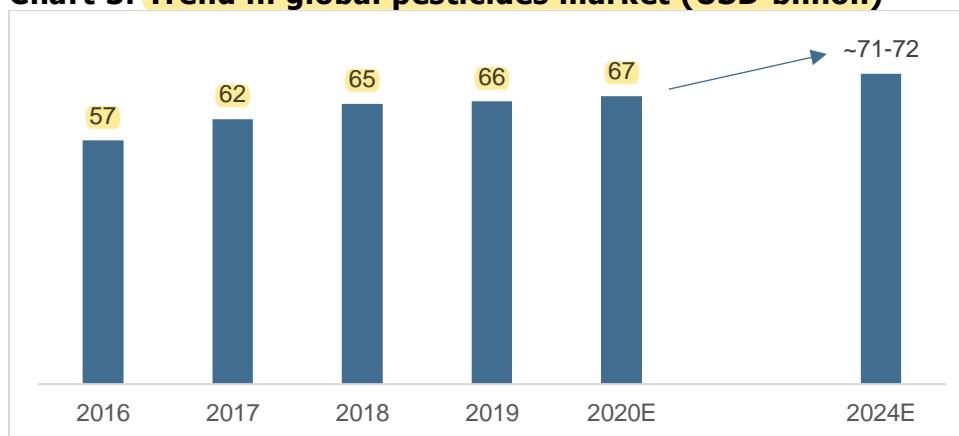
Going ahead, higher prices of edible oils, metals and crude oil in the international markets is likely to pressure domestic retail inflation. The passthrough of high international oil prices to the transport sector could indirectly impact other commodity prices. Food inflation is expected to be benign on the back of deflation in vegetable prices, good kharif output and adequate buffer stock of food grains. Retail inflation reading over the coming months could benefit from a helpful base and lower food inflation.

3. Global pesticides industry

3.1 Trend in global pesticides industry

During the five-year period 2016-2020, the global pesticides market has grown at a Compounded Annual Growth Rate (CAGR) of 4.3% from USD 57 billion in 2016 to USD 67 billion in 2020.

Chart 3: Trend in global pesticides market (USD billion)



Source: Industry sources, CareEdge Research estimates (E)

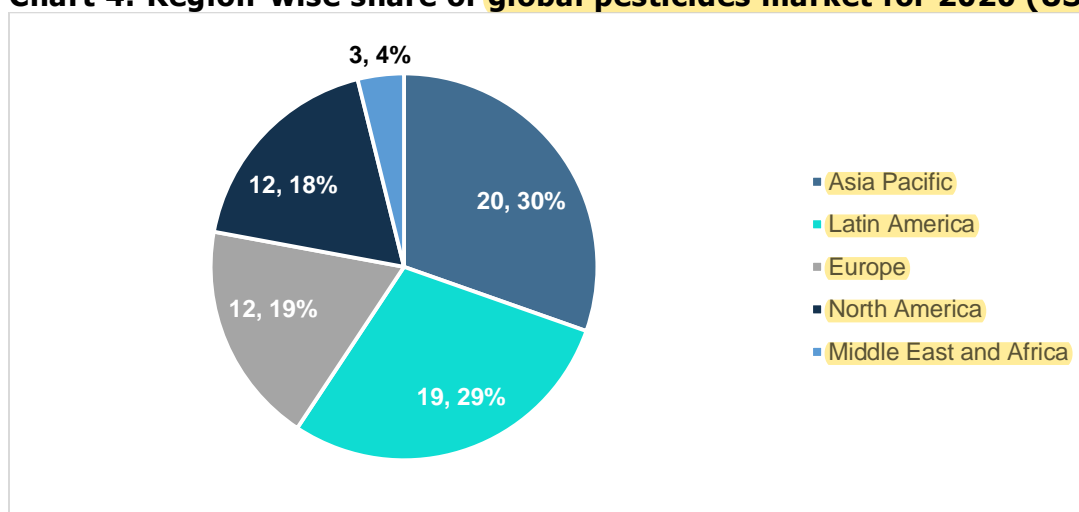
Pesticides also called agrochemicals are used in agriculture to support the growth and safety of plants, to protect crops from pests and are used for auguring the yields of crops. They also prevent crops from insects, diseases and weeds. These pests when not controlled affects the volume and quality of food crops. The mentioned benefits are the primary reasons that have supported the growth of this industry globally over the years. In addition to this, sufficiency of global food production in the world to meet the requirements of increase in world population has also been supporting the market of pesticides industry globally.

The above mentioned factors are expected to continue to provide support to the global pesticides industry and thus this market is estimated to grow at a CAGR of around 1.6%-1.8% during the period 2021-2024 and is likely to reach approximately USD 71-72 billion by 2024.

3.2 Region-wise global pesticides market

Asia Pacific and Latin America together accounted for more than 50% of the global pesticides market in 2020 with each region contributing around 30% each of the total USD 67 billion market. This was followed by Europe and North America that held a share of 19% and 18%, respectively, with each region contributing around USD 12 billion during the year. Middle East and Africa remained the smallest market accounting for 4% of the global pesticides market with a size of around USD 3 billion.

Chart 4: Region-wise share of global pesticides market for 2020 (USD billion)



Source: Industry sources, CareEdge Research estimates

Outlook

Asia Pacific will continue to be the largest market for global pesticides industry and is expected to grow at the fastest CAGR of 3.4%-3.7% by 2024 among all the regions of the industry. This is likely to augment the share of Asia Pacific region in the international market to 33% by 2024 from an estimated share of 30% in 2020.

The other pesticides market Latin America, North America, Middle East and Africa are likely to increase at a CAGR of 1.8%-2.4% by 2024. The pesticides market in Europe, on the other hand, is estimated to decline at a CAGR of 2.8%-2.9% during the forecasted period.

Table 5: Region - wise outlook estimates for global pesticides industry

| Region-wise market (USD billion) | 2020E | 2024E | CAGR |
|----------------------------------|-----------|-----------|------------------|
| Asia Pacific | 20 | 23 | 3.4%-3.7% |
| Latin America | 19 | 21 | 1.9%-2.0% |
| Europe | 12 | 11 | (2.8%) to (2.9%) |
| North America | 12 | 13 | 2.2% to 2.4% |
| Middle East and Africa | 3 | 3 | 1.8% to 2.0% |
| Total | 67 | 71 | 1.6%-1.8% |

Source: Industry sources, CareEdge Research estimates

3.3 Growth drivers for global pesticides industry

The growth in global pesticides industry as mentioned above will be supported by the driving factors that are listed below:

Asia Pacific market: The Asia Pacific market that accounts for the largest share in global pesticides industry includes populous countries like India and China that have an increasing population which demands food security. This, in turn, prompts these countries to better their productivity levels to meet the needs of food requirements. In addition to this, agriculture forms an important part of these countries' economy, which also requires these nations to focus on productivity levels. Thus, it is expected that the pesticides market in this region will grow at a faster CAGR of 3.4%-3.7% by 2024 compared to other regions.

Intensive farming: Farmers across the world are opting for intensive farming techniques to improve productivity of the crops per hectare, thus driving the consumption of pesticides. Intensive farming is an agricultural augmentation and mechanization system with an intention to maximize yields from available land with means of more use of pesticides and chemical fertilizers. These techniques aid to meet the growth in food demand from the rise in population and avert food shortages.

Growth in global population: The growth in global population is one of the demand drivers for pesticides usage as an increase in world population implies more food requirements with the available land. This, in turn, calls for pesticide usage to increase productivity of the crop to get more output from it.

The above mentioned factors are thus expected to support the global pesticides market going ahead.

3.4 Segments and structure of global pesticides industry

The global pesticides industry is dominated by herbicides segment followed by fungicides and insecticides segment. Of the global market size of around USD 59 billion in the year 2020, herbicides accounted for the highest share of about USD 25 billion (more than 40% of the industry). The other two major segments fungicides and insecticides contributed approximately USD 17 billion and USD 15 billion, respectively, towards the global pesticides industry during the year. The major three segments of the global pesticides industry are listed in the table below:

Table 6: Segments of global pesticides industry and its outlook (in USD billion)

| Segments (USD billion) | 2019 | 2020E | 2024E | Outlook CAGR |
|---------------------------------------|-----------|-----------|-----------|------------------|
| Crop market | | | | |
| Herbicides | 25 | 25 | 26 | 1.0%-1.2% |
| Fungicides | 16 | 17 | 18 | 1.5%-1.7% |
| Insecticides | 15 | 15 | 16 | 1.6%-1.8% |
| Others | 2 | 2 | 2 | 1.9%-2.1% |
| Total crop market | 58 | 59 | 62 | 1.3%-1.5% |
| Non-crop market | 8 | 8 | 10 | 4.5%-5.0% |
| Total global pesticides market | 66 | 67 | 71 | 1.6%-1.8% |

Source: Industry sources, CareEdge Research estimates (E)

Apart from crop market, another segment that has a contribution in global pesticides market includes non-crop market. This segment had a market size of about USD 8 billion in 2020.

These pesticides find their application in home and garden, turf and ornamentals, pest control operations, industrial vegetation management, forestry, public health, aquatic among others. They are used for control of weeds, diseases, insects and other pests. Also, they are used for plant growth regulation.

The non-crop market has increased at a CAGR of around 3.3% in the five-year period 2015-2019. With expected increase in application of these pesticides on account of the benefits offered by them, the global non-crop market is estimated to grow at a faster CAGR compared to that of crop market. The global non-crop market is expected to rise at a CAGR of about 4.5%-5% by 2024 and is estimated to reach the level of approximately USD 10 billion.

4. Introduction to pesticides industry in India

4.1 Evolution of pesticides industry in India

The evolution of pesticides in India was led by Green Revolution. In 1943, India saw one of the worst food disasters during the Bengal famine. Food shortages had resulted in death of around 40 lakh people in the eastern part of India. The problem of food shortage in India continued even after independence at different time period and the frequent food scarcity issue led to the beginning of Green Revolution in India.

Around 1960s, the Green Revolution was launched by the government of India with the support of M.S. Swaminathan, a geneticist, who is now referred as the father of the Green Revolution in India. The revolution started in 1967 and continued till 1978.

The Green Revolution in India resulted in growth in agricultural production, primarily in the states of Haryana, Punjab, and Uttar Pradesh. The main achievement in this revolution was the development of high-yielding variety of seeds of wheat and rust-resistant strains of wheat.

Aspects of Green Revolution in India

- High Yielding Varieties (HYV)
- Mechanization of agriculture
- Use of chemical fertilizers and pesticides
- Irrigation

The Green Revolution that engaged agricultural production with the usage of modern tools and techniques involved the aspect of pesticides and chemical fertilizers. This revolution resulted in conversion of agricultural system into an industrial system, which required utilization of modern methodologies like high yielding variety seeds, tractors, pesticides, and fertilizers, irrigation facilities. Until 1967, the government primarily focused on augmenting the farming areas. However, the rapid growth in population compared to food production demanded a major and immediate requirement to raise yield, which resulted in the evolution of Green Revolution.

The technique of Green Revolution concentrated on following three basic elements:

1. Using seeds with improved genetics (High Yielding Variety seeds)
2. Double cropping in the existing farmland and
3. The continuing expansion of farming areas

The Green Revolution had started around the world in several countries between the 1950s till the late 1960s. This had resulted in various research technology transfer initiatives throughout the world, which in turn, focused on increasing agricultural production. The revolution started with Norman Borlaug's genetic testing. A hybrid wheat plant that could withstand diseases and fungus (in addition to high yield) was created by him. He is also known as the father of Green Revolution.

4.2 Types of pesticides and their application

The Indian agrochemicals industry can be primarily divided into the following types: a. Insecticides b. Fungicides c. Herbicides.

a. Insecticides:

Insecticides enable protection of the crops from insects by either preventing their attack or destroying them. They help in controlling the pest population below a desired threshold level.

They can be further classified based on their mode of action:

- Contact insecticides: Insects gets killed on direct contact of these insecticides and they leave marginal residual activity which affects environment minimally.
- Systemic insecticides: Plant tissues absorbs these insecticides and destroys insects when the insects feed on plants. These are generally related with long term residual activity.

b. Fungicides:

Fungicides find their application in fruits, vegetables and rice and they are vital to contract post-harvest losses in vegetables and fruits. Fungicides are used to prevent fungi attack on crops and to handle diseases on crops. Protectants and eradicants are two types of fungicides. Protectants protects or hinders fungal growth and eradicants destroys the diseases on usage. This thus results in better productivity, contraction in crop blemishes and raises storage life.

c. Herbicides:

Herbicides also known as weedicides are used to destroy unwanted plants. Unavailability of cheap labour leads to major usage of herbicides in rice and wheat crops. The demand for herbicides is seasonal as they develop in damp, warm climate and perishes in cold spells. They are of two types depending on the way of action, selective and non-selective. Selective herbicides destroy specific plants not harming the desired crop and non-selective herbicides are used for widespread ground clearance to handle weeds pre-crop planting.

Based on the usage, there are three types of herbicides. 1. Application prior to sowing of the crop (pre-emergence) 2. Application post developing of weeds (post-emergence) 3. Application right away subsequent to sowing (early post-emergence).

d. Bio-pesticides:

These are the new age agrochemicals produced from substances of nature like plants, animal waste, bacteria and minerals. Bio-pesticides have a small share in agrochemicals market in India which is expected to grow backed by government support and increase in awareness about pesticides that are eco- friendly. These pesticides are easy to use and are environment friendly.

e. Others:

This primarily comprises fumigants, bio stimulants, nematicides, rodenticides. They prevent crops from attack of the pests at the time of crop storage.

