STATE OF BIOFERTILIZERS AND ORGANIC FERTILIZERS IN INDIA

STATE OF BIOFERTILIZERS AND ORGANIC FERTILIZERS IN INDIA

FEBRUARY 2022

Research direction: Amit Khurana

Research: Vineet Kumar

Analysis and writing: Amit Khurana and Vineet Kumar

Editor: Arif Ayaz Parrey

Cover and design: Ajit Bajaj

Production: Rakesh Shrivastava and Gundhar Das

MISEREOR
IHR HILFSWERK

We are grateful to Misereor for their support for this publication

Citation: Amit Khurana and Vineet Kumar 2022. *State of Biofertilizers and Organic Fertilizers in India,* Centre for Science and Environment, New Delhi

Published by
Centre for Science and Environment
41, Tughlakabad Institutional Area
New Delhi 110 062
Phones: 91-11-40616000
Fax: 91-11-29955879
E-mail: sales@cseinida.org
Website: www.cseindia.org

Contents

Executive summary

Soil health status and chemical fertilizers

Between 2015–16 and 2018–19, more than five crore soil samples from across India were tested in government-approved laboratories to understand the state of the country's soils. The results revealed severe and widespread deficiency of organic carbon and micronutrients in Indian soils. About 85 per cent of the samples were deficient in organic carbon; 97 per cent samples were deficient in available nitrogen; 83 per cent samples were deficient in phosphorus; and 71 per cent samples were deficient in potassium. At least half of the samples from 24 states and Union territories were deficient in organic carbon. Half of the samples from 32 states and Union territories were deficient in nitrogen, phosphorus and potassium (NPK). About 90 per cent of samples from 27 states and Union territories showed deficiency in available nitrogen. Nineteen and eight states had more than 90 per cent samples deficient in phosphorus and potassium respectively. Soils were deficient in micronutrients as well. About 47 per cent, 39 per cent, 37 per cent and 36 per cent soil samples were deficient in boron, zinc, iron and sulphur respectively.

In 2019, India was the second highest producer and consumer of chemical fertilizers in the world. In 2020–21, the chemical fertilizer consumption in India, excluding single super phosphate (SSP), was 62.98 million tonne, with a growth of more than 82.5 per cent since 2000–01. Per hectare fertilizer consumption for 2020–21 stands at 161 kg, with a growth of 75 per cent since 2000–01. In 2019–20, per hectare fertilizer consumption in 12 states and Union territories was more than the national average of 133.4 kg. In decreasing order of per hectare consumption, these states and Union territories are Bihar, Puducherry, Punjab, Haryana, Telangana, Andhra Pradesh, Uttar Pradesh, West Bengal, Tamil Nadu, Karnataka, Delhi and Uttarakhand.

More than 50 per cent of the chemical fertilizers consumed in India are in the form of urea. Between 2000–01 and 2020–21, consumption of complex fertilizers grew by 163 per cent, consumption of diammonium phosphate grew by 103 per cent, consumption of urea grew by 83 per cent, and consumption of muriate of potassium grew by 92 per cent. Consumption of SSP grew by 25 per cent between 2000–01 and 2018–19.

Total subsidy on chemical fertilizers is steeply growing every year. In 2020–21, the annual subsidy bill was Rs 1,31,230 crore, which is more than 10 times the subsidy

bill in 2001–02 (Rs 12,908 crore). The subsidy bill has grown sharply from 2019–20, when it was Rs 83,468 crore, partly due to rising international prices leading to higher subsidies on imported fertilizers. The share of subsidy on imported fertilizers in the total subsidy bill of chemical fertilizers was more than 25 per cent in that year. In 2020–21, the subsidy turned out to be Rs 9,400 per hectare of net sown area, while it ranged between Rs 5,000 and Rs 6,000 during 2016–20. In 2019–20, over two-thirds of the total subsidy was for urea and one-third was for phosphatic and potassic fertilizers. For city compost, only a negligible 0.04 per cent of the total subsidy on fertilizers was provided. City compost is an organic fertilizer on which market development assistance used to be given, which has been discontinued from October 2021.

States and Union territories with higher consumption of chemical fertilizers (than the national per hectare consumption of 133.4 kg in 2019–20) did not necessarily report a lesser number of soil samples deficient in organic carbon, nitrogen, phosphorus and potassium. Similarly, states and Union territories with lower per hectare consumption of chemical fertilizers (than the national average) did not necessarily report a higher number of deficient soil samples. Many studies suggest that crops no longer respond to chemical fertilizers as they used to. Chemical fertilizers have a deleterious effect on soil and crop productivity, and deficiency of nutrients has become a yield-limiting factor even with application of recommended doses of fertilizers.

Biofertilizers and organic fertilizers—policy and programmes

Concerns related to use of chemical fertilizers have led to a desperate search for alternative non-chemical options. These include biofertilizers and organic fertilizers. These non-chemical options are considered critical to the transition from chemical-based to sustainable farming practices like organic and natural farming. Availability of cost-effective quality biofertilizers and organic fertilizers is, therefore, of utmost importance.

Biofertilizers are ready to use live formulates of beneficial microorganisms that on application to seed, root or soil mobilize nutrients through their biological activity in particular, and help in building up the micro-flora and soil health in general. **Organic fertilizers** consist of decomposed organic material derived from animal, human and plant residues. They are of different types depending on the source of the organic material and nature of composting. For example, organic manure is a mix of cattle dung and plant residues, while vermicompost is developed with the help of earthworms. City compost is made from organic material in urban solid waste.

In India, biofertilizers and organic fertilizers were brought under the regulatory purview of the Fertilizer (Inorganic, Organic or Mixed) (Control) Order (FCO), 1985, under the Union Ministry of Agriculture and Farmers' Welfare, in 2006. As of now, 11 biofertilizers are approved under FCO, which include nitrogen fixers and phosphate-solubilizing and potassium-mobilizing biofertilizers of bacterial or fungal nature. They are available in solid and liquid formulations. Ten organic fertilizers are approved under FCO at present. In addition, many on-farm inputs are not part of the FCO-approved list but are used in organic and natural farming.

Government of India has initiated several schemes and programmes through which it promotes production and use of biofertilizers and organic fertilizers. These schemes include those aimed at farmers to promote organic and natural farming such as Paramparagat Krishi Vikas Yojana, Mission Organic Value Chain Development for North Eastern Region, National Food Security Mission and National Mission on Oilseeds and Oil Palm. However, the sum total of funds spent on these schemes and programmes is dwarfed by the annual subsidy provided on chemical fertilizers. For example, the total organic farming practicing area covered under these schemes and programmes is only about 2.7 per cent of India's net sown area of 140.1 million hectare. Between 2018 and 2021, a sum of only Rs 994 crore was released for Paramparagat Krishi Vikas Yojana, Rs 416 crore for the Mission Organic Value Chain Development for North Eastern Region, and about Rs four crore for biofertilizers under the National Food Security Mission.

Similarly, subsidy schemes aimed at supporting biofertilizer and organic fertilizer manufacturers and for laboratory infrastructure include the Capital Investment Subsidy Scheme (CISS), the Soil Health Management scheme, the Policy on Promotion of City Compost and the New National Biogas and Organic Manure Programme. The potential of these schemes is not being fully utilized. A small sum of Rs 18.9 crore has been released in the last 17 years for composting and biofertilizer production units under CISS. Only Rs 8.67 crore has been released for biofertilizer units and biofertilizer and organic fertilizer testing laboratories under the Soil Health Management Scheme between 2014–15 and 2018–19. Market development assistance for city compost between 2016–17 and January 2021 has been Rs 85.8 crore.

Biofertilizers and organic fertilizers—production trends

In 2020–21, India produced about 1,34,323 tonne of **carrier-based solid biofertilizers**. This marked a growth of about 435 per cent over the 2008–09 figure and 83 per cent over the 2018–19 figure. In 2020–21, states in southern

India were responsible for about half of India's carrier-based solid biofertilizer production, states in the West Zone were responsible for one-fourth of the production, and northern and eastern states added 19 per cent and 3 per cent to the total production respectively.

With a 48 per cent share, Tamil Nadu was the biggest producer of carrier-based solid biofertilizers in 2020–21, followed by Gujarat, Maharashtra, Uttar Pradesh and Haryana. Together, these five states were responsible for more than 90 per cent of the countrywide production of carrier-based solid biofertilizers. In the last two–three years, production has witnessed the highest growth in Tamil Nadu, followed by Uttar Pradesh, Tripura, Haryana, Rajasthan, Gujarat, Himachal Pradesh and Punjab, in that order.

In 2020–21, the total production of **liquid biofertilizers** in India was about 26,442 kilolitre (kl). This marked a growth of about 552 per cent over the 2014–15 figures. In 2020–21, states in southern India were responsible for about half of the countrywide liquid biofertilizers production, followed by states in the West Zone (with a 40 per cent contribution) and states in northern and eastern India, respectively producing 7.5 per cent and 3.4 per cent of India's liquid biofertilizers.

Karnataka was the single largest producer, with a 37 per cent share in countrywide liquid biofertilizers production, followed by Gujarat, Maharashtra, Kerala and Uttarakhand, in that order. Together, these five states produced about 88 per cent of India's liquid biofertilizers.

Over the last seven years, Karnataka has shown maximum growth in the production of liquid biofertilizers, followed by Kerala, Odisha, Tamil Nadu, Chhattisgarh and Maharashtra, in that order.

In 2017, India had 424 carrier-based solid biofertilizer manufacturing units and 108 for liquid biofertilizer manufacturing units. The production capacities are not optimally utilized by all states. There is also lack of compiled countrywide information on companies, registered biofertilizer products and authorizations given at the Central level.

In 2020–21, India produced 3.88 million tonne of organic fertilizers, a dramatic decrease from 338.72 million tonne in 2017–18. In 2017–18, Bihar led with 30 per cent production of organic fertilizers in India and was followed by Gujarat and Jharkhand. In 2018–19, Karnataka was the biggest producer of organic fertilizers, with a 94 per cent share in countrywide production. The state continued to be the

leading producer in 2019–20, but its share dropped to 64 per cent. In that year, Andhra Pradesh had the second biggest share. In 2020–21, with a share of 63 per cent, Chhattisgarh led the countrywide production or organic fertilizers and Karnataka slipped to the second spot. The reasons for the steep fall in national production of organic fertilizers within a span of three years, or the manner in which state-wise shares in the total production have changed substantially between years, are not clear.

In 2017–18, farm yard manure had the highest share with 56 per cent in the total organic fertilizers produced in India, followed by vermicompost with 23 per cent. Organic manure had a share of 11 per cent and city compost, only 3 per cent.

Biofertilizers and organic fertilizers—quality issues

India has 26 laboratories approved under FCO to perform quality tests on biofertilizers and organic fertilizers. These laboratories have a combined capacity to test 14,050 biofertilizer and organic fertilizer samples every year. They include seven Central government laboratories of Regional Centres of Organic Farming (RCOF). However, many states do not have their own laboratories.

Testing capacities of RCOF are not properly utilized. In 2019–20, only 28 per cent of the capacity was utilized. The number of biofertilizer samples tested decreased from 654 in 2013–14 to 483 in 2019–20. The proportion of biofertilizer samples failing the quality tests increased from 1 per cent in 2013–14 to 44 per cent in 2019–20.

Only 477 organic fertilizer samples were tested in 2019–20. The percentage of samples failing the tests rose from nine in 2013–14 to 46 in 2019–20.

Inputs received from a vast majority of stakeholders from across the country have also highlighted the widespread availability of inferior quality and spurious biofertilizer and organic fertilizer products. Stakeholders point out that the procurement of biofertilizers and organic fertilizers by the state through tenders at low prices is one of the major reasons for the inferior quality of the products distributed to farmers under various schemes. Media in states like Bihar, Chhattisgarh, Haryana, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh regularly report on the poor quality of biofertilizer and organic fertilizer products and issues related to poor FCO implementation by state agriculture departments, variation in laboratory test results between state and Centre-owned laboratories, existence of fake companies, and several complaints by farmers.

Massive but underutilized potential of organic fertilizers

India is fortunate to have an abundance of organic fertilizer sources. A 2020 study mentions that the potential quantity of organic material (cattle dung, crop residue and municipal solid waste) in the country is about 1,056 million tonne per annum, of which about 35 per cent is actually available for utilization. An earlier 2010 study estimated the potential availability at 1,566 million tonne, with potential nitrogen, phosphorus and pottasium (NPK) nutrient supply of 47.3 million tonne, but only 27 per cent of it is actually utilized. This potential availability of 47.3 million tonne of nutrient supply from organic sources is more than the current 34 million tonne current combined nutrient consumption from chemical fertilizers and organic and biofertilizers in crop production in India.

Other estimates support these numbers and assert that with utilization of biological nitrogen fixation and increase in nutrient utilization efficiency to up to 50 per cent, nutrients from organic sources can be used more efficiently and will be needed in smaller quantities.

Other estimates point out that only 5 per cent crop residues are recycled and almost two–thirds of the dung produced in India is not recycled back into agriculture. Similarly, not even 5 per cent of the organic waste generated by cities is converted into compost. Food waste and agro-waste are also underutilized. For example, 67 million tonne of food waste is not composted in India every year.

The NPK-based approach to calculating nutrient value of organic fertilizers and comparing it with the NPK value of chemical fertilizers is also questioned by many. Organic fertilizers provide many other benefits over and above their NPK value, while chemical fertilizers cause a lot of harm.

The potential of on-farm inputs is increasingly being discussed and accepted as well.

Biofertilizers and organic fertilizers—barriers and recommendations

Several barriers have been identified in more widespread use of biofertilizers and organic fertilizers. These are mostly related to funding, subsidies and support for promotion of biofertilizers and organic fertilizers; quality control; and data collection and reporting. Details are available in the chapter on barriers.

The major recommendations include:

a) A targeted, ambitious and well-funded nationwide programme is needed to drive the change towards organic and natural farming

b) Quality of biofertilizers and organic fertilizers must be ensured by developing and institutionalizing a robust monitoring and enforcement mechanism through collaboration between the Centre and states

c) Production and availability of biofertilizers and organic fertilizers must be ensured and their use must be promoted through a multi-pronged approach by the Centre and states.

Details are available in the chapter on recommendations.

1. State of Indian soil

Soil health can be determined by various physical, chemical and biological indicators. These include percentage of organic carbon, macro- and micro-nutrients, and micro- and macro-organisms present in the soil; its bulk density; water holding capacity; pH; and electrical conductivity.

1.1 Indian soil health as per Soil Health Card scheme

In 2014–15, the Union Ministry of Agriculture and Farmers' Welfare initiated the Soil Health Card (SHC) scheme as part of the National Mission of Sustainable Agriculture. The scheme involved large-scale testing of soil health parameters and disbursement of soil health cards to farmers. Overall, about 5.27 crore soil samples have been tested as part of Cycle 1 from 2015–16 to 2016–17 and Cycle 2 from 2017–18 to 2018–19. In addition, about 19.64 lakh tests have also been conducted as part of the Model Villages Programme.[1]

Results from across India reveal the deteriorating health of Indian soils. Most Indian soils are deficient in organic carbon and macronutrients. This means that levels of organic carbon and macronutrients are either "very low", "low" or "medium" for most soils in India (see *Box: Criteria for deficiency or sufficiency in samples*).

About 85 per cent samples are deficient in organic carbon. Of these samples, about 15 per cent contain very low levels of organic carbon, 49 per cent contain low levels of organic carbon and 21 per cent contain medium levels of organic carbon. Similarly, 97 per cent samples are deficient in nitrogen. Of these, 45 per cent samples show very low levels of nitrogen, 36 per cent samples show low levels of nitrogen and 16 per cent samples show medium levels of nitrogen. Again, 83 per cent samples are deficient in phosphorus. Of them, 17 per cent reveal very low levels of phosphorus, 31 per cent reveal low levels of phosphorus and 35 per cent reveal medium levels of phosphorus. About 71 per cent samples are deficient in potassium. Of these samples, about 5 per cent have very low levels of potassium, 14 per cent have low levels of potassium and 52 per cent have medium levels of potassium.

Indian soils are also deficient in micronutrients but not as much as they are deficient in macronutrients. Among micronutrients, more samples show deficits in boron, iron, sulphur and zinc content and a lesser number shows deficits in copper and manganese content (see *Graph 1: How deficient are Indian soils in organic carbon, macronutrients and micronutrients?*).

CRITERIA FOR DEFICIENCY OR SUFFICIENCY IN SAMPLES

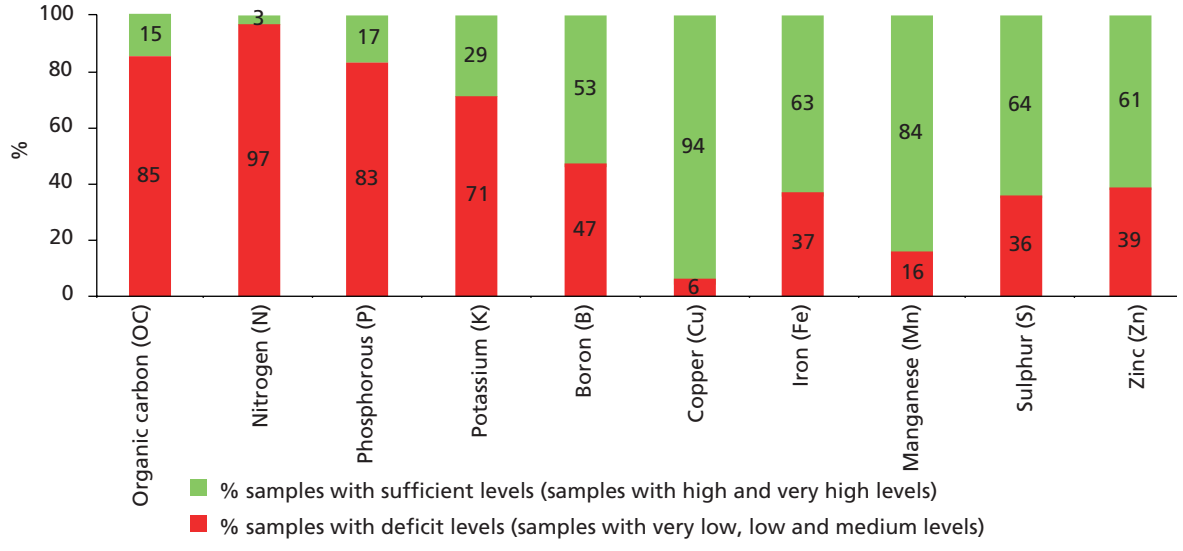
As per the Soil Health Card scheme, a soil is considered deficient in macronutrients like nitrogen, organic carbon, phosphorus and potassium if the levels of these macronutrients in the soil are "very low", "low" or "medium"; and sufficient if the levels of the macronutrients in the soil are "high" or "very high". Similarly, soils containing less than the prescribed level of a micronutrient—boron, copper, iron, manganese, sulphur and zinc, etc.—are considered deficient and soils containing equal to or more than the prescribed levels of micronutrients are considered sufficient.

The values for each nutrient are defined as follows:

- Organic carbon: very low (< 0.25 per cent), low (0.25–0.50 per cent), medium (0.5–0.75 per cent), high (0.75–1.0 per cent), very high (> 1.0 per cent).
- Nitrogen: very low (< 140 kg/ha), low (140–280 kg/ha), medium (280–560 kg/ha), high (560–700 kg/ha), very high (> 700 kg/ha);
- Phosphorus: very low (< 5 kg/ha), low (5–10 Kg/ha), medium (10–25 kg/ha), high (25–40 kg/ha), very high (> 40 kg/ha);
- Potassium: very low (< 60 kg/ha), low (60–120 Kg/ha), medium (120–280 kg/ha), high (280–560 kg/ha), very high (> 560 kg/ha);
- Boron: > 0.5 ppm; copper: > 2.0 ppm, iron: > 4.5 ppm, manganese: >2.0 ppm, sulphur: >10.0 ppm, zinc: > 0.6 ppm

Source: Indian Council of Agriculture Research, Ministry of Agriculture and Farmers' Welfare

Graph 1: How deficient are Indian soils in organic carbon, macronutrients and micronutrients?



Note: Figures are calculated based on data available on the ministry website (https://www.soilhealth.dac.gov.in/). They are combined results of cycle 1 and cycle 2 testing under SHC scheme. Figures are for the period 2015–16 to 2018–19

Source: Soil Health Card (SHC) scheme, Union Ministry of Agriculture and Farmers' Welfare, India

Deficiency status in states and Union territories

Organic carbon deficiency is widespread across the country. Twenty-four states and Union territories have at least half of their soil samples deficient in organic carbon. Of them, seven states have more than 90 per cent deficient samples. Haryana's soils are the most deficient in organic carbon, followed by those of Punjab, Uttar Pradesh, Rajasthan, Tamil Nadu, Mizoram and Andaman and Nicobar Islands, in that order (see *Graph 2: Organic carbon deficiency in soils of states and Union territories*).

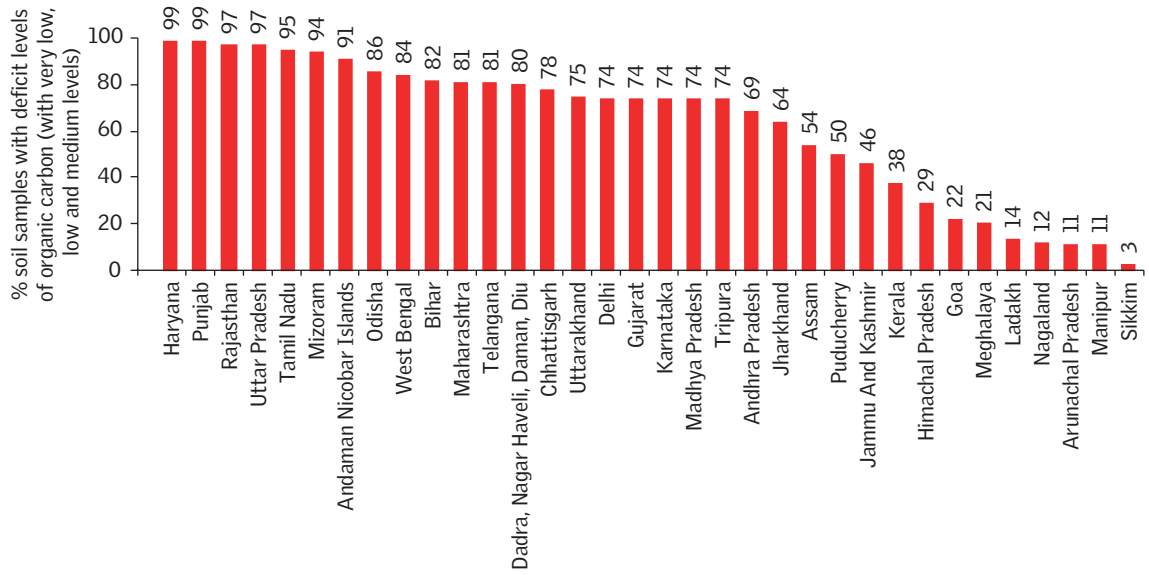
Nitrogen deficiency is also widespread and severe. Thirty-two states and Union territories have nitrogen deficiency in at least half of their soil samples. Of these, 27 states and Union territories have more than 90 per cent deficient samples. Worryingly, 15 states and Union territories have nitrogen deficiency in almost all (99-100 per cent) of their samples. These states are Andaman and Nicobar Islands, Bihar, Dadar and Nagar Haveli and Daman and Diu, Delhi, Haryana, Kerala, Madhya Pradesh, Manipur, Mizoram, Odisha, Puducherry, Rajasthan, Tamil Nadu, Uttarakhand and Uttar Pradesh (see *Graph 3: Deficiency of available nitrogen in soils of states and Union territories*).

Phosphorus deficiency is also prevalent in soils across India. Thirty-two states and Union territories have phosphorus deficiency in at least half of their soil samples. Of these, 19 states and Union territories have phosphorus deficiency in more than 90 per cent samples (see *Graph 4: Deficiency of available phosphorus in soils of states and Union territories*).

Indian soils are also deficient in potassium. Thirty-two states and Union territories have at least half of their soil samples deficient in potassium. Of these, eight states and Union territories have more than 90 per cent deficient samples (see *Graph 5: Deficiency of available potassium in soils of states and Union territories*).

