

Conventional versus Organic Farming

While coming back from school, Paheli and Boojho saw Himmat Singh, a farmer in the village, who was using spray-on in his crop field. Both of them became curious and wanted to know what Himmat Singh was doing. Boojho asked Himmat Singh about what he was spraying on the crop and why. Himmat Singh waved his hand to the children to keep themselves away from the field and wait till he finishes. After completing his work he came to them after washing hands. Boojho and Paheli together waited curiously. The farmer explained that he was spraying pesticides on plants for controlling insects and pests that spoil the crop, affecting the quality of the produce. Spraying of pesticide on crop fields kills both insects and pests.



**But, why do
we spray
synthetic
chemical
pesticides in
our farms when
we know they
are harmful?**



Fig. 2.1 Spraying of pesticides in the crop field

Next day in school, both shared their experience about the incident of the previous day at the field. They asked their teacher why the farmer had asked them to stay at a distance. Were the chemicals harmful? In class, they discussed the use of synthetic chemicals to increase production in agriculture.

Synthetic chemicals used in agriculture are categorised on the basis of their application in agriculture as follows:

Soil Supplements

- *Synthetic fertilisers*: These are the chemical supplements added to the soil, such as urea. They provide essential nutrients which support plant growth.
- *Growth agents*: These are synthetic, plant growth agents and perform specific functions in the overall development of the plants. For example, Indoli-3 acetic acid (IAA) and 2, 4 diphenoxo-acetic acid (2, 4-D).

Crop Protectors

Pesticides control pests and protect crops in agriculture. These include insecticides, herbicides, weedicides, fungicides, nematicides, etc., to control various harmful organisms in agriculture.

Food Additives for Livestock

Additives are chemicals used as food supplements for farm animals.

By now you must have understood that chemicals are used to improve quality and quantity of the farm produce. They improve plant nutrition and provide protection to the crops resulting in high production.

2.1 CONVENTIONAL FARMING PRACTICES

Prior to 1960s, our country witnessed food crisis due to low crop production. The country had to import foodgrains. This is the reason why agriculturists started getting attracted towards chemical inputs in the



I saw the
mali using
urea to
enhance
growth of
plants in
the garden.
Are these
synthetic
chemicals
'fertilisers'?

farming practices. The industries in England started producing chemical fertilisers and pesticides in large amounts for use in agriculture to enhance production. Gradually, by the middle of the 20th century, tractors and other infrastructure such as machines, chemical fertilisers and pesticides, etc., came into existence and became rapidly popular in the agricultural practices. Irrigation facilities were improved and high-yielding crop varieties were introduced in Indian agriculture.

Green Revolution in India

As a result of new advances in agriculture, the global productivity was increased drastically. This was the time when new chemical fertilisers and synthetic herbicides and pesticides were created. The chemical fertilisers provided extra nutrients; and synthetic herbicides and pesticides controlled weeds, insects and diseases caused by various organisms. This resulted in higher productivity.

In addition to the chemical advances, high-yielding variants of crops were introduced. Implementation of multiple cropping (growing two or more crops throughout the year) during this period led to higher productivity. New farming techniques and advances in agricultural technology were utilised by farmers all over the world, and when integrated, it intensified the results of the Green Revolution. Green revolution led to an increase in foodgrain production, especially in Punjab, Haryana and Uttar Pradesh during the early phase, and this was the period when India became self-sufficient in foodgrain production.



25 March 1914 –
12 September 2009

American biologist, Norman Borlaug was awarded the Nobel Prize in 1970 for his initiatives worldwide that contributed to the extensive increase in agricultural production — termed as the Green Revolution.



Indian plant geneticist, M.S. Swaminathan, also called the father of the Indian Green Revolution, is the pioneering force behind the change.

7 August 1925 – Present

Endosulfan: How did it affect Kerala?