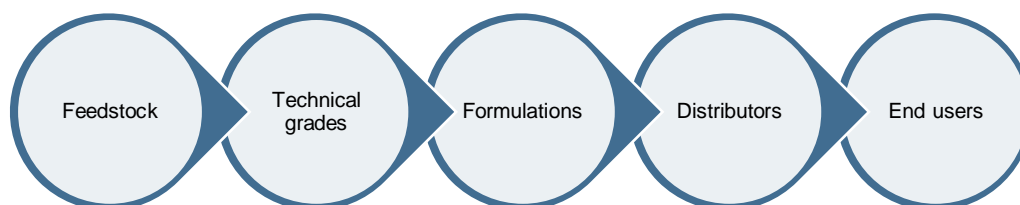
4.3 Overview of pesticide value chain

The value chain of pesticide industry involves five stages as shown in the chart below. The chain starts with feedstock moves to technical grades, formulations, distributors and concludes at end users.

The feedstock consists of petrochemical derivatives, natural feedstock and chemicals that goes in the making of technical grades. Once the technical grade or active ingredient is synthesized, the process moves to formulations. Chemical synthesis is the method of transforming a reactant

or starting material into a product or several products by one or more chemical reactions. The active ingredient controls pests and gives controlling action to the pesticides. This ingredient repels, destroys or alleviates pests. It is also known as pesticide's technical grade. The active ingredient is the technical grade of the pure pesticide.

Chart 5: Pesticide value chain



Pesticides are generally not applied in their pure form. It is usually formulated by adding inert ingredients that improve storage, handling, application, effectiveness or safety. The inert ingredients, which involves solvents, adjuvants and fillers aids handling, application, storage, effectiveness or safety of the pesticides. This is the formulation process of pesticides.

While the active ingredient destroys the pest, the inert ingredient facilitates ease of handling, spraying and coating on plants. Following this, formulations are available to distributors who sells it to the end users like farmers.

5. Indian pesticides industry

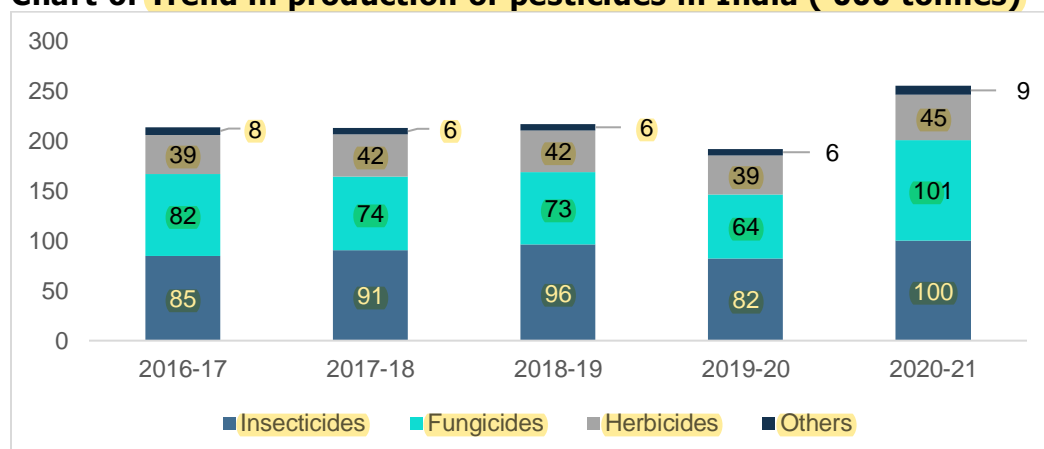
In the global agrochemicals market, India is the 4th largest producer led by USA, Japan and China. Also, India is a net exporter of agrochemicals and has emerged as the 13th largest exporter of pesticides globally. To understand the trend better, details on Indian agrochemicals market is provided below.

5.1 Pesticides production

5.1.1 Review

The output of pesticides in India (which includes 42 technical grades) increased at a CAGR of 4.5% from 214 thousand tonnes in 2016-17 to 255 thousand tonnes in 2020-21.

Chart 6: Trend in production of pesticides in India ('000 tonnes)



Source: Directorate of Plant Protection, Quarantine & Storage

Note: The production data includes quantity of technical grades only

During the year 2020-21, the production of pesticides grew by a strong 33% y-o-y to 255 thousand tonnes despite Covid-19 affecting other segments of the chemicals industry. It is important to note that the growth rate posted by pesticides segment was the highest among all the other segments of the overall chemicals industry during the year. The demand for pesticides from agriculture (which was not much affected by Covid-19 in 2020-21) and low-base effect are believed to have supported the output of pesticides in 2020-21.

During the first five months of FY22 (April-August 2021), pesticides output increased by 31.7% y-o-y to 123 thousand tonnes as per the Department of Chemicals and Petrochemicals.

It can be seen from the above chart that in terms of volume, insecticides accounted for the largest share of around 42% on an average during the period 2016-17 to 2020-21 followed by fungicides, herbicides and others that held a share of about 36%, 19% and 3%, respectively. In the five-year period, insecticides (the largest segment) and others (the smallest segment) each grew at a CAGR of 4.2% while fungicides increased at a faster CAGR of 5.4% on account of a 58% jump in its output during 2020-21 and herbicides rose at a CAGR of 3.6% during 2016-17 to 2020-21.

5.1.2 Outlook

The upward momentum in pesticides industry output is expected to continue going forward backed by a growth in food consumption in domestic market amid an expected increase in population, government support towards agriculture, demand from export markets, horticulture and floriculture market among others. The penetration of pesticides and agrochemicals in India is low and this poses an opportunity for growth for agrochemical producers. In addition to this, the government's aim to reduce dependency on China and improve self-sufficiency is expected to support industry's backward integration and thus its growth.

These factors are estimated to increase the pesticides industry output at a CAGR of 3.5%-4.0% by 2023-24 (Refer table below).

Table 7: Estimates of pesticides production by 2023-24 (thousand tonnes)

| Segments | 2020-21 | 2023-24E | CAGR |
|--------------|------------|------------|------------------|
| Insecticides | 100 | 113 | 4.0%-4.5% |
| Fungicides | 101 | 107 | 2.0%-3.0% |
| Herbicides | 45 | 51 | 4.5%-5.5% |
| Others | 9 | 11 | 5.0%-5.5% |
| Total | 255 | 283 | 3.5%-4.0% |

Source: CareEdge Research estimates (E)

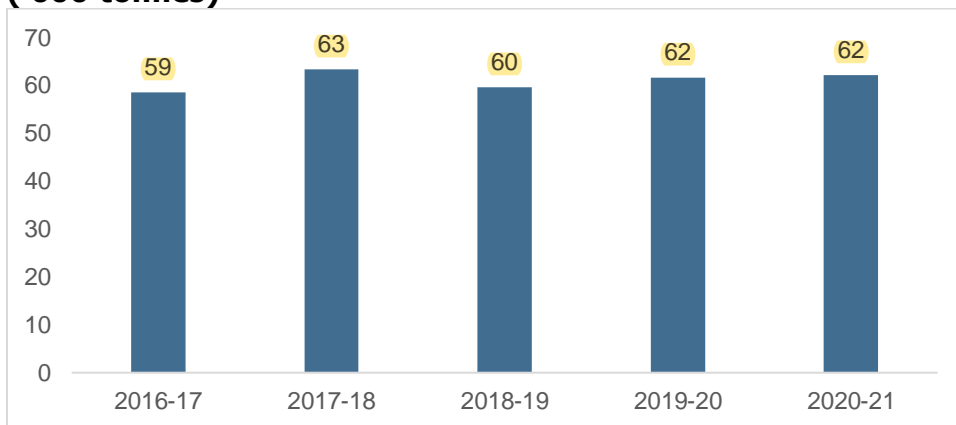
5.2 Pesticides consumption

5.2.1 Trend in chemical pesticides consumption

The domestic consumption of chemical pesticides grew at a CAGR of 1.5% from 59 thousand tonnes in 2016-17 to 62 thousand tonnes in 2020-21. It is to be noted that the growth reported

by chemical pesticides consumption is much slower compared to the pesticides production CAGR of 4.5%.

Chart 7: Trend in chemical pesticides consumption in India (technical grade) ('000 tonnes)

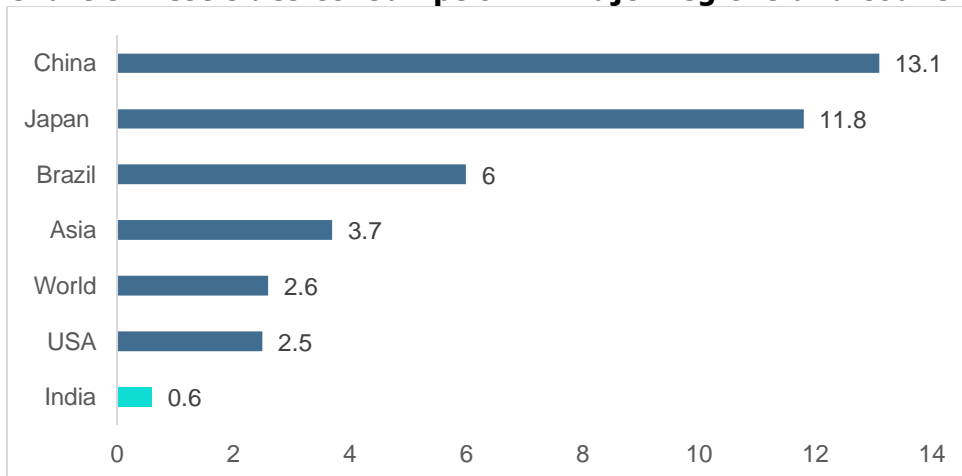


Source: Directorate of Plant Protection, Quarantine & Storage
 Note: This do not include data on the states/UTs that have not reported pesticides consumption. Also, figures of 2019-20 for Haryana, Jammu and Kashmir, Tripura, Pondicherry, Goa and Nagaland have been taken from inputs provided by the States/UTs during Zonal Conference (PP) for Rabi, 2020-21 Season.

5.2.2 Low per hectare pesticides consumption in India

Of the total pesticides produced in India, domestic chemical pesticides consumption accounted and averaged at around 28% during the period 2016-17 to 2020-21. The small share of consumption is primarily due to low pesticides per hectare consumption in India, which is one of the lowest internationally.

Chart 8: Pesticides consumption in major regions and countries 2017 (kg/ha)



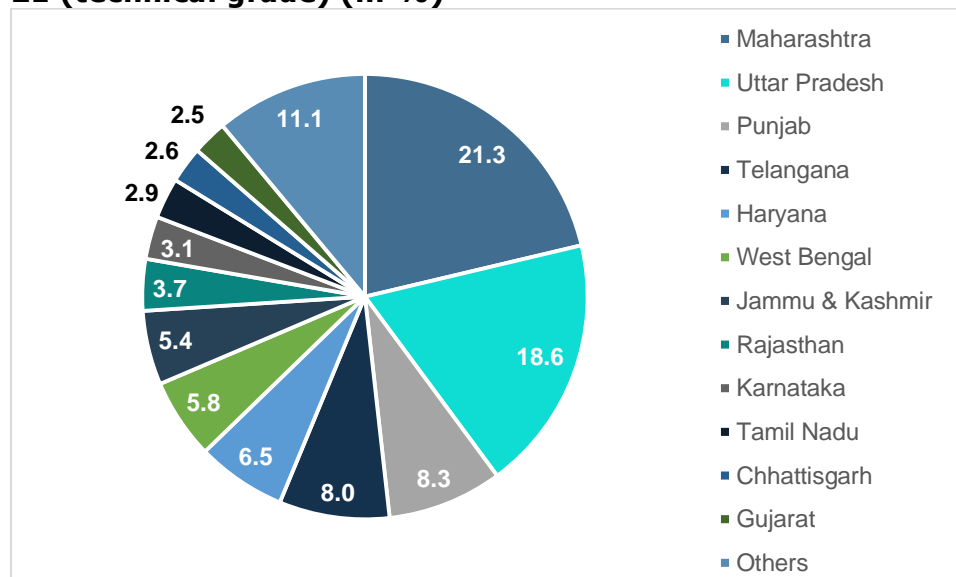
Source: FICCI March 2021

The per hectare consumption of pesticides in India is minimal 0.6 kg compared to the per hectare consumption of 13 kg and 12 kg in China and Japan, respectively. India’s per hectare consumption is low even than the world average of 2.6 kg per hectare and that of Asia which stood at 3.7 kg per hectare. The low consumption at home has made India the net exporter of pesticides and India has emerged as the 13th largest exporter of pesticides globally which is discussed later in the report.

5.2.3 State-wise consumption of chemical pesticides in India

The top ten states and UTs that reported chemical pesticides consumption accounted for around 86.4% of the total chemical pesticides domestic consumption in India during 2020-21.