Besides the data collected under the SHC scheme, several other studies also point out the depleting nutrient reserves, soil organic carbon and humus in India soils.[2&3]

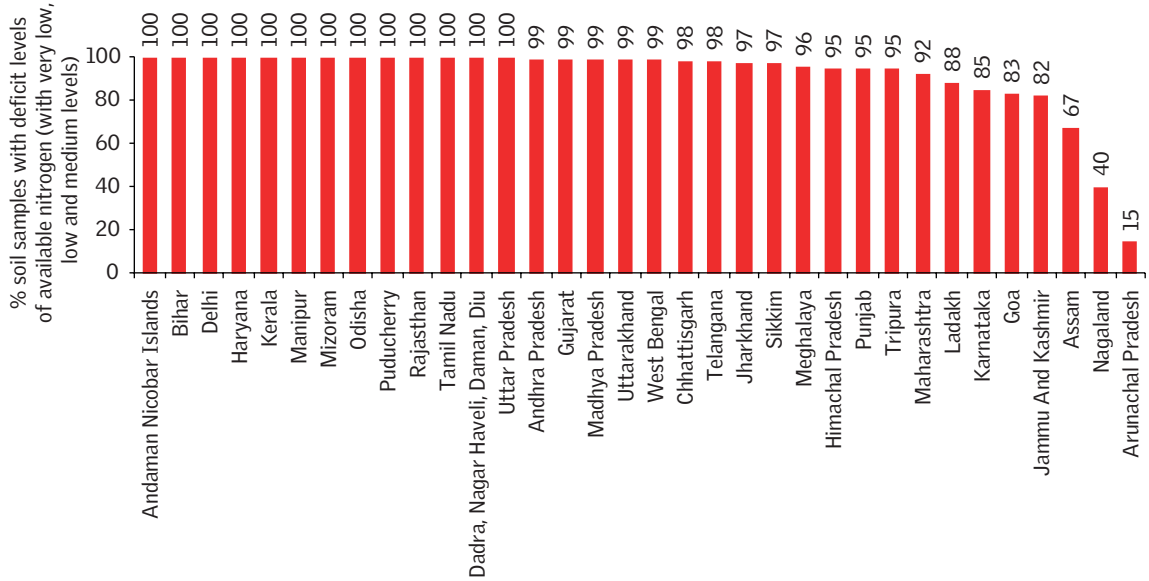
Graph 2: Organic carbon deficiency in soils of states and Union territories



Note: Figures are calculated based on data available on the ministry website (https://www.soilhealth.dac.gov.in/). These are combined results of cycle 1 and cycle 2 testing under SHC scheme

Source: Soil Health Card (SHC) scheme, Union Ministry of Agriculture and Farmers' Welfare, India

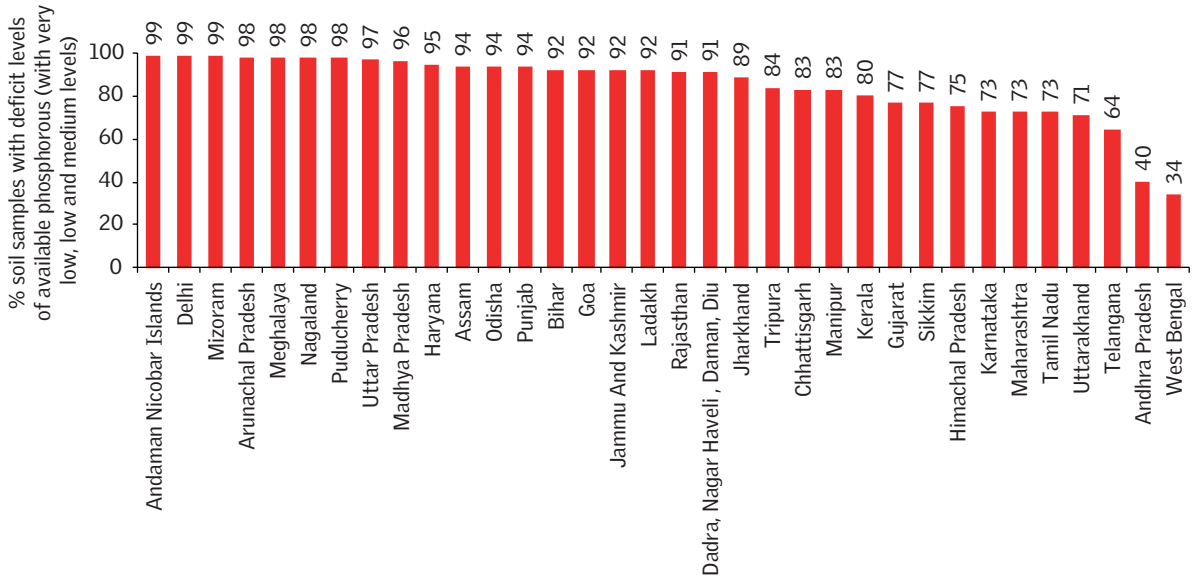
Graph 3: Deficiency of available nitrogen in soils of states and Union territories



Note: Figures are calculated based on data available on the ministry website (https://www.soilhealth.dac.gov.in/). These are combined results of cycle 1 and cycle 2 testing under SHC scheme

Source: Soil Health Card (SHC) scheme, Union Ministry of Agriculture and Farmers' Welfare, India

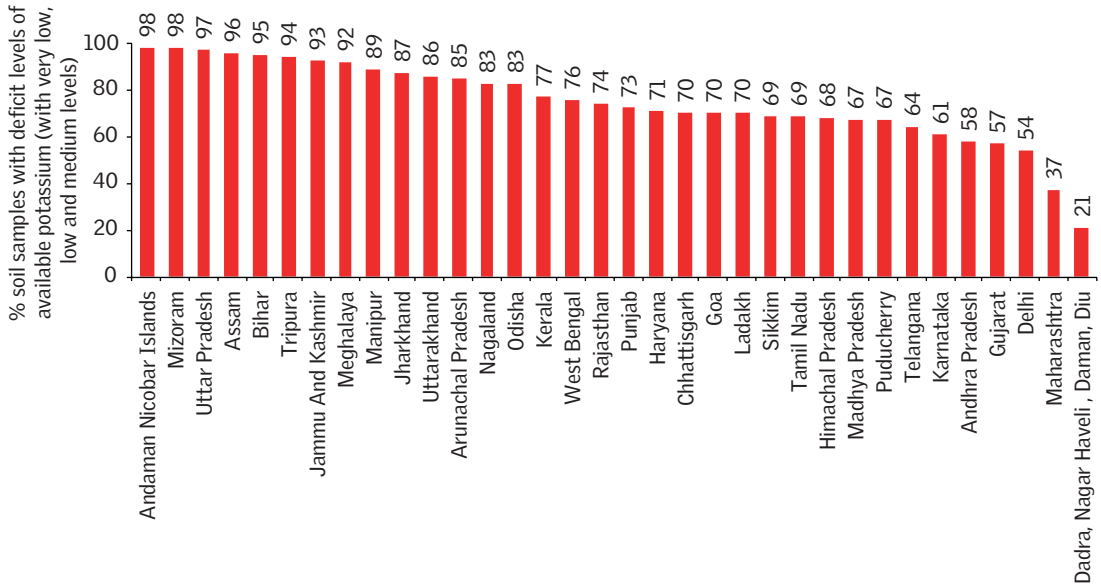
Graph 4: Deficiency of available phosphorus in soils of states and Union territories



Note: Figures are calculated based on data available on the ministry website (https://www.soilhealth.dac.gov.in/). These are combined results of cycle 1 and cycle 2 testing under SHC scheme

Source: Soil Health Card (SHC) scheme, Union Ministry of Agriculture and Farmer's Welfare, India

Graph 5: Deficiency of available potassium in soils of states and Union territories



Note: Figures are calculated based on data available on the ministry website (https://www.soilhealth.dac.gov.in/). These are combined results of cycle 1 and cycle 2 testing under SHC scheme

Source: Soil Health Card (SHC) scheme, Union Ministry of Agriculture and Farmers' Welfare, India

1.2 Importance of fertilization for nutrient replenishment in soil

Crops extract nutrients from soil. Replenishment of nutrients is crucial if crop production is to continue in the long run.

Soil replenishment can be done through several ways, for example, by recycling organic matter or biomass in soil or through practices that help regain and rejuvenate soil nutrients or by application of external fertilizers.

Recycling of organic matter or biomass can be done through application of organic fertilizers and practices like growing green manure crops or mulching. Some other practices that help regain nutrients include crop rotation, inter-cropping and mixed cropping. Biofertilizers can enable nutrient mobilization and solubilization in soil. Chemical-based fertilizers directly provide nutrients to the soil.

2. Chemical fertilizers—consumption and subsidy

About 11 per cent of the cultivated land area of the world is in India. The country was the second-highest consumer of chemical fertilizers in 2019, consuming about 15 per cent of chemical fertilizers produced the world over. Incidentally, India was also the second-biggest producer of chemical fertilizers, manufacturing 9 per cent of the global production.[4]

2.1 Growing use of chemical fertilizers in India

In 2020–21, the total consumption of chemical fertilizers in India, excluding SSP, was 62.98 million tonne. This is 82.5 per cent more than the 34.5 million tonne consumption in 2000-01. In addition, if we assume that the consumption of SSP has remained unchanged since 2018–19, the total estimated chemical fertilizer consumption comes to about 66.5 million tonne in 2020-21 (see *Graph 6: Growth in annual fertilizer consumption in India between 2000–01 and 2020–21*).

Urea, the key source of nitrogen in soil, is the most commonly used fertilizer in India. In 2020–21, it hogged 53 per cent of the total fertilizer consumption in the country, followed by 19 per cent and 20 per cent share of diammonium phosphate (DAP) and complex fertilizers respectively. DAP is a popular phosphatic fertilizer and complex fertilizers are a mix of nitrogen, phosphate, potassium and sulphur. Muriate of potash (MOP) had about 5 per cent share in the total fertilizer consumption in India.

In the last two decades (2000–01 to 2020–21), the consumption of complex fertilizers has grown by 163 per cent, consumption of DAP has grown by 103 per cent, consumption of urea has grown by 83 per cent, consumption of MOP has grown by 92 per cent. Consumption of SSP has grown by 25 per cent between 2000–01 and 2018–19.

In 2019–20, per hectare fertilizer consumption in 12 states and Union territories was more than the national average of 133.4 kg. In decreasing order of consumption, these states and Union territories are Bihar, Puducherry, Punjab, Haryana, Telangana, Andhra Pradesh, Uttar Pradesh, West Bengal, Tamil Nadu, Karnataka, Delhi and Uttarakhand (see *Graph 7: Per hectare fertilizer consumption in states and Union territories in 2019–20*).

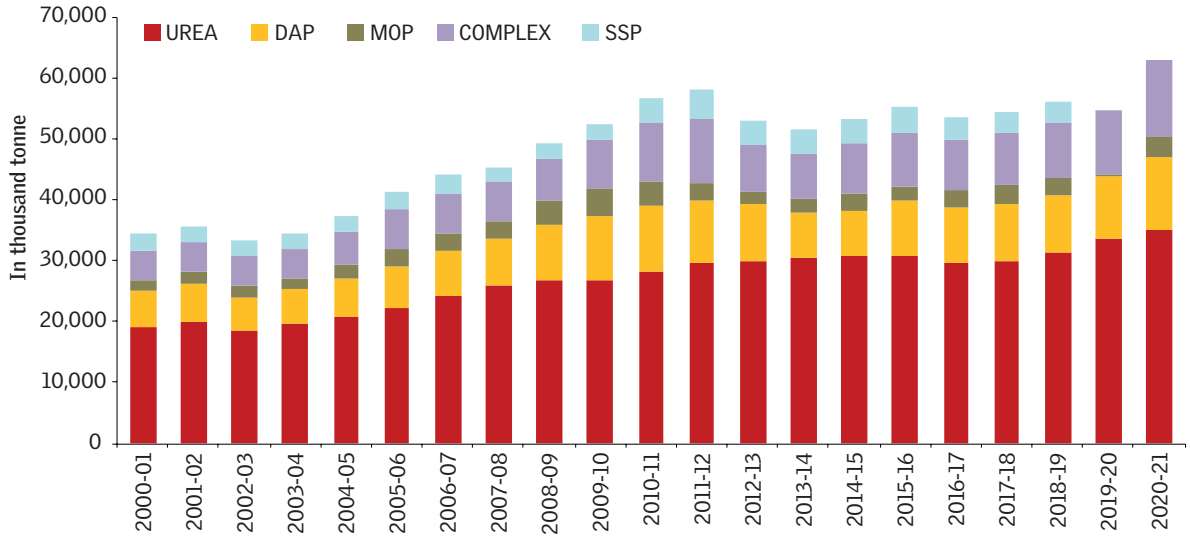
2.2 Growing subsidies for chemical fertilizers

Per hectare fertilizer consumption in India has been increasing—it was 92 kg/ha in 2000–01 and rose to 161 kg/ha in 2020–21, marking a growth of 75 per cent.[5,6&7] Heavy government subsidy for chemical fertilizers have fueled their high usage compared to non-chemical fertilizers. The growth in average per hectare consumption of fertilizers has expectedly reflected the subsidy provided over the last two decades (see *Graph 8: Trends in annual chemical fertilizer subsidy and per hectare fertilizer consumption in India*).

Total subsidy on chemical fertilizers is steeply rising every year. In 2020–21, the annual subsidy bill was Rs 1,31,230 crore, which is more than 10 times the subsidy bill of Rs 12,908 crore in 2001–02. Subsidy has grown sharply from 2019-20, when the bill was Rs 83,468 crore, partly due to rising international prices leading to high subsidies on imported fertilizers.[8,9&10] The share of subsidy on imported fertilizers was more than one-fourth in that year. In 2020–21, per hectare net sown area subsidy in India was Rs 9,400, while it ranged from Rs 5,000–6,000 between 2016 and 2020.

Urea has a substantial share in the overall subsidy. In 2019–20, over two-thirds of the total subsidy was designated only for urea. Of the remaining subsidy, about one-third

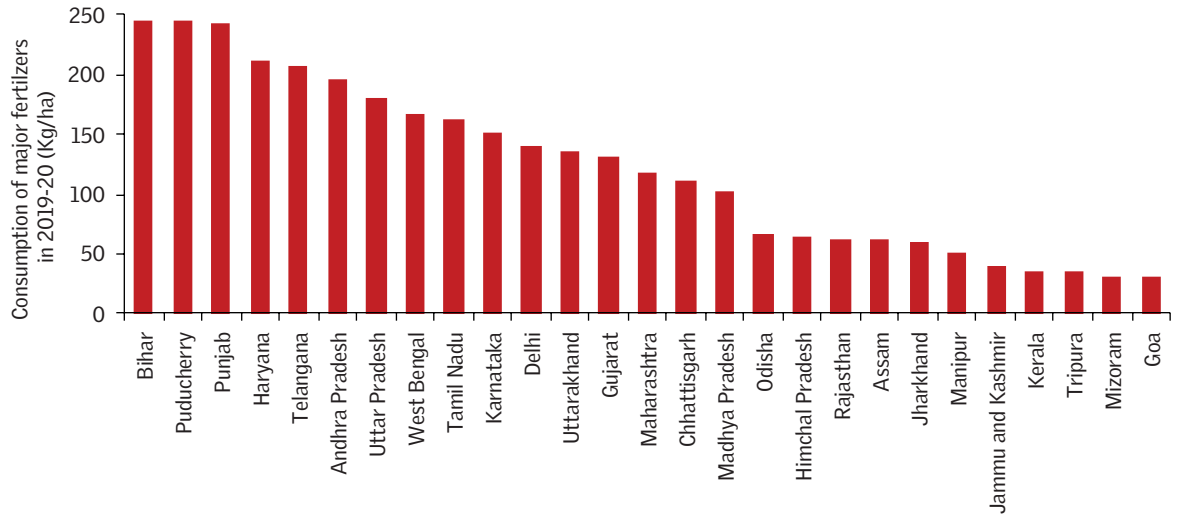
Graph 6: Growth in annual fertilizer consumption in India between 2000–01 and 2020–21



Note: From 2019–20, government data on NPKS fertilizers has been used in place of complex fertilizers. SSP figures are not given separately 2019–20 onwards

Source: Study of system of fertilizer subsidy, fifth report, Standing Committee on Chemicals and Fertilizers (2019–20), March 2020, Seventeenth Lok Sabha. Data for 2019–20 onwards is sourced from Lok Sabha unstarred question 2,119, 10 December 2021, responded to by Ministry of Chemicals and Fertilizers, Government of India

Graph 7: Per hectare fertilizer consumption in states and Union territories in 2019–20



Source: Rajya Sabha unstarred question no. 2,738 dated 19 March 2021

was nutrient-based subsidy for phosphatic and potassic fertilizers. Only a negligible 0.04 per cent of the subsidy was earmarked for city compost, an organic fertilizer.

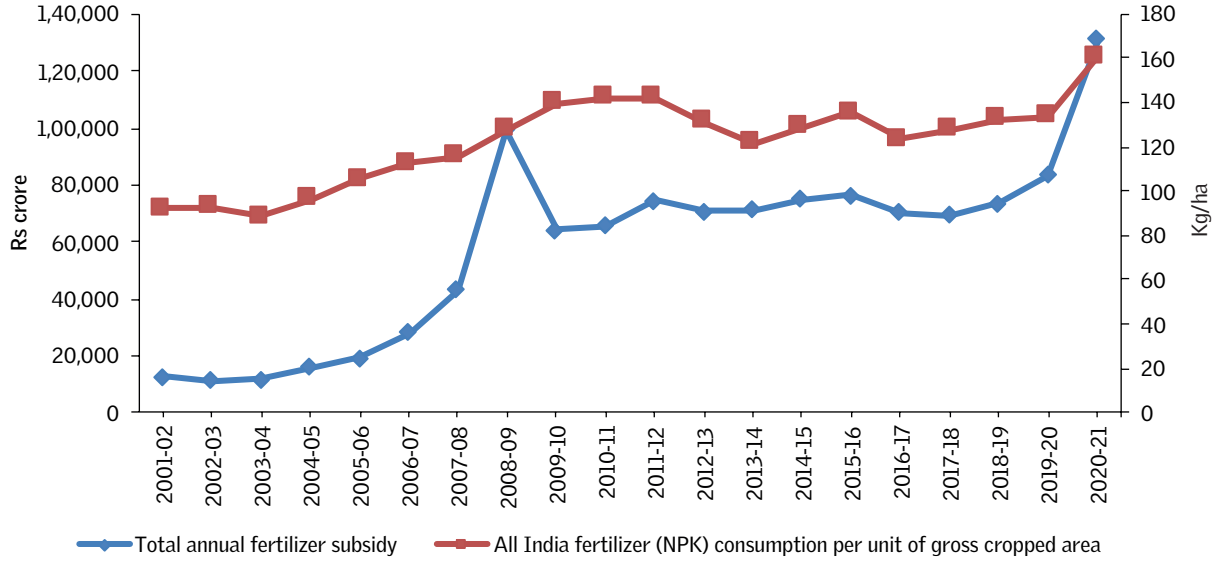
Subsidy for urea is given to manufacturers and importers based on the difference in the overall cost to them and selling price of Rs 244 per bag of 45 kg at the farm gate. For phosphatic and potassic fertilizers, subsidy is fixed at Rs 18.8 per kg of nitrogen nutrient, Rs 45.3 per kg of phosphorus nutrient, Rs 10.1 per kg of potassium nutrient and Rs 2.4 per kg of sulphur nutrient.[11] The market development assistance of Rs 1,500 per tonne that was given for city compost has been discontinued since October 2021.[12]

2.3 Chemical fertilizer use and nutrient deficiency in soils

An analysis of fertilizer consumption and the proportion of samples reflecting nutrient deficiency has revealed that states and Union territories with higher fertilizer consumption (than the national average of 133.4 kg/ha in 2019–20) did not necessarily have lesser soil samples with deficiency of carbon, nitrogen, phosphorus and potassium. Similarly, states and Union territories with lower fertilizer consumption compared to the national average did not necessarily have a higher number of deficient soil samples.

While there could be reasons that explains this phenomenon, or exceptions to it, it does raise broader questions about the relation between chemical fertilizer

Graph 8: Trends in annual chemical fertilizer subsidy and per hectare fertilizer consumption in India



Source: Study of system of fertilizer subsidy, fifth report, Standing Committee on Chemicals and Fertilizers, 2019–20, Seventeenth Lok Sabha. Rajya Sabha unstarred question number 2,761 dated 19 March 2021, Ministry of Chemicals and Fertilizers[13,14&15]

use and soil nutrient status (see *Annexure 1: Per hectare fertilizer consumption in 2019–20 and soil nutrient deficiency between 2015–16 and 2018–19*).

Several studies have suggested that crops no longer respond to chemical fertilizers as they used to. For example, a study that documented yield, fertilizer application and fertilizer response ratio in irrigated areas in India from 1970 to 2015 found that fertilizer response ratio (kg grain per kg nutrient applied in the form of fertilizers) has decreased to a quarter in this duration. It was 13.4 in 1970 and dropped down to 2.7 by 2015.[16]

It has been well established that due to heavy subsidization, the nitrogen-phosphorus-potassium (NPK) ratio has been skewed towards nitrogen. In 2020–21, it was 6.5:2.8:1 compared to the desirable 4:2:1. Results of All India Coordinated Research Project on Long-Term Fertilizer Experiments have indicated that continuous use of nitrogenous fertilizers alone has a deleterious effect on soil health and crop productivity showing deficiencies of other macro- and micro- nutrients. Even after application of recommended doses of NPK or more, deficiency of micronutrients and secondary nutrients becomes a yield-limiting factor over the years. Nutrient deficiency may also affect growth and cause physiological disorders in plants. These investigations were carried out at fixed sites for over five decades.[17&18]

3. Biofertilizers and organic fertilizers—policy and programmes

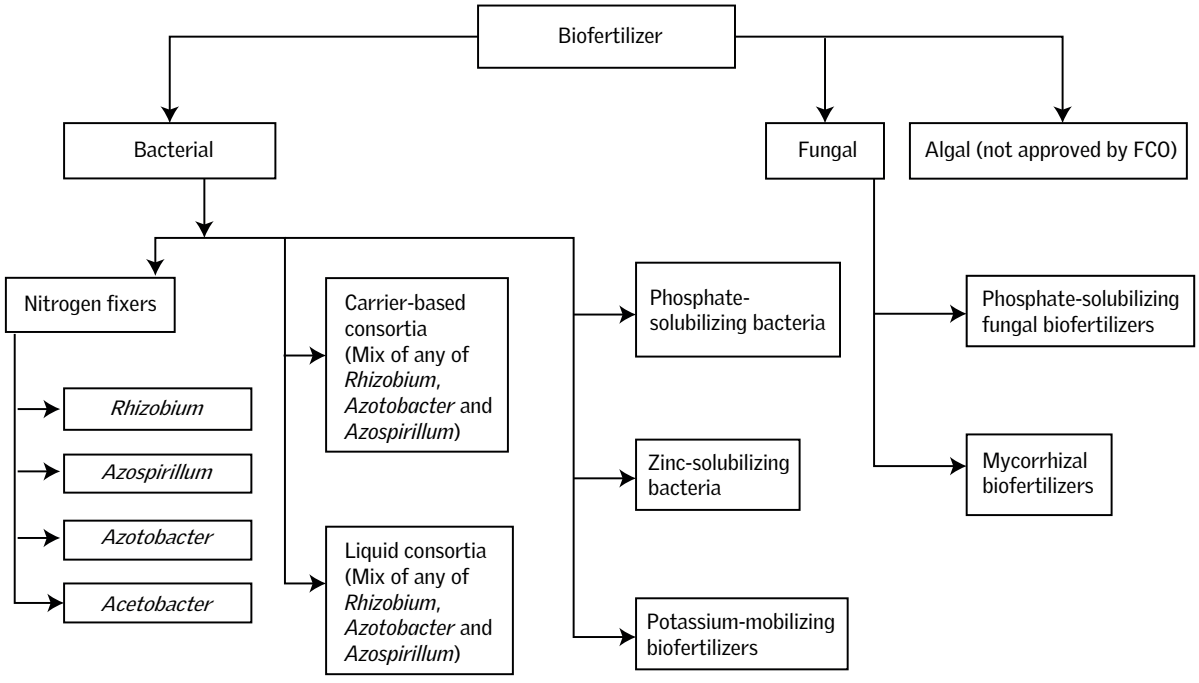
The growing concern over the harmful effects and diminishing returns of chemical fertilizers has led to a desperate search for alternative non-chemical options. These include biofertilizers and organic fertilizers. Actually, "search" is a misnomer here because organic fertilizers like manure have been in use since the dawn of agriculture, way before chemicals began to be used in the 1960s as part of the "green revolution" in the country. A return to these non-chemical options is considered critical in the transition from chemical-based to sustainable farming practices like organic and natural farming. Therefore, availability of cost-effective quality biofertilizers and organic fertilizers is important.

3.1 Biofertilizers

Biofertilizers are ready-to-use live formulates of beneficial microorganisms that on application to seed, root or soil mobilize and augment the availability of nutrients through their biological activity in particular, and help build up micro-flora and soil health in general.[19] They provide nutrients by working symbiotically with plant roots or through solubilization or mobilization of nutrients from soil or atmosphere. There are many identified beneficial microorganisms, of which a few are commercially exploited as biofertilizers. Biofertilizers are regulated through the Fertilizer (Inorganic, Organic or Mixed) (Control) Order (FCO) of 1985, under the Union Ministry of Agriculture and Farmers' Welfare, which was notified under the Essential Commodities Act of 1955 in 2006. Biofertilizers are available in solid and liquid formulations in packets and bottles that are supposed to be labelled as per the FCO. They are typically produced under controlled conditions in manufacturing units as part of an industry that is more organized than the organic fertilizer producing industry but less organized than the chemical fertilizer manufacturing industry.