Endosulfan was sprayed in the cashew plantations of Cheemeni estate in Kerala, from 1978 onwards regularly—thrice every year. It was sprayed aerially by using helicopters and small planes. The aerial spraying of Endosulfan was undertaken against the menace of the tea mosquito bug. As the plantations were mostly in mountainous areas, the pesticide drained and got washed down the slopes during the monsoons mixing into drinking water below. The consumption of this water by the people and animals resulted in diseases ranging from physical deformities, cancers, birth disorders and damages to brain and the nervous system. Children were found to be the worst affected having congenital anomalies, mental retardation, physical deformities and cerebral palsy.

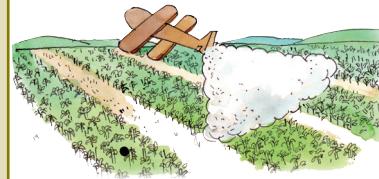


Fig. 2.2 Spraying of endosulfan

during 1967–68. These practices in agriculture brought tremendous increase in production bringing in a revolution in Indian agriculture called the **Green Revolution**.

However, these days, there are many food items available which are grown without the use of synthetic chemicals. The conventional agricultural practices have certainly benefitted the economy of the country but they have resulted in the harmful effects on the environment and on our health.

Harmful Effects of Conventional Farming

1. Use of synthetic chemical fertilisers lowers the quality of soil over a period of time.
2. Chemical pesticide contaminations in water and food affect the environment and our health. The insects which are harmful to crops become more resistant to the environment due to prolonged pesticide use.
3. The continuous use of chemical fertilisers reduces soil fertility as it lowers the content of organic matter (humus) in the soil. Due to low level of organic matter, soil loses the ability to hold small soil particles together and thus can be easily lost by erosion.



I have seen some newspaper reports while surfing the Internet about these chemicals causing many diseases in humans!



**See! He is
not spraying
synthetic
chemical
pesticides in
his fields!**



**Now-a-days,
I have seen
people prefer to
buy food items
categorised as
'organic' in the
market? Why?**

4. Heavy irrigation results in soil erosion and intensive tillage results in reduction of soil flora and fauna which are important for ecological interdependence.
5. Growing a single crop in the field in conventional farming causes problems for nutrient recycling of the soil and thus, reduces diversity of plants and animals.
6. Under conventional farming biodiversity is affected. It lowers the number and activity of earthworms and microbes. The number of pollinators also decreases and results in low production.

Paheli and Boojho are new wondering what alternative methods of farming practices there might be, which will result in safe agricultural production. While walking towards home, their attention was attracted towards a farm where they noticed a cowshed with cattle and many birds moving in the field. They could see various crops in the field along with the main crop. There was a boundary of trees around the field. They entered the field where farmer Gopicharan was spreading cow dung and vermicompost manure in the field. They saw earthworm burrows on the ground. In this field everything seemed natural. There were no chemicals.

Without any hesitation they entered the field. Gopicharan told them that these are nature-friendly farming practices. The produce would be organic.