Chart 9: State-wise consumption of chemical pesticides in India during 2020-21 (technical grade) (in %)



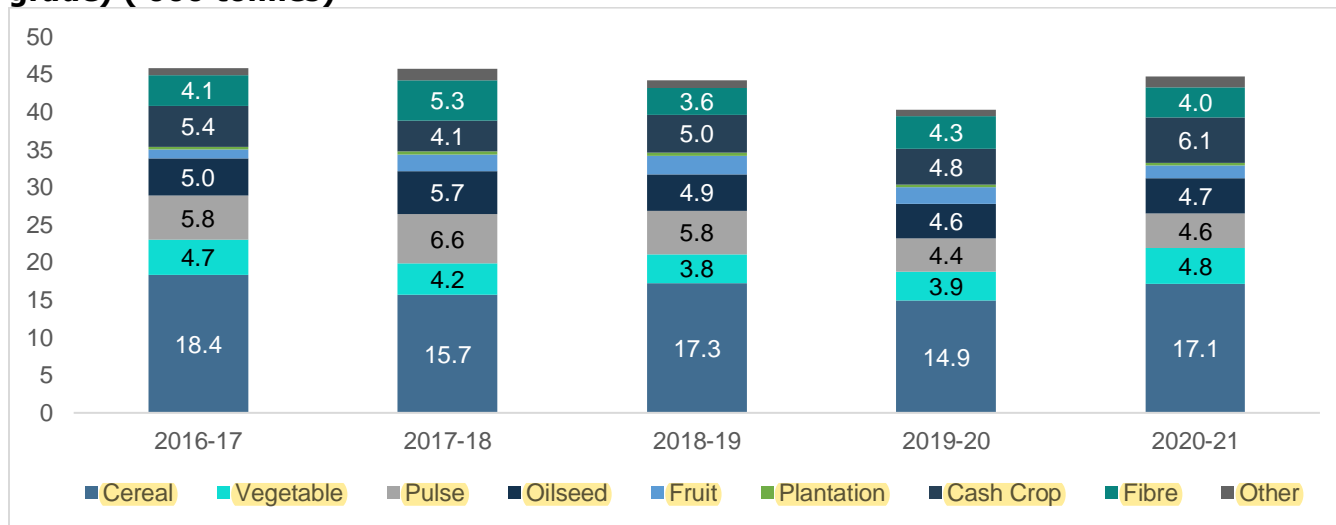
Source: Directorate of Plant Protection, Quarantine & Storage

Of the total, Maharashtra and Uttar Pradesh contributed to the significant share of 21.3% and 18.6%, respectively. Punjab and Telangana each accounted for around 8% in overall chemical pesticides consumption. Following this, Haryana, West Bengal and Jammu & Kashmir contributed in the range of around 5%-6.5% while Rajasthan, Karnataka, Tamil Nadu and Chhattisgarh held a share of around 2.5%-4%. Others (which includes remaining states and UTs) accounted for 13.6% of the total chemical pesticides consumption during the year 2020-21.

5.2.4 Commodity-wise consumption of chemical pesticides

Pesticides are used and applied across a variety of commodities which includes cereals, vegetables, pulses, oilseeds, fruits, plantation, cash crops, fibre and others.

Chart 10: Commodity-wise consumption of chemical pesticides (technical grade) ('000 tonnes)



Source: Directorate of Plant Protection, Quarantine & Storage

Of the total commodities covered by pesticides, cereals account for majority of the share contributing around 38% on an average during the five-year period 2016-17 to 2020-21. Following this, pulses, cash crops, oilseeds, vegetables and fibres contributed in the range of about 10%-12% on an average. The other commodities that have a small share includes fruits (4%), plantation (1%) and others (3%).

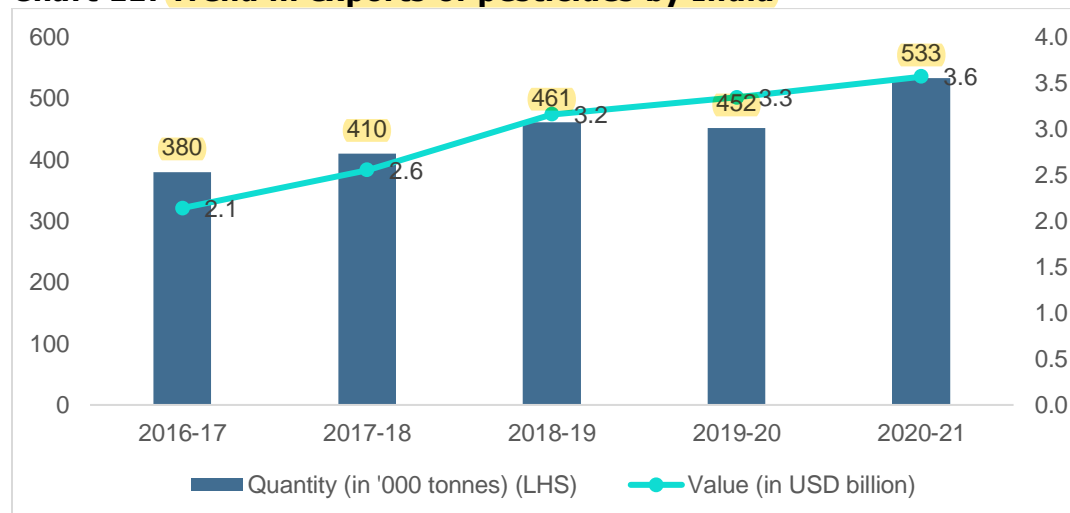
5.3 Pesticides exports

5.3.1 Trend in pesticides export by India

India is net exporter of pesticides and the outbound shipments account for a significant share of the total market size of the Indian agrochemicals industry. Exports of pesticides (technical and formulations both) grew at a CAGR of 8.8% from 380 thousand tonnes in 2016-17 to 533 thousand tonnes in 2020-21, the highest exports made so far by India. It is to be noted that export CAGR increased at a faster pace compared to that of production, which grew at a CAGR

of 4.5%. Moreover, the export value of pesticides grew at a relative higher CAGR of 13.6% from USD 2.1 billion (Rs.144 billion) in 2016-17 to USD 3.6 billion (Rs.265 billion) in 2020-21.

Chart 11: Trend in exports of pesticides by India



Source: Directorate of Plant Protection, Quarantine & Storage
 Note: This includes data on both technical and formulations

India exports pesticides to various countries across the world. Of all the nations, the key export destination for India is Brazil that held a dominant share of 17.7% in 2020-21 followed by USA, Bangladesh and Vietnam that accounted for 10.4%, 6% and 5.8%, respectively. The other countries to which exports from India ranged between 2.2%-3.4% included Australia, France, Indonesia and China.

Table 8: Volume-wise top 10 export-destinations of pesticides for India 2020-21

| Country | Share | Country | Share |
|------------|-------|-------------|-------|
| Brazil | 17.7% | France | 2.8% |
| USA | 10.4% | Indonesia | 2.4% |
| Bangladesh | 6.0% | China | 2.2% |
| Vietnam | 5.8% | Argentina | 1.9% |
| Australia | 3.4% | Netherlands | 1.3% |

Source: CMIE

5.3.2 Trend in segment-wise pesticides export

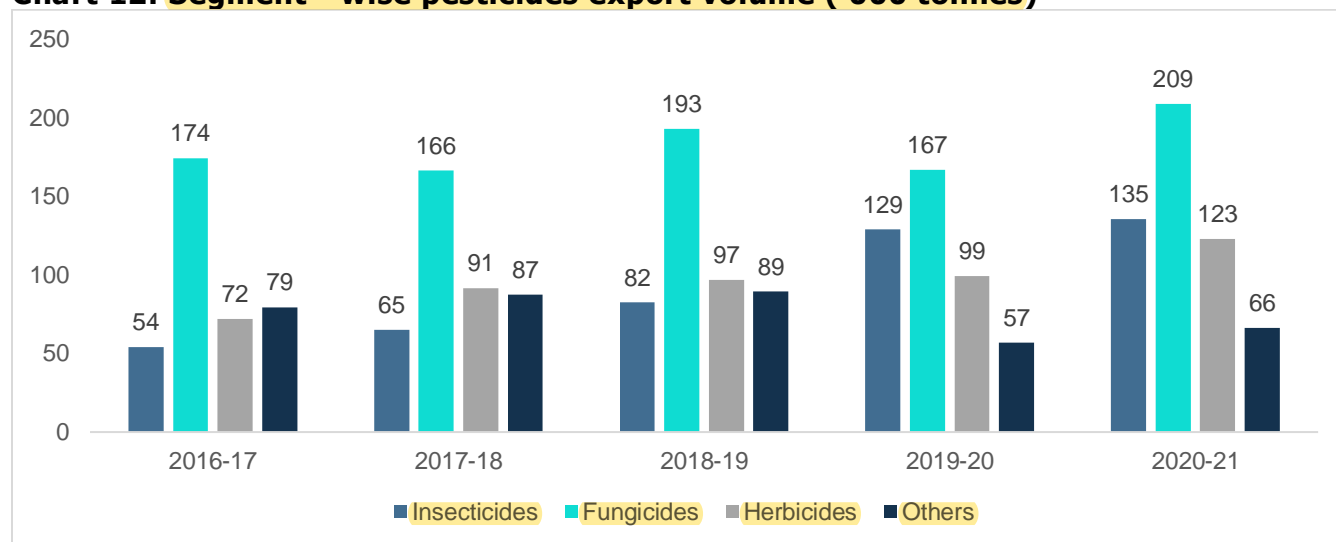
- Segment - wise export volume**

Of all the pesticides segments, fungicides accounted for the largest share of about 41% on an average over the five-year period 2016-17 to 2020-21 in terms of volume. This was followed by

herbicides, insecticides and others that contributed 22%, 21% and 17%, respectively, towards total pesticides exports.

In terms of CAGR, the largest segment – fungicides, increased at a CAGR of 4.6% slower than the CAGR of insecticides (25.7%) and herbicides (14.3%) segments. The remaining segment, others, however, declined at a CAGR of 4.4% during the five-year period.

Chart 12: Segment - wise pesticides export volume ('000 tonnes)



Source: Directorate of Plant Protection, Quarantine & Storage

- Segment - wise export volume (Outlook)**

An increase in Indian pesticides exports is expected to continue going forward backed by demand from the international market. The pesticide export volumes are estimated to grow at a CAGR of 5%-6% by 2023-24 with the fastest pace of rise likely to be witnessed by insecticides segment (9%-10%) followed by herbicides (6.5%-7.5%) and fungicides (3%-4%).

Table 9: Outlook for export volumes of pesticides (segment-wise) ('000 tonnes)

| Segments | 2020-21 | 2023-24E | CAGR |
|--------------|------------|------------|------------------|
| Insecticides | 135 | 178 | 9.0%-10% |
| Fungicides | 209 | 228 | 3.0%-4.0% |
| Herbicides | 123 | 150 | 6.5%-7.5% |
| Others | 66 | 60 | (-3.5%)-(4.0%) |
| Total | 533 | 615 | 5.0%-6.0% |

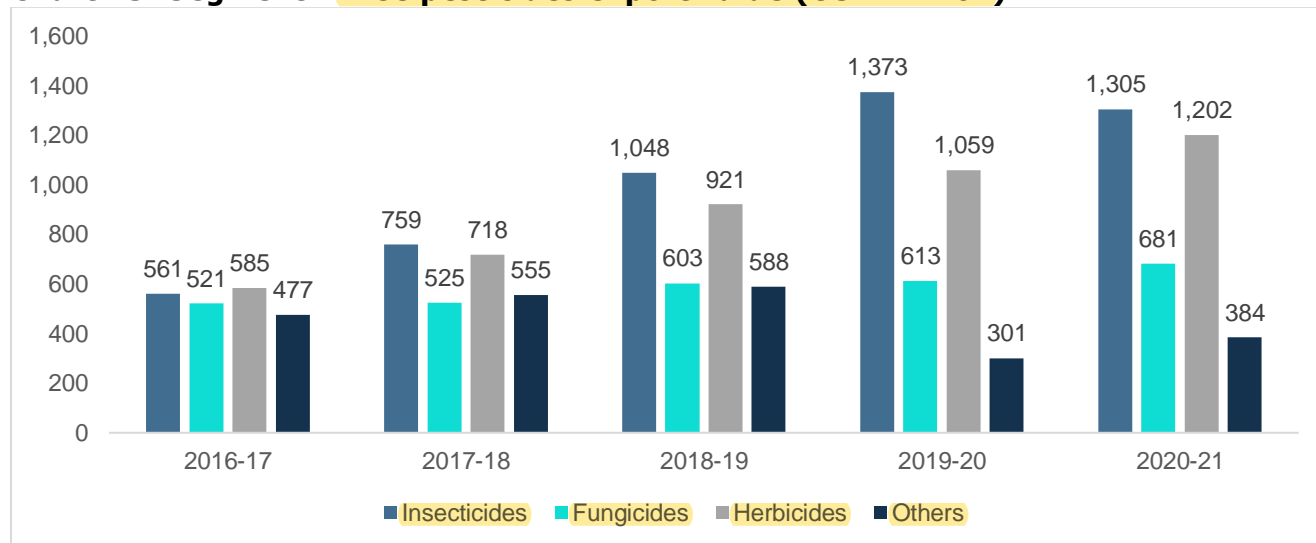
Source: Directorate of Plant Protection, Quarantine & Storage, CareEdge Research estimates (E)

- Segment - wise export value**

The scenario of segments in terms of contribution towards pesticides export value however is different with insecticides segment accounting for the highest share of 34% on an average during 2016-17 to 2020-21. This was followed by herbicides segment which contributed 30% in total pesticides exports value. Fungicides segment that had the largest share in terms of volume accounted for a smaller share of 20% in outbound shipments. The remaining segment, others, contributed 16% on an average during the five years.

In terms of CAGR, the insecticides segment reported the fastest CAGR of 23.5% during 2016-17 to 2020-21 followed by herbicides and fungicides that increased at a CAGR of 19.8% and 6.9%, respectively. The others segment, on the other hand, declined by a CAGR of 5.3% during the five-year period.

Chart 13: Segment - wise pesticides export value (USD million)



Source: Directorate of Plant Protection, Quarantine & Storage

- Segment - wise export value (Outlook)**

The demand for Indian pesticides globally will drive the export value of the industry. The pesticides exports from India are expected to grow at a CAGR of 7%-8% by the year 2023-24.