As of now, 11 types of biofertilizers are approved. The first four biofertilizers—*Azospirillum*, *Azotobacter*, phosphate-solubilizing bacteria and *Rhizobium*—were approved in 2006. In 2010, mycorrhizal biofertilizers and in 2012 *Acetobacter* were added to the list. Phosphate-solubilizing fungal biofertilizer was the latest addition in 2019 (see *Figure 1: Biofertilizers approved under Fertilizer Control Order*). In addition to bacterial and fungal biofertilizers, algal biofertilizers like

Figure 1: Biofertilizers approved under Fertilizer Control Order



Source: Fertilizer (Inorganic, Organic and Mixed) (Control) Order, 1985, amended in July 2021

blue green algae are also available in the market. However, they are not approved under FCO.

State governments are responsible for overall implementation of FCO. They are responsible for registering and authorizing manufactures, importers, dealers and distributors in line with specifications provided in FCO. They are also responsible for quality control. Only biofertilizers that meet FCO's quality standards can be sold in the market. For wholesale distribution, a single licence is sufficient in one state. However, for retail sales, separate licences are needed to sell in different districts in a state and every retail sale point needs a licence. Authorization needs to be renewed after every five years in accordance with provisions of FCO. State government- and municipality-owned retail sale points are exempted from the need to obtain authorization letters to sell biofertilizers.

At the Central level, National Centre of Organic Farming (NCOF) and its seven Regional Centres of Organic Farming are involved in quality control. Before 2004, NCOF was also involved in development of biofertilizers as the National Biofertilizer Development Centre.

The Indian Council of Agricultural Research (ICAR)'s flagship project "All India Network Project on Soil Biodiversity-biofertilizers" has developed improved and efficient strains of biofertilizers specific to different crops and soil types.

3.2 Organic fertilizers

Organic fertilizers are decomposed organic material derived from animal, human and plant residues. Their type varies depending on the source of the organic material and the nature of composting. For example, organic manure is a mix of cattle dung and plant residues, while vermicompost is developed with the help of earthworms. City compost is made from organic material found in urban solid waste. Most of the organic fertilizer sector is fragmented and unorganized. Some organic fertilizers like city compost, bio-enriched organic manure and phosphate-rich organic manure are largely developed by companies, whereas other organic fertilizers like organic manure and vermicompost are developed by companies as well as small-scale units or at the individual level.

Organic fertilizers are also regulated under FCO. They were first introduced in 2006, when three types of organic fertilizers were approved along with specifications of their quality. These were city compost, vermicompost and press mud. In 2009, only two of them—city compost and vermicompost—remained, and a separate category of "non-edible de-oiled cake" was also created. In 2012, two more organic fertilizers—phosphate-rich organic manure and organic manure—found a place in FCO. In October 2015, bio-enriched organic manure was added to the list. In 2019, bone meal (raw), bone meal (steamed) and potash derived from *Rhodophyte* were added to the list as well. In 2021, fermented organic manure and liquid fermented organic manure were included. As of now, 10 types of organic fertilizers are part of the FCO-approved list (see *Table 1: Organic fertilizers approved under Fertilizer Control Order*).

Table 1: Organic fertilizers approved under Fertilizer Control Order

1	City compost
2	Vermicompost
3	Phosphate-rich organic manure (PROM)
4	Organic manure
5	Bio-enriched organic manure
6	Raw bone meal
7	Steamed bone meal
8	Potash derived from Rhodophytes
9	Fermented organic manure
10	Liquid fermented organic manure

Source: Fertilizer (Inorganic, Organic and Mixed) (Control) Order, 1985, amended in July 2021

ON-FARM INPUTS BESIDES THE FERTILIZER CONTROL ORDER LIST

Many organic inputs prepared on-farm are used to increase soil fertility as part of organic and natural farming practices. These include formulations like panchgavya, jeevaamrit, ghanjeevaamrit and panchgavya and may contain any or all of the following: cow dung, cow urine, milk, curd, jaggery, ghee, banana, tender coconut and water. Jeevaamrit is prepared using local cow dung, cow urine, jaggery, pulse flour and undisturbed soil. Ghanjeevaamrit is processed cow dung mixed with cow urine. All of these inputs are not part of the FCO list.

STANDARDS FOR BIO-STIMULANTS

The Union Ministry of Agriculture and Farmers' Welfare recently introduced guidelines to regulate bio-stimulants through an amendment to FCO in February 2021. The guidelines defined a bio-stimulant as a "substance or microorganism or a combination of both whose primary function when applied to plants, seeds or rhizosphere is to stimulate physiological processes in plants and to enhance its nutrient uptake, growth, yield, nutrition efficiency, crop quality and tolerance to stress, regardless of its nutrient content, but does not include pesticides or plant growth regulators which are regulated under the Insecticide Act, 1968." Bio-stimulants include botanical extracts, including seaweed extracts; vitamins; protein hydrolysates and amino acids; cell free microbial products; antioxidants; anti-transpirants; humic and fulvic acid; and biochemicals. Detailed standards for them are yet to be finalized, but these biostimulants are available in the market.

The responsibility of registering and authorizing manufactures, importers, dealers and distributors of organic fertilizers in line with specifications provided in FCO also lies with state governments. Only organic fertilizers that meet FCO's quality standards can be sold in the market. States are also responsible for quality control. At the Central level, National Centre of Organic Farming and its seven Regional Centres of Organic Farming are involved in quality control. Manufacturers of vermicompost with annual production capacity less than 50 MT need not obtain any authorization.

3.3 Programmes to promote biofertilizers and organic fertilizers

The Central government's programmes to promote biofertilizers and organic fertilizers are limited in scale and funds and have had limited success. These can be broadly divided into two categories.

A. Those aimed at farmers as part of larger schemes

1. **Paramparagat Krishi Vikas Yojana (PKVY), Bhartiya Prakritik Krishi Padhati (BPKP) and National Mission on Clean Ganga (NMCG):** The PKVY is a flagship programme started in 2015–16 to promote cluster-based organic farming through participatory guarantee system for India (a decentralized

organic farming certification system). In 2020–21, Bhartiya Prakritik Krishi Padhati, based on principals of natural farming, was included in PKVY as a sub-scheme. The National Mission on Clean Ganga (NMCG) has also been made part of PKVY.

Under PKVY, Rs 31,000 per hectare for three years are allocated through direct benefit transfer (DBT) for enrolled farmers for production and procurement of on-farm and off-farm inputs like biofertilizers, bio-pesticides, organic fertilizers, botanical extracts and seeds. This is about 62 per cent of the total assistance, i.e., Rs 50,000 per hectare for a period of three years. Under BPKP, Rs 12,200 per hectare are allocated for three years, but for capacity building, etc. and not directly for inputs to be purchased as they are to be developed on-farm. This promotes on-farm biomass recycling and focuses on biomass mulching, cow dung–urine formulations and plant-based preparations.[20]

PKVY is hamstrung due to implementation challenges and low annual budgetary allocation of just a few hundred crore rupees compared to the huge annual subsidies given to chemical fertilizers. **As per a November 2021 response to a Lok Sabha question, during 2018–21, a sum of only about Rs 994 crore was released for PKVY schemes and the number of beneficiaries was about 0.95 million.** Another response to a Lok Sabha question in December 2021 mentions that over 1.15 million hectare of land has been taken up for organic farming as part of PKVY schemes till date**,** which is a very small part of total net sown area of the country.[21]

2. **Mission Organic Value Chain Development for North Eastern Region (MOVCNER):** It promotes organic farming of niche crops of northeastern region with focus on exports through third-party certification system as part of the National Programme for Organic Production. It provides Rs 32,500 per hectare for three years through direct benefit transfer to farmers for on-farm and off-farm inputs like biofertilizers, bio-pesticides, organic fertilizers, botanical extracts and seeds. **As per a November 2021 response to a Lok Sabha question, during 2018–21, a sum of only about Rs 416 crore was released for MOVCNER and the number of beneficiaries was about 34 thousand.** Another response to a Lok Sabha question of December 2021 mentions that over 2.65 million hectare of land has been taken up for organic farming as part of the National Programme of Organic Production, which also include coverage under MOVCDNER scheme till date**.**[22]

3. **National Food Security Mission:** Assistance of up to Rs 300 per hectare is provided for promotion of biofertilizers such as *Rhizobium*; *Azospirillum*; *Azotobactor* and phosphate-solubilizing bacteria; potash-mobilizing bacteria; zinc-solubilizing bacteria; and *Mycorrhiza* culture. Actual expenditure made in all states is very low. **It was Rs 1.85 crore in 2018–19, Rs 1.27 crore in 2019–20 and 0.75 crore in 2020–21 (until October 2021).**

4. **National Mission on Oilseeds and Oil Palm:** Assistance of up to Rs 300 per hectare is allocated for biofertilizers, for example, for the supply of *Rhizobium* culture, phosphate-solubilizing bacteria, zinc-solubilizing bacteria, *Azotobacter*, *Mycorrhiza* and vermicompost.

B. Those aimed at supporting manufacturers and marketers to increase production and promotion of biofertilizers and organic fertilizers:

1. **Capital Investment Subsidy Scheme**: It is a credit-linked back-ended subsidy scheme started in 2004 and implemented by Ministry of Agriculture and Farmers' welfare in collaboration with the National Bank for Agricultural and Rural Development (NABARD). Subsidy is provided for both compost and biofertilizer or bio-pesticide manufacturing units run by individual or private agencies as well as by state and Central government agencies. For setting up of a fruit and vegetable agro-compositing unit with a maximum production capacity of 100 tonne per day (TPD), 33 per cent of total financial outlay up to Rs 0.63 crore per unit is provided to individuals or private agencies. State and Central government agencies are provided 100 per cent assistance of up to Rs 1.9 crore.[23] For establishment of a biofertilizer or bio-pesticide production unit of 200 tonne per annum (TPA) capacity, 25 per cent of cost, limited to Rs 0.4 crore per unit, is provided as capital investment to individuals or private agencies. State and Central government agencies are provided 100 per cent assistance of up to Rs 1.6 crore.[24]

   However, despite these provisions, the total subsidy release for composting units has only been Rs 7.9 crore since 2004–05. This was to establish 28 fruit and vegetable compost units in 15 states and Union territories.[25] Of this, a sum of about Rs 4 crore has been released after 2012–13 for 12 units in six states.[26] Clearly, there has been little uptake in many states and Union territories during the last decade.

In the case of biofertilizers, between 2004 and 2017, only about Rs 11 crore subsidy has been released. During this time, 61 such units were supported. Additionally, 18 units were provided subsidy between 2018 and August 2020. This means a total of 79 biofertilizer units have been subsidized in 20 states and Union territories. **Overall, a total subsidy of only Rs 18.9 crore has been released in the last 17 years under both parts of CISS.**[27&28]

2. **Soil Health Management:** Under this programme, government provides a subsidy of Rs 1.6 crore for establishment of a biofertilizer manufacturing unit, up to a maximum capacity of 200 MT. The subsidy burden in shared in a 60:40 ratio between Central and state governments. **Total subsidy released for setting up of biofertilizer production units under this programme between 2014–15 and 2018-19 was only Rs 8.67 crore.** Only 10 biofertilizer production units and 16 organic or biofertilizer testing labs were funded till 2018–19.[29] Fifteen biofertilizer production units have been established till date (see *Annexure 2: Biofertilizer and compost or organic fertilizer production units under Capital Investment Subsidy Scheme and Soil Health Management programme and funds released*).[30]

3. **Policy on promotion of city compost:** Starting in 2016, market development assistance of Rs 1,500 per tonne of city compost was provided through a policy on promotion of city compost by the Union Ministry of Chemical and Fertilizers. Market development assistance was initially provided to existing fertilizer marketing companies, who were expected to market city compost along with chemical fertilizers. Subsequently, manufactures of city compost were also involved.[31] **From 2016–17 to January 2021, the total subsidy given as market development assistance was Rs 85.8 crore for 12.2 lakh tonne of city compost. In 2020–21 (until January 2021), a subsidy of Rs 36 crore has been provided for 2.94 lakh tonne of city compost**.[32]

   Market development assistance was discontinued from October 2021. This was based on the review of the market development assistance policy and recommendations of Expenditure Finance Committee in August 2021.[33] The committee observed that the number of city compost units is very small and government policy is to rationalize the number of schemes and avoid duplication. The committee recommended that as there are similar schemes in other departments with larger budgetary allocations and better field presence, promotion of city compost should be discontinued.

4. **New National Biogas and Organic Manure Programme:** Under the Union Ministry of New and Renewable Energy, the programme involves promotion of construction of biogas plants. One of the objectives is to provide biogas slurry as on organic enriched bio-manure and link it with enrichment units such as vermicomposting, phosphate-rich organic manure and other organic enrichment facilities. Depending upon the size and location, central financial assistance in the range of Rs 1,600 to Rs 35,000 per plant is provided.

4. Biofertilizers—production and quality

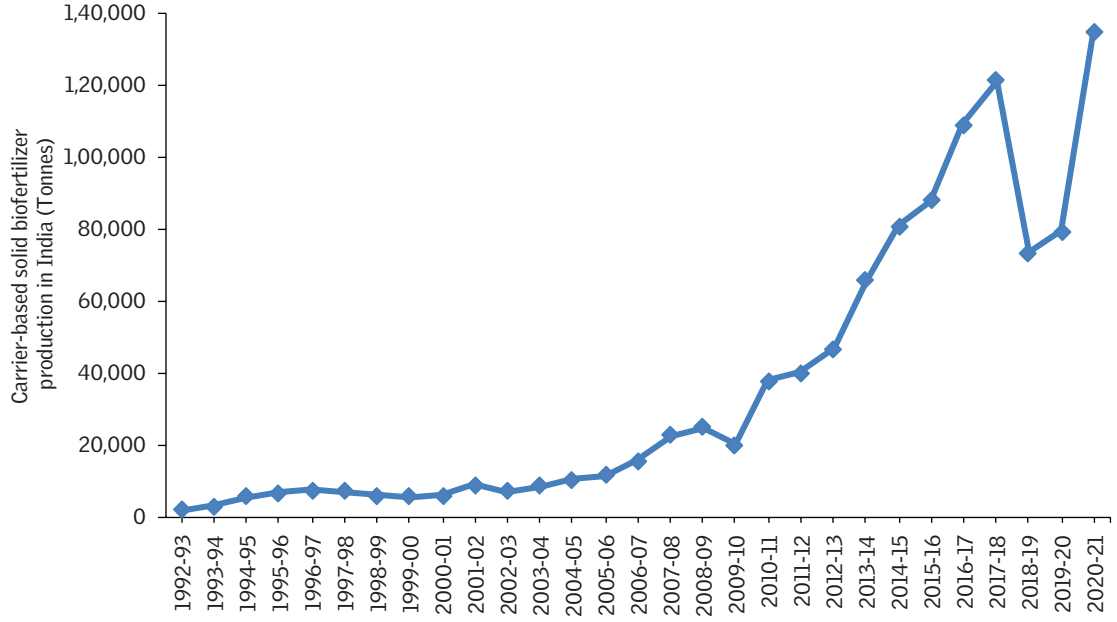
4.1 Production of biofertilizers in India

Carrier-based solid biofertilizers

In 2020-21, total production of carrier-based solid biofertilizers in India was about 134,323 tonne. This marked a growth of about 6,600 per cent from 1992–93, 435 per cent from 2008–09 and 83 per cent from 2018–19 (see *Graph 9: Growth in carrier-based solid biofertilizer production in India from 1992–93 to 2020–21*).

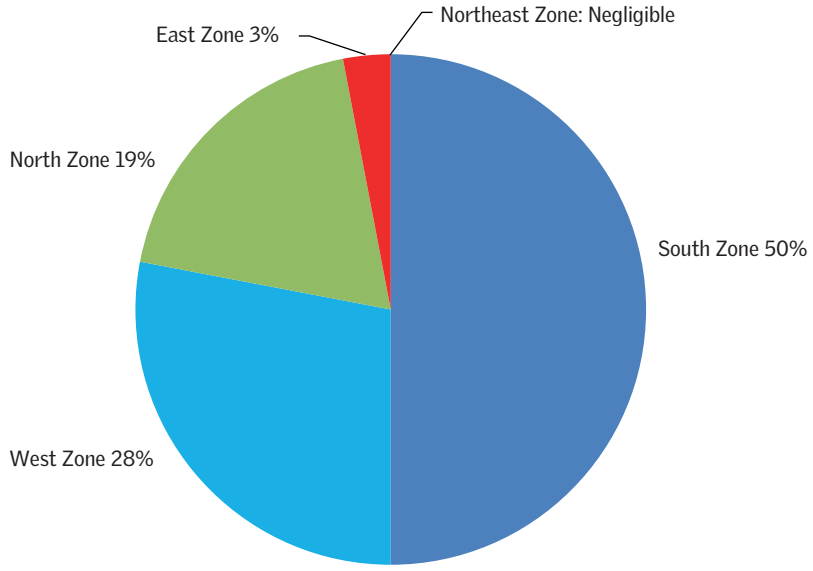
In 2020–21, states in southern India produced about half of the carrier-based solid fertilizers produced in the country, and states in the West Zone produced a little over one-fourth. About one-fifth was produced in northern India and 3 per cent in eastern Indian states. Northeastern states produced less than 1 per cent (see *Graph 10: Zonal carrier-based solid biofertilizer production in 2020-21*).

Graph 9: Growth in carrier-based solid biofertilizer production in India from 1992–93 to 2020–21



Source: Biofertilizer Statistics 2019–20 (12th edition), the Fertilizer Association of India, December 2020; Lok Sabha unstarred question 413, pesticides and biofertilizers, 30 November 2021, Ministry of Agriculture and Farmers' Welfare; Lok Sabha unstarred question 2,549, 1 August 2017; biofertilizer production, Ministry of Agriculture and Farmers' Welfare, Government of India

Graph 10: Zonal carrier-based solid biofertilizer production in 2020-21

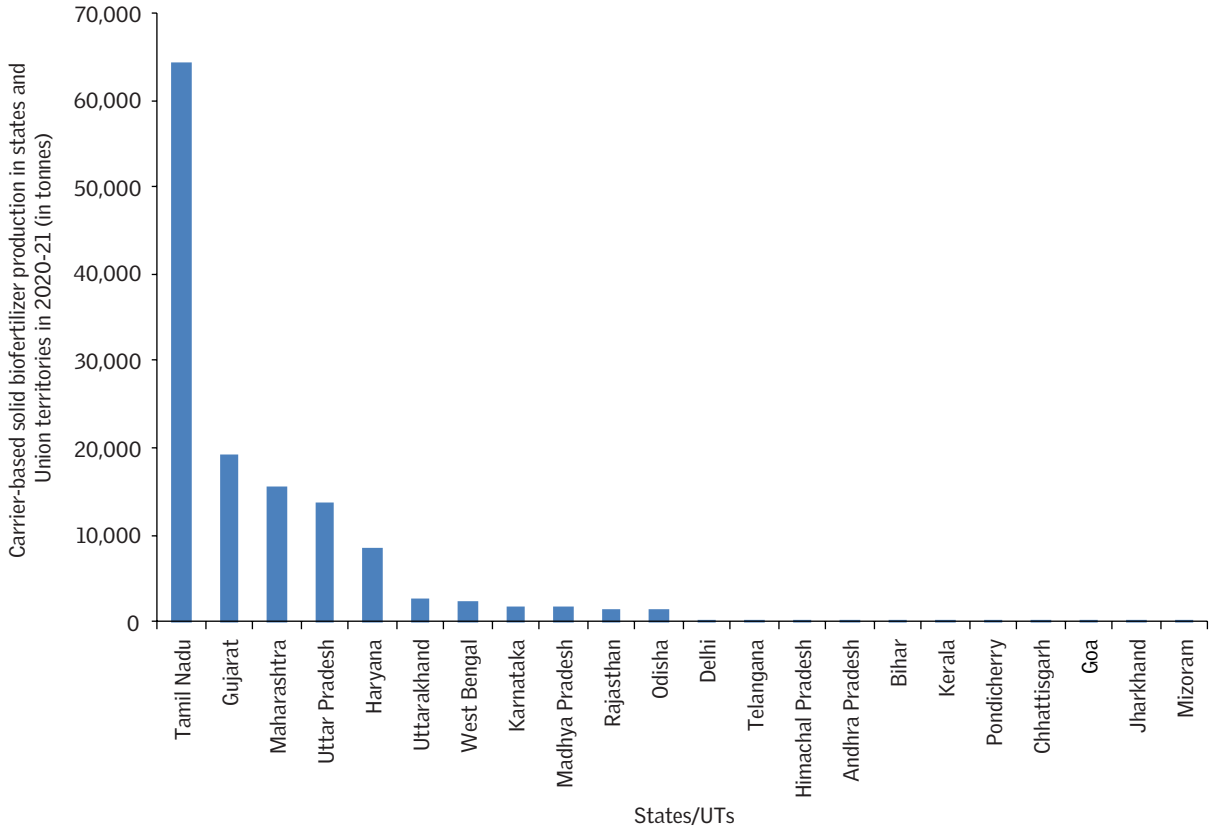


Source: Lok Sabha unstarred question 413, pesticides and biofertilizers, 30 November 2021, Ministry of Agriculture and Farmers' Welfare, Government of India

Tamil Nadu was responsible for nearly half of the carrier-based fertilizer production in India in 2020–21. It was followed by Gujarat, Maharashtra, Uttar Pradesh and Haryana with about 14 per cent, 12 per cent, 10 per cent and 6 percent share in the production respectively. Together these five states were responsible for over 90 per cent of India's carrier-based fertilizer production (see *Graph 11: Carrier-based solid biofertilizer production in states and Union territories in 2020-21*).

Between 2018–19 and 2020–21, production of carrier-based fertilizers has grown by 1,438 per cent in Tamil Nadu, followed by 460 per cent in Uttar Pradesh, 300 per cent in Haryana, 98 per cent in Rajasthan and 80 per cent in Gujarat. Production of carrier-based fertilizers grew by 29 per cent in Punjab between 2018–19 and 2019–20. Tripura and Himachal Pradesh also witnessed a high growth rate in the production of carrier-based fertilizers, but over a low production volume. On the other hand, production has dropped in Andhra Pradesh, Delhi, Chandigarh, Chhattisgarh, Karnataka, Kerala, Madhya Pradesh, Manipur, Mizoram, Odisha, Puducherry and Telangana from the 2018–19 levels (see *Table 2: Carrier-based solid biofertilizer production and growth in states and Union territories*).

Graph 11: Carrier-based solid biofertilizer production in states and Union territories in 2020-21



Source: Lok Sabha unstarred question 413, Pesticides and Biofertilizers, 30 November 2021, Ministry of Agriculture and Farmers' Welfare, Government of India

Liquid biofertilizers

India produced about 26,442 kilolitre (kl) of liquid biofertilizers in 2020–21. This marked a growth of 552 per cent from the 4,055 kl of liquid biofertilizers production in 2014–15 (see *Graph 12: Liquid biofertilizer production in India between 2014–15 and 2020–21*).

States in the southern India produced about half of India's liquid biofertilizers, followed by states in the West Zone, that had a 40 per cent share. Northern India produced 7.5 per cent of India's liquid biofertilizers and eastern India produced about 3.4 per cent. Northeastern states produced less than 1 per cent (see *Graph 13: Zonal liquid biofertilizer production in 2020–21*).

