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Soil Management: An Important Aspect for Sustainable Farming

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SUMMARY

A sustainable farming system should be considered a management system that uses inputs, whether produced on the farm or purchased externally, most efficiently to maximize the productivity and profitability from the operation while minimizing their adverse effects on the quality of soil and water and keeps it buffered against risks. Soil management is applying operations, practices and treatments to protect soil and enhance its performance (such as soil fertility or soil mechanics). It includes soil conservation, soil amendment and optimal soil health. In sustainable agriculture, soil management plays a vital role in keeping soil healthy and preventing agricultural land from becoming poorly productive.

INTRODUCTION

Sustainable farming is the successful management of resources for agricultural production which satisfy the needs of society today while maintaining or enhancing the quality of the environment and conserving natural resources. A farming system can be considered sustainable if it ensures that "today's development is not at the expense of tomorrow's development prospects" (World Commission on Environment and Development, 1987). No farming system will be sustainable unless the soil which forms its pivot and is the essential natural resource is managed scientifically to meet the present and future needs, its productivity and quality are maintained continuously. Thus, there is no reduction of output with inputs.

The important aspects of sustainable farming are:

- Meeting the developing needs of today and tomorrow without deceleration of growth rate with constant inputs.
- Economic viability and enhanced productivity,
- Successful management of resources – internal or external, renewable or non-renewable.
- Maintenance, preferably enhancement, of quality of environment, and
- Conservation of natural resources of soil and water. (Kanwar 2012)

Agricultural sustainability may be defined as a function described by equation (1) (Lal, 1994):

$$\textbf{Agricultural sustainability} = d\,(P_t \times S_p \times W_t \times C_t)\,dt. \ldots (1)$$

Where, Pt is the productivity potential with input of the limiting or non-renewable resource; S_p is the measure of critical soil property, i.e., rooting depth, soil organic matter content, cation exchange capacity; W_t is the plant available water resource and quality; Ct is the climatic factor with reference to evaporation and soil temperature flux of radioactive gases. Thus, it is a product of numerous parameters affecting productivity and sustainability

Need of Soil Management for Sustainable Agriculture:

Main component of sustainable agriculture is SOIL. If we look worldwide there is depletion of soil quality, land resources, occurrence of land degradation, climate change and global warming. Therefore, application of operation and practices, particularly site-specific treatment to protect or enhance soil health for today and the future on a sustainable basis, is crucial. The site-specific soil management practices adopted in sustainable farming that reduces the soil health threats with respect to soil organic matter, nutrient mining, fertility, erosion, problematic soil formation, pollution or heavy metal contamination is sustainable soil health management.

Soil Management for Sustainable Farming

- Integrated Nutrient Management
- Minimum or reduced or zero tillage instead of conventional tillage
- Legume based crop rotation
- Mulching
- Crop residue management
- Proper grazing management (Rotational grazing)
- Scientific water management

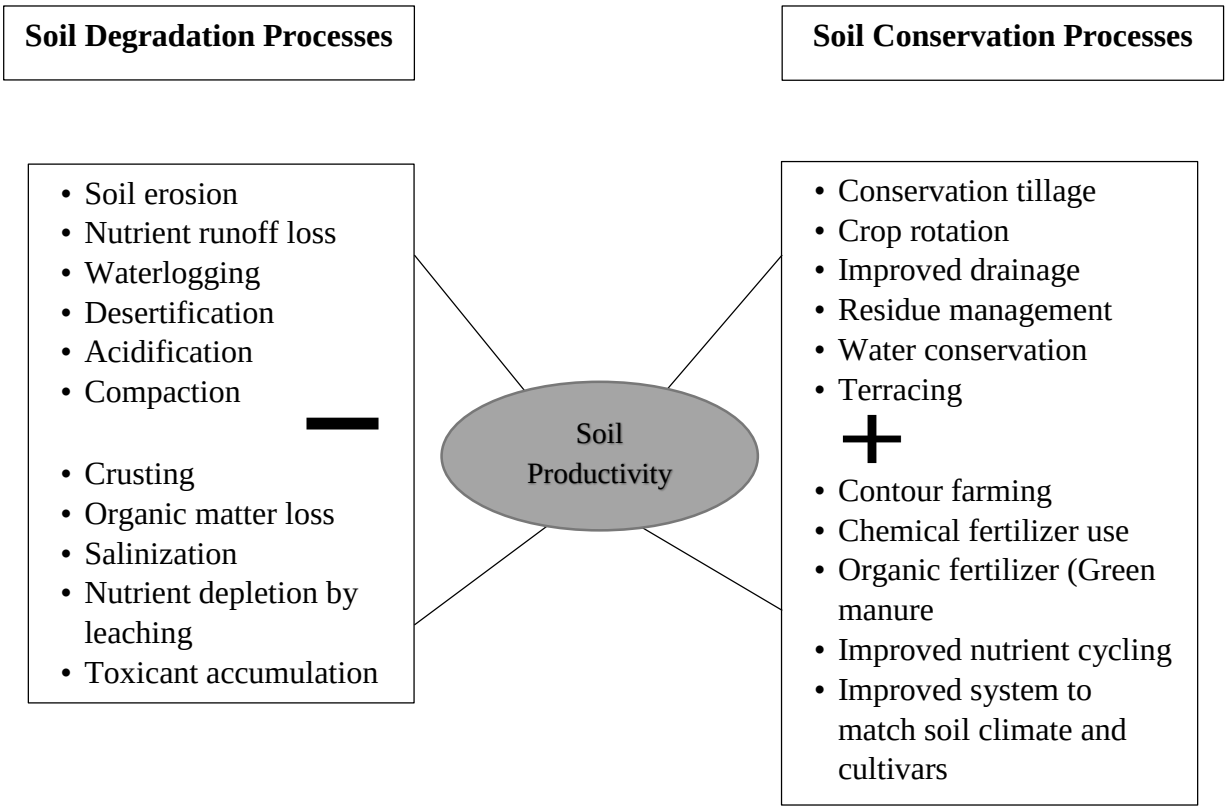

Fig 1. Relationship between soil degradation processes and soil conservation practices

The management practices that improve and protect soil quality (physico-chemical and biological condition of soils) and meet the needs of plants with respect to nutrients, water, oxygen, soil physical conditions for germination, growth of plumule and radicle, root system and its support and also satisfy the goals of sustainable agriculture.

With better soil management, farmers can fight climate change and make agriculture more sustainable:

With regenerative farming, farmland can be used for capturing carbon. The idea that farmers can capture carbon and improve their bottom lines simultaneously is gaining ground in the agriculture sector and among business leaders and policymakers. They would like to pay farmers for adopting conservation practices, such as using cover crops and reduced till methods that take carbon from the atmosphere and store it, presumably for centuries, in the soil. Proponents say that the large-scale adoption of so-called carbon farming can transform the industry from a greenhouse gas emitter to a global carbon absorber. One-way farmers can get paid is to sell carbon credits for each metric ton of CO_2 equivalent they sequester. Private marketplaces for those credits are emerging now, and while their methodologies for verifying carbon practices and certifying credits appear robust, they are not all the same (Bomgardener *et al*., 2021).

CONCLUSION

To achieve food security in the future, the management of soil sustainability will be a challenge through site-specific nutrient management and appropriate soil conservation practices. The research will be required to avoid further degradation of soils through erosion or contamination and produce safe, sufficient and nutritious food for healthy diets.

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