Table 10: Outlook for export value of pesticides (segment-wise) (USD million)

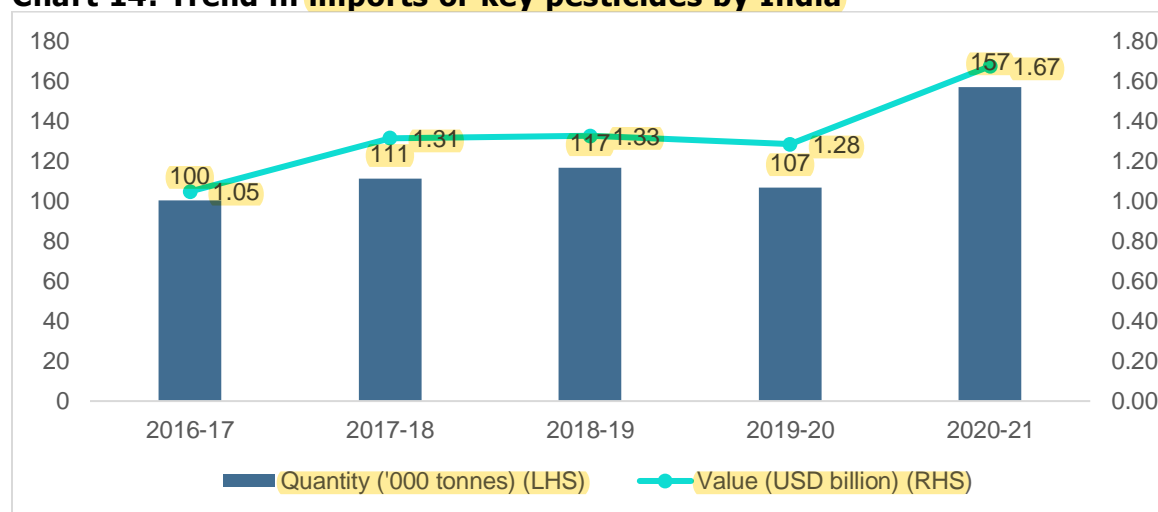
| Segments | 2020-21 | 2023-24E | CAGR |
|--------------|--------------|--------------|------------------|
| Insecticides | 1,305 | 1,732 | 10%-11% |
| Fungicides | 681 | 811 | 5.5%-6.5% |
| Herbicides | 1,202 | 1,535 | 8.5%-9.5% |
| Others | 384 | 362 | (2.0%) to (3.0%) |
| Total | 3,572 | 4,440 | 7.0%-8.0% |

Source: Directorate of Plant Protection, Quarantine & Storage, CareEdge Research estimates (E)

5.4 Pesticides imports

5.4.1 Trend in pesticides imports by India

The quantity of pesticides imported by India is quite less compared to that of the pesticides exports. However, the quantity of pesticides imported by India has increased at a faster CAGR of 11.9% compared to that of exports during the period 2016-17 to 2020-21. The imports increased to 157 thousand tonnes in 2020-21 from 100 thousand tonnes in 2016-17. The value of imports grew at a higher CAGR of 12.4% from USD 1.05 billion (Rs.70 billion) in 2016-17 to USD 1.67 billion (Rs.124 billion) in 2020-21.

Chart 14: Trend in imports of key pesticides by India

Source: Directorate of Plant Protection, Quarantine & Storage

China is the major source of pesticides imports and accounted for more than half of India's total imports with a share of 55.2% during 2020-21. This was followed by Taiwan, USA, and Israel contributing 10.7%, 10.4% and 4.6%, respectively. Other countries from which pesticides were

imported included Germany (share of 3%), while Singapore, Japan and Belgium each accounted for 2% of the total pesticides imports by India.

Table 11: Volume-wise top source of pesticides imports for India 2020-21

| Country | Share |
|---------|-------|
| China | 55.2% |
| Taiwan | 10.7% |
| USA | 10.4% |
| Israel | 4.6% |

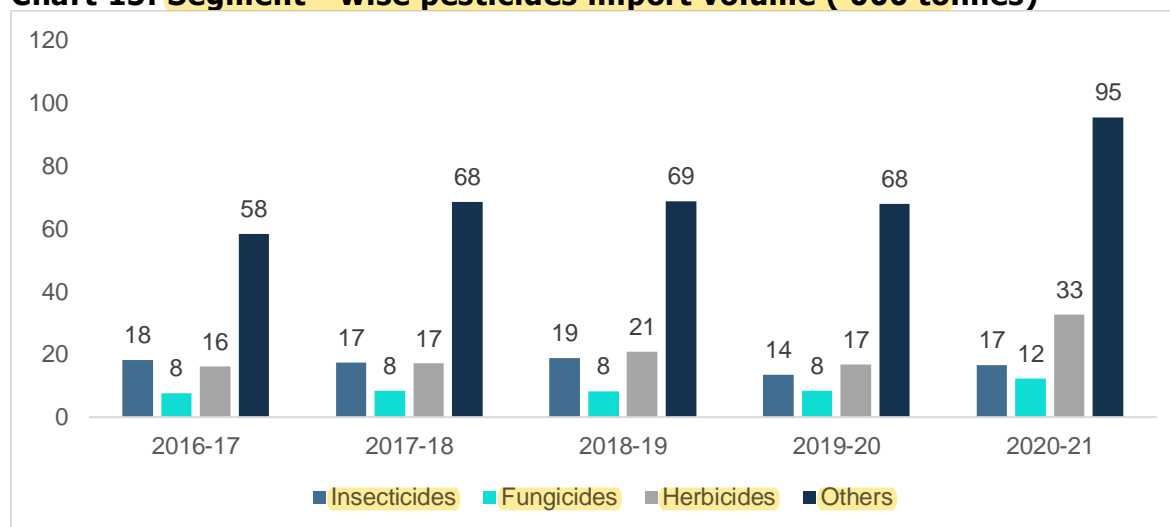
Source: CMIE

5.4.2 Trend in segment-wise imports

- Segment-wise import volume**

Of all the pesticides segment imported by India, herbicides accounted for 17.5% followed by insecticides and fungicides with a share of 14.3% and 7.6%, respectively, on an average during 2016-17 to 2020-21. In terms of CAGR, while herbicides and fungicides grew in the range of around 13%-19%, the quantity of insecticides imported declined by a CAGR of 2.3% during 2016-17 to 2020-21.

Chart 15: Segment - wise pesticides import volume ('000 tonnes)



Source: Directorate of Plant Protection, Quarantine & Storage

Note: Others include fumigants, plant growth regulators and miscellaneous (where miscellaneous comprises disinfectants, paper impregnated, repellent for insect, weedicides and weed killing agents etc.)

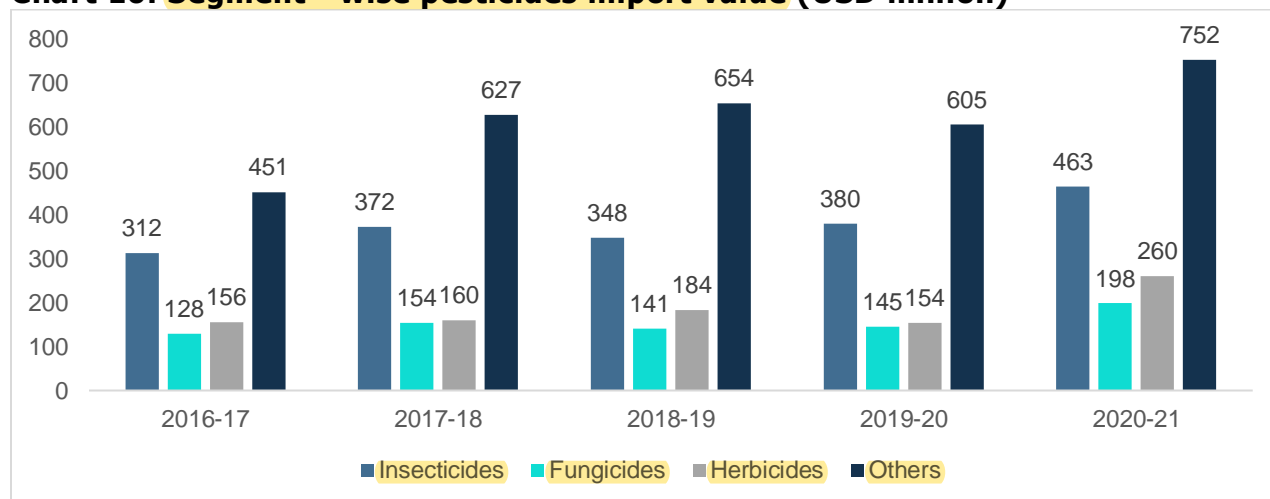
Apart from this, imports also include fumigants, plant growth regulators and miscellaneous (where miscellaneous includes disinfectants, paper impregnated, repellent for insect, weedicides and weed killing agents etc.) that are together covered under others. The component others accounted for the remaining share of 60% on an average during the period 2016-17 to 2020-21 and it grew at a CAGR of 13.1%.

- Segment-wise import value**

During the five-year period 2016-17 to 2020-21, insecticides, herbicides and fungicides contributed about 28.2%, 13.8% and 11.5%, respectively, in the overall import value of pesticides. The component others as described above accounted for the remaining share of 46.5% on an average in terms of import value.

On CAGR front, the pesticides import of all the four components grew in double-digit in the range of 10%-14% during these years.

Chart 16: Segment - wise pesticides import value (USD million)



Source: Directorate of Plant Protection, Quarantine & Storage

Note: Others include fumigants, plant growth regulators and miscellaneous (where miscellaneous comprises disinfectants, paper impregnated, repellent for insect, weedicides and weed killing agents etc.)

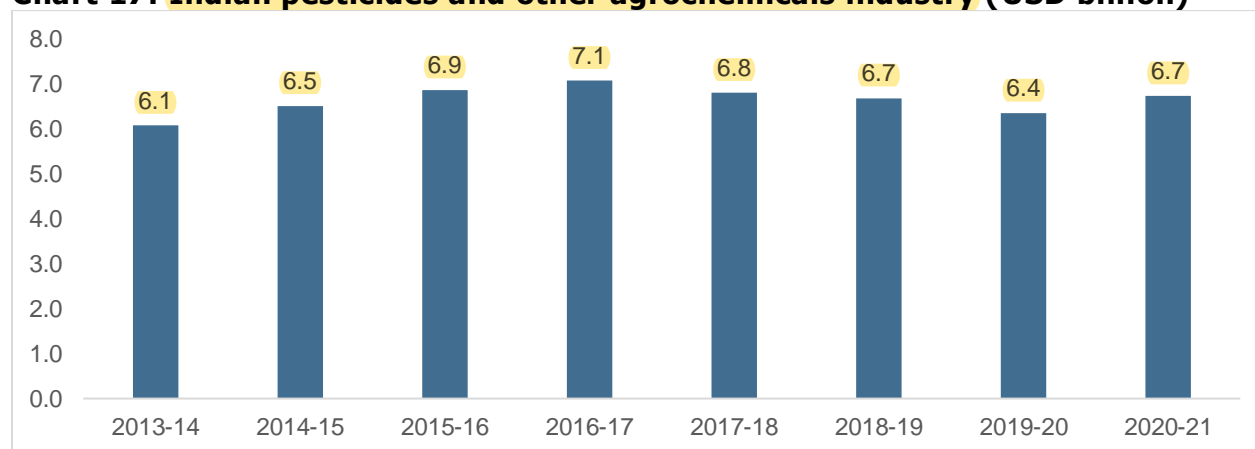
5.5 Trend in growth of Indian pesticides and other agrochemicals industry

5.5.1 Review

The overall Indian pesticides and other agrochemicals market grew at a CAGR of 4.5% from Rs.368 billion in 2013-14 to Rs.439 billion in 2017-18. In terms of USD, the Indian market increased at a CAGR of 2.9% from USD 6.1 billion in 2013-14 to USD 6.8 billion in 2017-18.

In the following period 2018-19 to 2020-21, while domestic pesticides consumption (in volume terms) grew at a CAGR of 2.1%, exports that account for a large chunk of India's agrochemicals market rose at a higher CAGR of 7.5%. These factors are thus believed to have supported the pesticides and other agrochemicals industry in these three years.

Chart 17: Indian pesticides and other agrochemicals industry (USD billion)

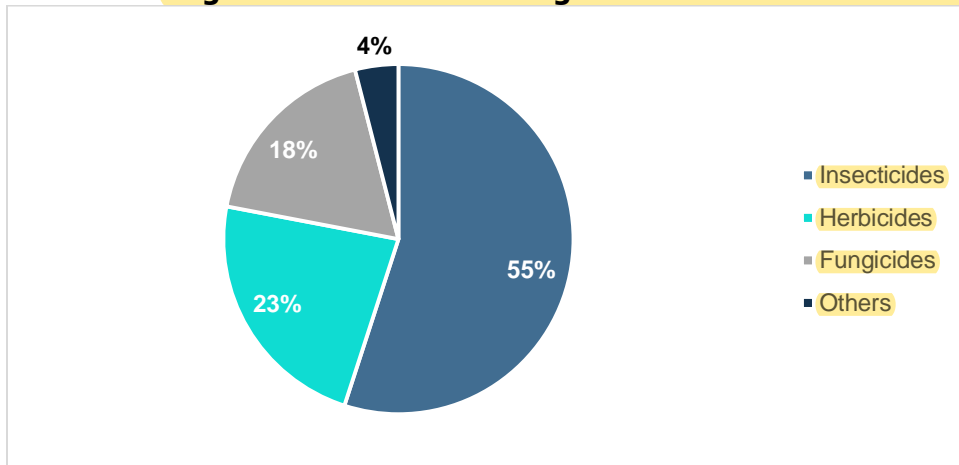


Source: Department of Chemicals and Petrochemicals

Note: The market size of industry for years 2018-19, 2019-20 and 2020-21 are CareEdge Research estimates

The Indian pesticides industry can be primarily divided into the following types: a. Insecticides b. Fungicides c. Herbicides. Insecticides account for a major share of around 55% followed by herbicides and fungicides with an approximate share of 23% and 18%, respectively.

Chart 18: Segment-wise share of agrochemicals in Indian market (in %)



Source: Industry sources, CareEdge Research estimates

5.5.2 Outlook

The overall Indian pesticides and other agrochemicals industry is estimated to increase at a CAGR of 5.2%-5.7% by 2023-24 on account of an upward growth expected in the international market and a likely increase in domestic usage of pesticides in India.