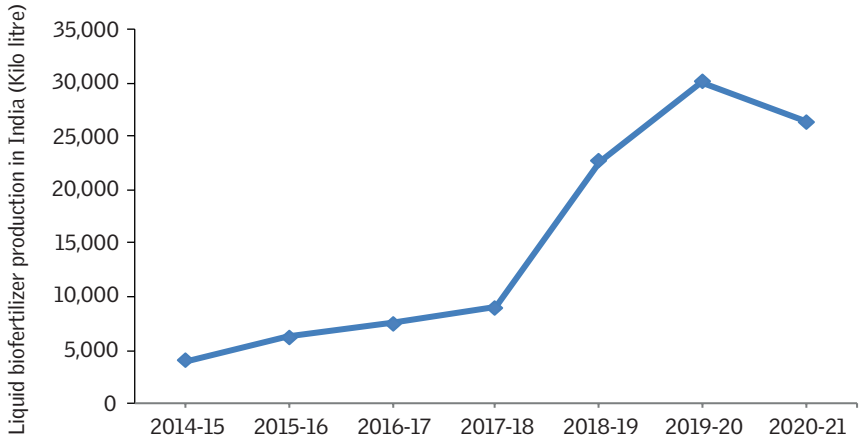
Table 2: Carrier-based solid biofertilizer production and growth in states and Union territories

State or Union territory	2008–09	2009–10	2010–11	2011–12	2012–13	2013–14	2014–15	2015–2016	2016–2017	2017–2018	2018–19	2019–20	2020–21	Growth (times final volume is of initial volume)	Growth (in per cent, between 2018–19 and 2020–21)
	In tonne														
South Zone															
Andhra Pradesh	168	1,345	1,000	1,126	1,336	2,714	2,669	3,063	3,376	4,984	264	228	181	1.1	-31
Karnataka	11,921	3,696	6,930	5,760	7,684	9,907	16,463	23,043	31,553	34,493	3,254	3,607	1,866	0.16	-43
Kerala	1,187	1,936	3,257	904	1,046	3,521	4,917	4,926	4,994	6,040	108	91	97	0.08	-11
Puducherry	562	453	783	509	621	517	561	284	204	298	122	122	76	0.14	-38
Tamil Nadu	4,688	3,733	8,691	3,374	11,576	14,105	15,373	23,721	27,428	28,059	4,187	11,611	64,384	13.7	1,438
Telangana*	-	-	-	-	-	-	-	-	-	574	2,556	1,536	320	0.56	-87
West Zone															
Chhattisgarh*	0	0	0	276	502	712	1,025	954	955	969	172	27	56	0.2	-68
Gujarat	1,150	1,309	6,318	2,037	978	6,411	3,668	3,963	3,910	4,248	10,596	20,788	19,108	16.6	80
Goa*	0	0	443	0	370	66	803	821	822	839	2044	50	30	0.07	-99
Madhya Pradesh	848	1,588	2,456	2,309	1,408	4,824	2,638	2,741	5,609	6,562	74,27	1,330	1,748	2.1	-76
Maharashtra	1,250	1,861	2,924	8,744	5,898	6,219	14,847	7,825	8,324	10,025	15,050	15,897	15,591	12.5	4
Rajasthan	354	806	820	200	982	1,315	600	680	711	792	792	2,143	1,570	4.4	98
North Zone															
Delhi	1,165	1,022	1,205	1,617	0	396	105	106	116	120	394	345	347	0.3	-12
Chandigarh*	0	0	0	0	0	1,146	873	0	0	-	-	-	-	0.76	
Haryana	14	6	7	914	5,833	26	1	1,097	2,361	2,505	2,129	2,795	8,517	597.7	300
Himachal Pradesh*	0	9	9	1	0	45	0	3	3	8	135	320	200	23.5	48
Punjab*	1	301	3	692	2,311	2,125	6,305	2,197	5,534	5,645	7,167	9,252	-	8,116.0	29
Uttar Pradesh	886	963	1,217	8,695	1,310	2,682	4,099	3,053	2,836	3,441	2,452	2,143	13,724	15.5	460
Uttarakhand	48	32	45	263	2,758	5,494	2,130	3,549	3,721	3,942	3,360	3,119	2,692	55.8	-20
East Zone															
Bihar*	0	0	136	75	52	52	65	97	107	129	131	375	162	1.2	24
Jharkhand	15	15	0	8	35	14	9	9	19	21	21	5	15	1.0	-31
Odisha	405	290	358	590	407	1,098	1,074	468	516	560	8,167	449	1,405	3.5	-83
West Bengal	241	257	393	603	1,110	1,683	2,062	2,826	3,195	3,513	2,050	2,200	2,235	9.3	9
North East Zone															
Arunachal Pradesh*	0	0	0	0	0	59	59	3,063	120	233	0	-	-	3.9	-
Assam*	129	121	130	68	89	149	88	1,315	1,359	1,743	617	640	-	5.0	4
Mizoram	2	3	2	0	0	4	4	4	3	9	3	1	1	0.25	-80
Nagaland*	16	18	22	13	7	7	7	9	51	71	17	19	-	1.2	7
Sikkim*	0	0	0	0	10	10	12	13	16	33	-	-	-	3.5	-
Tripura*	15	278	850	1,543	514	225	240	1,143	1,154	1,188	82	340	-	23.2	316
Manipur*	-	-	-	-	-	-	-	0	25	24	82	13	-	0.53	-84
Total (India)	25,065	20,040	37,998	40,324	46,837	65,528	80,696	90,974	109,020	121,067	73,377	794,47	134,323	5.4	83

Notes: (-) Indicates data not available; * In some cases, based on data availability, initial year could be different from 2008–09 and final year could be different from 2020–21.

Source: Biofertilizer Statistics 2019–20 (12th edition), the Fertilizer Association of India, December, 2020. Lok Sabha unstarred question 413, Pesticides and Biofertilizers, 30 November 2021, Ministry of Agriculture and Farmers' Welfare, Government of India. Lok Sabha unstarred question 2,549, 1 August 2017, biofertilizer production, Ministry of Agriculture and Farmers' Welfare, Government of India. International Journal of Current Microbiology and Applied Sciences, ISSN: 2319-7706 Volume 6 Number 11 (2017)[34]

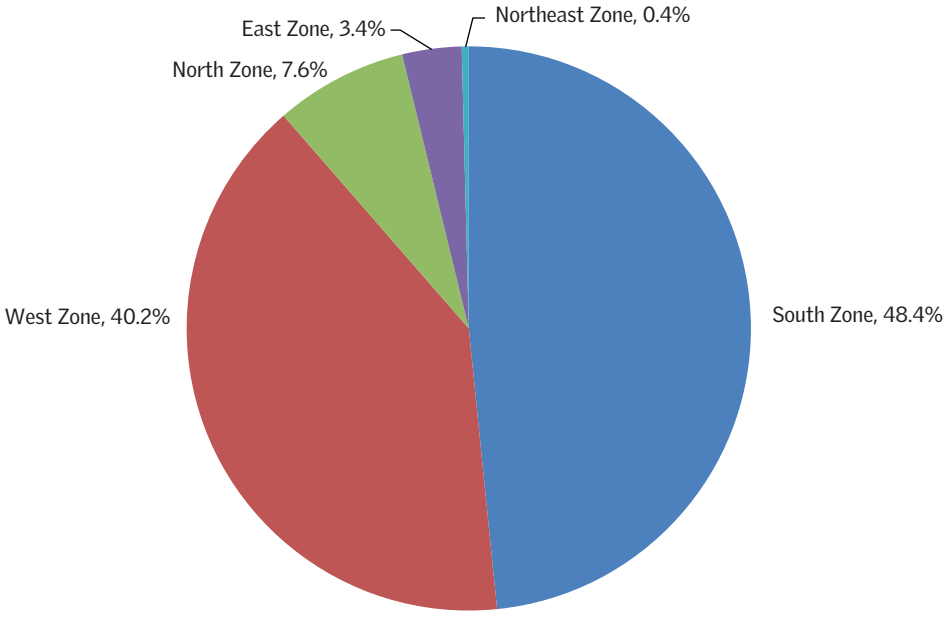
Graph 12: Liquid biofertilizer production in India between 2014–15 and 2020–21



Note: Data of 2020–21 is provisional

Source: Lok Sabha unstarred question 413, pesticides and biofertilizers, 30 November 2021, Ministry of Agriculture and Farmers' Welfare, Government of India; Lok Sabha unstarred question 2,549, 1 August 2017; Biofertilizer production, Ministry of Agriculture and Farmers' Welfare, Government of India; Fertilizer Statistics 2020–21, the Fertilizer Association of India.

Graph 13: Zonal liquid biofertilizer production in 2020–21

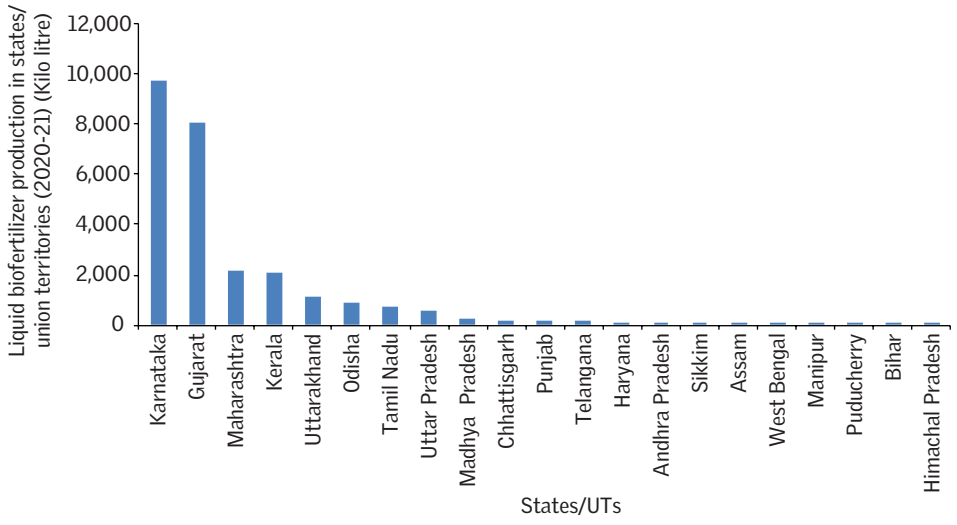


Source: Lok Sabha unstarred question 413, pesticides and Biofertilizers, 30 November 2021, Ministry of Agriculture and Farmers' Welfare, Government of India; Fertilizer statistics 2020–21, the Fertilizer Association of India.

With about 37 per cent share in the total production, Karnataka leads the manufacture of liquid fertilizers in the country in 2020–21. It is followed by Gujarat with over 31 per cent of the share. Maharashtra and Kerala, each produced about 8 per cent and Uttarakhand produced about 4 per cent of the liquid fertilizers manufactured in India in 2020–21. Together these five states manufactured about 88 per cent of the liquid biofertilizers produced in India in 2020–21 (see *Graph 14: Liquid biofertilizer production in states and Union territories in 2020–21*).

Between 2014–15 and 2020–21, production of liquid biofertilizers in Karnataka grew by about 421 times. It grew by 201 times in Kerala, 65 times in Tamil Nadu, and 6.6 times in Maharashtra. Odisha and Chhattisgarh witnessed 182 times and 17 times growth in production of liquid fertilizers respectively between 2014–15 and 2020–21, but over low production volumes. The production of liquid biofertilizers in Andhra Pradesh dropped over the same time period (see *Table 3: Liquid biofertilizer production and growth in states and Union territories*).

Graph 14: Liquid biofertilizer production in states and Union territories in 2020–21



Source: Lok Sabha unstarred question 413, pesticides and biofertilizers, 39 November 2021, Ministry of Agriculture and Farmers' Welfare, Government of India; and Fertilizer Statistics 2020–21, the Fertilizer Association of India

Table 3: Liquid biofertilizer production and growth in states and Union territories

States or Union territories	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21	Growth (times final volume is of initial volume)	Growth (in per cent, between 2014–15 and 2020–21)
	In kilolitre								
South Zone									
Andhra Pradesh	275	318	365	370	-	-	99	0.4	-64
Karnataka	23	488	993	1,353	758	1,218	9,713	421.2	42,020
Kerala	11	57	60	83	2	5,512	2,112	201.0	19,997
Puducherry	2	4	11	28	6	8	2	1.5	47
Tamil Nadu	11	862	875	984	537	1,482	732	64.8	6,378
Telangana*	-	-	-	44	12,712	175	150	3.4	-
West Zone									
Chhattisgarh	10	9	10	17	134	190	163	17	1,598
Gujarat	2,801	2,873	2,858	3,519	431	9,444	8,056	2.9	188
Goa	0	0	0	-	-	-	-	-	-
Madhya Pradesh	119	131	238	290	327	316	262	2.2	120
Maharashtra	325	390	398	427	4,194	237	2,141	6.6	559
Rajasthan*	0	0	0	1	1	-	-	1	-
North Zone									
Haryana	46	58	70	76	247	-	108	2.3	131
Himachal Pradesh*	33	190	195	210	12	138	0	4.2	-
Punjab	74	150	210	236	221	192	157	2.1	111
Uttar Pradesh	98	223	461	744	2,445	2,540	593	6.0	505
Uttarakhand	208	428	697	534	281	4,980	1,151	5.5	453
Jammu and Kashmir	0	0	0	0	0	-	-	-	-
East Zone									
Bihar*	0	0	0	0	-	1,900	2	105	-
Jharkhand	0	0	0	0	-	-	-	-	-
Odisha	5	14	32	46	150	1,719	860	182.9	18,189
West Bengal	15	24	26	38	38	-	34	2.3	129
North East Zone									
Arunachal Pradesh*	0	318	0	0	0	-	-	-	-
Assam*	0	23	26	33	-	5	35	1.5	-
Manipur*	0	0	0	-	100	12	4	0.04	-
Sikkim*	0	0	0	-	52	-	69	1.3	-
Tripura*	0	0	0	0	-	40	-	-	-
Lakshadweep	0	0	0	0	-	-	-	-	-
Total (India)	4,055	6,241	7,526	9,033	22,646	30,106	26,442	6.5	552

Note: Data of 2020–21 provisional. (-) Indicates data is not available. * In some cases, based on data availability, initial year could be different from 2014-15 and final year could be different from 2020–21.

Source: Lok Sabha unstarred question 413, pesticides and biofertilizers, 30 November 2021, Ministry of Agriculture and Farmers' Welfare, Government of India; Lok Sabha unstarred question 2,549, 1 August 2017; Biofertilizer production, Ministry of Agriculture and Farmers' Welfare, Government of India; and Fertilizer Statistics 2020–21, the Fertilizer Association of India.

4.2 Biofertilizer manufacturing capacity and utilization in states and Union territories

As per the latest available information from the Ministry of Agriculture and Farmers' Welfare, through an answer to a Lok Sabha question in 2017, India has 532 biofertilizer manufacturing units.[35] Of these, 424 units spread across 28 states and Union territories manufacture carrier-based solid biofertilizers and 108 units spread across 17 states and Union territories manufacture liquid biofertilizers. In eight states and Union territories, there are no biofertilizer manufacturing units. Official estimates of capacity are updated infrequently, but as per information garnered from various stakeholders, there are some 600-650 biofertilizer manufacturing units in the country at present.

If we compare the total manufacturing capacity in 2017 with the actual biofertilizer production in subsequent years, we can see that the capacity remains underutilized. This is especially true of carrier-based solid biofertilizer capacity—its utilization stood at 59 per cent in 2017–18, 36 per cent in 2018–19, 39 per cent in 2019–20 and 65 per cent in 2020–21.

States and Union territories with less than 10 per cent utilization rates of solid biofertilizer manufacturing capacity are Andhra Pradesh, Chhattisgarh, Goa, Karnataka, Kerala, Mizoram and Puducherry. States and Union territories that utilize more than 10 per cent but less than 50 per cent of their capacity are Delhi, Madhya Pradesh, Odisha, Uttarakhand and West Bengal. States and Union territories producing more solid biofertilizers than their 2017 capacity are likely to have set up additional units or increased their capacity during these years.

On the other hand, liquid fertilizer capacity utilization has improved over the years. In 2017–18, only 55 per cent of the capacity was utilized, the figure rose to 139 per cent, 184 per cent and 162 per cent in 2018–19, 2019–20 and 2020–21 respectively.

Underutilization of liquid biofertilizer manufacturing capacity is not as severe as that of solid biofertilizer manufacturing capacity. States and Union territories with less than 10 per cent utilization of liquid biofertilizer manufacturing capacity are Assam, Himachal Pradesh and Puducherry. States utilizing between 10 per cent and 50 per cent of their liquid biofertilizer production capacity are Andhra Pradesh, Chhattisgarh, Tamil Nadu and Uttar Pradesh. States and Union territories producing more liquid biofertilizers than their 2017 capacity are likely to have set up additional units or increased their capacity during these years.

TAMIL NADU—INITIATIVES TO PRODUCE AND DISTRIBUTE BIOFERTILIZERS

Tamil Nadu is a leading producer of both solid and liquid biofertilizers. The state has recognized that the advantages of good quality biofertilizers with high microbial population load include greater efficacy, soil health and productivity. Therefore, the state government vigorously encourages use of biofertilizers to overcome the ill-effects of indiscriminate use of chemical fertilizers.

The state is a pioneer in biofertilizer production. Its department of agriculture has established 22 biofertilizer production units in 22 districts. These units have a combined production capacity of 11 lakh litre per annum of liquid biofertilizers, that can cover up to 20 per cent of gross cultivated area of the state. Biofertilizers like Azospirillum and Azophos for paddy and other crops; Rhizobium for pulses and groundnut; and Phosphobacteria and potash-mobilizing bacteria for all crops are produced by these units. The selling price for carrier-based biofertilizers is kept at Rs 6 per 200 g packet; for liquid biofertilizers it is up to Rs 280 per litre.

Biofertilizers are distributed to farmers through agricultural extension centres. In 2021–22, the government plans to distribute about 5.35 lakh litre of liquid biofertilizers for 9.65 lakh hectare land through subsidy under several agriculture schemes. For example, under the National Agriculture Development Programme, it will provide about 46,000 litre of biofertilizers for 2.96 lakh hectare of land growing paddy, pulses, millets and oilseeds. As part of the National Food Security Mission, it will provide about 1.64 lakh litre of biofertilizers for 3.19 lakh hectare of land growing rice, pulses, coarse cereals, nutri-cereals, oilseeds, cotton and sugarcane. Under the Sustainable Cotton Cultivation Mission, 25,000 litre of biofertilizers is planned to be distributed for 50,000 hectare of cotton crop. As part of the Chief Minister's Dryland Development Mission, three lakh litre of biofertilizers is to be distributed for three lakh hectare of land growing millets, pulses, oilseeds and cotton. In addition to the state-owned production units, nine private units produce 9.85 lakh litre of liquid biofertilizer annually and 14 private units produce 23,625 MT of carrier-based biofertilizer annually.

Source: Department of Agriculture, Government of Tamil Nadu

It is also likely that production of liquid biofertilizers is being preferred over solid biofertilizer production. However, a few states and Union territories have not fully utilized their 2017 capacity of both solid and liquid fertilizer production. These include Andhra Pradesh, Chhattisgarh, Puducherry, and West Bengal.

Biofertilizer production companies

Limited information is available on production details of biofertilizer companies. State governments may have kept the records, but information has not been compiled on companies, registered biofertilizer products and authorizations provided at the Central level. This could be because there is no requirement for any agency at the Central level to maintain such data.

The Fertilizer Association of India has compiled some data, but it is not enough to develop a sense of the overall structure and composition of the industry. Its

IFFCO AND KRIBHCO

Indian Farmers Fertilizer Cooperative (IFFCO) and Krishak Bharti Cooperative Ltd (KRIBHCO) are two leading cooperatives operating in the chemical fertilizer sector. They are also among the biggest biofertilizer manufacturers in India.

IFFCO started biofertilizer production at its Phulpur plant in Uttar Pradesh in 1996–97. Later, it expanded the production of biofertilizers to its units in Bareilly, Uttar Pradesh, Kalol, Gujarat and Paradeep, Odisha. IFFCO produces liquid biofertilizers and the total capacity of all its units in 13.25 lakh litre. It produced about 8.66 lakh litre in 2017–18, 9.64 lakh litre in 2018–19, 10.27 lakh litre in 2019-20, and 11.28 lakh litre in 2020-21. It manufactured about 4.26 per cent of the total Indian liquid biofertilizers production in 2020–21. Its key products are liquid consortia NPK (Rhizobium, Azotobacter and Acetobacter), zinc-solubilizing bacteria, potassium-mobilizing biofertilizer, phosphate-solubilizing bacteria and Azospirillum. Liquid consortia NPK has the highest demand with 77 per cent share of IFFCO's biofertilizer sales volume. This is followed by 10 demand for phosphate-solubilizing bacteria and 6 per cent for Azotobacter. The price of all these biofertilizers has been kept at Rs 128 per litre.

KRIBHCO started biofertilizer production in 1995–96 and started liquid biofertilizer production in 2011–12. Currently, it produces 10 liquid biofertilizers, including phosphate-solubilizing biofertilizer, Acetobacter, Azotobacter, Azospirillum, Rhizobium, potash-mobilizing biofertilizer, zinc-solubilizing biofertilizer and liquid consortia NPK (a mixture of Azotobacter, phosphate-solubilizing biofertilizer and potash-mobilizing biofertilizer). KRIBHCO distributes them across 17 states. Initially, the highest demand was for Azotobacter and phosphate-solubilizing biofertilizer, but now liquid consortia NPK is in the highest demand. It is being sold in half-litre, one-litre and five-litre packs. The highest sales are made in Uttar Pradesh, Gujarat and Maharashtra. KRIBCO also sells city compost and natural potash.

latest Biofertilizer Statistics 2019–20 lists production data of only 36 out of the 424 carrier-based solid biofertilizer companies officially recorded in 2017, i.e., 8.5 per cent of the companies. The production data of this small percentage of companies is also not available for each year over the last few years. For 2019–20, it is available for only nine units, which account for merely 2.3 per cent of the total production of that year. One of these nine companies—Multiplex Biotech Pvt Ltd, Karnataka—produced 1.6 per cent of the total production. This suggests that it is the biggest among the listed companies and the rest have small production capacities. The nine units collectively utilize only about 61 per cent of their stated capacity (see *Annexure 3: Solid biofertilizer manufacturers and their production and capacity utilization*).

Similarly, the Biofertilizer Statistics 2019–20 list production data of only 18 per cent of liquid biofertilizer manufacturing companies, i.e., 20 out of 108 companies officially recorded in 2017. For 2019–20, data it is available for only 12 units that account for only 7.2 per cent of the total production in the year. The five major producers among these 12 belong to Indian Farmers Fertilizer Cooperative

(IFFCO) and Krishak Bharti Cooperative Ltd (KRIBHCO). Together these five companies manufactured about 6 per cent of the total production in India in 2019–20. These 12 units collectively utilize about 40 per cent of their stated capacity (see *Annexure 4: Liquid biofertilizer manufacturers and their production and capacity utilization*).

4.3 Quality of biofertilizers—standards, laboratories and test results

Standards

FCO has provided specifications for 11 types of biofertilizers. These specifications are applicable to both solid and liquid biofertilizers and on parameters such as total viable count, contamination level, pH value and efficiency character. Biofertilizers that do not meet these specifications are not allowed for sale under FCO (see *Table 4: Specification of biofertilizers as per Fertilizer Control Order*).

