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Methods to enhance the fertilization of soil

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Abstract
India is the land of agriculture. Most of the people do agricultural activities. The nature of soil is very crucial for the production of crops. The fertilizing property of soil decides whether that soil is appropriate for the agricultural activities or not.
It is observed that it is easy to grow crop on the soil having high rate of fertilization as compared to that of having lower fertilization. If the fertilization property of soil is lower then it can be enhanced with the help of various methods available. The current paper highlights the methods to enhance the fertilization of soil.

Keywords: soil, fertilization, agriculture

Introduction
The fertilization of soil depends on various factors like atmospheric conditions, ground water level, amount of rainfall etc. It is found that the fertilization of soil is lower in the dry areas as compared to other areas. These days, many kind of organic compounds are added in the soil so as to increase the fertilization.
The quality of crop produced from the highly fertilized soil is far better than that of obtained from the lower fertilized soil. The reason is that highly fertilized soil contains a mixture of water, air, nitrogen, phosphorous etc. All these mentioned materials are very crucial for the good crop, therefore, good quality crop is yielded from this kind of soil and benefits a lot.
There are many reasons for the defertilization of the soil. Deforestation and over-fertilizing can cause loss of essential elements from the soil. It is observed that nitrogen in the soil can be evaporated as gas known as nitrogen leaching. This nitrogen leaching can be the reason for the lower fertilization of the soil.
To avoid the situation of nitrogen leaching, it is suggested to provide nitrogen fertilizers in the soil so that the fertilizing efficiency of the soil can be maintained. Many other types of pesticides and fertilizers are also used by the farmers to enhance the fertilization of the soil so that crop production can be made.
Nitrogen and Phosphorus are considered as good nutrient for better soil fertility and it is believed that soil enriched with the nutrients like nitrogen and phosphorus is good for the production of soil as these two nutrients are vary essential for the growing crop.
Soil acidity is measured with the help of soil pH. It is observed that the soil having higher rate of hydrogen ions is acidic whereas soil having lower rate of hydrogen ions is alkaline. Loss of soil due to water known as soil erosion is another factor of lower soil fertility as major nutrients of soil are lost by the water and soil gets less fertilized.
Nutrients are essential for crop production. All plants require nutrients to grow and a significant portion of these nutrients are removed and exported when a crop is harvested. Sustainable crop production requires the nutrients that are removed to be replaced with synthetic fertilizers, manures, municipal wastes or, in a few cases, the atmosphere.
Nutrients are removed from the soil in harvested materials that leave the field. The quantity of nutrient removed is less than total uptake and varies significantly with crop species, yield, where the nutrient is stored in the plant and the portion of the crop that is removed.
Mass flow occurs as dissolved nutrients in the soil solution flow towards roots as the plant takes up water. The amount of nutrient taken up by this process is determined by the amount of available water in the soil, the concentration of nutrient in soil solution and the volume of water consumed by the plant (ex: mass flow is less in dry soil and during cool weather).

Methods to enhance soil fertility
Higher annual temperatures, more extreme weather events and persistent droughts, and increasing population are also exhausting the land. These conditions are creating a cycle of soil degeneration which is stunting agricultural yields and presenting farmers with a new crop of concerns.

Cover cropping / green manure
In our *State of the World 2011* report, agro ecologist and author Roland Bunch defines cover crops / green manure as "any plant, whether a tree, bush, or vine, that is used by a farmer to…improve soil fertility or control weeds." In practice, cover crops are planted alongside or interspersed with other crops to cut soil-eroding wind, prevent overexposure to the sun, and stimulate a healthy soil system. Just as farmers will turn to manure to bolster the soil, they can also clip and spread cover crops' leaves as organic green manure.

Cover cropping / green manure in action
There are more than a million farmers now actively using cover crops / green manure worldwide. In Africa alone, there

are over 120 plant species that are being used or could be used for this purpose. One promising example is the cowpea (also known as the black-eyed pea). This legume is both a nitrogen-fixer, which means that it takes nitrogen from the air and replenishes it in the soil, and deeply rooted, which makes it resistant to drought. Furthermore, the cowpea itself is a nutritious staple food for both people and animals.

Microdosing Fertilizer

Microdosing is defined as "the application of small, affordable quantities of fertilizer with the seed at planting time or as top dressing 3 to 4 weeks after emergence." This precise process stands in stark contrast with the field-wide fertilization used by many farmers.