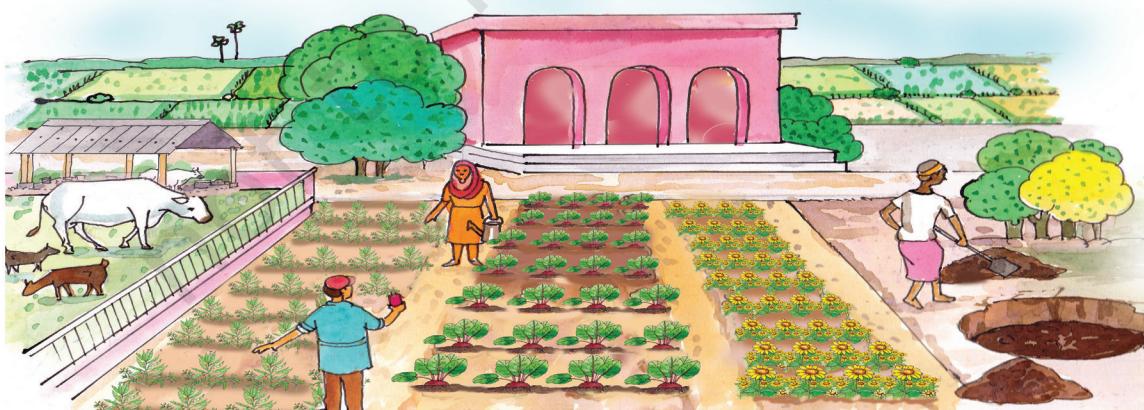


Fig. 2.3 Organic farm

2.2 WHAT IS ORGANIC FARMING?

Organic Farming believes that the plants, animals and human beings stay closely associated with each other, as shown in Fig. 2.3. Therefore, the primary objective of organic farming is to produce safe agricultural products, maintain and improve soil fertility, quality of food, environment and health. Organic farming completely avoids the use of any synthetic chemicals such as fertilisers, growth agents, food additives or pesticides. Organic farming reduces the dependency on external inputs and gives the optimum productivity by making the best use of ecological principles and processes, which eventually leads to the reduced cost of crop cultivation. It is a method of farming where crops are grown by using organic manure, bio-fertilisers and by adopting other nature-friendly practices such as crop rotation, mixed farming, etc. Use of synthetic chemicals and fertilisers is completely prohibited.

2.3 STATUS OF ORGANIC FARMING IN INDIA

Many states in India including Kerala, Uttarakhand, Sikkim, Gujarat, Rajasthan, Karnataka, Himachal Pradesh, Uttar Pradesh, Odisha and Madhya Pradesh are the major contributors in organic farming. Among all the states, Madhya Pradesh has covered the largest area under organic certification, followed by Himachal Pradesh and Rajasthan. Sikkim was the first state declared as a fully organic state in 2016. It has approximately 75,000 hectares of its land under organic cultivation.

Activity 2.1

Collect seeds of various types of crops grown in a farm near you. Sow these seeds in the kitchen garden of your school. Use only organic methods of farming and closely monitor the progress of the plants.



Fig. 2.4 Organic produce

The gardner bhaiya in the school told me once, that the farmyard manure, green manure, compost, crop residues and vermicompost are organic manure.



Sir Albert Howard gave the concept of organic farming in 1940. He is also known as the 'Father of Modern Organic Agriculture'.

Sikkim, the Fully Organic State of India

The Government of Sikkim started the organic initiatives in the year 2003. Sikkim Organic Mission was launched in 2010 for conversion of entire agricultural land into organic management system, following the guidelines outlined in the National Programme in Organic Production (NPOP). The Government of India declared Sikkim as the first organic state on 18 January 2016 and it is celebrated as the **Sikkim Organic Day**. Farmers from all over Sikkim bring their produce such as fruits, vegetables, flowers and cereals to an exhibition. They are also awarded prizes for the best produce in various categories. A token *krishi* loan is also given to the farmers.

Activity 2.2

Locate the states in the map below which are contributing to organic farming. Identify the states with different colours. Take the help of your teacher to make the index.



Organic Farming in Sikkim

Dhanpati Sapkota is an award winning progressive farmer from Sikkim. In the beginning, he cultivated paddy, maize and millets for domestic consumption. When the initiative of organic farming was taken up by the state, he switched over to organic farming practices from conventional farming.

With this, he got an opportunity to attend training as well as exposure visits within the state which helped him a lot in his initial days of organic farming. In the beginning, for at least two years, production was very less which disheartened him. So, he began experimenting in his farming system. In one plot of his land he followed organic method in total, while on the other plot partial organic method was followed where he continued to use chemical fertilisers and pesticides. The immediate results showed a better yield in the latter. However, after a year or two he observed soil deterioration in it. This eventually convinced him to shift his entire farming to organic farming. Along with this, he also began experimenting with the use of bio-fertilisers. To protect plants from diseases, insects and pests, he started preparing his own bio-pesticides, fungicides and insecticides from locally available plants, animal products and discovered that they were very effective. He also focused on animal husbandry and livestock management.

Today, he has milking cows, thus, he sells organic milk also. He gets supply of manure from the cows for his farm. He has established a vermicompost unit also in his farm. He cultivates cherry pepper, cauliflower, broccoli, tomatoes and maize in rotation. He sells his organic products to Sikkim Supreme (food processing factory in Sikkim) and Sikkim State Cooperative Supply and Marketing Federation limited (SIMFED). A large part of his produce is also sold to local households for domestic consumption. He believes that to have a healthy life we all need to adopt organic farming practices.