Table 12: Outlook for Indian pesticides and other agrochemicals industry (USD million)

| Segment | 2020-21E | 2023-24E | Outlook CAGR |
|--------------|--------------|--------------|------------------|
| Insecticides | 3,705 | 4,301 | 4.8%-5.3% |
| Herbicides | 1,549 | 1,830 | 5.5%-5.9% |
| Fungicides | 1,213 | 1,440 | 5.6%-6.0% |
| Others | 269 | 323 | 5.9%-6.4% |
| Total | 6,736 | 7,894 | 5.2%-5.7% |

Source: Industry sources, CareEdge Research estimates

While demand for India pesticides is likely to remain high, India aims to strengthen the process of backward integration for industry. This is because India is dependent on China for some of the technical insecticides and thus any disruptions at this source destination (like chemical plant shutdown in China to reduce pollution) has the potential to affect India’s supply chain. While such situations also provide an opportunity to India to increase the exports of pesticides, it does impact the supply chain of the industry. To avoid such instances, the Indian government said that it is considering to increase the scope of the Production Linked Incentive (PLI) scheme to include the domestic manufacturing of agrochemicals. If implemented, the scheme will result in increased

competitiveness of domestic producers, and given the reliance on exports, benefits will help India increase its market share in the global agrochemicals markets. The scheme will also help the industry become self-sufficient and will be able to integrate backward to produce its own technical grade ingredients instead of relying on China for supplies.

Moreover, many countries across the world are looking forward to 'China plus one strategy' to avoid excess dependence on China. The adoption of this strategy internationally will benefit India, as the countries that import pesticides from China may now opt for India, which is the 4th largest producer and 13th largest exporter of agrochemicals globally.

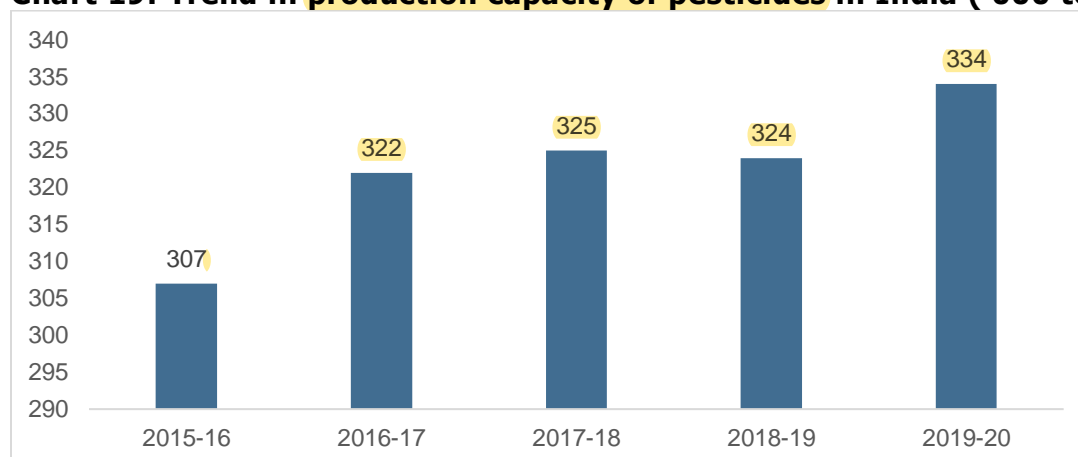
While the above mentioned factors will support the Indian pesticides industry going forward, it is worth to mention that the Indian pesticides industry remained resilient even during the pandemic year (2020-21) as exports from the Indian pesticides industry increased by a healthy 18% to 533 thousand tonnes and grew by 11.7% to Rs.265 billion on a y-o-y basis.

In addition to this, India has competitive edge in terms of low labour cost and has support towards chemical clusters, which will also aid the growth of agrochemicals industry in the coming years.

5.6 Pesticides production capacity in India

The pesticides production capacity in India meets the domestic and export requirements of the nation. Over the years, the production capacity in India has increased at a CAGR of 2.1%. It has increased from 307 thousand tonnes in 2015-16 to 334 thousand tonnes in 2019-20.

It can be seen that the pesticides production capacity has grown in each of the years for the above mentioned period except for 2018-19 where the capacity declined by a marginal 0.3% to 324 thousand tonnes. It is important to note that the industry's capacity utilisation on an average has been around 64% in these last five years.

Chart 19: Trend in production capacity of pesticides in India ('000 tonnes)

Source: Department of Chemicals and Petrochemicals

Note: The capacity refers only to technical grade

5.7 Generic and premium pesticides

The Indian pesticides market is primarily dominated by generics that account for almost 75-80% of the total market with speciality or premium pesticides accounting for the remaining share. The generic pesticides are sold at a cheaper price compared to that of speciality pesticides that tend to offer higher effectiveness.

Generic pesticides are manufactured with the availability of molecules that go off-patent as it gives a chance for commercial development of generic pesticides. A patent is an exclusive right granted by the government for an invention, which is a product or a process that provides, in general, a new way of doing something, or offers a new technical solution to a problem. A patent confers on its owner the legal right to exclude others from making, using, offering for sale, or importing a patented product or product obtained from a patented process without his/her consent for a period of 20 years.

The period of 20 years commences from the date on which the relevant patent application was filed. The patent protection period of 20 long years gives the patentee ample opportunity to recoup the money spent on initial research and subsequent commercial introduction. The patent rights are territorial and limited to the country where they have been granted.

Table 13: Grant and launch date of some of patented pesticides in India during 2015-2022

| S. No. | Pesticides | Patentee | Date of grant of patent in India | Date of patent expiry | Date of launch of patented pesticide in India |
|--------|-------------------------|----------------------------------|----------------------------------|-----------------------|---|
| 1 | Aminopyralid(H) | Dow AgroSciences | 23-11-2010 | 12-01-2021 | Not launched |
| 2 | Flucetosulfuron(H) | LG Chem Investment | 25-11-2013 | 12-10-2020 | 2016 |
| 3 | Metamifop (H) | Dongbu Hannong Chemicals | 31-03-2008 | 24-07-2019 | 2018 |
| 4 | Pinoxaden (H) | Syngenta | 16-05-2007 | 11-03-2019 | 2010 |
| 5 | Saflufenacil (H) | BASF | 09-11-2007 | 30-04-2021 | 2020 |
| 6 | Topramezone (H) | BASF | 26-06-2009 | 16-01-2018 | 2015 |
| 7 | Bistrifluron (I) | Dongbu Hannong Chemical Col Ltd. | 22-02-2002 | 26-06-2017 | Not launched |
| 8 | Chlorantraniliprole (I) | DuPont | 14-07-2006 | 13-08-2022 | 2008 |
| 9 | Penflufen (F) | Bayer Crop Science | 23-02-2009 | 09-07-2022 | 2016 |
| 10 | Pyraclostrobin (F) | BASF | 08-09-2010 | 19-12-2015 | 2015 |

Source: Crop Care Federation of India

Note: H, F and I refers Herbicide, Fungicide and Insecticide, respectively

From the above table it can be seen that while some of the patented pesticides were launched early or in the mid of duration from date of grant of patent till the date of patent expiry, some of the patented pesticides were only launched towards the end of the date of patent expiry and some of them were not even launched till the date of patent expiry.

5.8 Industry growth drivers

- **Agriculture:**

Agriculture is the primary source of livelihood for about 58% of India's population. As a result, the share of agriculture and allied sector to total economy's Gross Value Added (GVA) has been significant and has increased over the years as shown here in the table.

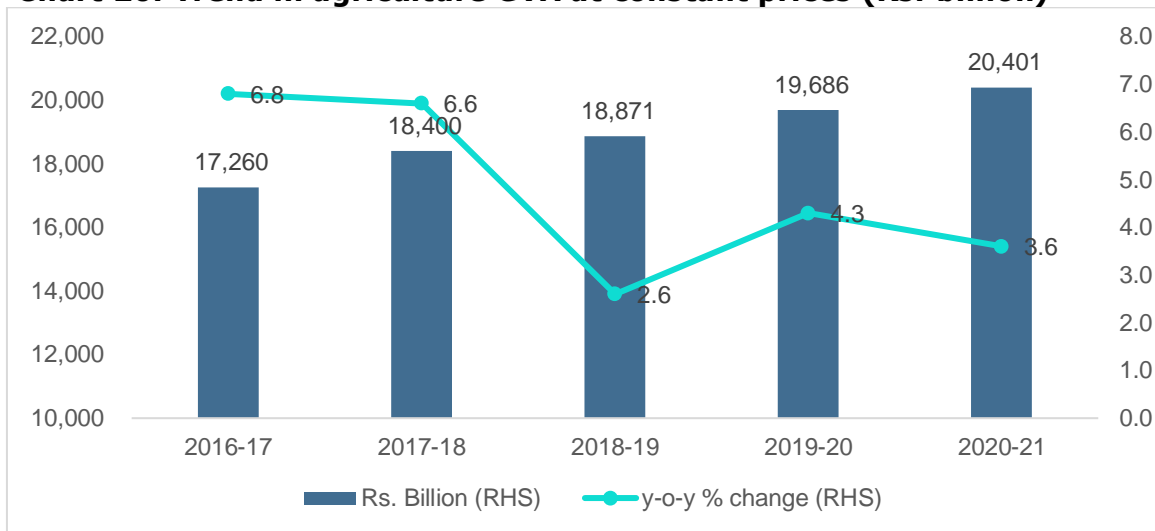
Table 14: Percentage share of GVA of agriculture and allied sector to total economy

| Year | % share |
|---------|---------|
| 2018-19 | 17.6 |
| 2019-20 | 18.4 |
| 2020-21 | 20.2 |

Source: PIB release

The expansion in share of agriculture and allied sector’s GVA is backed by an upward trend in the GVA of agriculture activities. During the five year period 2016-17 to 2020-21, the GVA for agriculture increased at a CAGR of 4.3% from Rs.17,260 billion in 2016-17 to Rs.20,401 billion in 2020-21.

Chart 20: Trend in agriculture GVA at constant prices (Rs. billion)



Source: CMIE

The growth in agriculture GVA has been supported by various measures on credit, market reforms and food processing. Moreover, in addition to several measures aimed at increasing productivity and improving marketing of agricultural produce, the government also carries out a large food management programme with a significant financial implication in terms of food subsidy. The growth in agriculture sector is expected to result in more demand of agrochemicals in India thus aiding its overall production and consumption.

- Government support:**

The government provides aid to the rural economy through various budget announcements that aim at reviving rural areas and raising farmer’s income. In addition to this, growth in credit facilities to farmers through institutional credit mechanisms and low interest rate farm loans are likely to motivate farmers towards usage of pesticides that helps increase the productivity and yields of crops. Besides, increase in minimum support price (MSP) of crops also may contribute to pesticides usage.

- **Growth in food demand:**

With expected increase in population, the demand for food grain in India is likely to rise. These consumption requirements are to be met with decreasing arable land and small holdings of land. Thus, raising farm productivity becomes important and this can be done with optimal usage of products like agrochemicals. It is to be noted that per hectare consumption of pesticides in India is one of the lowest in the world.

- **Increase in demand of horticulture and floriculture:**

Fruits and vegetables have a significant share of around 90% in the Indian horticulture output. With increase in consumption of healthy and nutritive food, demand of fruits and vegetables is likely to augment. This, in turn, is expected to support higher consumption of fungicides which helps in contracting post-harvest losses in fruits and vegetables.

- **Increase in awareness of Bio-pesticides:**

Increase in awareness with respect to environment friendly usage of agrochemicals and the use of integrated pest management (IPM) mechanism are expected to encourage the application of bio-pesticides. The bio-pesticides market in India constitutes a small proportion, which provides an opportunity to the segment to grow moving forward.

- **Off-patent molecules:**

Any pesticide that goes off-patent provides an opportunity to the Indian industry to develop generic molecules. Such an event thus opens up opportunity for Indian manufacturers to increase their exports. As per industry sources, an opportunity amounting over USD 4.2 billion comprising around 19 technicals are estimated to go off-patent between 2019 to 2026. This is likely to support pesticide exports from India going forward.

- **Export markets:**

The outbound shipments account for a major share of the Indian agrochemicals market and has grown at a CAGR of around 8.8% over the five year period 2016-17 to 2020-21 thus driving the overall agrochemicals industry. These exports have not just supported the agrochemicals industry but also the overall chemical exports from India as the contribution of pesticides has been significant. Pesticides exports accounted for about 45% of the chemical exports value during 2019-20. To support the ambition of making India a USD 5 trillion economy by 2025, the

Indian agrochemical industry is estimated to make outbound shipments of around Rs.385 billion by 2025. This target is also likely to encourage agrochemical/pesticides exports from India.

5.8 Challenges faced by industry

- **Research & Development (R&D) costs:** The companies are required to invest in R&D to develop new molecules that usually involves high cost. Also, developing a **new molecule takes around 9 years on an average.** While R&D is important to introduce innovation, the investment and time it demands restricts the development of R&D.
- **Distribution systems:**
The weak distribution system hinders the reach of agrochemicals to each and every remote area of the country. This, in turn, restricts its availability to the users that are spread at the remotest location of India. The industry requires efficient distribution through retailer to enhance its availability
- **Spurious products:**
Unavailability of pesticides at different locations gives an opportunity to spurious products to make their way. The usage of these counterfeit products, in turn, may also affect the crops besides being effective thus harming the honor of agrochemicals industry and its sales. Unawareness among farmers also contribute towards the growth of such products.
- **Lack of awareness:**
There is lack of awareness among farmers with respect to optimum and proper application of pesticides which is affecting the growth of agrochemicals industry. The companies however have been working towards increasing awareness about the usage of pesticides in farmers. Also, companies have been educating the farmers about the benefits of agrochemicals and its safe usage. This is expected to increase the demand for pesticides.

Companies are educating farmers on aspects such as right quantity, right use, right application method for usage of pesticides. Besides, farmers are also trained with respect to appropriate chemicals that are to be used for identified pest problems.