Using wastewater for irrigation

As urban areas grow in developing countries, residents and governments are struggling to find ways to properly dispose sewage and waste water. The United Nations Food and Agriculture Organization notes that wastewater contains most of the essential elements of fertilizer in the proper amounts. Effective treatment and application of wastewater could dually contribute to healthier urban areas and provide vital, organic fertilizer to rural areas.

Reintegrating Livestock

As many as one billion people around the world "rely on farm animals for their livelihoods," according to researchers from the International Livestock Research Institute. But animals are not only important for their egg and meat production, but also because they can be integrated into larger agricultural systems. Animal manure can be an effective – and inexpensive – way to boost the health of organic topsoil.

Preventing Nitrogen Leaching (Inhibitors)

Nitrogen is essential to healthy soil. Chemical fertilizers and nitrogen-fixing plants, such as legumes, can help provide nitrogen to soils. Yet, nitrogen, like water, follows a cycle that includes leaching or escaping from the ground as a gas. Poor land management, erosion, over fertilization, and chemical runoff can all contribute to nitrogen depletion, which will leave the land dry and unusable. To combat nitrogen loss, soil scientists have been experimenting with chemical inhibitors that will keep vital nutrients in the ground longer.

Discussion

Diffusion is driven by micro-scale differences in the soil solution's nutrient concentrations and a variety of environmental factors that influence nutrient movement. This process is important for nutrients such as P and K that are strongly retained by soil and therefore are present at very low concentrations in soil solution. During diffusion, random movement of ions in soil solution slowly and steadily moves nutrients from areas of relatively high concentration (on or near soil particles) to areas of relatively low concentration (on or near the root). Plants take advantage of this process by depleting the concentration of nutrients near the root surface to levels that are below that of the bulk soil solution. Given the micro-scale nature of this process, diffusion distances are very short (much less than 1 mm) and high densities of roots are required for significant uptake.

Mineralization is the microbial process of converting organic nutrients into inorganic forms making them available to plants. Mineralization occurs when soil microorganisms feed on organic matter that contains concentrations of nutrients that are greater than their own immediate requirements. Since the organic matter contains more nutrients than the organisms require, they release the unneeded nutrients to the soil solution. Organic materials with a low carbon (C) to nutrient ratio are likely to cause mineralization during their decomposition.

The total number of exchangeable cations that a soil can hold depends on the number of exchange sites and is called cation exchange capacity (CEC). The CEC of a soil is primarily dependent on the amount and type of clay, organic matter, as well as the amount of Fe, Al and Mn oxides. Each of these soil components has different retention properties, but generally the higher the CEC the greater the capacity of the soil surfaces to adsorb cations without potential deleterious effects on plants and/or soil biological functions. Soil organic matter and clay particles have large surface areas and have a large number of exchange sites. Most Prairie soils have reasonably high CEC due to sufficient concentrations of clay and organic matter, combined with neutral to alkaline pH (see Soil pH below). Sand particles have a much smaller surface area and fewer exchange sites; therefore, sandy soils have a lower CEC. These soils are more vulnerable to leaching of nutrient cations.

In addition to its role in retaining cations in exchangeable forms, soil organic matter also has the capacity to adsorb some cations very strongly in non-exchangeable forms that are relatively stable and unavailable for uptake by plants or movement with water. Micronutrients such as Cu and Mn are held especially strongly by soil organic matter and their low availability in high organic matter soils (ex: peat soils) may cause Cu and Mn deficiencies in crops. Conversely, Zn is not held strongly by organic matter, so availability of Zn increases in the presence of organic matter.

Conclusion

Organic matter enhances the formation of chelates and other soluble organic complexes, helping to dissolve and mobilize some micronutrients and trace metals. These soluble organic complexes allow some micronutrients to move more readily to plant roots for uptake by crops. However, these soluble complexes also enable these micronutrients to run off more easily into surface water or leach more easily into ground water, especially in sandy soils.

Leaching is the downward movement of water and soluble substances in soil below the root zone. It is an environmental concern when it contributes to groundwater contamination. Leaching occurs during periods of wet weather, at certain times of year (most likely early spring and late fall) and in certain places in the landscape, especially in sandy soils. Depressions in the landscape where groundwater recharge occurs are more susceptible to leaching because they collect water from surrounding areas, particularly during heavy rainfall events or during snowmelt runoff over frozen soils, which then moves downward to groundwater.

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