Table 4: Specifications of biofertilizers as per Fertilizer Control Order

Rhizobium	
Total viable count	Colony forming unit (CFU) minimum 5 x10^7 cells per gram of powder, granules or carrier material; or per gram capsule content in gelatin base; or 1 x 10^8 cells per ml of liquid
Contamination level	No contamination at 10^5 dilution
pH	6.5–7.5
Efficiency character	Should show effective nodulation on all species listed on the packet and there should be a minimum of 25 per cent increase in dry matter yield in test plant, 25 days after sowing (DAS) when tested as per the method given under controlled conditions
Azotobacter	
Total viable count	CFU minimum 5 x 10^7 cells per gram of powder, granules or carrier material; or per gram capsule content in gelatin base; or 1 x 10^8 cells per ml of liquid
Contamination level	No contamination at 10^5 dilution
pH	6.5–7.5
Efficiency character	The strain should be capable of fixing at least 10 mg of nitrogen per gram of sucrose consumed
Azospirillum	
Total viable count	CFU minimum 5 x 10^7 cells per gram of powder, granules or carrier material; or per gram capsule content in gelatin base; or 1 x 10^8 cells per ml of liquid
Contamination level	No contamination at 10^5 dilution
pH	6.5–7.5
Efficiency character	Formation of white pellicle in semi-solid nitrogen-free bromothymol blue media
Phosphate-solubilizing bacteria	
Total viable count	CFU minimum 5 x 10^7 cells per gram of powder, granules or carrier material; or 1 x 10^8 cells per ml of liquid
Contamination level	No contamination at 10^5 dilution
pH	6.5–7.5 for moist or dry powder, granulated carrier-based and 5.0–7.5 for liquid-based
Efficiency character	The strain should be capable of solubilizing at least 30 mg per litre of phosphorus in a liquid broth when tested as per the method given using tricalcium phosphate or aluminium phosphate or iron phosphate as phosphate source

Mycorrhizal biofertilizers	
Total viable spores	Minimum 10 viable spores per gram of finished product
pH	6.0–7.5
Inoculum potential	1,200 IP per gram of finished product by MPN method with 10 fold dilution
Pottasium-mobilizing biofertilizers	
Total viable count	CFU minimum 5 x 10^7 cells per gram of powder, granules or carrier material; or per gram capsule content in gelatin base; or 1 x 10^8 cells per ml of liquid
Contamination level	No contamination at 10^5 dilution
pH	6.5–7.5 for carrier-based in the form of powder or granules; and 5.0–7.5 for liquid-based or capsule in gelatin base
Efficiency character	The strain should be capable of solubilizing at least 20 mg per litre of potash in a liquid broth when tested as per the method given using aluminium potassium silicate as the source of potassium
Zinc-solubilizing bacteria	
Total viable count	CFU minimum 5 x 10^7 cells per gram of powder, granules, or carrier material; or per gram capsule content in gelatin base; or 1 x 10^8 cells per ml of liquid
Contamination level	No contamination at 10^5 dilution
pH	6.5–7.5 for carrier-based in the form of powder or granules; and 5.0–7.5 for liquid-based
Efficiency character	The strain should be capable of solubilizing at least 20 mg per litre of zinc in a liquid broth when tested as per the method given using zinc oxide, zinc carbonate or zinc phosphate as zinc source
Acetobacter	
Total viable count	CFU minimum 5 x10^7 cells per gram of powder, granules, or carrier material; or per gram capsule content in gelatin base; or 1 x 10^8 cells per ml of liquid
Contamination level	No contamination at 10^5 dilution
pH	5.5–6.0 for moist or dry powder, granulated or carrier-based; and 3.0–6.0 for liquid-based
Efficiency character	Formulation of yellowish pellicle in semi-solid nitrogen-free medium
Carrier-based consortia	
Individual organism viable count	CFU minimum in a mixture of any two or maximum three of the following micro-organisms: *Rhizobium* or *Azotobacter* or *Azospirillum*: 1 x 10^7 cells per gram Phosphate-solublizing biofertilizers: 1 x 10^7 cells per gram Potassium-mobilizing biofertilizers: 1 x 10^7 cells per gram
Total viable count of all the biofertilizers in the product	CFU minimum 3 x 10^7 cells per gram of carrier
Efficiency character	The efficiency character of individual microorganisms to be determined as mentioned in case of individual biofertilizers through quantitative estimation methods
Liquid consortia	
Individual organism viable count	CFU minimum in a mixture of any two or maximum three of the following micro-organisms: CFU minimum *Rhizobium* or *Azotobacter* or *Azospirillum* 5 x 10^7 cells per milliliter (ml) CFU minimum PSB: 5 x 10^7 cells per milliliter (ml) CFU minimum KSB: 5 x 10^7 cells per per milliliter (ml)
Total viable count of all biofertilizers in the product	CFU minimum 1.5 x10^8 cells per milliliter (ml)
pH	5.0–7.0
Contamination	No contamination at any dilution
Efficiency character	The efficiency character of individual microorganisms to be determined as mentioned in case of individual biofertilizers through the quantitative estimation methods

Phosphate-solubilizing fungal bioferilizers	
Spore count	Minimum 1 x 10^6 spores per gram; minimum 1 x10^7 viable fungal spores per ml of liquid
Contamination level	Nil for liquid inoculums 1 x 10^3 cells per gram for carrier-based preparations
pH	Liquid: 3.5–5.5; carrier: 6.0–7.7
Efficiency character	The strain should be capable of solubilizing at least 30 mg per litre of phosphorus in a liquid broth when tested as per the method given using tricalcium phosphate or aluminium phosphate or iron phosphate as phosphate source

Note: Tolerance limit:- In case of *Rhizobium, Azotobacter, Azospirillum*, phosphate-solubilizing bacteria, potash-mobilizing bacteria, zinc-solubilizing bacteria, the total viable count shall not be less than 1x10^7 CFU/g of carrier material in the form of powder or granules or 5x10^7 CFU/ml in case of liquid formulations. In case of consortia, the total viable count shall not be less than 1x10^7 in case of carrier-based and 1x10^8 in case of liquid formulations. In case of *Mycorrhizal* biofertilizers, total viable spores shall not be less than 8/g of finished product
Source: Fertilizer (Inorganic, Organic or Mixed) (Control) Order, 1985, as amended up to July 2021

Table 5: Biofertilizer and organic fertilizer quality control laboratories and their capacity

State	Government of India		State		Total	
	Number of laboratories	Capacity (samples per year)	Number of laboratories	Capacity (samples per year)	Number of laboratories	Capacity (samples per year)
Rajasthan	-	-	1	500	1	500
Uttar Pradesh	1	500	3	3,000	4	3,500
Karnataka	1	500	3	1,500	4	2,000
Tamil Nadu	-	-	2	1,000	2	1,000
Kerala	-	-	1	1,000	1	1,000
Haryana	1	500	1	NA	2	500
Himachal Pradesh	-	-	2	NA	2	NA
Madhya Pradesh	1	500	-	-	1	500
Maharashtra	1	500	5	3,000	6	3,500
Manipur	1	400	-	-	1	400
Assam	-	-	1	NA	1	NA
Odisha	1	500	1	500	2	1,000
West Bengal	-	-	3	150	3	150
Total	7	3,400	23	10,650	30	14,050

Note: NA indicates not available; (-) Indicates no laboratory
Source: Government response to RTI filed by CSE[36]

Laboratories

There are 26 notified laboratories under FCO for testing the quality of biofertilizers. These laboratories also are responsible for testing organic fertilizers. Seven of these laboratories, with a combined capacity of testing 3,400 samples annually, are Central government-owned. The remaining 19 are under state governments. In addition, there are four laboratories in Haryana, Himachal Pradesh and Assam that are not notified under FCO. The 23 laboratories in 11 states have a combined capacity to test 10,650 samples in a year. **Together with the Central government-owned laboratories, the total capacity increases to at least 14,050 samples per year in 30 laboratories across 13 states** (see *Table 5: Biofertilizer and organic fertilizer quality control laboratories and their capacity*).

SAMPLE COLLECTION

As per the Fertilizer Control Order, authorized inspectors of state governments are empowered to draw an appropriate number of samples based on lot size. Samples must be randomly selected from the lot.

Earlier, samples were simply sent to National Centre of Organic Farming or the appropriate Regional Centre of Organic Farming. As the sent samples retained the name of the manufacturing company and other details, they were vulnerable to manipulation by unscrupulous elements.

Therefore, from July 2020, a new practice was initiated in which labels of biofertilizer samples drawn are defaced and a new label containing the generic name of the biofertilizer, its expiry date, date of sampling and a code number (created by the inspecting authority) is pasted over it. Samples are sealed and out of every three samples, one is sent to the incharge of a laboratory notified by the state government or the director of the National Centre of Organic Farming. If a sample has been sent to National Centre of Organic Farming, an authorized officer recodes it before forwarding it to any Regional Centre of Organic Farming. The second sample is handed over to the manufacturer or dealer, as the case may be, and can be tested in case the manufacturer and dealer disputes the results of the test (on sample number 1). The third sample is sent to the next higher authority by the inspector for safekeeping.

However, since coding is a new practice, some states are yet to initiate it.

Though the overall sample testing capacity seems adequate, many states do not have their own laboratories to ensure timely quality checks. Maharashtra, with six laboratories, and Uttar Pradesh, with four laboratories, have the highest testing capacities.

Test results

The compiled results of quality tests conducted on biofertilizers at Regional Centres of Organic Farming (RCOF) laboratories are available. These results help in understanding the national picture as they receive samples from across the country. Results of the last six years from seven RCOF laboratories point towards the following:

- The proportion of samples failing quality tests is rising. From 1 per cent in 2013–14, it has reached 44 per cent in 2019–20. This trend is reflected across RCOF laboratories, with at least about 30 per cent samples failing in 2019–20. At the Nagpur laboratory, 74 per cent of samples failed quality tests (see *Table 6: Percentage of biofertilizer samples failing quality tests at regional laboratories*).

- The number of samples being tested is decreasing. From 654 in 2013–14, it has reduced by 26 per cent to 483 samples in 2019–20.

Table 6: Percentage of biofertilizer samples failing quality tests at regional laboratories

Year	Number of samples tested	Percentage of samples failing quality tests							
		All Regional Centres of Organic Farming (RCOF)	RCOF, Panchkula	RCOF, Bengaluru	RCOF, Jabalpur	RCOF, Bhubaneshwar	RCOF, Ghaziabad	RCOF, Imphal	RCOF, Nagpur
2013–14	654	1	-	0	4	0	-	0	0
2014–15	904	6	-	3	21	4	-	1	0
2015–16	563	4	0	0.6	8	46	-	0	0
2016–17	552	4	0	0.8	21	6	-	0	0
2017–18	472	22	28	2	23	17	42	6	17
2018–19	415	14	19	0	15	50	8	0	56
2019–20	483	44	39	29	44	29	44	-	74

Note: (-) indicates data not available or samples not tested; there are some variations in data received through RTI responses from different departments. Compilation of test results conducted at state-owned laboratories is not available

Source: Response to RTI filed by CSE[37]

- Only 483 samples of biofertilizers and 477 samples of organic fertilizers were tested in 2019–20. The total testing capacity is 3,400 samples per year. This means, only about 28 per cent of testing capacity for biofertilizers and organic fertilizers was utilized.

While compilations of results of tests conducted at other state-owned laboratories are not available, this high proportion of samples failing quality tests at Central-level laboratories is in line with inputs received from a vast majority of stakeholders across the country, who highlight the easy and widespread availability of poor quality and spurious biofertilizers as well as irregularities in local enforcement machinery meant to keep their proliferation in check.

State-wise break-up of RCOF results suggests that samples from almost all states and Union territories failed at one time or another between 2013 and 2020. In several cases, they failed in more than one year. In the last few years, compared to others states, a relatively higher proportion of samples from Gujarat, Madhya Pradesh and Punjab have failed (see *Table 7: State- and Union territory-wise break-up of biofertilizer samples failing quality tests at RCOF laboratories*).

In addition to the RCOF data, test results from state-owned laboratories in Karnataka, Odisha and Tamil Nadu were also received. These are for a larger number of samples than those reflected by RCOF laboratory results. In some cases, these results exhibit trends that are similar to those of RCOF laboratories.

Table 7: State- and Union territory-wise break-up of biofertilizer samples failing quality tests at RCOF laboratories

State or Union territory	Percentage of failed samples (total samples tested)						
	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20
Andhra Pradesh	0 (28)	0 (65)	0 (52)	0 (56)	13 (31)	50 (2)	-
Assam	0 (2)	0 (8)	0 (148)	0 (40)	50 (10)	0 (8)	-
Bihar	0 (1)	100 (1)	100 (12)	0 (1)	75 (4)	13 (24)	0 (1)
Chhattisgarh	3 (62)	7 (72)	7 (70)	5 (37)	21 (34)	25 (4)	67 (12)
Goa	-	0 (1)	-	0 (2)	-	-	-
Gujarat	0 (132)	0 (142)	0 (17)	0 (25)	44 (9)	52 (25)	48 (63)
Haryana	-	0 (4)	0 (21)	0 (16)	0 (3)	31 (16)	25 (16)
Himachal Pradesh	-	-	0 (11)	-	0 (12)	0 (6)	0 (8)
Jammu and Kashmir	-	-	-	-	-	-	0 (8)
Jharkhand	0 (2)	71 (14)	20 (5)	9 (11)	35 (17)	0 (3)	-
Karnataka	-	-	0.5 (213)	0.8 (121)	3 (124)	0 (40)	50 (2)
Karnataka (from state)	-	-	-	NA (217)	NA (206)	NA (319)	0.2 (510)
Kerala	-	-	0.8 (118)	0.9 (117)	0 (100)	0 (90)	0 (4)
Madhya Pradesh	5 (22)	46 (13)	10 (10)	55 (20)	20 (70)	14 (42)	44 (86)
Maharashtra	-	0 (2)	0 (5)	0 (5)	25 (8)	-	80 (15)
Manipur	-	-	-	-	-	0 (7)	-
Meghalaya	-	-	-	0 (8)	-	-	-
Odisha	0 (52)	0 (21)	0 (11)	-	22 (9)	0 (45)	0 (2)
Odisha (from state)	-	-	-	6 (101)	2 (135)	2 (86)	0 (152)
Punjab	-	0 (35)	0 (87)	0 (39)	29 (70)	15 (82)	46 (211)
Rajasthan	-	-	-	-	20 (5)	0 (2)	20 (5)
Tamil Nadu	-	-	0 (14)	0 (20)	0 (19)	-	0 (4)
Tamil Nadu (from state)	-	-	-	-	-	-	0.1 (760)
Telangana	-	-	-	-	67 (6)	70 (10)	78 (9)
Tripura	0 (167)	1 (294)	0 (21)	0 (173)	0 (71)	0 (4)	0 (20)
Uttar Pradesh	-	-	-	-	38 (24)	15 (20)	-
Uttarakhand	-	-	-	-	81 (27)	19 (27)	64 (11)
West Bengal	0 (2)	0 (1)	0	57 (7)	-	-	-

Note: (-) indicates sample not tested; NA indicates data not available. No data was available for any year for the following states and Union territories: Andaman and Nicobar Islands, Arunachal Pradesh, Chandigarh Dadra and Nagar Haveli and Daman and Diu, Delhi, Ladakh, Lakshadweep Mizoram, Nagaland, Puducherry and Sikkim

Source: Government response to RTI filed by CSE[38] and data requested from individual states (Karnataka, Odisha and Tamil Nadu)

Mystery of testing biofertilizers not approved by FCO

In addition to the results of quality tests of FCO-approved biofertilizer samples, until 2019–20 the National Centre of Organic Farming (NCOF) used to report test results of non-FCO approved biofertilizer samples as well. Why was NCOF testing samples of biofertilizers that had not been approved in the first place? What were

Table 8: Results of non-FCO approved biofertilizer sample quality testing

Testing laboratory	2016–17		2017–18	
	Samples tested	Samples found non-standard (per cent)	Samples tested	Samples found non-standard (per cent)
RCOF, Ghaziabad	116	0	338	-
RCOF, Panchkula	100	0	9	-
RCOF, Jabalpur	32	0	12	83
RCOF, Bhubaneswar	0	0	100	43
RCOF, Imphal	89	0	8	-
RCOF, Nagpur	0	0	-	-
RCOF, Bengaluru	246	0	175	-
Total	583	0	642	47

Source: NCOF annual reports

the parameters on which the tests were conducted because, obviously, FCO did not provide their quality specifications? If these biofertilizers were approved at the state and Union territory level, what was the basis of such approval? Did state and Union territory governments even have the power to approve biofertilizers not finding a place in FCO? On the other hand, if approval for such biofertilizers was not granted by state and Union territory governments, how were they available in the market?

The results of quality testing—called "non-FCO standards"—also add to the mystery. In 2016–17, 583 samples of these non-FCO approved biofertilizers were tested. Not a single one failed the tests. In 2017–18, 642 samples were tested, of which 47 per cent samples failed the quality tests, but only at two—RCOF Jabalpur and RCOF Bhubaneshwar—of the seven laboratories performing such tests. In 2018–19 and 2019–20, respectively 164 and 78 non-FCO biofertilizer samples were tested by all RCOFs. No samples failed in these years[39] (see *Table 8: Results of non-FCO approved biofertilizer sample quality testing*).

While compiled data related to procurement of biofertilizers by states and Union territories is not available in the public domain, interaction with stakeholders suggests that a significant proportion of the procurement takes place through tenders for distribution to farmers as part of several Central and state schemes. Often, the low selling price quoted in such tenders is the reason for inferior quality of the biofertilizers delivered, which is also linked to the use of unlawful financial means in the approval process. Inferior quality biofertilizers provided to farmers may not always lead to desired results in terms of nutrient augmentation in the soil or crop productivity. The subsidization fails to encourage farmers to purchase at unsubsidized price from the open market.

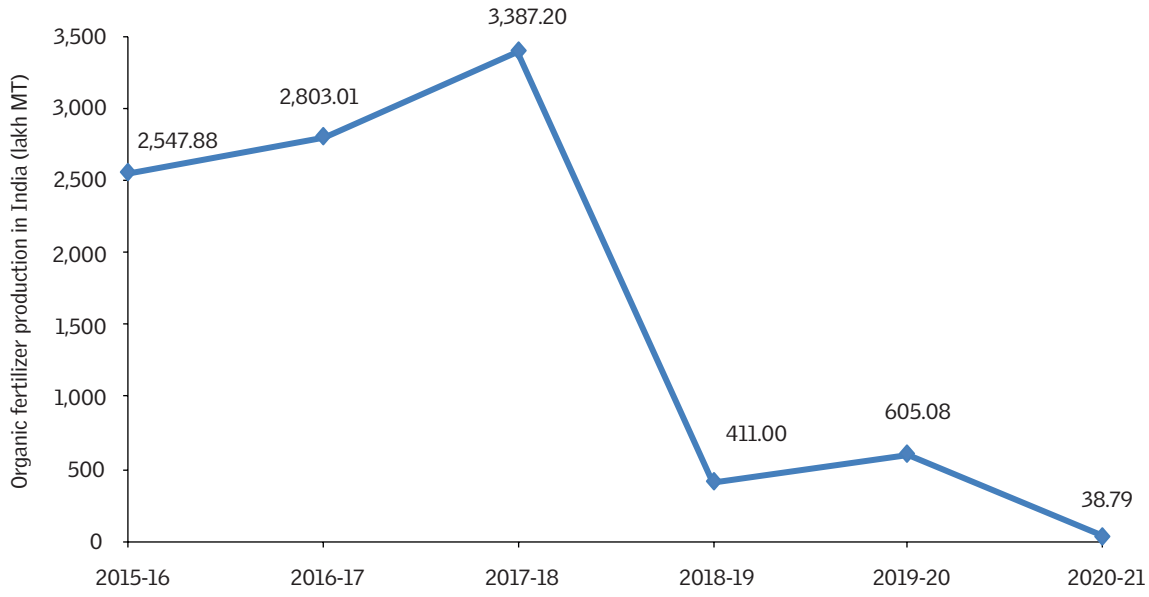
5. Organic fertilizers—production and quality

5.1 Organic fertilizer production in India

Government figures suggest that India's organic fertilizer production grew by 33 per cent between 2015–16 and 2017–18 to reach at 3,387 lakh tonne before nosediving to 411 lakh tonne in one year and continuing its sharp decline to 38.8 lakh tonne by 2020–21 (see *Graph 15: Sharp decline in organic fertilizer production in India*). Thus, there was a 99 per cent decline between 2017–18 and 2020–21. The reasons behind the sudden drop in organic fertilizer production from a peak in 2017–18 are not clear.

A possible reason suggested by some stakeholders is the change in the method of calculation of countrywide organic fertilizer production from the data provided by states and Union territories. Earlier, these stakeholders say, there were huge variations in the manner in which different states and Union territories calculated their organic fertilizer production. The national compilation largely ignored these regional discrepancies.

Graph 15: Sharp decline in organic fertilizer production in India



Source: Lok Sabha unstarred question 1,656, 2 July 2019, Ministry of Agriculture and Farmers' Welfare, Government of India (for 2015–16 to 2017–18 data); Lok Sabha unstarred question 2,184, 10 December 2021, Ministry of Agriculture and Farmers' Welfare, Government of India (for 2018–19 to 2020–21 data)

If that is the case, one can take solace in the fact that at least the latest figures are based on a more informed and uniform method of calculation. However, if this contention of certain stakeholders is erroneous, then the sharp decline in production is real and a matter of serious concern.

Other stakeholders also indicate the possibility of a substantial variation in actual and reported figures.

All states and Union territories have witnessed a decline in production in the range of 80–100 per cent from 2017–18. Considering the widespread decline and drastic change in the scale of numbers, a comparison among states and Union territories has been made based on their share in overall Indian production (see *Table 9: Organic fertilizer production in states and Union territories between 2015–16 and 2020–21*). Data on state- and Union territory-wise shares in India's organic fertilizer production presents a tumultuous scenario marked by huge annual variations.

In 2017–18, Bihar had a share of 30 per cent in the countrywide production of organic fertilizers, followed by Gujarat, with a 15 per cent share, and Jharkhand, with a 12 per cent share. Three other states had more than 5 per cent share each and another 11 states have more than 1 per cent share each in the total organic fertilizer production in India.

In 2018–19, the scenario changed completely. In that year, Karnataka was responsible for 94 per cent of organic fertilizer production in India. Tamil Nadu and Telangana were the only other states that contributed more than 1 per cent to the countrywide organic fertilizer production.

In 2019–20, Karnataka continued to be the leading producer of organic fertilizers in India, but its share had dropped to 64 per cent. With a 13 per cent share in national production, Andhra Pradesh came in second, followed by seven states with a share of more than 1 per cent each.

In 2020-21, with a 63 per cent share, Chhattisgarh was the leading producer of organic fertilizers, followed by Karnataka, with an 8 per cent share, and another 12 states with more than 1 per cent share each. In decreasing order of their share, these states are Assam, Maharashtra, Tamil Nadu, Bihar, Madhya Pradesh, Nagaland, West Bengal, Punjab, Odisha, Kerala, Gujarat and Rajasthan (see *Graph 16: Organic fertilizer production in states and Union territories in 2020–21*).

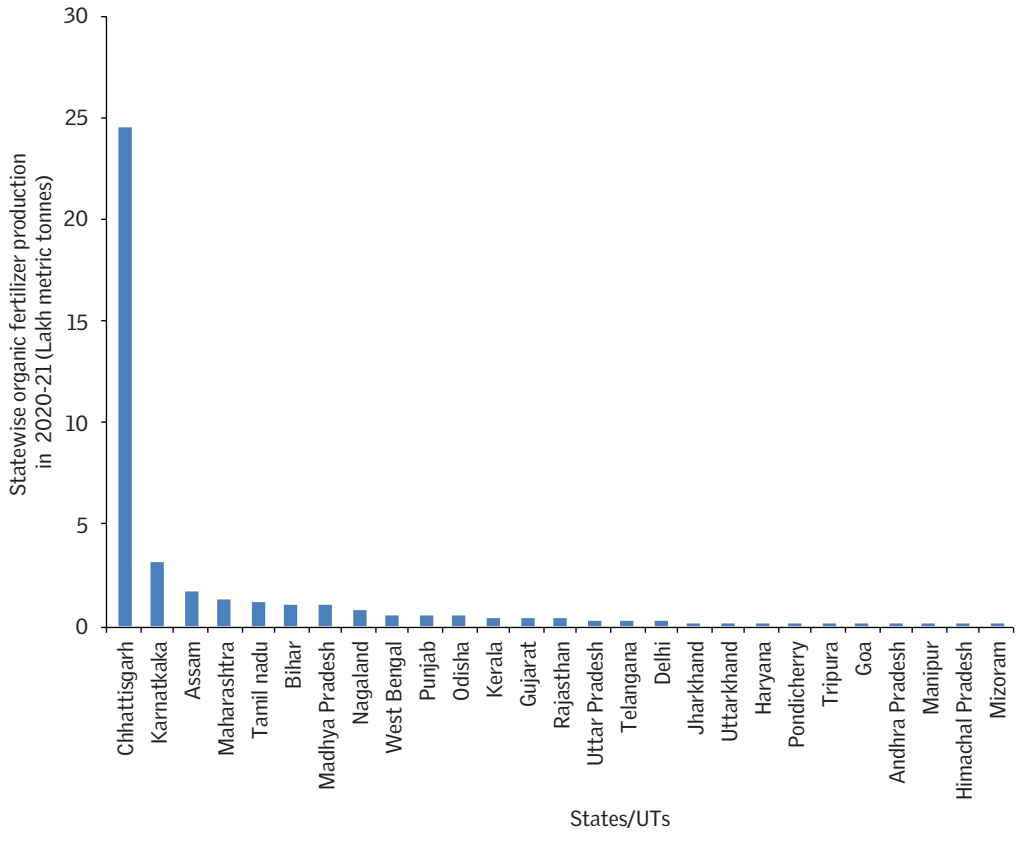
Table 9: Organic fertilizer production in states and Union territories between 2015–16 and 2020–21

State or Union territory	Annual production (in lakh tonne)						Growth (in per cent between 2017–18 and 2020–21)	Per cent share in total production 2017–18	Per cent share in total production 2018–19	Per cent share in total production 2019–20	Per cent share in total production 2020–21
	2015–16	2016–17	2017–18	2018–19	2019–20	2020–21					
Andhra Pradesh	85.97	95.93	201.81	0.79	78.92	0.003	-100	5.96	0.19	13.04	0.01
Arunachal Pradesh	1.6	1.94	5.44	0	0.02	0	-100	0.16	0	Negligible	0
Assam	935.66	186.28	200.25	0	4.42	1.75	-99	5.91	0	0.73	4.51
Bihar	33.27	939.6	997.16	1.37	1.19	1.05	-100	29.44	0.33	0.20	2.70
Chhattisgarh	120.9	130.61	169.2	0.06	28.11	24.52	-86	5.00	0.02	4.65	63.21
Chandigarh	15.25	16.45	28.2	0	0	0	-100	0.83	0	0	0
Delhi	1.1	1.6	2.1	0.04	0.17	0.23	-89	0.06	0.01	0.03	0.59
Goa	0.82	1.38	0.98	0.0006	0.10	0.005	-100	0.03	Negligible	0.02	0.01
Gujarat	380.68	502.06	517.79	1.23	3.76	0.45	-100	15.29	0.30	0.62	1.16
Haryana	21.19	24.57	48.39	0.04	0.47	0.05	-100	1.43	0.01	0.08	0.12
Himachal Pradesh	54.1	55.91	61.34	0.05	17.30	0.0002	-100	1.81	0.01	2.86	Negligible
Jammu and Kashmir	2.13	2.33	2.16	0	0.01	0	-100	0.06	0	Negligible	0
Jharkhand	500.9	398.13	406.17	0	0.03	0.07	-100	11.99	0	0.01	0.17
Karnataka	40.77	44.86	64.2	387.60	387.65	3.16	-95	1.90	94.31	64.07	8.14
Kerala	4.66	5.03	24.70	0.78	12.55	0.45	-98	0.73	0.19	2.07	1.17
Madhya Pradesh	54.84	61.93	108	0.40	11.89	1.03	-99	3.19	0.10	1.97	2.67
Maharashtra	30.94	36.24	89.89	0.23	0.91	1.31	-99	2.65	0.06	0.15	3.39
Manipur	0.81	1.03	1.07	0.0005	0.00002	0.002	-100	0.03	Negligible	Negligible	Negligible
Mizoram	2.18	2.4	3.11	0	0.0002	0.0001	-100	0.09	0	Negligible	Negligible
Meghalaya	28	31.2	32.8	0	0.01	0	-100	0.97	0	Negligible	0
Nagaland	2.93	3.63	4.07	0	0.81	0.81	-80	0.12	0	0.13	2.10
Odisha	25.41	27.75	31.35	0.71	0.64	0.49	-98	0.93	0.17	0.11	1.27
Punjab	8.9	10.51	41	0.45	21.49	0.50	-99	1.21	0.11	3.55	1.28
Puducherry	4.55	7.77	8.87	0.01	0.01	0.01	-100	0.26	Negligible	Negligible	0.03
Rajasthan	34.14	37.26	65.24	0.46	2.52	0.45	-99	1.93	0.11	0.42	1.15
Sikkim	0.39	0.45	1.09	0	1.61	0	-100	0.03	0	0.27	0
Tamil Nadu	20.42	17.7	45.58	11.1	9.18	1.18	-97	1.35	2.70	1.52	3.04
Telangana	3.2	3.94	6.82	4.66	20.13	0.27	-96	0.20	1.13	3.33	0.7
Tripura	3.51	2.75	4.25	0	0.01	0.01	-100	0.13	0	Negligible	0.03
Uttar Pradesh	25.7	28.2	53.8	0.17	0.19	0.33	-99	1.59	0.04	0.03	0.86
Uttarakhand	45.03	51.05	72.49	0.32	0.31	0.06	-100	2.14	0.08	0.05	0.15
West Bengal	57.93	72.52	87.88	0.52	0.69	0.59	-99	2.59	0.13	0.11	1.53
Total (India)	2547.88	2803.01	3387.20	411.00	605.08	38.79	-99	100	100	100	100

