



## Soil amendments and benefits

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### Introduction

Before understanding soil amendment, it is necessary to first know about soil. Soil is one of the major bases of life on Earth, which is water. It acts as a storehouse of nutrients and also ensures structural support and the availability of nutrients to the plants. Today, intensive farming methods, excessive exploitation of natural resources, excessive use of agricultural chemicals, and climate change have had a very adverse effect on the health of the soil. As a result, the physical, chemical, and biological properties of the soil are deteriorating, and the fertility of the soil is continuously decreasing. Along with maintaining soil productivity and health, soil amendment can enhance soil quality for sustainable agriculture. To maintain a better quality of soil, natural, organic, and chemical soil amendment substances are mixed in it as per their nature and requirements for soil improvement, which improves the fertility and physical, chemical, and biological properties of the soil.

**Need for Soil Amendment:** The Green Revolution in India in 1960 To overcome food

shortages and hunger, chemical fertilizers, herbicides, and pesticides were used indiscriminately and in inappropriate quantities. The use of these chemicals increased the production of crops, but due to their prolonged use, the natural properties and fertility of the soil gradually began to deteriorate. Today, in the era of intensive farming, the soil is being overexploited by the farmer, and to get more production, he has become dependent on chemical fertilizers, herbicides, and pesticides and is using them inappropriately. Due to the use of these chemicals, there are many harmful effects on the fertility and health of the soil, such as water holding capacity, seed germination, nutrients, number of microorganisms, soil aeration, reduction in organic matter and productivity, distortion in soil structure, and pH. Imbalances, etc., have appeared. At the same time, the remains of these chemicals keep accumulating in the soil for many years, which affects the physical, chemical, and biological properties of the soil, and hence the soil and water get polluted. Due to this distortion in the properties of the soil, its

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fertility is decreasing. At present, considering the lack of organic matter and nutrients in Indian soil, it seems impossible to stay away from chemical fertilizers. But to reduce the effect of these chemicals on the soil and to keep the soil healthy as well as fertile, it is necessary to amend it by adding soil amendments from time to time so that the soil can be made fertile again and capable of producing crops.

#### **Types of soil deformation and their factors—**

Mainly, three types of deformed soil are found in India:

**Acidic Soil:** At present, the area of acidic soil in India is about 49 million hectares, which is about 256 mm. The pH value of soil is less than 5.5. The area of acidic soil is continuously increasing, the main reason for which is the excessive use of fertilizers leaving acidic residues like ammonium chloride, ammonium sulphate, urea, etc. to get higher production from crops. Due to the continuous use of these fertilizers, the pH value of the soil decreases below 7, due to which the soil becomes acidic and its production capacity starts decreasing.

**Alkaline Soil:** The area of alkaline soil in India is approximately 3-78 mha. This is mostly found in areas where, due to the nature of drainage and lack of artificial facilities, the soil below is impermeable, water cannot be removed, and when the temperature of the

environment increases, the collected water evaporates, leaving the surface of the soil dry. However, alkaline residues accumulate and make the soil alkaline. These residues mainly contain sodium salts. The pH value of alkaline soils is generally between 8 and 10, which is mostly unsuitable for crops. The use of alkali and salt-rich water by farmers for irrigation fields and the use of excessive amounts of potash fertilizers are the main reasons for the occurrence of alkalinity in cultivable land.

**Saline Soil:** India's area of saline soil is 2–96 mha. In saline soil, soluble chloride and sulphate salts of sodium, calcium, and magnesium are found in large quantities and form a white layer on the surface of the soil, due to which the plants become unable to absorb nutrients from the soil and dry up. The pH value of these soils is generally less than 8.5. They are formed due to natural reasons as well as by the irrigation of fields with saline water by farmers and the use of excessive chemical fertilizers.

**Types of soil amendment:** To improve the quality of degraded soil, some natural and man-made substances are added to the soil. These products or substances used in soil improvement can be divided into two main categories: **1)** inorganic or man-made products; and **2)** organic or substances made from natural substances; Every substance used

in soil improvement has a special use and benefit for the soil.

**Organic Soil Amendment:** In this method, products made from natural soil are used, which are made from plant remains, cow dung manure, wood sawdust, animal remains, etc. There are various types of products in organic soil remediation that are used to improve soil structure, water holding capacity, nutrient availability, increase the number of microorganisms, and soil fertility.

**Cowdung Manure:** Cowdung manure is cheap and easily available in rural areas. Using it in the field increases the soil structure, aeration and water holding capacity, and availability of nutrients. Along with improving the structure of heavy clay soil and light sandy soil, it also increases the amount of nitrogen, phosphorus, and potassium in the soil. Cow dung manure is beneficial for all types of problematic and degraded soils.

**Green manure:** The use of green manure increases soil capacity, improves acidity and alkalinity, and also reduces soil erosion. Green manure increases the number and activity of microorganisms in the soil and also increases the fertility and production capacity of the soil.

**Vermi Compost:** Vermicomposting increases soil health, fertility, and the availability of nutrients, as well as the number, activity, and water-holding capacity of

microorganisms in the soil. It increases the amount of almost all the essential elements in the soil, thereby reducing the need for fertilizers.

**Biochar:** Biochar attracts moisture and nutrients (NPK) and stores them in its stomata, making them available to plants for a long time. Biochar is the pH of acidic soil. Increases the value and improves the structure of light and heavy soils.

**Vermiculite:** It preserves soil water and nutrients for a long time and keeps the soil soft so that better germination can occur.

**Crop residues:** Mixing crop residues in the soil after crop production increases the amount of organic matter and nutrients, improving plant growth. Crop residues are used in all types of soils.

**Inorganic soil amendments:** Some synthetic chemicals can stabilize soil structure and aggregates and improve soil fertility, just like organic soil amendments. These are common mineral substances that are by-products of mining or industrial production. These include mineral conditioners like gypsum, lime, perlite, fly ash, sulphur, zeolite, phosphogypsum, etc., and contain synthetic polymers that are beneficial for the soil, like

**Gypsum:** Gypsum is mainly used in the treatment of alkaline soil. Mixing it in the soil increases the availability of nutrients like calcium, boron, etc. in the soil. This prevents

the formation of a hard layer in the soil, which improves the drainage of water in the soil.

**Lime:** Lime is mainly used to improve acidic soil. It increases the pH value of acidic soil. It increases the availability of phosphorus, molybdenum, potassium, magnesium, and calcium by reducing the toxicity of zinc, magnesium, and iron in the soil.

**Fly ash:** Along with soil purification, it is also used as a source of nutrients. This improves both the productivity and fertility of the soil and increases the mobility of nutrients in the soil. It is very beneficial for less fertile soil.

**Synthetic polymers:** Polymers are high-molecular-weight chemical substances whose minimum concentration is used in soil improvement. Their polymers are of many types, such as cationic polymers. Unionized ones like polyvinyl chloride and polyphenol hydrochloride get absorbed by the soil by cation exchange and form floccules in the soil. These polymers are suitable for the improvement of saline soils.

**Anionic polymers:** anionic polymers such as hydrolyzed polyacrylonitrile. Vinyl acetate and malic acid are used to prevent casting in alkaline soil so that the germination of seeds can be increased. Many chemical substances fall under the category of synthetic polymers, which improve the structure, aggregates, and chemical properties of soil.