Source: Department of Agriculture, Sikkim



Fig. 2.5 Dhanpati Sapkota in his field

Learning from Dhanpati Sapkota's experience, we see that effective organic farming depends on farm animals like cows, buffaloes, sheep and goat. These animals have many important roles to play in agriculture—cow dung and its urine are used as manure alongwith insect-pest and disease management. They increase soil fertility. These

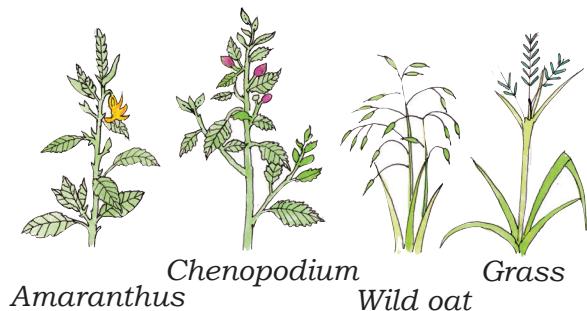


Fig. 2.6 Common weeds of agricultural farm

animals also help in controlling weeds in the agricultural fields. Besides, they help the farmers in ploughing agricultural lands and in transportation of agricultural goods. The crop residues of the farm are given to the animals as food and fodder. Therefore, in the organic system of farming, there is an interaction and interdependence of animals and plants.

2.4 How USEFUL IS ORGANIC FARMING FOR US?

Organic farming provides us healthy soil, plant and 5Fs of agriculture (food & fodder, fibre, fuel, forest and flower). The biological activity in soil increases as we add organic manure to it. For example, the population of earthworms and other beneficial organisms increases tremendously under organic soils. These kind of organisms increase availability of food to the plants. Such plants give us healthy food which is free from harmful chemicals. Since organic farming discourages the use of chemicals, pollution of air, soil and water is minimised.

The various benefits from organic farming not only improve the lives of the farming community but also help in conserving the precious natural resources and environment. The other benefits of organic farming are as follows:

1. Improvement of Soil Fertility

Organic farming improves soil fertility. It improves the supply and retention of plant nutrients. This in turn keeps agricultural production at a higher level and makes it sustainable.

2. Reduced Water Usage and Requirement

Soil building methods in organic farming like mulching, use of green manure and crop rotation improve the physical condition of soil which helps



Fig. 2.7 Mulching

in preventing soil erosion. It also improves the water-holding capacity of soil and hence, roots can penetrate easily. Also, farmers require less water to grow different crops.

3. Safer Working Conditions

Farmers and farm workers enjoy safer working environment and direct health benefits with the adoption of organic farming. It is common knowledge that a large number of people working in the agriculture sector are affected by a number of diseases because of the use of agro-chemicals.

Mulching is a layer of organic material like straw, dry leaves or compost to prevent evaporation of water, improve soil fertility and reduce weed growth.

4. Better Quality of Health

The risk of contamination of food and water is substantially reduced, when no pesticides are used. Organic farming reduces human and animal health hazards which in turn lead to better quality of health. It also helps in keeping environment healthy by reducing the level of pollution.

5. Greater Biodiversity

Organic farming provides a safe place for wild plants. Lands around the organic farms have more types of wild plants which provide benefits for wildlife. These plants are important for birds, bees, beetles and butterflies. Ladybirds, a type of beetle, feed on many insects which are harmful for crops. All these species of plants, animals and other living things co-exist in harmony.

Activity 2.3

Observe your local surroundings and make a list of diverse fauna and flora you noticed. Present your observations in your class.

Fauna	Flora

Activity 2.4

Visit an organic and a conventional farm in your area and observe differences in plant and animal species. Present your findings about the differences in biodiversity of flora and fauna in these farms in the form of a poster.

Activity 2.5

Bring two soil samples — one from an organic farm and the other from a conventional farm. Now with the help of your teacher, count the total number of earthworms in each type of soil. Record the life diversity in the soil of an organic farm.