- **Genetically Modified (GM) seeds:**

GM seeds have the potential to decrease the application of pesticides. These seeds introduce pest avoidance qualities in high yielding crops. GM seeds thus have immunity developed in them which tends to prevent them from vagaries of nature. This quality of GM seeds thus have the potential to affect the demand of agrochemicals.

- **Organic farming:**

With growing health-consciousness among people, there has been an increase in demand of organic food and thus organic farming. Thus, there is need for agrochemicals industry to consider these concerns and work towards addressing the same thus preventing the impact of such concerns on industry growth.

5.9 Snapshot and potential of pyrethroids

5.9.1 Introduction to pyrethroids

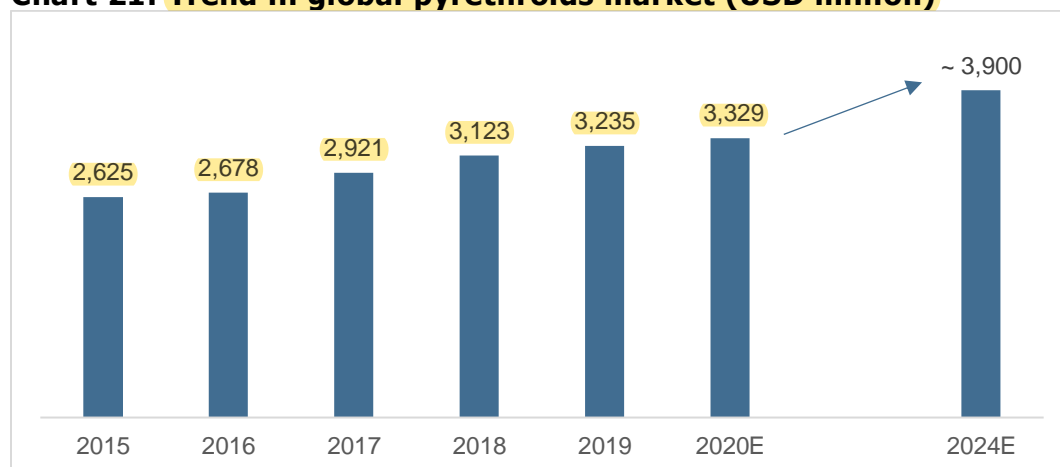
According to Biotechnology and Biological Sciences Research Council (BBSRC), natural pyrethrins are derived from Chrysanthemums, the same genus as common daisies, and are an important component of plant defences against insect pests. For thousands of years they have been extracted and used to combat insect pests. However, the natural pyrethrins are not particularly effective when used on fields of crops as they are quite unstable, breaking down quickly when exposed to sunlight. To overcome their limitations, scientists developed synthetic compounds, called pyrethroid insecticides, based on the chemistry of the natural pyrethrins. Both work by targeting sodium channels in the cell membranes of insect nervous systems. By locking these channels open, the pyrethroids block normal nerve impulses, paralysing the insect and ultimately killing it.

Compared to natural pyrethrins, the synthetic pyrethroids are more stable in direct sunlight. They are also significantly more effective against a wider range of insects, so farmers need to apply less insecticide to their crops. This also means pyrethroids are less likely to build up to dangerous levels in the environment. However, pyrethroids can harm some beneficial insects such as bees or the parasitic wasps that prey on pests, and they are also toxic to fish and other aquatic organisms. Because humans possess enzymes that quickly break down pyrethroid insecticides, the pyrethroids are only toxic to people in large quantities or over long periods of time.

5.9.2 Global pyrethroids market

The global pyrethroids market increased at a CAGR of 5.4% from USD 2,625 million in 2015 to USD 3,235 million in 2019. This increase in the market is backed by agricultural requirements as the use of pyrethroids help improves crop yield. They are also safer compared to organophosphate pesticides. In addition to this, the global pyrethroids market is also supported by public health and animal health needs. These factors are expected to aid the global pyrethroids market and the industry is expected to increase a CAGR of around 4% to touch the size of approximately USD 3,900 million by 2024.

Chart 21: Trend in global pyrethroids market (USD million)



Source: Industry sources, CareEdge Research estimates (E)

Share of user industries in global pyrethroids market

Agriculture is the largest user industry of pyrethroids market in the international market, which accounts for around 75% of the market value where pyrethroids help improves yield of crops by killing the insects. The other end users include public health and animal health with an approximate share of 19% and 6%, respectively, in pyrethroids market.

Table 15: Share of user industries in global pyrethroids market 2020E (in %)

| User industry | % share |
|---------------|------------|
| Agriculture | 75 |
| Public health | 19 |
| Animal health | 6 |
| Total | 100 |

Source: Industry sources, CareEdge Research estimates (E)

The use of pyrethroids in public health involves usage in public and domestic hygiene, protection from malaria etc. Pyrethroids are utilized to impregnate bed nets to reduce the proliferation of malaria as per World Health Organisation's Global Malaria Programme etc. In case of animal health, they are used against all types of parasites in livestock, dogs, cats among others.

Global pyrethroids market by product type

The global pyrethroids is led by cypermethrin accounting for the highest share of 24% followed by lambda-cyhalothrin (22%), deltamethrin (12%), bifenthrin (10%), permethrin (7%) and others (25%).

Table 16: Global pyrethroids market by product type (USD million)

| Market by product type | 2020E | % share |
|------------------------|--------------|------------|
| Cypermethrin | 816 | 24 |
| Lambda-Cyhalothrin | 738 | 22 |
| Deltamethrin | 396 | 12 |
| Bifenthrin | 344 | 10 |
| Permethrin | 237 | 7 |
| Others | 831 | 25 |
| Total | 3,362 | 100 |

Source: Industry sources, CareEdge Research estimates (E)

Cypermethrin: They are used in application on long-lasting insecticidal nets that are largely used for prevention from mosquitoes that spread malaria, dengue and yellow fever diseases.

Lambda-cyhalothrin: The market for this product is led by an increase in concerns about diseases that are transferred by insects, increase in commercial pest management services and rise in awareness about disease prevention.

Deltamethrin: The advancement of efficient technologies, increase in consumption of home pest control, growth in government initiatives to augment agriculture yields are among the prime factors supporting the rise of this market.

Bifenthrin: This is a type of synthetic pyrethroid which finds its application in protection of pests and insects, like mosquitoes, ticks, fleas, termites, and cockroaches. Bifenthrin can be found in various forms such as sprays and granules. The demand for bifenthrin has grown with an increase in the production of food crops.

Permethrin: The toxicity of permethrin for mites is its driving factor. Also, toxicity in case of other insects is also driving its demand from several insecticidal applications. Another use that is pharmaceutical in nature includes head lice treatment that is also supporting its consumption. Increasing health awareness among consumers is also increasing pharmaceutical applications of permethrin.

Permethrin, cypermethrin, and deltamethrin are mainly applied as active ingredients in nets. DDT (dichloro-diphenyl-trichloroethane) and pyrethroids have the same mode of action.

5.9.3 Pyrethroids market in India

Overview

Pyrethroids are found to be highly cost-effective by most farmers (which supports farm economics per acreage) and are beneficial to them as they are substantially more effective against an extensive range of insects. They act fast, are very adequate against chewing insects and have very low water solubility. This implies that pyrethroids are less likely to result in threatening levels in the environment. Pyrethroids need very low dosage to attack and kill insects in comparison to organophosphate pesticides and they are low in toxicity to mammals and birds. Their insecticidal job remains active over a longer duration that aids in controlling overlapping generations of pests. They are also easily biodegradable in nature.

Earlier in India, pyrethroids were applied significantly on the cotton crops that provided higher returns on investment. However, when BT cotton was launched in India in initial 2000s, this resulted in reduction in pesticides to be applied to a crop. This affected

pyrethroids market as the area under BT cotton cultivation increased sharply over a period of 13 years. The area under BT cotton cultivation grew to 119 lakh hectares (accounting for about 93% of the total 128 lakh hectares) in 2014-15 from a marginal 0.29 lakh hectares (that accounted for a share of only around 0.4% of the total 77 lakh hectares) in 2002-03. This caused the demand for pyrethroids to remain static till about 2015 and subsequently producers started looking for pyrethroids application in rice, fruits and vegetables.

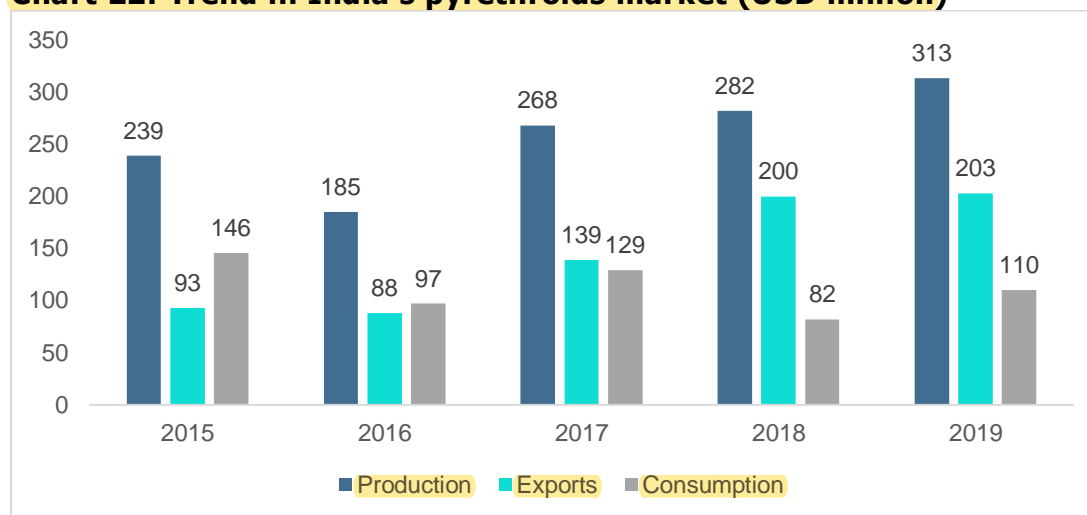
Nevertheless in 2016, pyrethroids saw a revival in demand mainly on account of the need for a substitute for some organophosphates (OP) and carbamates that were under scrutiny for their high toxicity risks. Moreover, pyrethroids found opportunity in several areas like home and garden and animal health applications. They are also utilised to impregnate bed nets, in case of vector control, that contracts the spread of malaria.

Over a period of time, India has emerged as the largest producer of pyrethroids. China that accounts for more than half of the international need of pyrethroids was accustomed to make pyrethroids after importing intermediates from India. However, China in a bid to improve air quality have led to the closure of various chemical plants. This has supported higher export volume of pyrethroids from India.

Trend in Indian pyrethroids market

The Indian pyrethroids production value had increased at a CAGR of 7% from USD 239 million in 2015 to USD 313 million in 2019 and the production volume of pyrethroids grew at a CAGR of 11,415 tonnes in 2015 to 17,747 tonnes in 2019.

Chart 22: Trend in India’s pyrethroids market (USD million)



Source: Industry sources

Exports that accounted on an average for more than 50% during the five-year period grew at a faster CAGR of 21.5% from USD 93 million in 2015 to USD 203 million in 2019. Consumption value of pyrethroids, on the other hand, declined at a CAGR of 6.8% to USD 110 million in 2019 from USD 146 million in 2015.

The growth in India’s pyrethroids production and exports have been primarily supported by agriculture (the largest end user industry accounting for around 80% of the Indian pyrethroids market) followed by demand from user industries like public health and animal health that contributed about 17% and 3%, respectively, towards the Indian pyrethroids market. Going ahead, these factors will continue to help the pyrethroids market in India and will also provide aid to pyrethroids exports from India.

Table 17: Outlook estimates for pyrethroids market in India

| Indicators | 2015 | 2016 | 2017 | 2018 | 2019 | 2020E | 2024E | Outlook CAGR |
|-------------------------------|--------|--------|--------|--------|--------|--------|--------|--------------|
| Volume (in tonnes) | | | | | | | | |
| Production | 11,415 | 10,721 | 12,525 | 15,155 | 17,747 | 18,954 | 24,659 | 6%-7% |
| Value (in USD million) | | | | | | | | |
| Production | 239 | 185 | 268 | 282 | 313 | 337 | 454 | 7%-8% |
| Consumption | 146 | 97 | 129 | 82 | 110 | 118 | 156 | 7%-8% |
| Exports | 93 | 88 | 139 | 200 | 203 | 218 | 287 | 7%-8% |

Source: Industry sources, CareEdge Research estimates (E)

5.10 Industry regulations and government initiatives

5.10.1 The Pesticide Management Bill 2020

The Insecticides Act, 1968 (the Act) was enacted to regulate the import, manufacture, sale, transport, distribution and use of insecticides with a view to prevent risk to human beings or animals. In the said Act, there is a lack of sufficient deterrence against violations and there is no stricter penalty to safeguard the farmers interest. There is also no mechanism to regulate pricing and disposal in an environmentally sound manner. Further, the Act is more than fifty years old and its provisions are inadequate to meet the multi-dimensional management and administration of pesticides in present times. It is also important to align India's obligations with various International forums.

In view of the above, stricter penalties are required for safeguarding the interest of farmers, which is jeopardised by the rampant availability of the pesticides which are of dubious and deceptive identity, composition and source. Representation of farmers and greater participation of States in formulation of technical standards for holistic management of pesticides is required. It is also pertinent to strike a balance amongst all stakeholders' aspirations.

In this background, a need was felt to bring a new legislation providing for better management of pesticides. With this in view, it is proposed to replace the Insecticides Act, 1968 by a new legislation, namely, the Pesticide Management Bill, 2020.

