AGRIALLIS
Science for Agriculture and Allied Sector: A Monthly Magazine
Volume 5, Issue 5
www.agriallis.com

Article Id
AL04217

FARM TECHNIQUES TO CARBON SEQUESTRATION

[1]Parijat De* and [2]Basabduttaa Bhabai

Email
parijatsoil@gmail.com

[1]RKVY, Uttar Banga Krishi Viswavidyalaya, Pundibari, Coochbehar, West Bengal-736165, India

[2]Central Seed Research Station for Jute and Allied Fibres, Bud Bud, Burdwan, West Bengal-713403, India

By volume, the earth's atmosphere (dry air) is made up of 78.09% nitrogen, 20.95% oxygen, 0.03% carbon dioxide, and trace quantities of other gases. Carbon is found in all living species and is the primary component of life on Earth. Carbon is cycled between reservoirs, the atmosphere, seas, terrestrial and marine biota, and other reservoirs in the form of carbon dioxide, carbonates, organic molecules, and so on. According to Stewart and Hessami (2005), natural processes such as photosynthesis (the intake of carbon dioxide by plants), respiration (the release of energy and carbon dioxide), dissolution, and carbonate precipitation assist carbon exchange. Climate change is becoming an increasingly serious problem as the amount of greenhouse gases (GHGs) in the atmosphere increases. It might be regulated by reducing GHGs, particularly carbon dioxide, and sequestering carbon in the soil. Carbon dioxide (CO_2), methane (CH_4), and nitrous oxide are the three most significant GHGs (N_2O). Human activities have raised the concentrations of CO_2, CH_4, and N_2O in the atmosphere by 30%, 145%, and 15%, respectively, since the industrial revolution (IPCC, 2007). CO2 is a unique GHG that traps long-wave radiation reflected from the earth's surface and is likely the only one that has a significant influence in plant physiology. CO_2 is responsible for 7.5% of overall global warming, because of the massive amounts of carbon dioxide already stored in these pools and their ability to continue soaking up carbon dioxide, soil, vegetation, and the ocean are all considered potential carbon dioxide sinks. Photosynthesizing plant absorbs carbon dioxide and stores it as biomass carbon in the terrestrial environment. When dead biomass decomposes through roots, carbon dioxide enters the soil carbon pool. Although the seas hold the majority of the earth's carbon, soils contain around 75% of the carbon pool on land, which is three times more than the amount stored in living plants and animals. As a result, soils play a critical role in sustaining a balanced global carbon cycle. Soil carbon sequestration is the process of transporting carbon dioxide from the atmosphere into the soil via crop leftovers and other organic substances in a non-reemitted state. This carbon transfer, also known as "sequestration," serves to offset emissions from fossil fuel burning and other carbon-emitting activities while improving soil quality and long-term agronomic production. Soil carbon sequestration may be achieved by management strategies that contribute large amounts of biomass to the soil while causing little soil disturbance, conserving soil and water, improving soil structure, and increasing soil fauna activity. Conservation agriculture, minimum/zero tillage, cover crops, crop residue, and organic agriculture are all management approaches for carbon sequestration in soils.

Conservation Agriculture

Conservation agriculture has demonstrated the ability to transform many soils from carbon sources to carbon sinks by sequestering it in soil. Conservation agriculture benefits agriculture by lowering erosion, increasing water infiltration, enhancing soil surface aggregates, reducing compaction through biological tillage promotion, increasing surface soil organic matter and carbon content, and regulating soil temperatures.

Minimum or Zero Tillage

Tillage should be kept to a minimum or non-existent. The primary goal of tillage is to provide a favourable soil environment for plant development. It is one of the key causes causing soil carbon reserves to deplete. When soil organic matter is exposed to air during tillage, it oxidizes, resulting in a decrease in organic matter (OM) content unless extra OM is returned to the soil via residues, compost, or other sources. Tillage destroys the pores left behind by roots and microbial activity. The impact on below-ground biology is not fully understood. As the energy from raindrops is dispersed, the bare surface-exposed following ploughing is prone to soil aggregate collapse. As a result, soil pores get clogged, water penetration decreases, and runoff increases.

Crop Residue

It is also feasible to transport carbon dioxide from the atmosphere into the soil by mixing crop wastes. This carbon transfer, also known as "sequestration," serves to offset emissions from fossil fuel burning and other carbon-emitting activities while improving soil quality and long-term agronomic production. Soil carbon sequestration may be achieved by management strategies that contribute large amounts of biomass to the soil while causing little soil disturbance, conserving soil and water, improving soil structure, and increasing soil fauna activity.

Cover Crop

The use of crops such as legumes and small grains for protection and soil enhancement between times of normal crop production is known as cover cropping. Cover crops increase carbon sequestration by improving soil structure and contributing organic matter. Nair *et al.* (2015) reported in their studies on six winter and summer cover crops grown in phytotrons at three temperatures in two soils, gravelly loam soil (GL) and fine sandy soil (FS), that among winter cover crops, the highest and lowest amounts of C accumulated were 0.597 kg/ m2 by *Vicia faba L.* and 0.149 kg/ m2 by white clover, respectively, in the FS soil. Sunhemp (*Crotalaria juncea L.*) gathered the most C (0.481 kg/m2) among summer cover crops, whereas castor bean (*Ricinus communis*) accumulated the least (0.0102 kg/m2) at 30^{o}C on GL soil. Following a full cycle of winter and summer cover crops, the mean SOC in the GL and FS soils rose by 13.8 and 39.1%, respectively, as compared to the respective soils.

Organic Matter

Organic agriculture is a comprehensive production management method that avoids the use of synthetic fertilisers, pesticides, and genetically modified organisms, reduces pollution of air, soil, and water, and improves the health and productivity of interdependent communities of plants, animals, and humans. FYM has long been regarded as a good source of organic matter for improving soil fertility. Potter *et al*. (1998) discovered that manure treatment resulted in the greatest quantity of C sequestration over a wide variety of soil and climatic conditions. Clay soil has the fastest rate of sequestration. Manure soils showed higher levels of soluble C and a slower turnover rate than control or treated plots.

Conclusions

Sustainable agricultural production methods are being encouraged due to the rising human needs and their effects on the environment. Using less-intensive and wisely planned farming techniques can stabilise the dependence of agricultural output on climatic change. In order to find farming systems that can manage the delicate balance between climatic change and agricultural productions, the agro-environmental attributes must be taken carefully into accounting this context; carbon farming offers a comprehensive and sustainable approach to managing land usage that is good for both the environment and society. It is well-known for its decreased GHG emissions and carbon sequestration, which mostly depend on the temperature, soil properties, vegetation, and land-use practices.

References

Change, C. (2007). IPCC fourth assessment report. *The physical science basis*, *2*, 580-595.

Nair, R., Mehta, C. R. & Sharma, S. (2015). Carbon sequestration in soils-A Review. *Agricultural Reviews*, *36*(2), 81-99.

Potter, K. N., Torbert, H. A., Jones, O. R., Matocha, J. E., Morrison Jr, J. E. & Unger, P. W. (1998). Distribution and amount of soil organic C in long-term management systems in Texas. *Soil and Tillage Research*, *47*(3-4), 309-321.

Stewart, C. & Hessami, M. A. (2005). A study of methods of carbon dioxide capture and sequestration—the sustainability of a photosynthetic bioreactor approach. *Energy Conversion and management*, *46*(3), 403-420.