Note: In 2015–16, data was collected as per rural compost, farm yard manure, city compost, organic manure, vermicompost and other manures. In 2016–17, phosphate-rich organic manure (PROM) was added to the list. In 2017–18, organic manure included rural compost as well

Source: Lok Sabha unstarred question 1,656, 2 July 2019 (for 2015–16 to 2017–18 data); Lok Sabha unstarred question 2,184, 10 December 2021 (for 2018–19 to 2020–21 data)

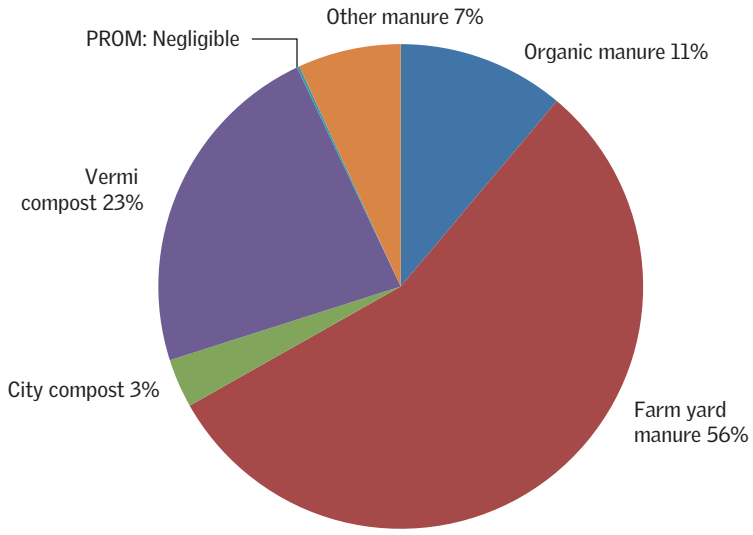
Graph 16: Organic fertilizer production in states and Union territories in 2020–21



Source: Lok Sabha unstarred question 2,184, 10 December 2021, Ministry of Agriculture and Farmers' Welfare, Government of India

The latest year for which information on share of different organic fertilizers in the total production is available is 2017–18. The total production in that year was 3,387 lakh tonne. Farm yard manure had the highest share of 56 per cent in it, followed by vermicompost, with a 23 per cent share. Organic manure had a share of 11 per cent in total organic fertilizer production and city compost only 3 per cent (see *Graph 17: Share of different types of organic fertilizers in 2017–18*).

Graph 17: Share of different types of organic fertilizers in 2017–18



Source: Lok Sabha unstarred question 1,656, 2 July 2019, Ministry of Agriculture and Farmers' Welfare, Government of India

5.2 Quality of organic fertilizers—standards, laboratories and test results

Standards

FCO has provided specifications for 10 types of organic fertilizers. Specifications are provided for one or more of the following parameters: moisture, particle size, bulk density, total organic carbon, total nitrogen, total phosphate, total potassium, colour, odour, heavy metals, carbon–nitrogen ratio, pH value, conductivity, total viable count (nitrogen, phosphorus, potassium and zinc bacteria; or nitrogen and phosphorus bacteria; or nitrogen and potassium bacteria), pathogens, water soluble potash and total sulphur. Other additional parameters have been used for specifications of bone meal (raw) and bone meal (steamed). FCO does not permit the sale of organic fertilizers not meeting these specifications (see *Annexure 5: Organic fertilizer standards as per FCO, 1985, amended in July 2021*).

Laboratories

The 26 laboratories notified under FCO are also responsible for testing organic fertilizers. However, compiled organic fertilizer quality test results from only Regional Centre of Organic Farming (RCOF) laboratories are available for the last few years. These results help to understand the national picture because they receive samples from across the country. The results point towards the following:

- The proportion of samples failing quality tests is rising. From 9 per cent in 2013–14, it has reached to 46 per cent in 2019–20. This trend is reflected in almost all RCOF laboratories, wherein more than one-third samples of organic fertilizers failed quality tests in 2019–20. At RCOF, Bhubaneshwar, more than three-fourths of organic fertilizer samples failed quality tests. At RCOF, Nagpur, more than two-thirds of organic fertilizer samples failed quality tests (see *Table 10: Percentage of organic fertilizer samples failing quality tests at regional laboratories*).

- The number of organic fertilizer samples tested has increased. From 191 in 2013–14, it has risen to 477 in 2019–20; a 150 per cent jump.

- Overall, as mentioned earlier, only 28 per cent of combined testing capacity for organic fertilizers and biofertilizers is utilized.

As is the case with biofertilizers, inputs from stakeholders bear out the fact that a high proportion of organic fertilizer samples fail quality tests in Central-level laboratories. Stakeholders also point out the easy and widespread availability of poor quality and spurious organic fertilizers as well as irregularities in the local enforcement machinery meant to prevent their spread.

State-wise break-up of RCOF results suggests that organic fertilizer samples from almost all states and Union territories failed at one time or another between 2013 and 2020. In several cases, they failed in more than one year. In the last few years, a relatively higher percentage of samples from Gujarat, Karnataka, Madhya Pradesh,

Table 10: Percentage of organic fertilizer samples failing quality tests at regional laboratories

Year	Number of samples tested	Percentage of samples failing quality tests							
		All RCOF	RCOF, Panchkula	RCOF, Bengaluru	RCOF, Jabalpur	RCOF, Bhubaneshwar	RCOF, Ghaziabad	RCOF, Imphal	RCOF, Nagpur
2013–14	191	9	0	0	21	16	-	60	3
2014–15	445	7	0	0	44	71	-	15	0
2015–16	252	12	0	2	39	62	-	3	0
2016–17	295	16	0	13	30	62	-	0	0
2017–18	430	21	0	7	22	63	19	0	7
2018–19	438	27	0	9	22	68	16	31	63
2019–20	477	46	0	33	41	78	45	0	68

Note: (-) indicates data not available

Source: Response from NCOF to RTI filed by CSE[40]

Maharashtra, Odisha, Punjab and Tamil Nadu have failed quality tests (see *Table 11: State- and Union territory-wise break-up of organic fertilizer samples failing quality tests at RCOF laboratories*).

Table 11: State- and Union territory-wise break-up of organic fertilizer samples failing quality tests at RCOF laboratories

State or Union Territory	Percentage of failed samples (total samples tested)						
	2013–14	2014–15	2015–16	2016–17	2017–18	2018–19	2019–20
Andhra Pradesh	0 (43)	0 (40)	0 (63)	0 (29)	9 (11)	100 (7)	92 (12)
Assam	60 (5)	0 (2)	0 (7)	0 (24)	0 (14)	42 (26)	50 (6)
Bihar	20 (15)	80 (15)	73 (11)	83 (6)	60 (5)	0	100 (3)
Chhattisgarh	18 (11)	63 (16)	20 (20)	0 (9)	42 (19)	-	25 (4)
Goa	0 (1)	0 (4)	-	0 (16)	0 (4)	-	0 (8)
Gujarat	0 (35)	0	0 (6)	0 (14)	9 (32)	30 (64)	41 (73)
Haryana	-	-	-	50 (4)	11(9)	18 (11)	33 (3)
Himachal Pradesh	-	-	-	-	0 (5)	0 (1)	-
Jharkhand	50 (2)	0 (1)	100 (2)	100 (2)	0 (1)	100 (1)	50 (2)
Karnataka	-	-	3 (217)	8 (83)	10 (107)	14 (93)	20 (10)
Karnataka (from state)						- (281)	- (546) 2020–21: 15 (318)
Kerala	-	-	4 (53)	6 (34)	4 (72)	5 (55)	36 (14)
Madhya Pradesh	20 (25)	20 (10)	64 (11)	43(21)	21 (91)	22 (144)	37 (175)
Maharashtra	21 (14)	0 (64)	0 (7)	0 (16)	0 (8)	47 (15)	85 (40)
Meghalaya	-	-	-	0 (2)	0 (1)	-	-
Nagaland	-	-	0 (3)	-	-	-	-
Odisha	0 (4)	56 (9)	0 (2)	53 (17)	55 (38)	35 (55)	35 (46)
Punjab	-	-	-	-	0 (8)	0 (16)	54 (56)
Rajasthan	-	-	-	-	20 (5)	33 (3)	90 (10)
Tamil Nadu	-	-	0 (90)	27 (41)	0 (15)	0 (6)	40 (5)
Tamil Nadu (from state)	-	-	-	-	-	-	9.2 (1,401)
Telangana	-	-	-	-	-	100 (1)	-
Tripura	-	18 (11)	5 (19)	0 (14)	0 (9)	0 (9)	-
Uttar Pradesh	-	-	-	-	33 (3)	0 (2)	100 (1)
Uttarakhand	-	-	-	-	100 (2)	0 (9)	67 (3)
West Bengal	-	-	-	-	100 (3)	-	-
Andaman and Nicobar Islands	-	-	-	-	0 (4)	-	-
Delhi	-	-	-	0 (2)	0 (6)	25 (16)	18 (11)
Jammu and Kashmir	-	-	-	-	21 (29)	43(7)	0 (1)

Note: (-) denotes that either data is not available or no samples have been tested. No data was available for any year for Chandigarh, Dadra and Nagar Haveli and Daman and Diu, Ladakh, Lakshadweep, Manipur, Mizoram, Puducherry and Sikkim

Source: Response to RTI filed by CSE[41]

Again, as is the case with biofertilizers, stakeholders point out that procurement of organic fertilizers by the government through tenders at low prices is one of the reasons for their inferior quality. Inferior quality organic fertilizers provided to farmers may not always lead to desired results in terms of nutrient augmentation in the soil or crop productivity. The subsidization also fails to encourage farmers to purchase at unsubsidized price from the open market.

Mystery of testing organic fertilizers not approved by FCO

Many organic fertilizers not approved under FCO are nevertheless tested for quality at the laboratories. In 2016–17, not a single sample of the 280 samples of organic fertilizers tested failed the quality tests. All these results were from only two laboratories: RCOF, Jabalpur and RCOF, Bhubaneshwar. RCOF laboratories at Bengaluru, Ghaziabad and Imphal also tested samples but no results were reported. RCOF, Panchkula did not test any samples of organic fertilizers not approved under FCO (see *Table 12: Results of non-FCO approved organic fertilizer sample quality testing*).

Table 12: Results of non-FCO approved organic fertilizer sample quality testing

Testing laboratory	2016–17		2017–18	
	Samples tested	Samples found non-standard (per cent)	Samples tested	Samples found non-standard (per cent)
RCOF, Ghaziabad	64	0	50	-
RCOF, Panchkula	0	0	-	-
RCOF, Jabalpur	36	0	7	100
RCOF, Bhubaneswar	0	0	58	76
RCOF, Imphal	64	0	14	-
RCOF, Nagpur	16	0	-	-
RCOF, Bengaluru	100	0	115	-
Total	280	0	244	21

Source: NCOF annual reports

In 2018–19 and 2019–20, 176 and 11 non-FCO samples were tested by all RCOFs. In 2018–19, 5 per cent samples failed the test and in 2019–20, no sample failed the test.[42]

MASS MEDIA HIGHLIGHTS THE ISSUE OF AVAILABILITY AND SALE OF SPURIOUS ORGANIC FERTILIZERS AND BIOFERTILIZERS

Numerous news reports in local media in Bihar, Chhattisgarh, Haryana, Madhya Pradesh, Maharashtra, Rajasthan and Uttar Pradesh between 2018 and 2020 highlight issues arising due to poor quality of organic fertilizers and biofertilizers available in the market. The major issues include:

- **Related to companies:** Fake companies selling fake organic fertilizers; illegal manufacturing units being busted; unapproved organic fertilizers and biofertilizers with fake labels being sold; and companies with dubious names branding their products similar to big brands[43,44, 45,46,47, 48,49,50, 51,52, 53, 54, 55,56, 57,58,59,60, 61&62]

- **Related to state agriculture departments:** Involvement of local agriculture department officials in sale of spurious organic fertilizers and biofertilizers by not performing quality tests and allowing sale of spurious, substandard and fake products; corruption allegations against local government officials related to distribution of substandard products to farmers; inaction by officials against illegal practices despite being aware of them; and court cases filed by agriculture departments on other state government departments involved in purchase of organic fertilizers[63,64,65,66,67,68,69&70]

- **Related to laboratory results:** Samples failing quality tests in one laboratory passing in another[71]

- **Related to farmer complaints:** Crops destroyed due to fake products[72,73&74]

5.3 Massive potential of organic fertilizer sources

Several organic sources can be used to supply nutrients to soil and crops. These include animal wastes; field crop and horticulture crop residues; roadside forestry and social forestry wastes, municipal solid waste compost; food waste; and waste from the agro-industry. Over the years, a few comprehensive estimates have been made to quantify the availability and potential of such sources.

A 2020 paper published by the Indian Institute of Soil Science—an Indian Agricultural Research Institute in Bhopal—states that based on 2017–18 data, the quantity of actually available organic material is 365.37 million tonne, which is 35 per cent of the potential availability (estimated at 1056.1 million tonne). According to the paper, this figure of actual availability is based on three sources only, and consist of 57 per cent share of crop residues, 39.5 per cent livestock dung and 2.6 per cent of municipal solid waste.

Earlier, a 2010 estimate by the National Academy of Agriculture Sciences puts the quantity of available organic material at 1,566 million tonne. This includes animal wastes; field crop and horticulture crop residues; roadside forestry and social forestry wastes; and municipal solid waste compost. The estimate mentions

that the potential nitrogen–phosphorus—potassium (NPK) nutrient supply from these organic sources works out to 47.3 million tonne. This is more than the 34 million tonne current nutrient consumption in crop production in India as per an estimate of Indian Institute of Soil Science published in July 2020. The National Academy of Agriculture Sciences estimate also revealed that the quantity of nutrients utilized from organic sources was 12.86 million tonne, i.e., 27 per cent of the potential.

Indian Institute of Farming Systems Research has estimated the quantity of organic waste that would be required under different scenarios to replace chemical fertilizers as the source of nutrients for crops by 2050. India will need 730 million tonne of organic waste to substitute 25 per cent of inorganic fertilizers, if biological nitrogen fixation is also made use of and organic nutrient utilization efficiency is increased from 27 per cent to 50 per cent. Similarly, 1,440 million tonne of organic waste would be required if 50 per cent of inorganic fertilizers are to be substituted. Biological nitrogen fixation takes place through biofertilizers; green manures; green leaf manures; leguminous plants; including pulses; intercropping and crop rotation with legumes; etc.

A few other estimates made earlier highlight that only 5 per cent crop residues are recycled and only about one–third of the dung produced in India is recycled back into agriculture.[75] Similarly, not even 5 per cent organic waste generated by cities is converted into compost.[76] Similarly, food waste and agro-industry wastes are also not utilized properly. A study by Central Institute of Post-Harvest Engineering and Technology (CIPHET) highlights that every year 67 million tonne of food waste does not get composted in India.[77]

Many also question using the same NPK approach to calculate nutrients in organic fertilizers that is used to calculate the nutrient value of inorganic fertilizers. It is contended that doing so leads to incorrect calculation of demand and supply as the approach ignores the role of organic fertilizers in improving the overall soil health and biology that, in turn, helps in better solubilization and mobilization of nutrients from soil and air with the help of microorganisms.

The potential of on-farm inputs is increasingly being discussed and accepted. Indian Council of Agricultural Research institutions, with Indian Institute of Farming Systems Research as the focal point, has developed one-acre Integrated Organic Farming System models in several states under the scheme “All India Network Programme on Organic Farming”. These models promise to meet 70–90 per cent of organic input requirement on the farm itself within two years of

operation. In addition, natural farming adopted on 4.9 lakh hectare in eight states as per Bhartiya Prakritik Krishi Padhati under the Paramparagat Krishi Vikas Yojna scheme is based on on-farm inputs.

5.4 Approaches to promote organic fertilizers and on-farm inputs

Many different approaches could be taken to promote and upscale the production of organic fertilizers and on-farm inputs. These include support for individual and small manufacturers of organic fertilizers, state initiatives to involve community in production, promotion of sale of locally-made on-farm inputs through local shops, and training farmers for on-farm input production. These approaches can be combined with efforts aimed at ensuring quality manufacturing or organic fertilizers at a large scale. A few successful case studies have been highlighted in the *Box: Successful organic fertilizer initiatives*.

SUCCESSFUL ORGANIC FERTILIZER INITIATIVES

Godhan Organics is a manufacturer and supplier of vermicompost. Started in 2018 by Karambir Agarwal, Godhan is based in Bahadurgarh, Haryana. It manufacturers up to 400 tonne vermicompost per month and has the capacity to manufacture up to 1,000 tonne. The company has signed a memorandum of understanding with the Bahadurgarh municipality, under which the municipality provides the company cattle dung collected from the city streets under Swachh Bharat Abhiyan. The company also purchases cow dung from nearby *gaushalas* at Rs 0.5 per kg. It also uses segregated vegetable waste, hotel waste and agro-waste. The bulk sale price of vermicompost is Rs 5–6 per kg. Godhan Organics has an annual sale of around Rs 1.5 crore, with a net profit of 15–20 per cent. Karambir suggests that to upscale vermicompost manufacturing, government should create awareness among compost consumers, and provide subsidy assistance, laboratory testing and market support to smaller manufacturers.

SJ Organics, led by Sana Khan, has been manufacturing vermicompost in Meerut, Uttar Pradesh, since 2013. The company has also collaborated with a group of several small-scale vermicompost producers. It purchases from them and sells the vermicompost under its brand. The company purchases cattle dung directly from private contractors and collectors of cattle dung at Rs 0.4–0.6 per kg. It sells to nurseries, retailers, *beejbhandar*s, and as per government tenders of the horticulture department for their nurseries, but not to farmers. The company sells vermicompost at Rs 5–20 per kg. Its annual turnover is more than Rs 1 crore and it is also exporting vermicompost.

Chhattisgarh's Godhan Nyay Yojana was launched in July 2020. The scheme was launched to increase the income of farmers and cattle ranchers, promote organic compost, reduce chemical fertilizer use and improve soil health. The scheme involves local self-help groups and community members to make vermicompost. Cattle dung is purchased at Rs 2 per kg from rural areas and vermicompost is sold back to local farmers at a fixed price of Rs 8 per Kg through cooperatives. This initiative has the potential to make organic manure easily available to farmers locally while addressing the issue of stray cattle at the same time, if implemented in close collaboration with the local community.

Andhra Pradesh's Community Managed Natural Farming Programme aims to provide support and training to promote need-based input shops for easy availability of inputs like *jeevaamrutham*, *ghanjeevamrutham*, *agniasthrams*, *brahmaasthrams*, etc. in each village. Local infrastructure like cattle-shed linings, tanks and custom hiring centres are being established to help on-farm input preparation and usage. These arrangements involve participation of farmer groups, self-help groups and local NGOs.

Government of Sikkim has been training farmers on on-farm production of organic inputs, so that farmers don't have to depend on external inputs. Financial incentives are also provided to make vermicompost pits and rural compost pits. Funds from various government schemes— Mission Organic Value Chain Development for North Eastern Regions and Paramparagat Krishi Vikas Yojna—are utilized for these initiatives. Due to shortage of funds, financial support is not provided to all farmers, but training support is given to all. These trainings encourage usage of multiple combinations of organic inputs.

The Himachal Pradesh government is focusing on providing natural farming training to farmers, encouraging them to prepare on-farm inputs. The government is providing assistance in the form of trainings, purchase of indigenous cows, drums for input storage, cowshed lining for urine collection and *sansadhan bhandars* for preparation and sale of various natural farming formulations.

EVIDENCE ON HOLISTIC BENEFITS OF ORGANIC AND NATURAL FARMING

Centre for Science and Environment's report 'Evidence on Holistic Benefits of Organic and Natural Farming in India', February 2022 makes it abundantly clear that organic and natural farming have several holistic benefits over chemical-dependent inorganic farming. The former is not only more profitable and sustainable but also productive over time. The report also finds that organic and natural farming also fare better than integrated farming (a mix of inorganic and organic approaches) on profitability and sustainability, while being at par with it in terms of productivity.

The report analyzed and consolidated evidence collected between 2004 and 2020 from two sets of sources. The first source was the All-India Network Project on Organic Farming (AI-NPOF), led by Indian Institute of Farming System Research (IIFSR) of the Indian Council of Agricultural Research (ICAR). Currently, AI-NPOF is being implemented across 20 centres in 16 states. The other source is a set of 90 unique Indian scientific studies on different aspects of organic and natural farming published or presented between 2010 and 2020. These studies reflect evidence from different geographies, settings and stakeholders on issues that are not limited to those captured in the AI-NPOF project and add more diversity to the overall evidence as well as complement it.

Based on long-term results of AI-NPOF (2014–19), productivity (crop yield) of organic farming is significantly higher than that of inorganic farming and almost equal to that of the integrated approach across 31 select crops from five food groups—vegetables, oilseeds, pulses, spices and cereals. The scientific studies show that in comparison to the inorganic approach, yields improve over time with organic inputs and bio-inputs.

In case of profitability (cost of cultivation, income and livelihood), based on AI-NPOF results from 2014–19, gross returns, net returns and benefit–cost ratio are better with the organic approach. This is despite the high cost of cultivation observed with the organic approach, largely due to external procurement of organic or bio-inputs for experimental farms. The scientific studies yielded similar findings, except in cultivation costs, which they found to be lower with organic farming due to on-farm inputs. With natural farming, all parameters were favourable due to low input costs and possibility of regular income due to multi-cropping.

In terms of sustainability (soil health and environment), AI-NPOF showed that the organic approach resulted in better health of soil macro- and micro-nutrients, organic carbon and rhizosphere microbial population bacteria, fungi, soil actinomycetes and phosphate-solubilizing bacteria than the inorganic approach. It also fared better than the integrated approach in all aspects.

The scientific studies also favoured organic results in the above parameters, with additional benefits on earthworms, soil moisture content, soil water holding capacity and biodiversity. Moreover, organic farming showed other benefits related to carbon sequestration and pools, and lower carbon dioxide and nitrous oxide emissions. With natural farming, in addition to the benefits seen with the organic approach, studies also pointed towards resilient crops, energy and water efficiency and conservation, plant and animal biodiversity, and climate change mitigation.

On food quality, AI-NPOF results showed that the organic approach fares slightly better than integrated farming and significantly better than inorganic farming. Other scientific studies similarly favoured organic farming, even with several additional crops and parameters.