The proposed Bill, inter alia, provides for the following, namely:

- (i) to ensure transparency and effective implementation of the provisions of the proposed legislation and also to enable the Central Government to make rules relating to the manner in which the powers and functions of the Registration Committee would be exercised;
- (ii) provision has been made for encouraging indigenous manufacturing;
- (iii) provision has also been made for promoting pesticides that are biological and based on traditional knowledge;
- (iv) while registering a pesticide, the Registration Committee apart from evaluating its safety and efficacy, would also be guided by factors like necessity, end use, risk involved and availability of safer alternatives;

- (v) fixation of maximum residue limits for pesticides have been made mandatory;
- (vi) provision has been made for review, suspension and cancellation of registration and ban on pesticides;
- (vii) the State Governments may prescribe qualifications for Licencing Officer, Pesticide Inspector and Pesticide Analyst to be appointed by them;
- (viii) provision has been made to constitute an authority to exercise such powers and perform such functions relating to regulating the price of pesticides;
- (ix) provision has been made for deemed revocation of licences in case of cancellation of registration of a pesticide;
- (x) the Central Government may, by notification, specify ordinary use pesticides in respect of which a licence to sell or stock will not be required;
- (xi) empowering the Central Government and the State Governments to accredit private laboratories to carry out any or all functions of a Pesticide Testing Laboratory on compliance of prescribed standards;
- (xii) offences have been categorised separately in terms of the degree of severity like 'punishment for obstruction', 'punishment on violations of conditions of registration and licensing', 'punishment for activities related to import and export of pesticides', 'punishment for activities involving unregistered and unlicensed pesticides', 'punishment for activities involving falsified pesticides', 'punishment for activities involving banned pesticides', 'punishment for causing hurt, grievous hurt or death', etc.;
- (xiii) to deter the subsequent offences, a provision has been made for imposing a fine of not less than twice the fine that was imposed at the time of the first conviction, in case of subsequent offences, irrespective of the maximum fine provided for such offence;
- (xiv) it has also been provided that if a person is convicted for third time or more for violations of conditions of registration and licencing, he shall be liable to imprisonment for a term extending up to one year;
- (xv) provision has been made to empower the Central Government to constitute a fund, inter alia, for making ex gratia payments to persons or their legal heirs, as the case may be, who have suffered hurt, grievous hurt or have died in the course of poisoning due to occupational exposure to pesticide;

- (xvi) to enable the Central Government to give directions to a State Government, the Central Pesticide Board and in case of exigency, to the Registration Committee for carrying out all or any of the provisions of the proposed legislation or rules made thereunder.

The Bill seeks to achieve the above objectives.

The Pesticide Management Bill 2020 was under assessment by the Parliamentary Standing Committee on Agriculture. The government had asked for public inputs. The Committee has recently submitted its report in December 2021 where it suggested several measures to further strengthen the Pesticide Management Bill, 2020 and to inculcate sufficient safety provisions for farmers and introduce a system of checks and balances against possible misuse of power by pesticide inspectors. Also, the Committee rejected the pesticides industry's demand on three key issues – price control, criminalization and data protection.

The bill was presented in Rajya Sabha in 2008 with an aim to upgrade the act of 1968. In 2017, the act was upgraded and presented as a draft. The bill was introduced by the Agriculture Minister in the Rajya Sabha in 2020.

The bill is expected to protect farmers from spurious brands and will promote pesticides that are biological in nature.

5.10.2 Central Insecticides Board and Registration Committee

All the provisions of the Insecticides Act were brought into force with effect from 1st August, 1971. In the Act and the Rules framed there under, there is compulsory registration of the pesticides at the central level and licence for their manufacture, formulation and sale are dealt with at the state level. With the enforcement of the Insecticides Act in the country pesticides of very high quality are made available to the farmers and general public for house-hold use, for protecting the agricultural crops from the ravages of their pests, humans from diseases and nuisance caused by public health pests and the health hazards involved in their use have been minimised to a great extent. For the effective enforcement of the Insecticides Act, the two bodies have been constituted at the Central level viz. Central Insecticides Board and Registration Committee.

Central Insecticides Board - established Under Section 4 of the Insecticides Act, 1968**Objectives**

- a. The Central Insecticides Board advises the Central Government and State Governments on technical matters arising out of the administration of this Act and to carry out the other functions assigned to the Board by or under this Act.
- b. The matters on which the Board may advise includes :
 - the risk to human being or animals involved in the use of insecticides and the safety measures necessary to prevent such risk;
 - the manufacture, sale, storage, transport and distribution of insecticides with a view to ensure safety to human beings or animals.

Functions

- a. Advise the Central Government on the manufacture of insecticides under the Industries (Development and Regulation) Act, 1951 (65 of 1951).
- b. Specify the uses of the classification of insecticides on the basis of their toxicity as well as their being suitable for aerial application.
- c. Advise tolerance limits for insecticides residues and establishment of minimum intervals between the application of insecticides and harvest in respect of various commodities.
- d. Specify the shelf-life of insecticides.
- e. Suggest colourisation, including colouring matter which may be mixed with concentrates of insecticides, particularly those of highly toxic nature.
- f. Carry out such other functions as are supplemental, incidental or consequential to any of the functions conferred by the Act or the Rules.

By laws have been framed for Central Insecticides Board. The by laws require Central Insecticides Board to meet atleast once in 6 months.

Registration Committee - established under Section 5 of the Insecticides Act, 1968**Objectives**

- a. To register insecticide after scrutinizing their formulae and verifying claims made by the importer or the manufacturer , as the case may be, as regards their efficacy and safety to human being and animals; and
- b. To perform such other functions as are assigned to it by or under this Act.

Functions

The Registration Committee shall, in addition to the functions assigned to it by the Act , perform the following functions, namely

- a. Specify the precautions to be taken against poisoning through the use or handling of insecticides
- b. Carry out such other incidental or consequential matters necessary for carrying out the functions assigned to it under the Act or these rules.

Registration Committee meets normally once in a month to transact its business. It meets fortnightly exclusively for registration for export, if required.

5.10.3 Proposal to ban some pesticides

The government considering the demands of nations that imports from India have banned certain pesticides to avoid the loss of exports from India. For example, pesticide residue problems affected the exports of Basmati rice to the European Union (EU) following strict rules imposed by the EU on usage of chemicals. Similarly, Saudi Arabia also insisted on tightening norms on the minimum residue levels of pesticides on Basmati rice imported from India. Punjab, which accounts for close to half of the exported rice from India, then announced a ban on the usage of 9 chemicals during the kharif season 2020.

The Union government also reviewed 66 contentious pesticides for their toxicity. While 18 of these were banned in 2018, the government, in January 2021, had appointed an expert panel to review the agrochemicals industry's objections to the proposed ban on 27 widely used pesticides.

5.10.4 Government initiatives

Agriculture being a state subject, the State Government is primarily responsible for the growth and development of agriculture sector and developing perspective plans for their respective states and ensuring effective implementation of the programmes/schemes. However, Government of India supplements the efforts of the State Governments through various schemes / programmes. The details of various schemes, reforms and policies are given below:

- Unprecedented enhancement in budget allocation
- Fixing of MSP at one-and-a half times the cost of production
- Increase in procurement from farmers
- Income support to farmers through PM KISAN
- Pradhan Mantri Fasal BimaYojana (PMFBY)
- Institutional credit for agriculture sector
- Providing Soil Health Cards to farmers
- Promotion of organic farming in the country
- Neem Coating of Urea
- Agri Infrastructure Fund
- Promotion of FPOs Scheme
- National Bee and Honey Mission (NBHM)
- Pradhan Mantri Krishi Sinchai Yojana (PMKSY)
- Micro Irrigation Fund
- Agricultural Mechanization
- Changes in Disaster Relief Standards
- Setting up of E-NAM extension Platform
- Improvement in farm produce logistics, Introduction of Kisan Rail
- Creation of a Start-up Eco system in agriculture and allied sector

Government has taken several steps for increasing investment in agriculture sector such as enhanced institutional credit to farmers; promotion of scientific warehousing infrastructure for increasing shelf life of agricultural produce; setting up of Agri-tech Infrastructure Fund for making farming competitive and profitable; developing commercial organic farming etc.

Government is implementing various schemes for supply of farm inputs, like seeds, fertilizers, agricultural machinery and equipments, irrigation facilities, institutional credit, etc., at subsidized rates to the farmers in the country. Government has recently taken several steps for increasing investment and growth in agriculture sector which include creation of Long Term Irrigation Fund (LTIF), Micro Irrigation Fund for water use efficiency, promotion of commercial organic farming, etc. The details of such major schemes /steps are given below.

Government of India has launched the Central Sector Scheme of financing facility under Agriculture Infrastructure Fund (AIF) to boost Agriculture Infrastructure relating to post harvest management and community farming assets. Under this scheme entities such as farmers, agri entrepreneurs, starts up, Central/ State agency or local body sponsored public private partnership projects etc. can take benefit for setting up eligible infrastructure projects.

Rashtriya Krishi Vikas Yojana (RKVY)

Under Rashtriya Krishi Vikas Yojana (RKVY) Scheme of Ministry of Agriculture, grants-in-aid is given to state governments on the basis of the projects approved in State Level Sanctioning Committee Meeting (SLSC). States can take up projects for the development of Agriculture and allied sector in Public Private Partnership (PPP) for Integrated Agriculture Component.

Mission for Integrated Development of Horticulture (MIDH)

Under Mission for Integrated Development of Horticulture (MIDH) of this Ministry financial assistance in the range of 35% to 55% of eligible projects cost is available in the form of credit linked back ended for creation of Post-Harvest management infrastructure like Pack Houses, Pre-cooling units, Integrated pack houses, Refrigerator van, Primary/mobile Processing unit, cold storage etc farm gate level to consumption level.

The post-harvest component is demand/entrepreneurs-driven from among entrepreneurs, private companies, cooperatives, farmers groups etc. through commercial ventures for which assistance is available through respective State Horticulture Mission.

Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) Scheme

The Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) Scheme is being implemented with a view to provide income support to all landholding farmer families across the country, to enable them to take care of expenses related to agriculture and allied activities as well as domestic needs. The Scheme,

effective from 1.12.2018, aims to provide a payment of Rs.6000/- per year for the farmers' families with cultivable land holding, subject to certain exclusions. The financial benefit of Rs.6000/- is being released by the Central Government in three 4-monthly instalments of Rs.2000/- over the year directly into the bank accounts of the eligible farmers under Direct Benefit Transfer mode.

Further, Government of India has launched the Aatmanirbhar Bharat Abhiyan (ABA) to strengthen Infrastructure, Logistics, Capacity Building, Governance and Administrative Reforms for Agriculture.

In addition to this, the government has been working towards doubling farmers income by 2022. With respect to this, the government had constituted an Inter-ministerial Committee in April 2016 to examine issues relating to "Doubling of Farmers Income" (DFI) and recommended strategies to achieve the same. The committee submitted its report to the government in September 2018 containing the strategy for doubling of farmers' income by the year 2022.

The DFI strategy as recommended by the Committee include seven sources of income growth viz;

- (i) improvement in crop productivity;
- (ii) improvement in livestock productivity;
- (iii) resource use efficiency or savings in the cost of production;
- (iv) increase in the cropping intensity;
- (v) diversification towards high value crops;
- (vi) improvement in real prices received by farmers; and
- (vii) shift from farm to non-farm occupations.

6. Competitive landscape

6.1 Bharat Rasayan Ltd:

Bharat Rasayan is engaged in the production of fatty acid anhydrides, grignard reagents, pharma/drug intermediates, esters and solvents on a regular basis. The company also manufactures cosmetic ingredients with primary focus in the personal care (skincare, haircare and anti-bacterial) preservatives. Considering the emerging need in the global market for personal care preservatives, Bharat Rasayan introduced ethylhexylglycerin, 1, 2 octanediol, 1, 2 hexanediol, dimethyl isosorbide and others.

The company serves a wide range of industries including but not limited to pharmaceuticals, bulk drugs, R&D, petrochemicals, flavors and fragrances and specialty chemicals. Also the company provides manufacturing / contract manufacturing of diverse compounds to meet certain unique needs. Bharat Rasayan has multipurpose production facilities at Tarapur in Maharashtra.

| Bharat Rasayan Ltd. | | | |
|--|-------------|-------------|-------------|
| Financial indicators | FY19 | FY20 | FY21 |
| Net sales (Rs. million) | 9,922 | 12,150 | 10,920 |
| Net sales (y-o-y % change) | 24.8 | 22.5 | -10.1 |
| Operating margin (PBIDTM) (in %) | 19.2 | 20.3 | 22.7 |
| Net margin (in %) | 11.2 | 13.0 | 15.1 |
| Return on Capital Employed (ROCE) (in %) | 31.7 | 33.7 | 30.5 |
| Interest cover (x) | 10.5 | 13.5 | 49.9 |
| Total debt (Rs. million) | 409 | 239 | 13 |
| Inventory days | 56.0 | 55.7 | 55.0 |
| Receivable days | 92.1 | 79.6 | 91.3 |
| Payable days | 16.6 | 16.1 | 21.2 |
| Working capital cycle (in days) | 131.5 | 119.1 | 125 |

Source: Ace Equity, CareEdge Research

6.2 Dhanuka Agritech Ltd:

Dhanuka Agritech provides a wide range of agrochemical solutions under its herbicide, insecticide, fungicide and Plant Growth Regulator (PGR) portfolio of brands which controls

broad range of pests and disease problems in the farmer's farmland. This includes offerings like quizalofop ethyl 5% EC, Cartap Hydrochloride 75% SG, Kasugamycin 5% + Copper Oxychloride 45% WP, Halosulfuron Methyl 75% WG among others. The company has three manufacturing units located at Sanand (Gujarat), Udhampur (Jammu & Kashmir) and Keshwana (Rajasthan) with 39 warehouses.

| Dhanuka Agritech Ltd. | | | |
|--|-------------|-------------|-------------|
| Financial indicators | FY19 | FY20 | FY21 |
| Net sales (Rs. million) | 10,058 | 11,201 | 13,875 |
| Net sales (y-o-y % change) | 4.5 | 11.4 | 23.9 |
| Operating margin (PBIDTM) (in %) | 16.6 | 17.7 | 21.8 |
| Net margin (in %) | 11.2 | 12.6 | 15.2 |
| Return on Capital Employed (ROCE) (in %) | 23.8 | 26.4 | 37.9 |
| Interest cover (x) | 149.7 | 106.8 | 101.1 |
| Total debt (Rs. million) | 177 | 217 | 507 |
| Inventory days | 74.7 | 74.4 | 71.7 |
| Receivable days | 77.4 | 75.1 | 63.8 |
| Payable days | 35.2 | 37.7 | 35.9 |
| Working capital cycle (in days) | 117.0 | 111.9 | 99.6 |

Source: Ace Equity, CareEdge Research

6.3 Dharmaj Crop Guard Ltd:

Dharmaj Crop Guard offers a full-suite range of products that includes a wide array of agrochemicals like insecticides, herbicides, fumigants, fungicides, plant growth regulators, rodenticides, and others. The products offered involves fipronil 40% + imidacloprid 40% WG, hexaconazole 5% SC, pendimethalin 38.7% CS, amino acid liquid, boron 20% among others. The company business verticals include (a) Domestic Institutional sales of agro chemicals: (b) Exports: (c) Branded Products and (d) Public Health.