2.5 SIGNIFICANCE OF HIGHER BIODIVERSITY AT ORGANIC FARMS

Biodiversity is an important basis for many processes in our ecosystems to function. Habitats with numerous species are shown to better adapt to environmental changes. Many ecological processes are influenced by higher biodiversity.



Fig. 2.8 Pollination

1. Pollination

Flower-visiting insects such as honeybees, wild bees and bumblebees benefit from the higher coverage and diversity of secondary flora in organic grain fields. Organic agriculture, thus, improves the pollination of flowering plants in the surrounding environment.

Activity 2.6

Visit an organic farm. Sit peacefully and close your eyes and try to hear various sounds of visiting pollinators. Try to identify them. Open your eyes and note the kind of pollinators visiting different flowers. Try to identify these insects with the help of a farmer or your teacher.

Note for teachers: Teachers can use 3D models of these insects. Students may be allowed to touch and feel these models.

Conversation between two Bees

Cheku: Hey! Piku bee, have you heard of vanishing bees in our neighbouring village?



Piku: Oh! Yes Cheku!! I heard few beekeepers talking about it. They were saying that beekeepers from the other village are continuously losing about 30% of their bees every year.

Cheku: But, here we are not facing any such problem. Farmers are doing mixed farming in their mango grove and getting benefits of high production of both mangoes and honey.

Piku: Yes, in fact our population has increased tremendously since last few years. That's why production of mangoes is increasing every year.

Cheku: So, what can be the possible reason for this decline of bee population in the nearby village?

Piku: Farmers in that village still use chemical fertilisers and pesticides in their mango grove which are harmful for us and our environment. I think these chemicals are the reason behind the low number of bees.

Cheku: (Happily) Thank God! We live in this village. Here everyone uses organic farming practices. All are living together in harmony. More mango! More honey!! All are happy!!

I wish someone could guide farmers of that village too.

2. Reduction in soil erosion on arable land

Diverse plants grown on organic farms reduce the loss of soil by erosion. Growing of legumes and other deep-rooted crops help to bind soil particles together and hence reduce soil erosion. Further, microbial activity is high in soils at organic farm, which in turn improves soil structure. The water-holding capacity of soil increases and it absorbs more water and remains moist for a longer time. It results in reduced loss of water by run-off and hence, prevents the loss of soil.



Fig. 2.9 Heap of cow dung

3. Degradation of dung and other organic matter

Organic pastures allow richer fauna to exist in dung than in conventional pastures, as they are not contaminated by chemical veterinary drugs. Dung fauna considerably add to the degradation and recycling of dung and in turn improve the quality of produce.

Activity 2.7

Visit an animal farmyard and discuss with the caretaker—

- How does he/she treat cow dung?
- How long does it take before it can be used as a manure?

4. Natural pest reduction



Fig. 2.10 Natural predatory insect feeding on insect-pest

Organic farming leads to a significantly more balanced number of beneficial insects that reduce pests and yield losses in crops. Certain insects (pests) harmful to crops are controlled by other insects (predators). Such predatory insects are found in more number in organic farms. Some examples are given in Table 1.

Table 1: List of selected pests and their predator insects

Insect Pest	Insect Predator
Aphids	Lacewing, Ladybug, Minute pirate bug, Praying mantis
Cabbage loopers	Parasitic wasp
Caterpillars	Minute pirate bug, Parasitic wasp
Cutworms	Parasitic wasp

Activity 2.8

You can try to make a difference in your home environment. Grow different kinds of flowering plants and use organic manure in your kitchen garden or plants. Do not use any chemical pesticide or synthetic fertiliser. If required, natural means can be used to control the insect-pests or



Fig. 2.11 Organic farming interlinks agriculture, animals and human beings with each other

diseases. When these plants flower, you can find out a number of insects visiting them. Try to identify the species of these pollinators and make a record of it.

GLOSSARY

Arable land—The land which can be ploughed and used to grow crops.

Biodiversity—Diversity of life forms on the earth, such as variety of animals, plants and micro-organisms.

Bio-fertilisers—Substances which contain living micro-organisms that help the plants to grow.

Conventional farming—It is a method of growing plants such as fruits and vegetables using chemical fertilisers and pesticides.