6. Barriers in the growth of biofertilizers and organic fertilizers

Extensive research and interaction with relevant stakeholders (government, manufacturers and farmers) from across the country has revealed several barriers in the growth of biofertilizers and organic fertilizers. These barriers include:

A. Related to governments at the Centre and in states

1. Funds, subsidies and support for promotion of biofertilizers and organic fertilizers

- Total budgetary allocation to promote organic and natural farming is very low compared to the requirements
- A level-playing field is missing for manufactures of biofertilizers and organic fertilizers as well as for farmers willing to use non-chemical fertilizer options because of the heavy subsidies afforded to chemical fertilizers
- Total funds spent on promotion of biofertilizers and organic fertilizers is limited despite being allocated as part of multiple schemes(PKVY, MOVCDNER, NFSM, NMOOP etc.) aimed at farmers
- Funds under schemes like Capital Investment Subsidy scheme Soil Health Management aimed at providing support infrastructure for biofertilizer and organic fertilizer manufacturing have not seen much uptake in states and remained underutilized
- Market development assistance for promoting city compost has been discontinued, which can severely limit the uptake of municipal solid organic waste as a source for organic manure
- Very low budgetary allocation has been reserved for research and development of biofertilizers in public research institutions
- There is inadequate support for farm-level extension, training of farmers and local small manufactures
- Production of biofertilizers and organic fertilizers is concentrated in a few states. Only a handful are producing most of the total of each category of non-chemical fertilizers
- There is low production capacity utilization which is linked to limited demand which, in turn, is related to limited government support for promotion of non-chemical fertilizers

- State initiatives are largely limited to implementation of Central schemes despite huge scope for production- and procurement-related support

2. Quality control

- Local-level implementation of FCO and monitoring mechanisms lack credibility and trust
- Sample collection and testing is inadequate. Bias in sample collection at the local-level has been observed
- Only eight states have government-owned notified testing laboratories. Overall testing capacity underutilized
- Samples are increasingly failing to meet criteria specified under FCO—a sign either of declining quality of tested samples or the fact that tests were not properly performed earlier
- Credibility of the testing process is lost due to samples of products not approved under FCO also being tested. Products that cannot be tested as per FCO continue to be available in the market
- State procurement through tenders at low-prices is also cited as a reason for the poor quality of biofertilizers and organic fertilizers being distributed
- Limited legal action against defaulters and violators also leads to loss of credibility of the enforcement mechanisms
- Training of laboratory and inspecting personnel is inadequate
- Stakeholders and local media often highlight cases of corruption involving local officials responsible for quality control of non-chemical fertilizers and the potential impact on quality of biofertilizers and organic fertilizers

3. Data collection and reporting

- A national compilation of test results is not available, hampering an understanding of the countrywide state and quality of non-chemical fertilizers
- Often, results of tests are not even disclosed in public domain at the state level, and it is difficult to establish the quality of biofertilizers and organic fertilizers at the state level
- Data on production of biofertilizers and organic fertilizers shows significant variations between years, with no explanation offered for the variations, and this can adversely impact policy and decisions

B. Related to manufacturers of biofertilizers and organic fertilizers

- Low and uncertain demand prevents biofertilizer and organic fertilizer industry from optimally utilizing its capacity and discourages more investment in the industry. Farmers are not very aware of the benefits of non-chemical

fertilizers. Dealers are also not very interested in buying and selling them

- Availability of spurious and fake biofertilizer and organic fertilizer products in the market leads to loss of trust among farmers and discourages genuine manufacturers
- Corruption in securing licences and authorizations for manufacturing, selling and quality testing of biofertilizers and organic fertilizers acts as a hindrance to their manufacture and sale
- Limited government support for production, promotion and procurement of biofertilizers and organic fertilizers hampers production and sale
- Technology transfer from laboratories to the biofertilizer and organic fertilizer manufacturing industry is slow and cumbersome. Good quality microorganism strains are not easily available. Some identified strains have yet to be fully commercialized. Availability of strains suitable to different agro-environments is a cause of concern for the industry
- Whether small and medium manufacturers are ready to move to liquid biofertilizers from solid carrier-based biofertilizers is a concern, especially in view of changing demand due to advantages like greater shelf life, transport and storage that liquid biofertilizers have over solid carrier-based biofertilizers
- There is limited involvement of state agriculture universities and Krishi Vigyan Kendras in the production of biofertilizers or organic fertilizers

C. Related to farmers

- There is a lack of awareness regarding optimum practices related to organic and natural farming, which involves usage of biofertilizers and organic fertilizers
- Consequently, there is limited confidence in the ability of organic and natural farming approaches to match the crop yield obtained through the chemical-based approach
- Adequate quantities of quality biofertilizers and organic fertilizers are not available at the local level
- Use of biofertilizers, organic fertilizers and on-farm inputs is labour-intensive in comparison to chemical fertilizers.
- There is lack of awareness among farmers regarding usage and storage conditions of biofertilizers. Farmers are not adequately trained regarding non-chemical fertilizer approaches
- There is a perception that non-chemical options alone cannot result in the desired crop yield. They can only play a supplementary role
- There is lack of motivation and trust among farmers regarding biofertilizers and organic fertilizers. This is linked with poor results from use of inferior quality and substandard non-chemical fertilizer products distributed by local authorities and spurious and fake products available in the market

7. Recommendations and the way ahead

Use of biofertilizers and organic fertilizers is dependent on the adoption of organic and natural farming or an integrated approach. An increase in the use of biofertilizers and organic fertilizers will, in turn, reduce the dependence on chemical fertilizers, and increase soil fertility and health in the longer term.

Many government programmes support organic farming. The government has also expressed a desire to make natural farming a mass movement. The key questions remains: How do we go about it?

There are several aspects for achievement of success in the domain of organic and natural farming. Availability of quality biofertilizers and organic fertilizers at an affordable price is the most crucial factor in this transition.

The sectors of biofertilizers and organic fertilizers are relatively unorganized and unregulated compared to the chemical fertilizer sector and receive much less attention and support from the governments at the Centre and state. However, biofertilizer and organic fertilizer sectors are at different stages of maturity and consolidation. There is a difference in their producers, the nature of products and their acceptance among farmers. While there is some convergence in the way ahead in their promotion, both of them also require specific actions. The recommended interventions include:

A. A targeted, ambitious and well-funded nation-wide programme must be developed to drive the change towards organic and natural farming.

This includes bringing together different ministries and several programmes and outlining the Centre–state relationship in terms of funds, accountability and coordination. It must also establish strong drivers such as a vibrant market that benefits farmers while addressing existing barriers in the adoption of organic and natural farming. Doing so would require strong political commitment and will at the Centre and state levels.

B. Quality of biofertilizers and organic fertilizers must be ensured by developing and institutionalizing a robust monitoring and enforcement mechanism in collaboration with Centre and states across the country:

- This should include greater sampling frequency, and more testing, supported by a wider and enhanced laboratory network, followed by annual disclosure of collated results in the public domain
- Testing of products and their approval should be strictly in line with FCO
- This should also include audit and inspection of manufacturing, distribution and selling entities to ensure that fake, sub-standard, misbranded and mislabelled products are not registered, manufactured and available in the market
- Tracking of all sales should happen and be enabled through digitization
- Legal and fiscal deterrent action should be taken against defaulters and violators. Similarly, reports related to corruption at the local level should be strictly addressed
- States should procure and distribute only good quality biofertilizers and organic fertilizers, tested as per the FCO, to farmers

C. Production and availability of biofertilizers and organic fertilizers must be ensured and their use must be promoted through multiple approaches by the Centre and states:

- Corrective measures should be introduced so that infrastructure support to produce biofertilizers and organic fertilizers is augmented and has more uptake. The non-chemical fertilizer sector must be provided support to move to better options (such as from solid to liquid biofertilizers) and for timely leveraging of public research
- Transferring subsidy from chemical fertilizers to production and promotion of biofertilizers and organic fertilizers must be considered. Provision of incentives to companies selling non-chemical fertilizers should also be considered
- Existing supply chains of big fertilizer cooperatives must be utilized to make available and distribute biofertilizers and organic fertilizers
- Market development assistance scheme (applicable for city compost until 30 September 2021) should be considered for reintroduction as well as expansion to other biofertilizers and organic fertilizers
- Farmers should also be incentivized for using biofertilizers and organic fertilizers in order to save natural resources, prevent ecological damage and help to mitigate effects of climate change. Offering payments for ecosystem

services provided by biofertilizers and organic fertilizers should be considered and a mechanism should be developed and mainstreamed in this regard

Specific to organic fertilizers

- Through a structured programmatic intervention involve community, local institutes, rural cooperatives, farmer organizations, self-help groups, *gaushalas* and local small-scale entrepreneurs in production and distribution of organic fertilizers like vermicompost, farm yard manure and organic manure. Such a programme will provide co-benefits such as livelihood opportunities, waste recycling and management, and resource efficiency at the local level
- There must be investment in building capacity and training small-scale manufacturers and entrepreneurs on composting techniques, quality assurance, and marketing and selling manure to upscale production
- There must be capacity building of agriculture extension officials through modification in educational curriculum and professional on-the-job trainings to train and assist farmers on organic fertilizer production and on-farm inputs
- Farmers should be mobilized and trained to produce on-farm inputs through farmer-field schools, using information and communication tools, regular hand-holding, interaction with a pool of experts, mainstreaming best practices, and exposure visits, along with support for tools required for such inputs
- States should develop structured programmatic interventions to use existing unutilized organic sources like crop residues, agro-industry waste, and municipal organic waste for city compost. Upscaling these programmatic interventions can help overcome issues of stubble burning and help prioritize recycling of surplus biomass generated on-farm instead of converting it to non-farm usage like waste-to-energy or eco-friendly products
- Invest in developing newer and cost-effective technologies for effective and efficient composting and ensure wide-scale adoption of such technologies

Annexures

Annexure 1: Fertilizer consumption in states and Union territories (per hectare, 2019–20) and soil deficiency (2015–16 to 2018–19)

State or Union territory	Overall rank in country in per ha fertilizer consumption	Nutrient-specific							
		Organic carbon		Nitrogen		Phosphorus		Potassium	
		Rank in country	Deficient samples (per cent)	Rank in country	Deficient samples (per cent)	Rank in country	Deficient samples (per cent)	Rank in country	Deficient samples (per cent)
Bihar	1	10	82	10	100	15	92	5	95
Puducherry	2	24	50	4	100	7	98	26	67
Punjab	3	2	99	25	95	13	94	18	73
Haryana	4	1	99	5	100	10	95	19	71
Telangana	5	11	81	20	98	32	64	28	64
Andhra Pradesh	6	21	69	17	99	33	40	30	58
Uttar Pradesh	7	3	97	12	100	8	97	3	97
West Bengal	8	9	84	18	99	34	34	16	76
Tamil Nadu	9	5	95	6	100	28	73	23	69
Karnataka	10	16	74	29	85	30	73	29	61
Delhi	11	18	74	11	100	2	99	32	54
Uttarakhand	12	15	75	14	99	31	71	11	86
Gujarat	13	17	74	16	99	26	77	31	57
Maharashtra	14	12	81	27	92	29	73	33	37
Chhattisgarh	15	14	78	19	98	22	83	22	70
Madhya Pradesh	16	19	74	15	99	9	96	27	67
Odisha	17	8	86	13	100	12	94	13	83
Himachal Pradesh	18	27	29	26	95	27	75	25	68
Rajasthan	19	4	97	1	100	19	91	17	74
Assam	20	23	54	32	67	11	94	4	96
Jharkhand	21	22	64	22	97	20	89	10	87
Manipur	22	32	11	8	100	23	83	9	89
Jammu and Kashmir	23	25	46	31	82	14	92	7	93
Kerala	24	26	38	3	100	24	80	15	77

State or Union territory	Overall rank in country in per ha fertilizer consumption	Nutrient-specific							
		Organic carbon		Nitrogen		Phosphorus		Potassium	
		Rank in country	Deficient samples (per cent)	Rank in country	Deficient samples (per cent)	Rank in country	Deficient samples (per cent)	Rank in country	Deficient samples (per cent)
Tripura	25	20	74	24	95	21	84	6	94
Mizoram	26			9	100	1	99	2	98
Goa	27	28	22	30	83	16	92	20	70
Andaman & Nicobar Islands	28	6	94	7	100	3	99	1	98
Lakshadweep	29	-	-	-	-	-	-	-	-
Daman and Diu	30	13	80	2	100	18	91	34	21
Dadar & Nagar Haveli	31	13	80	2	100	18	91	34	21
Meghalaya	32	29	21	23	96	5	98	8	92
Nagaland	33	31	12	33	40	6	98	14	83
Arunachal Pradesh	34	33	11	34	15	4	98	12	85
Sikkim	35	34	3	21	97	25	77	24	69
Chandigarh	36	-	-	-	-	-	-	-	-

Note: (-) Indicates data not available

Source: CSE analysis based on fertilizer consumption and soil health data

Annexure 2: Biofertilizer and organic fertilizer production units under Capital Investment Subsidy scheme (CISS) and Soil Health Management (SHM), and funds released

State	Biofertilizer production units under CISS (2004–17)*		Fruit and vegetable compost units under CISS (2004 to 30 July 2020)		Biofertilizer production units under SHM (2014–15 to 2018–19)	
	No. of units	Funds released (Rs lakh)	Number of units	Funds released (in Rs lakh)	Number of units	Funds released (in Rs lakh)
Andhra Pradesh	4 + 1	70.66	2	48.00	-	-
Arunachal Pradesh	-	-	-	-	1	36
Assam	3 + 2	53.12	2	42.94	1	23.43
Bihar	-	-	1	4.12	-	-
Delhi	-	-	1	20	-	-
Goa	1	20.00	1	11.6	-	-
Gujarat	6 + 1	140.83	1	4.77	-	-
Haryana	1	17.07	1	63	-	-
Himachal Pradesh	2	45.54	-	-	-	-
Karnataka	6	145.57	8	339.68	-	-
Kerala	3	40.69	2	21.29	-	-
Madhya Pradesh	1	40.00	1	2.26	-	-
Maharashtra	10 + 12	149.89	1	35.71	-	-
Meghalaya	1	5.67	-	-	1	108
Manipur	-	-	1	17.53	-	-
Punjab	5 + 1	43.07	-	-	-	-
Rajasthan	1	8.25	-	-	-	-
Sikkim	-	-	-	-	1	144
Tamil Nadu	5	93.82	4	148.33	2	144
Telangana	5	87.52	-	-	1	144
Tripura	1	20.00	-	-	1	108
Uttarakhand	2	27.00	-	-	-	-
Uttar Pradesh	2 + 1	80	1	19.18	2	160
West Bengal	2	13.90	1	15.13	-	-
Total	61 + 18	1,102.61	28	793.55	10	867.43

Note: (-) Indicates data not available; * Units added between 2018 and August 2020 are shown with + sign. Funds released for these are not available

Source: Rajya Sabha unstarred question 1,281, production of organic manure through agricultural wastes and animal dung, answered on 30 July 2021; and Ministry of Agriculture and Farmers' Welfare and subsidy released for biofertilizer units since inception of National Project on Organic Farming through NABARD[78]

Annexure 3: Solid biofertilizer manufacturers and their production and capacity utilization

Company	Location	Capacity (tonne)	Biofertilizer products	Production				Capacity utilization in 2019–20 (per cent)
				2016–17 (tonne)	2017–18 (tonne)	2018–19 (tonne)	2019–20 (tonne)	
Brahmputra Valley Fertilizer Corporation Ltd	Assam	100	Phosphate-solubilizing bacteria (PSB) and Azotobacter	25.47	35.75	44.23	38.53	39
The Odisha Agro-Industries Corporation Ltd	Odisha	30	PSB, Rhizobium, Azotobacter and Azospirillum	-	-	-	-	-
Bidhan Chandra Krishi Viswavidyalaya	West Bengal	61	PSB, Rhizobium, Azotobacter and Azospirillum	3.63	2.37	-	-	-
State biofertilizer production unit	Mizoram	4	PSB, Rhizobium, Azotobacter and Azospirillum	2	2.5	2.5	-	-
Department of Agriculture, Government of Nagaland	Nagaland	20	PSB, Rhizobium, Azotobacter and Azospirillum	12	-	-	-	-
Cooperative Rural Development Trust, IFFCO	Phulpur, Uttar Pradesh	1,000	PSB, Rhizobium, Acetobacter, Azotobacter and Azospirillum	69.42	-	-	-	-
Krishak Bharati Cooperative Ltd	Uttar Pradesh	150	Potassium-mobilizing biofertilizer (KMB), PSB, Rhizobium, Acetobacter, Azotobacter and Azospirillum	-	-	-	-	-
Shri Ram Solvent and Extraction Pvt Ltd	Uttarakhand	500	KMB, PSB, Rhizobium, Acetobacter, Azotobacter and Azospirillum	297.53	159.56	61.2	97.91	20
K.C.P. Sugar and Industries Corporation Ltd	Andhra Pradesh	1,200	PSB, Rhizobium, Azotobacter, Azospirillum and Mycorrhiza	0.75	0.21	-	-	-
Sneha Biotech	Andhra Pradesh	406	Nitrogen fixers and PSB	-	-	-	-	-
Multiplex Biotech Pvt Ltd	Karnataka	1,450	Rhizobium, Azotobacter, Azospirillum, PSB, Vesicular Arbuscular Mycorrhizae (VAM), poluculture and KMB	414.17	634.8	1416.1	1265	87
Madras Fertilizer Ltd	Karnataka	100	Azospirillum and PSB	25.84	3.28	-	-	-
Agro-Biotech Research Centre Ltd	Kerala	1,200	PSB, Rhizobium, Azotobacter, Azospirillum and biopotash	-	-	-	-	-
The Fertilizers and Chemicals Travancore Ltd	Kerala	150	Rhizobium, Azospirillum and PSB	125.68	35.28	8.04	120.2	80
Central Soil and Plant Health Centre	Kerala	20	Azospirillum and VAM	16.78	19.61	24.74	-	-
Puducherry Agro-Service and Industrial Corporation	Puducherry	75	Rhizobium, Azospirillum and PSB	3.47	9.41	-	-	-

Company	Location	Capacity (tonne)	Biofertilizer products	Production				Capacity utilization in 2019–20 (per cent)
				2016–17 (tonne)	2017–18 (tonne)	2018–19 (tonne)	2019–20 (tonne)	
Madras Fertilizer Ltd	Tamil Nadu	250	Rhizobium, Azospirillum and PSB	110.74	83	150.08	47.04	19
SIMA Cotton Development and Research Association	Tamil Nadu	150	Azospirillum and PSB	6	6	4	5	3
Tamil Nadu Agriculture University	Tamil Nadu	58	Rhizobium, Azospirillum, PSB and VAM	-	-	-	-	-
Tamil Nadu Cooperative Sugar Federation	Tamil Nadu	40	Acetobacter, Arbuscular Mycorrhizae, PSB and VAM	188.21	151.86	41.04	-	-
Bacterial Culture Production Laboratory	Telangana	140	Rhizobium, Azospirillum, PSB, KSB and Azotobacter	101	130.1	98.4	100.4	72
Gujarat State Cooperative Marketing Federation Ltd	Gujarat	now closed	Rhizobium, Azospirillum and PSB	-	-	-	-	-
Cooperative Rural Development Trust, IFFCO	Gujarat	330	PSB, Rhizobium, Acetobacter, Azotobacter and Azospirillum	12.2	-	-	-	-
Agri-Business and Development Cooperative	Madhya Pradesh	150	PSB, Rhizobium and Azotobacter	67.94	78.8	97.9	-	-
NAFED Biofertilizer	Madhya Pradesh	450	PSB, Rhizobium and Azotobacter	286.13	-	-	-	-
Indore Biotech Input and Research Pvt Ltd	Madhya Pradesh	4,500	PSB, KMB, Rhizobium, Azotobacter and Azospirillum	-	-	-	-	-
M.P. state Agro-Industries Development Corporation (biofertilizer plant)	Madhya Pradesh	150	Rhizobium, Azotobacter and PSB	-	-	-	-	-
National Fertilizers Ltd	Madhya Pradesh	130	Rhizobium, Azotobacter and PSB	104.54	130.04	159.23	173.1	133
Agricultural Development Trust's Krishi Vigyan Kendra	Maharashtra	40	Rhizobium, Azotobacter, PSB and KMB	-	-	-	-	-
Krishak Bharati Cooperative Ltd	Maharashtra	150	Rhizobium, Azotobacter, PSB, KMB, Azospirillum and Acetobacter	-	-	-	-	-
Mahatama Phule Krishi Vishwavidhyapeeth	Maharashtra	50	Rhizobium, Azotobacter, PSB, Azospirillum, Acetobacter, blue-green algae and compost culture	19.67	18.17	16.09	-	-
Om Agro Organics	Maharashtra	450	Rhizobium, Azotobacter and PSB	60	-	-	-	-
Sahakarmaharshi Bhausaheb Thorat S.S.K. Ltd	Maharashtra	400	Azotobacter and PSB	5.49	-	-	-	-

Company	Location	Capacity (tonne)	Biofertilizer products	Production				Capacity utilization in 2019–20 (per cent)
				2016–17 (tonne)	2017–18 (tonne)	2018–19 (tonne)	2019–20 (tonne)	
Sahakar Maharshi Shankarrao Mohite-Patil Sahakari Karkhana Ltd	Maharashtra	150	PSB	7	6.12	8.96	7.73	5
Kan Biosys Pvt Ltd	Maharashtra	450	Azotobacter, PSB and Azospirillum	147.51	293.26	-	-	-
Jaipur Biofertilizers	Rajasthan	10,600	PSB, KMB, Azospirillum, zinc-solubilizing bacteria and Mycorrhiza	289	385	-	-	-
Total : 36 companies	-	25,104	-	2,402.16	2,185.1	2,132.5	1,855	7
Contribution of these 36 companies in India's total solid biofertilizer production (per cent)	-	-	-	2.2	1.8	2.9	2.3	-

Note: (-) Indicates data not available

Source: Biofertilizer Statistics 2019–20, the Fertilizer Association of India

Annexure 4: Liquid biofertilizer manufacturers and their production and capacity utilization

Company	Location	Capacity (litre)	Biofertilizer products	Production				Capacity utilization in 2019–20 (per cent)
				2016–17 (litre)	2017–18 (litre)	2018–19 (litre)	2019–20 (litre)	
Cooperative Rural Development Trust, IFFCO	Odisha	200,000	Azotobacter, Acetobacter, Rhizobium, potassium-mobilizing biofertilizer (KMB), phosphate-solubilizing bacteria (PSB) and zinc-solubilizing biofertilizer (ZSB)	45,003	53,170	95,029	113,085	57
Cooperative Rural Development Trust, IFFCO	Aonla, Uttar Pradesh	100,000	Azotobacter, Acetobacter, Rhizobium, PSB, KMB and ZSB		109,407	147,436	178,764	179
Cooperative Rural Development Trust, IFFCO	Phulpur, Uttar Pradesh	600,000	Azotobacter, Acetobacter, Rhizobium, PSB, KMB and ZSB	636,377	549,816	489,614	474,750	79
Krishak Bharati Cooperative Ltd	Uttar Pradesh	100,000	Azotobacter, Acetobacter, Rhizobium and PSB	1	-	-	-	-
West Coast Harbo Chemical Ltd	Karnataka	6,000	PSB and KMB	3,890	4,820	5,000		
Agro-Biotech Research Centre	Kerala	-	-	-	-	-	-	-
Tamil Nadu Cooperative Sugar Federation	Tamil Nadu	120,000	PSB and Acetobacter	-	-	112,360	-	-
Tamil Nadu Agriculture University	Tamil Nadu	100,000	Rhizobium, Azospirillum, PSB and Vesicular Arbuscular Mycorrhizae (VAM)	-	-	-	-	-
Krishak Bharati Cooperative Ltd	Gujarat	2,500,000	Azotobacter, Acetobacter, Rhizobium, PSB, KMB and ZSB	575,470	514,260	700,850	758,820	30
Anand Agriculture University	Gujarat	450,000	Azotobacter, Rhizobium, Azospirillum, PSB and KMB	8,427	6,909	8,375	9,150	2
Cooperative Rural Development Trust, IFFCO	Gujarat	475,000	Azotobacter, Acetobacter, Rhizobium, PSB, KMB and ZSB	131,510	153,862	2,326	260,920	55
Gujarat Agro-industries Corporation Ltd	Gujarat	670,000	Azotobacter, Rhizobium, Azospirillum, PSB, and KMB	295,887	304,806	229,327	170,518	25
Gujarat State Fertilizers and Chemicals Ltd	Gujarat	175,000	Azotobacter, Azospirillum and PSB	22,850	17,860	33,870	45,070	26
Indore Biotech Input and Research (P) Ltd	Madhya Pradesh	4,500,000	Azotobacter, Rhizobium, Azospirillum, PSB and KMB	-	-	-	-	-
National Fertilizers Ltd	Madhya Pradesh	130,000	Rhizobium, Azotobacter, PSB and ZSB	104,430	93,310	108,230	114,230	88
Sahakarmaharshi Bhausaheb Thorat S.S.K. Ltd	Maharashtra	11,000	Azotobacter, Acetobacter and KMB	6,650	5,123	2,369	2,493	23
Sahakar Maharshi Shankarrao Mohite-Patil SahakariKarkhana Ltd	Maharashtra	16,800	Azotobacter and PSB	12,470	26,350	32,350	16,800	100
Vasantdada Sugar Institute	Maharashtra	55,000	Rhizophospho, Azophospho, Acetobacter DC culture, sulphur-oxidizing microorganisms, KMB	31,620	49,532	17,984	15,493	28
Krishak Bharati Cooperative Ltd	Maharashtra	100,000	Azotobacter, Rhizobium, Azospirillum and Acetobacter	531	-	-	-	-
Kan biosys Pvt Ltd	Maharashtra	320,000	Azotobacter, Azospirillum, PSB and KMB	29,984	43,730	-	-	-
Total for 20 companies	-	-	-	2E+06	1,932,954	1,985,119	2,160,093	
Contribution of these 20 companies to India's production (per cent)	-	-	-	25	21	9	7	-