Manufacturing Plant of the company is located in Gujarat which have received quality control certifications ISO 9001:2015, ISO 14001:2015 and ISO 45001:2018 for development and manufacturing of agrochemical formulations. Company is having their Laboratory accredited from National Accreditation Board for Testing and Calibration Laboratories ("NABL") and in house R&D facility. The company is rapidly growing its sales network across India as well as in overseas market and is continuously investing in expanding its manufacturing capability.

| Dharmaj Crop Guard Ltd. | | | |
|--|-------------|-------------|-------------|
| Financial indicators | FY19 | FY20 | FY21 |
| Net sales (Rs. million) | 1,387 | 1,968 | 3,002 |
| y-o-y % change | 118.7 | 41.9 | 52.5 |
| Operating margin (PBIDTM) (in %) | 8.1 | 9.6 | 10.8 |
| Net margin (in %) | 3.7 | 5.4 | 7.0 |
| Return on Capital Employed (ROCE) (in %) | 32.0 | 36.2 | 40.0 |
| Interest cover (x) | 4.4 | 7.2 | 20.5 |
| Total debt (Rs. million) | 365 | 586 | 753 |
| Inventory days | 49.2 | 62.5 | 64.1 |
| Receivable days | 38.0 | 58.2 | 39.4 |
| Payable days | 39.5 | 74.1 | 55.0 |
| Working capital cycle (in days) | 47.7 | 46.6 | 48.5 |

Source: MCA - Annual Report, CareEdge Research

6.4 Heranba Industries Ltd:

Heranba Industries Ltd offers a wide range of technicals, intermediates, formulations and public health products. The segments covered by the company includes insecticides, herbicides, fungicides, plant growth which offers deltamethrin, profenophos, temephos, metribuzin, hexaconazole etc. The company has three independent manufacturing facilities located at Vapi in Gujarat. Two of these units are involved in production of various technicals and intermediates, while the third plant is purely a formulation and packing facility. Exports accounted around 48% of the company's revenues in the past three years.

| Heranba Industries Ltd. | | | |
|--|-------------|-------------|-------------|
| Financial indicators | FY19 | FY20 | FY21 |
| Net sales (Rs. million) | 10,044 | 9,514 | 12,187 |
| Net sales (y-o-y % change) | 35.5 | -5.3 | 28.1 |
| Operating margin (PBIDTM) (in %) | 13.8 | 14.5 | 17.6 |
| Net margin (in %) | 7.5 | 9.7 | 11.9 |
| Return on Capital Employed (ROCE) (in %) | 51.9 | 42.9 | 45.4 |
| Interest cover (x) | 12.4 | 15.6 | 39.6 |
| Total debts (Rs. million) | 61 | 70 | 101 |
| Inventory days | 37.8 | 47.1 | 43.7 |
| Receivable days | 82.9 | 92.8 | 84.3 |
| Payable days | 88.5 | 102.0 | 77.4 |
| Working capital cycle (in days) | 32.2 | 37.9 | 50.6 |

Source: Ace Equity, CareEdge Research

6.5 India Pesticides Ltd:

India Pesticides have diversified into manufacturing herbicide and fungicide technicals and Active Pharmaceutical Ingredients (API). It offers technical/APIs such as thiocarbamate, folpet, cymoxanil, captan etc. The company has two complexes at Industrial area of Uttar Pradesh State Industrial Development Corporation (UPSIDC) on outskirts of Lucknow city. The sites are equipped with facilities to manufacture both technical and formulations such as WDG, EC, WP, SL, SC etc. for domestic as well as international markets in small and bulk packing. The company had earned about 57% of the revenues from export market during FY21.

| India Pesticides Ltd. | | | |
|--|-------|-------|-------|
| Financial indicators | FY19 | FY20 | FY21 |
| Net sales (Rs. million) | 3,407 | 4,796 | 6,490 |
| Net sales (y-o-y % change) | 37.3 | 40.8 | 35.3 |
| Operating margin (PBIDTM) (in %) | 20.7 | 21.6 | 29.2 |
| Net margin (in %) | 12.9 | 14.8 | 20.7 |
| Return on Capital Employed (ROCE) (in %) | 30.5 | 37.0 | 52.1 |
| Interest cover (x) | 12.0 | 18.9 | 53.4 |
| Total debts (Rs. million) | 116 | 111 | 83 |
| Inventory days | 29.3 | 28.2 | 30.6 |
| Receivable days | 162.4 | 137.5 | 111.8 |
| Payable days | 61.4 | 56.4 | 52.7 |
| Working capital cycle (in days) | 130.3 | 109.3 | 89.6 |

Source: Ace Equity, CareEdge Research

6.6 Punjab Chemicals & Crop Protection Ltd:

Punjab Chemicals produces various agrotechnicals, Agroformulations, API's, Pharmaceutical Intermediates, Phosphorous Derivatives and Speciality Chemicals. Some of the products offered by the company includes metamitron, diflufenican, celecoxib, 3,4,5 trimethoxy aniline, 2,6 dimethoxy phenol etc. The company has two manufacturing units at Derabassi and Lalru in Punjab and one at Pune in Maharashtra. The company earned 64% of the revenues from exports during FY21.

| Punjab Chemicals & Crop Protection Ltd. | | | |
|--|-------------|-------------|-------------|
| Financial indicators | FY19 | FY20 | FY21 |
| Net sales (Rs. million) | 6,404 | 5,475 | 6,764 |
| Net sales (y-o-y % change) | 31.2 | -14.5 | 23.5 |
| Operating margin (PBIDTM) (in %) | 11.9 | 11.0 | 14.1 |
| Net margin (in %) | 3.2 | 2.9 | 7.5 |
| Return on Capital Employed (ROCE) (in %) | 25.2 | 22.2 | 34.6 |
| Interest cover (x) | 2.9 | 2.5 | 6.5 |
| Total debt (Rs. million) | 446 | 834 | 1,046 |
| Inventory days | 42.3 | 56 | 50.7 |
| Receivable days | 29.4 | 36.5 | 34.4 |
| Payable days | 71.3 | 78.7 | 63.7 |
| Working capital cycle (in days) | 0.4 | 13.8 | 21.4 |

Source: Ace Equity, CareEdge Research

6.7 Rallis India Ltd:

Rallis India (a Tata enterprise) is engaged in the business of crop care and seeds. The domestic crop care business comprises of domestic branded formulations and institutional business (fungicides, insecticides, herbicides) and international business involves manufacturing and export of active ingredients, formulations and contract manufacturing. The company is engaged in research, development, production, processing and distribution of hybrid seeds for field crops and vegetables. The company has two manufacturing facilities in Gujarat (Ankleshwar and Dahej) and two manufacturing facilities in Maharashtra (Lote and Akola). During FY21, exports accounted for 37% of the revenues during the year.

| Rallis India Ltd. | | | |
|--|-------------|-------------|-------------|
| Financial indicators | FY19 | FY20 | FY21 |
| Net sales (Rs. million) | 19,836 | 22,515 | 24,294 |
| Net sales (y-o-y % change) | 32.4 | 13.5 | 7.9 |
| Operating margin (PBIDTM) (in %) | 13.7 | 13.3 | 15.0 |
| Net margin (in %) | 7.8 | 8.2 | 9.4 |
| Return on Capital Employed (ROCE) (in %) | 17.7 | 17.6 | 20.0 |
| Interest cover (x) | 28.1 | 25.5 | 45.8 |
| Total debt (Rs. million) | 2,672 | 1,400 | 1,445 |
| Inventory days | 96.4 | 111.2 | 109.9 |
| Receivable days | 74.8 | 72.8 | 64.3 |
| Payable days | 95.9 | 112.3 | 110.0 |

| | | | |
|---------------------------------|------|------|------|
| Working capital cycle (in days) | 75.3 | 71.7 | 64.2 |
|---------------------------------|------|------|------|

Source: Ace Equity, CareEdge Research

6.8 Sumitomo Chemical India Ltd:

Sumitomo Chemical India manufactures, imports and markets products for crop protection, grain fumigation, rodent control, bio pesticides, environmental health, professional pest control and feed additives for use in India. The company offers products such as clothianidin 50% WDG, pyridalyl 10% EC, sulfosulfuron 75% WG, tebuconazole 12.5% + azoxystrobin 12.5% SC among others. The company has five manufacturing facilities in Gujarat and Maharashtra at Bhavnagar, Gajod, Tarapur, Vapi and Silvassa. Exports accounted for 17% of the company's revenue during FY21.

| Sumitomo Chemical India Ltd. | | | |
|--|-------------|-------------|-------------|
| Financial indicators | FY19 | FY20 | FY21 |
| Net sales (Rs. million) | 22,230 | 24,234 | 26,427 |
| Net sales (y-o-y % change) | 16.3 | 9.0 | 9.0 |
| Operating margin (PBIDTM) (in %) | 13.4 | 14.3 | 19.2 |
| Net margin (in %) | 7.5 | 8.5 | 13.1 |
| Return on Capital Employed (ROCE) (in %) | 26.2 | 24.2 | 33.6 |
| Interest cover (x) | 55.4 | 38.9 | 67.4 |
| Total debt (Rs. million) | 156 | 445 | 445 |
| Inventory days | 105.5 | 95.4 | 92.6 |
| Receivable days | 100.1 | 114.2 | 116.9 |
| Payable days | 93.8 | 93.2 | 90.1 |
| Working capital cycle (in days) | 111.9 | 116.4 | 119.4 |

Source: Ace Equity, CareEdge Research

Company-wise operational details

| | Bharat Rasayan Ltd. | Dhanuka Agritech Ltd. | Dharmaj Crop Guard Ltd. | Heranba Industries Ltd. | India Pesticides Ltd. | Punjab Chemicals & Crop Protection Ltd. | Rallis India Ltd. | Sumitomo Chemical India Ltd. |
|--|---------------------|-----------------------|-------------------------|-------------------------|-----------------------|---|-------------------|------------------------------|
| Year of incorporation | 1989 | 1980 | 2015 | 1996 | 1984 | 1975 | 1948 | 2000 |
| Number of products in portfolio | 200+ | 100+ | 190+ | 290 | 151+ | 7 | NA | 200+ |
| Infrastructure | | | | | | | | |
| Total manufacturing sites | 2 | 3 | 1 | 3 | 2 | 3 | 4 | 5 |
| Capacity (MT) | 33,000 | NA | 25,500 | 14,024 | 19,500 | 23,502 | 27,780 | NA |
| Network | | | | | | | | |
| Distributors | NA | 6,500 | 3,700+ | 9,400 | NA | NA | 3,879 | 14,000 |
| Depots | NA | NA | 8 | 21 | 20 | NA | 28 | 65 |
| Countries | 65 | NA | 20 | 60 | 20 | NA | 31 | 60 |

Source: Industry sources

Note: NA indicates not available

Company-wise revenue performance

| Parameters | Bharat Rasayan Ltd. | Dhanuka Agritech Ltd. | Dharmaj Crop Guard Ltd. | Heranba Industries Ltd. | India Pesticides Ltd. | Punjab Chemicals & Crop Protection Ltd. | Rallis India Ltd. | Sumitomo Chemical India Ltd. |
|--------------------------------------|---------------------|-----------------------|-------------------------|-------------------------|-----------------------|---|-------------------|------------------------------|
| Revenue FY21 (Rs. million) | 10,920 | 13,875 | 3,002 | 12,187 | 6,490 | 6,764 | 24,294 | 26,427 |
| PBIDT FY21 (Rs. million) | 2,474 | 3,030 | 323 | 2,284 | 1,895 | 953 | 3,650 | 5,065 |
| Net profit FY21 (Rs. million) | 1,645 | 2,106 | 211 | 1,542 | 1,345 | 505 | 2,287 | 3,453 |
| Revenue CAGR % (FY19-FY21) | 4.9 | 17.5 | 46.9 | 10.2 | 38.0 | 2.8 | 10.6 | 9.0 |
| PBIDT CAGR % (FY19-FY21) | 14.1 | 34.6 | 70.1 | 28.3 | 63.8 | 11.8 | 15.7 | 30.5 |
| Net profit CAGR % (FY19-FY21) | 21.4 | 36.8 | 103.6 | 43.0 | 75.0 | 58.0 | 21.8 | 43.8 |

Source: Ace Equity, MCA – Annual Report, CareEdge Research

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About:

CareEdge (CARE Group) is a knowledge-based analytical group that aims to provide superior insights based on technology, data analytics capability and detailed research methods. CareEdge is one of the leading credit rating agencies in India. It has an impressive track record of rating companies for almost three decades and has played a pivotal role in developing the corporate debt market in India. CareEdge provides near real time research on all domestic and global economic developments. The wholly owned subsidiaries include CareEdge Advisory & Research arm focused on providing advisory and consultancy services and CareEdge Risk solutions a platform that provides risk management solutions

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