Green manure—Plants or crops which are ploughed back into the soil.

Green revolution—Use of pesticides, artificial fertilisers and high-yielding varieties of crops to meet the increased demand for food products.

Habitat—The natural home or environment of an animal, plant or other organism.

Insect-pest or pest—A destructive insect that attacks crops, food, livestock, etc.

Pasture—Land covered with grass and other low plants suitable for grazing animals, especially cattle or sheep.

Pollinators—A pollinator is an animal or insect that causes plants to make fruit or seeds. Pollinators do this by moving anthers of the flower of a plant to stigma of the pistil of same or another flower. This pollen then fertilises the egg in the ovary of the pistil.

Predatory insects—The predatory insect feeds upon other insects (prey) that are usually smaller and weaker than it, frequently devouring them completely and rapidly.

Run-off—The draining away of water (or substances carried in it) from the surface of an area of land.

Vermicompost—Process of composting using various types of worms/earthworms.

Weed—A plant that grows in an unwanted place, especially in a garden or field where it prevents the cultivated plants from growing freely.

WHAT HAVE WE LEARNT?

1. Synthetic chemicals used in agriculture are categorised as — soil supplements, crop protectors and food additives for livestock.
2. Green revolution due to conventional agricultural practices brought tremendous increase in the agricultural production.
3. Synthetic chemicals used in agriculture contaminate food and have negative impact on our health and environment.
4. Organic farming means adopting nature-friendly farming practices.
5. In India, Sikkim has been declared as the first fully organic state by NPOP.

6. Farm animals play an important role in organic farming.
7. Organic farming increases the soil fertility and reduces soil erosion and water requirement.
8. Organic farming provides safer working conditions and better quality of health.
9. Organic farms are rich in biodiversity.
10. Biodiversity helps in the functioning of nature in many ways.

Exercises

1. Answer the following questions.

- i. What type of synthetic chemicals are used in agriculture and why?
- ii. Explain the conventional farming practices. What could be the long-term effects of using conventional methods of farming?
- iii. What is organic farming? How does organic farming improve soil fertility?
- iv. Why are organic farms more diverse in terms of flora and fauna, in comparison to conventional farms?
- v. How does organic farming help in reducing soil erosion?
- vi. How does organic farming help in controlling pests and insects? Give two examples of predatory insects.
- vii. “Animals have an important role to play in organic farming”. Elaborate.

2. Provide one word for the following sentences.

- i. Synthetic chemical used to control weeds.
- ii. A layer of organic material like straw or compost to protect evaporation of water in fields.
- iii. An organism that helps in pollination.
- iv. Beneficial insects that control harmful insects.

3. Fill in the blanks.

- i. In organic farming practices, use of _____ is completely prohibited.

- ii. Biodiversity is greater in _____ farms.
 iii. Sikkim Organic Day is celebrated on _____ every year.

4. Tick (✓) the correct answer.

- i. Organic farming does not use
 a) organic waste b) pesticides c) animal manure
- ii. Which state of India was declared as the first fully organic state?
 a) Gujarat b) Himachal Pradesh c) Sikkim
- iii. Which one of the following products is largely exported from India?
 a) Tea b) Pulses c) Oilseeds

5. Match Column A with Column B.

Column A	Column B
(a) Father of modern organic agriculture	grazing on pastures
(b) Weed management	largest area under organic certification
(c) Madhya Pradesh	Sir Albert Howard

6. Read the statements and write true or false.

- i. Cow dung and urine are used as manure alongwith insect-pest and disease management in organic farming.

- ii. Compost is a synthetic chemical used in conventional farming. _____
- iii. In an organic farm, the number of pollinators is less than a conventional farm. _____

7. Project Activities

- i. Visit a farm near you and find out —
 a) Location of the farm.
 b) Name of the farmer.

- c) What type of farming he/she does?
- d) What kind of manure does he/she use on his/her farm?
- e) What are the type of crops grown in the farm?

(Besides the questions given above, prepare more questions with the help of your teacher and friends.)

- ii. Prepare a picture chart showing various types of organic manure.
- iii. Prepare a collage of animals useful for organic farming.