Note: (-) Indicates data not available; Source: Biofertilizer Statistics 2019-20, the Fertilizer Association of India

Annexure 5: Organic fertilizer standards as per FCO, 1985, amended in July 2021

	City compost	Vermi-compost	Phosphate-rich organic manure (PROM)	Organic manure	Bio-enriched organic manure	Potash derived from Rhodophytes	Fermented organic manure	Liquid fermented organic manure
Moisture percentage by weight	Maximum 2.5	15–25	Maximum 25	Maximum 25	30–40	Maximum 5	30–40	90–97
Colour	-	Dark brown to black	-	-	-	-	-	-
Odour	-	Absence of foul odour	-	-	-	-	-	
Particle size	Minimum 90 per cent material should be able to pass through 4 mm IS sieve						Minimum 90 per cent material should be able to pass through a 4 mm IS sieve	-
Bulk density (g/cm3)	-	0.7 –0.9	Less than 1.6	Less than 1.0	Less than 1.0	-	-	-
Total viable count (N,P,K and Zn bacteria) or (N and P bacteria) or (N and K bacteria)	-	-	-	-	5×10^6 (within three months from date of manufacture)	-	-	-
Total organic carbon, per cent by weight, minimum	12	18	10	14	14	-	14	14
Total nitrogen (as N), phosphate (as P_2O_5) and potash (as K_2O) per cent by weight, minimum*	1.2	-	-	Total NPK nutrients should not be less than 3 per cent	Total NPK nutrients should not be less than 3 per cent	-	Total NPK nutrients should not be less than 1.2 per cent	1.2
Total nitrogen (as N) per cent by weight, minimum	-	1	0.4	0.5	0.8	-	-	-
Total phosphate (as P_2O_5) per cent by weight, minimum	-	0.8	8	0.5	0.5	-	-	-
Total potassium (as K_2O) per cent by weight, minimum	-	0.8	-	0.5	0.8	-	-	-
C:N ratio	< 20	-	Less than 20:1	Less than 20	Less than 18	-	Less than 20	Less than 20
pH	6.0–8.0	-	6.7	6.5–7.5	6.5– 8	-	6.5–8.0	6.5–8.0
Conductivity (as dsm-1) not more than	6	-	10	5	4	-	4	4
Pathogen	-	-	-	Nil	-	-	Nil	-
Water soluble potash, per cent by weight, minimum	-	-	-	-	-	20	-	-

	City compost	Vermi-compost	Phosphate-rich organic manure (PROM)	Organic manure	Bio-enriched organic manure	Potash derived from Rhodophytes	Fermented organic manure	Liquid fermented organic manure
Total sulphur (as S), per cent, by weight, minimum	-	-	-	-	-	1.5	-	-
Heavy metal content (as mg/kg), maximum								
Arsenic as (As_2O_3)	10	-	10	10	10	10	10	10 (on dry basis)
Cadmium (as Cd)	5	5	5	5	5	5	5	5 (on dry basis)
Chromium (as Cr)	50	50	50	50	50	50	-	50 (on dry basis)
Copper (as Cu)	300	-	300	300	300	300	300	300 (on dry basis)
Mercury (as Hg)	0.15	-	0.15	0.15	0.15	0.15	0.15	0.15 (on dry basis)
Nickel (as Ni)	50	50	50	50	100	50	50	-
Lead (as Pb)	100	100	100	-	100	100	100	50 (on dry basis)
Zinc (as Zn)	1,000	-	1,000	1,000	1,000	1,000	1,000	1,000 (on dry basis)

	Bone meal, raw	Bone meal, steamed
Moisture per cent by weight, maximum	8	7
Acid insoluble matter per cent by weight, maximum	12	
Total phosphorus (as P_2O_5) per cent by weight, minimum	20	22
Two per cent citric acid soluble phosphorus (as P_2O_5) per cent by weight, minimum	8	16
Nitrogen content of water-insoluble portion per cent by weight, minimum	3	
Particle size	The material shall pass wholly through 2.36 mm IS sieve of which not more than 30 per cent shall be retained on a 0.85 mm IS sieve	Not less than 90 per cent of the material shall pass through 1.18 mm IS sieve

*Tolerance limit: The sum total of nitrogen, phosphorus and potassium nutrients shall not be less than 1 per cent in case of city compost, 2.5 per cent in case of vermicompost and 2.8 per cent in case of organic manure. In case of PROM, the phosphate content in terms of P_2O_5 content shall not be less than 7.8 per cent

Note: (-) Indicates specifications not provided

Source: The Fertilizer (Inorganic, Organic or Mixed) (Control) Order 1985, amended up to July 2021, published by the Fertilizer Association of India

References

1. T.P. Trivedi *et al* 2010. *Degraded and Wastelands of India Status and Spatial Distribution*, Indian Council of Agricultural Research New Delhi. Available at https://icar.org.in/files/Degraded-and-Wastelands.pdf, as accessed on 18 December 2021

2. Anon 2017. "Strategies for Sustainability in Agriculture", Volume VI, *Report of the Committee on Doubling Farmers' Income*, Document prepared by the Committee on Doubling Farmers' Income, Department of Agriculture, Cooperation and Farmers' Welfare, Ministry of Agriculture & Farmers' Welfare. Available at https://agricoop.gov.in/sites/default/files/DFI%20Volume%206.pdf, as accessed on 18 December 2021

3. Kuldip Sati, Chanchal Soni and Yatika Gupta 2021. *Fertilizers Statistics 2020–21,* the Fertilizer Association of India, New Delhi

4. T. K. Chanda, Kuldeep Sati, Chanchal Soni, Rohit Chaturvedi, 2019. *Fertilizer Statistics 2018–19*, the Fertilizer Association of India, New Delhi

5. Rajya Sabha , Unstarred Question 2,738 answered on 19 March 2021, *Excessive Use of Fertilizers and Pesticides in Agriculture* (data for year 2015–16 to 2019–20)

6. Lok Sabha Unstarred Question 3,582 answered on 10 August 2021, *Data on Fertilizer Subsidy, Ministry of Chemical and Fertilizers*, Department of Fertilizer (for 2018–19 to 2020–21)

7. Anon 2020. *Study of system of fertilizer subsidy*, Fifth report, Standing Committee on Chemicals and Fertilizers, 2019–20, 17th Lok Sabha

8. Rajya Sabha unstarred question number 2,761, 19 March 2021, responded to by Ministry of Chemicals and Fertilizers

9. Lok Sabha Unstarred Question 3,582, answered on 10 August 2021, Data on Fertilizer Subsidy, Ministry of Chemical and Fertilizers, Department of Fertilizer

10. Anon 2021. *Cabinet approves Nutrient Based Subsidy (NBS) rates for Phosphatic & Potassic (P&K) Fertilizers for the year 2021-22*, 12 October 12 2021, Cabinet Committee on Economic Affairs. Available at https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1763348, as accessed on 12 November 2021

11. Lok Sabha Unstarred Question 1,071, answered on 3 December 2021, *Promotion of Alternative Fertilizers, Department of Fertilizers*, Ministry of Chemicals and Fertilizers, Government of India

12. T. K. Chanda, Kuldeep Sati, Chanchal Soni, Rohit Chaturvedi 2019. *Fertilizer Statistics 2018–19*, the Fertilizer Association of India, New Delhi

13. Rajya Sabha Unstarred Question 2,738 answered on 19 March 2021, *Excessive Use Of Fertilizers And Pesticides In Agriculture* (for year 2015–16 to 2019–20)

14. Lok Sabha Unstarred Question 3,582 answered on 10 August 2021, *Data on Fertilizer Subsidy, Ministry of Chemical and Fertilizers*, Department of Fertilizer (for 2018–19 to 2020–21)

15. S.K. Chaudhari, Adlul Islam, P. P. Biswas. and A. K. Sikka 2015. *Integrated soil, water and nutrient management for sustainable agriculture in India*. Indian Journal of Fertilizers11(10), 51–62

16. Anon 2021. *AICRP on Long Term Fertiliser Experiments (AICRP-LTFE)*, Indian Council of Agriculture Research. Available at https://aicrp.icar.gov.in/ltfe/, as accessed on 18 December 2021

17. Anon 2021. *Excessive Use of Fertilizer*, Ministry of Agriculture & Farmers' Welfare, posted on 9 February 2021 by PIB Delhi. Available at https://pib.gov.in/PressReleasePage.aspx?PRID=1696465, as accessed on 18 December 2021

18. Anon 2021. *Frequently Asked Questions*, Tamil Nadu Agriculture University. Available at https://agritech.tnau.ac.in/org_farm/orgfarm_faq's_bioferti.html, as accessed on 18 December 2021

19. Lok Sabha Unstarred Question 413, answered on 30 November 2021. *Pesticides And BioFertilizers*, Ministry Of Agriculture And Farmers' Welfare, Department of Agriculture and Farmers' Welfare, Government of India. Available at http://164.100.24.220/loksabhaquestions/annex/177/AU413.pdf, as accessed on 18 December 2021

20. Lok Sabha, Unstarred Question 1,387, answered on 7 December 2021. *Promotion of Organic Farming*, Ministry Of Agriculture And Farmers' Welfare, Department of Agriculture and Farmers' Welfare, Government of India

21. *Ibid*

22. Lok Sabha Unstarred Question 354, answered on 20 July 2021. *National Project on Organic Farming*, Ministry of Agriculture and Farmers' Welfare, Department of Agriculture, Cooperation and Farmers' Welfare, Government of India

23. Lok Sabha Unstarred Question 1,490, answered on 20 September 2020. *Biofertilizer Production*, Department Of Agriculture, Cooperation And Farmers' Welfare, Ministry Of Agriculture And Farmers Welfare, Government Of India

24. Rajya Sabha Unstarred Question 1,281, answered on 30 July 2021. *Production of Organic Manure Through Agricultural Wastes and Animal Dung*, Ministry Of Agriculture And Farmers' Welfare, Department of Agriculture, Cooperation and Farmers' Welfare, Government of India

25. Lok Sabha Unstarred Question 354, answered on 20 July 2021. *National Project on Organic Farming*, Ministry of Agriculture and Farmers' Welfare, Department of Agriculture, Cooperation and Farmers Welfare, Government of India

26. Lok Sabha, Unstarred Question 1,490, answered on 20 September 2020. Biofertilizer Production, Ministry Of Agriculture And Farmers' Welfare, Department Of Agriculture, Cooperation And Farmers' Welfare, Government of India

27. Information received from Ministry of Agriculture and Farmers' Welfare, Government of India

28. Anon 2020. Ministry of Agriculture & Farmers' Welfare, Promotion of Biofertilizers, 4 February 2020, by PIB Delhi. Available at https://pib.gov.in/PressReleasePage.aspx?PRID=1601905, as accessed on 18 December 2021

29. Lok Sabha Unstarred Question 413, answered on 30 November 2021. Pesticides And Biofertilizers, Ministry Of Agriculture And Farmers' Welfare, Department Of Agriculture and Farmers' Welfare, Government of India

30. Anon 2020. Ministry of Chemicals and Fertilizers, Press Release 15 September 2020, by PIB Delhi. Available at https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1654529, as accessed on 18 December 2021

31. Anon 2021. Standing Committee On Chemicals & Fertilizers (2020-21), Seventeenth Lok Sabha, March, 2021, Ministry Of Chemicals And Fertilizers, (Department Of Fertilizers) Demands For Grants (2021-22), Twentieth Report Lok Sabha Secretariat, New Delhi

32. Lok Sabha Unstarred Question 1,071, answered on 3 December 2021, Promotion of Alternative Fertilizers, Government of India, Ministry of Chemicals and Fertilizers, Department of Fertilizers

33. Manashi Barman, Srijita Paul, Aditi Guha Choudhury, Pinaki Roy and Jahnavi Sen 2017. "Biofertilizer as Prospective Input for Sustainable Agriculture in India", *International Journal of Current Microbiology and Applied Sciences*, ISSN: 2319-7706 Volume 6 Number 11 (2017) pp. 1177-1186. Available at https://doi.org/10.20546/ijcmas.2017.611.141, as accessed on 18 December 2021

34. Lok Sabha Unstarred Question 2549, answered on 1 August 2017. *Biofertilizer Production*, Ministry Of Agriculture And Farmers Welfare Department Of Agriculture, Cooperation And Farmers Welfare. Available at http://164.100.24.220/loksabhaquestions/annex/12/AU2549.pdf, as accessed on 30 October, 2021

35. RTI application filed by Vineet Kumar 2020-21, Centre for Science and Environment, New Delhi addressed to Ministry of Agriculture and Farmers Welfare, Government of India

36. *Ibid*

37. *Ibid*

38. *Ibid*

39. *Ibid*

40. *Ibid*

41. *Ibid*

42. Anon 2019. "Jaivik khaad ke naam par chal raha hai gorakhadhandha, kisaanon ke saath huee badee thagee", *News 18*, 29 October 2019. Available at https://hindi.news18.com/news/bihar/purnia-police-busted-a-fake-company-of-organic-compost-in-purnia-bihar-nodta-2558305.html, as accessed on 13 July 2021

43. Prashant Tiwari 2019. "Jaivik khaad va keetanaashak ke naam par becha ja raha chemical", *Swatantra Prabhat*. Available at https://www.swatantraprabhat.com/post/kisano-k-sath-chhalawa, 17 March 2019, as accessed on 13 July 2021

44. Prashant Tiwari 2019. "Tax bharata hoon bechooga jahar, jaivik ke naam par kemikal bechane vaalee kampaniyaan dikhaatee hai tevar", *Swatntra Prabhat*. Available at https://swatantraprabhat.com/post/lucknow-news-18091, 25 March 2019, as accessed on 15 August 2021

45. Anon 2018. "Bik rahee nakalee jaiv aur raasaayanik khaad", *Dainik Jagran*, 19 April 2018. Available at https://www.jagran.com/bihar/patna-city-spurious-bio-and-chemical-fertilizer-is-being-sold-in-patna-17850736.html, as accessed on 15 August 2021

46. Anon 2018. "Bik rahee nakalee jaiv aur raasaayanik khaad," April 2018. *Dainik Jagran*. Available at https://www.jagran.com/bihar/patna-city-spurious-bio-and-chemical-fertilizer-is-being-sold-in-patna-17850736.html, as accessed on 15 August 2021

47. Anon 2014. "Nakalee potaash phaiktaree ka khulaasa," *Prabhat Khabar*. Updated on 23 December 2014. Available at https://www.prabhatkhabar.com/state/bihar/samastipur/240076, as accessed on 15 August 2021

48. Ankit Dixit 2019. "Nakalee khaad maamale mein chal rahe haee voltej draama aaj samaapt," *Before Print News*, 19 October 2019. Available at https://www.beforeprint.in/news/bihar-news/purnia-news/purnia-the-ongoing-high-voltage-drama-in-the-fake-manure-case-ends-today/, as accessed on 15 August 2021

49. Anon 2018. "Nakalee urvarak se bhara pada hai baajaar, laib mein test ke dauraan ho raha phel, kisaan pareshaan," *Dainik Jagran*, 6 June 2018. Available at https://www.jagran.com/bihar/patna-city-the-market-is-full-of-fake-fertilizer-18047656.html, as accessed on 15 August 2021

50. Anon 2020. "Pakadee gaee nakalee jaivik khaad kee phaiktree," *Dainik Jagran*, Uttar Pradesh, 22 July 2020. Available at https://www.jagran.com/uttar-pradesh/deoria-fake-organic-fertilizer-factory-busted-in-gauribazar-operator-arrested-20538583.html, as accessed on 15 August 2021

51. Ashutosh Pandey 2020. "Seetaapur mein nakalee khaad ke kisse hai bemishaal", *Saket Lehar,* 13 January 2020. Available at https://www.saketlehernews.page/2020/01/seetaapur-mein-nakalee-khaad-k-VgoBv9.html, as accessed on 15 August 2021

52. Ajay Singh 2020. "Kisaanon ke saath dhokha, devariya mein pakada gaya nakalee khaad ka jakheera", *Hindustan*, 21 July 2020. Available at https://www.livehindustan.com/uttar-pradesh/deoria/story-cheating-with-farmers-fake-fertilizer-caught-in-deoria-3365915.html, as accessed on 15 August 2021

53. Pankaj Kumar Soni 2020. "Chhaapemaaree mein nakalee khaad kaarakhaana mila, 22 laakh kee khaad baraamad, phaiktree huee seel", *Press World Information Weekly*, 24 July 2020. Available at https://www.pressworldinformation.page/2020/07/chhaapemaaree-mein-nakalee-kha-m9PBWM.html, as accessed on 15 August 2021

54. Anon 2019. "Krishi vibhaag ne kee nakalee jaivik khaad ko lekar ek aur badee kaaryavaahee", *Raj Express*, 19 September 2019. Available at https://www.rajexpress.co/india/central-india/madhya-pradesh/agriculture-department-took-action-against-fake-organic-manure, as accessed on 15 August 2021

55. Mahendra Singh Bundela 2019. "Krishi vibhaag ne nakalee jaivik khaad ko lekar kee ek or badee kaaryavaahee", *Aajtak 24*, 18 September 2019. Available at https://www.aajtak24.in/2019/09/krashi-vibhag-ne-nakli-jevik-khad-ko.html, as accessed on 15 August 2021

56. Anon 2019. "Bhaajapa neta kee phaiktree mein jaivik khaad ke naam par ban raha nakalee khaad, 10 varsh pahale bhee phaiktree ko kiya tha seel", *Swaraj Digital*. Available at https://swarajdigital.in/mp-news/bjp-leader-factory, as accessed on 15 August 2021

57. Anon 2020. "Kisaanon ko nakalee khaad bechate teen yuvak chadhe pulis ke hatthe", *Dainik Nav Jyoti*, 16 September 2020. Available at https://www.dainiknavajyoti.net/jalore/Three-youths-selling-fake-fertilizers-to-police--police-arrested.html, as accessed on 15 August, 2021

58. Anon 2020. "CM Flying kee raid: godaam mein chal rahee nakalee ghee, khaad va keetanaashak banaane kee factory pakadee, maalik par kes darj", *Dainik Bhaskar*. Available at https://www.bhaskar.com/local/haryana/news/factory-making-fake-ghee-manure-and-pesticide-caught-in-warehouse-case-filed-against-owner-127690343.html, as accessed on 15 August 2021

59. Anon 2017. "Nakalee jaivik khaad bechate pakada vyaapaaree, chhatteesagadh", *glibs*, 3 June 2017. Available at https://glibs.in/Crime/chhattisgarh-news--rajnandgaon-news-4029.html, as accessed on 13 Juy 2021

60. Anon 2017. "Truck me nakli jaivik khad", *Khabar 24 x 7, 25* June 2017. Available at https://khabar24x7.in/?p=1638, as accessed on 15 August 2021

61. Anon 2020. "Nakalee keetanaashak davaon kee bikree par vibhaag kee kaarravaee", *Hariyar Express*, Chhattisgarh, 21 October, 2020. Available at https://hariyarexpress.com/?p=28071, as accessed on 15 August 2021

62. Laxmi Narayan Dewangan 2019. "Jile mein khaad ke paanch saimpal phel, krshi vibhaag ne samitiyon mein vitaran roka", *Patrika,* 9 April 2019. Available at https://www.patrika.com/bemetara-news/five-samples-of-fertilizers-in-district-failed-distribution-stopped-4400119/, as accessed on 15 August 2021

63. Rajendra Singh Jadaun 2018. "Hariyaana krrshi vibhaag mein jaivik khaad kee khareed mein ghotaala", *Patrika,* Haryana, 23 June 2018. Available at https://www.patrika.com/ambala-news/scam-in-procurement-of-organic-manure-in-haryana-agriculturedepartment-2997908/, as accessed on 15 August 2021

64. Anon 2019. "Tax bharata hoon bechooga jahar, jaivik keetanaashak ke naam par kemikal bechane vaalee kampaniyaan dikhaatee hai tevar", *Swatantra prabhaat*, 25 March 2019. Available at https://swatantraprabhat.com/post/lucknow-news-18091 , as accessed on 13 July 2021

65. Anon 2020. "Dukaanon mein milee nakalee khaad, jila prashaasan ne dee dabish, macha hadakamp"*Dainik Bhaskar*, 6 December 2020. Available at https://www.bhaskarhindi.com/city/news/fake-manure-found-in-shops-district-administration-did-not-give-a-damn-stir-192225, as accessed on 15 August 2021

66. Anon 2019. "Jaivik khaad ke naam par nakalee khaad bechane vaalon se log pareshaan, madhyapradesh", *Nai Dunia*, 26 August 2019. Available at https://www.naidunia.com/madhya-pradesh/rewa-narsinghpur-news-3115495, as accessed on 15 August 2021

67. Anon 2019. "Is tarah pakad mein aaee nakalee khaad banaane phaiktree", *Nai Duniya, Madhya Pradesh*, 27 July 2019. Available at https://www.naidunia.com/madhya-pradesh/dewas-dewas-news-police-taken-action-against-a-loaded-truck-after-that-artificial-fertilisers-factory-is-identified-3067518, as accessed on 15 August 2021

68. Anon 2012. "Raasaayanik khaad ko jaivik khaad banaane ka bhandaaphod", *Dainik Tribune*, 30 April 2012. Available at https://www.dainiktribuneonline.com/news/archive/features/, as accessed on 15 August 2021

69. Anon 2017. "Nakalee khaad davaee dekar laakhon thage", *Dainik Bhaskar*, 2017. Available at https://www.bhaskar.com/news/RAJ-OTH-MAT-latest-nokha-news-061504-2160993-NOR.html, as accessed on 15 August 2021

70. Anon 2018. "Sarakaar kee jay ho: jis khaad ko raayapur mein bataaya phel use naagapur mein bataaya paas", *Patrika*, 29 March 2018. Available at https://www.patrika.com/bemetara-news/prom-bio-fertilizer-pass-in-nagpur-ab-test-1-2563898/, as accessed on 15 August 2021

71. Anon 2020. "Jaivik ke naam par becha ja raha hai jahar, phasal aur sehat donon ke lie khataranaak", E TV Bharat, 7 October 2020. Available at https://react.etvbharat.com/hindi/chhattisgarh/state/raipur/big-market-of-chemical-pesticide-are-harming-crops-and-health-in-chhattisgarh/ct20201007002045184, as accessed on 15 August 2021

72. Ram Mohan Raghuwanshi 2020. "Bhaarateey kisaan sangh ka dharana pradarshan", *Panch Sarpanch*, 24 February 2020. Available at https://www.panchsarpanch.page/2020/02/bhaarateey-kisaan-sangh-ka-dha-EmpneS.html, as accessed on 15 August 2021

73. Balmeek Pandey 2019. "Is gaanv mein nakalee khaad beche jaane kee shikaayat, ek ko hiraasat mein lekar pulis ne shuroo kee jaanch" *Madhya Pradesh*, 29 June 2019. Available at https://www.patrika.com/katni-news/fake-fertilizer-and-pesticide-sold-complaint-in-katni-4770209/ , as accessed on 15 August 2021

74. ML Jat, HS Jat, Andrew Mcdonald and AK Sikka 2015. *National Dialogue on Efficient Nutrient Management for Improving Soil Health at IARI Campus*, IARI, New Delhi

75. Richa Agarwal 2019. "India's city compost policy needs overhauling", *Down to Earth*, 15 February 2019. Available at https://www.downtoearth.org.in/blog/agriculture/india-s-city-compost-policy-needs-overhauling-63248, as accessed on 30 November 2021

76. Vipin Kumar Bansal 2021. *Waste to Wealth and Organic Farming—A way forward to employment generation*, National Centre of Organic Farming. Available at https://ncof.dacnet.nic.in/uploads/page/Waste-to-Wealth--OF--1pdf-e3a85fd5cfd5b479b2bbddc935203182.pdf, as accessed on 30 November 2021

77. Information received on "subsidy released for biofertilizer units since inception of NPOF through NABARD" 2021, from Ministry of Agriculture and Farmers Welfare, Government of India

It is becoming clearer by the day that chemical fertilizers are not a sustainable solution to the problem of depletion of soil nutrients as a result of agriculture, particularly crop production. Biofertilizers and organic fertilizers not only provide nutrients to crops, they also help in restoring soil health and ecological balance. As we (re)discover the power and potential of biofertilizers and organic fertilizers, we need to ensure their quality and accessibility.

This report assesses the state of biofertilizers and organic fertilizers in India. It also suggests ways and means by which their production and use can be promoted.

Centre for Science and Environment
41, Tughlakabad Institutional Area, New Delhi 110 062
Phones: 91-11-40616000 Fax: 91-11-29955879
E-mail: cseindia@cseindia.org Website: www.cseindia.org