



The impact of agriculture practices on soil health

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ABSTRACT

This comparative study investigates the impact of diverse agricultural practices on soil health. The key indicators to check soil health are aggregates, soil texture, available water capacity, and macronutrients. Four predominant methods – conventional tillage, conservation agriculture, no-till farming, and organic farming are studied through different research papers. This research paper is a combined data from different research papers thoroughly studied.

In the conventional tillage method, the soil is heavily disturbed whereas in conservation agriculture emphasizes less soil disturbance, using techniques like cover cropping and rotating crops. In No-till farming the soil is not disturbed and the seeds are directly planted in the soil so that they can preserve soil structure and prevent erosion. Organic farming doesn't include any synthetic chemicals it focuses on natural fertilizers which help improve soil health and encourage microbial activity and nutrient cycling.

This research provides important information for the farmers and others involved in the agriculture sector. It shows the pros and cons of different farming methods extracted from different research papers. This helps us in improving soil health by better understanding the methods of agriculture. This can help the farmers make smart choices that keep the soil fertile and ecosystems strong in the long run.

Keywords: conservation agriculture, no-till farming, conventional agriculture, organic agriculture, soil health.

I. INTRODUCTION

As in today's time day by day population is increasing so is the food demand to complete the food demand proper agriculture methods and soil health are the most necessary factors and we are learning that maintaining soil health is crucial. Sustainable agriculture, which aims for long-lasting and resilient farming practices, requires a better understanding of how different farming techniques affect the soil. This paper dives into the relationship, looking at how conventional tillage, conservation agriculture, no-till farming, and organic farming. By exploring this method, the paper aims to shed light on which method is best to support soil health and long-term productivity, which will help to guide the farmers to know which practices will ensure both a fruitful harvest and thriving ecosystems

In the quest for higher crop yield, conventional tillage has been the traditional method which involves deeply digging and turning over the soil using mechanical implements such as plods, harrows, and cultivators. Conventional tillage can effectively control weeds and create a favourable seedbed it also comes with drawbacks which include increased soil erosion, and loss of soil organic matter.

The second method, conservation agriculture suggests a different and more sustainable way of doing things differently. It suggests being gentler with the soil, using methods like cover crops and rotating what you plant

The third method known as no-till farming is where the plants are sowed into the soil without tilling the soil. This method relies on specialized equipment that places seeds directly into untilled soil. This practice minimizes soil disturbances and preserves soil structure, organic matter, and beneficial soil organisms

The fourth method is organic farming which involves only natural fertilizers, it avoids synthetic chemicals, organic farming is recognized as a holistic and environment-friendly approach to agriculture it promotes biodiversity, soil health, and animal welfare

This paper dives deep into existing research and real-world studies to explore how different farming methods affect the health of the soil. By uncovering the complex connections between how we farm and the health of the soil, this review aims to help farmers, policymakers, and researchers make smart choices that support sustainable agriculture. It's all about finding the right balance between growing food and taking care of the environment.

What are the causes of this problem:-

1. **Erosion:** Soil erosion, whether due to water or wind, can result in the loss of the topsoil layer, which is rich in organic matter and nutrients. This compromises soil structure and fertility.
2. **Overgrazing:** Uncontrolled grazing by livestock can lead to soil compaction, erosion, and a decline in vegetation cover, negatively impacting soil health.
3. **Deforestation:** Removing trees and vegetation disrupts the natural balance of ecosystems, leading to increased soil erosion, loss of organic matter, and reduced nutrient cycling.
4. **Excessive Use of Agrochemicals:** The overuse of synthetic fertilizers, pesticides, and herbicides can disrupt the natural microbial balance in the soil, negatively affecting soil health and biodiversity.
5. **Monoculture:** Continuous cultivation of a single crop (monoculture) can deplete specific nutrients, promote soilborne diseases, and reduce overall soil biodiversity.
6. **Poor Irrigation Practices:** Improper irrigation methods can result in waterlogging or salinization, adversely affecting soil structure and nutrient availability.
7. **Industrial Pollution:** Soil contamination from industrial activities, such as heavy metal deposition or chemical spills, can have severe impacts on soil health, rendering it unsuitable for agricultural purposes.
8. **Climate Change:** Changes in temperature and precipitation patterns associated with climate change can affect soil moisture levels, nutrient cycling, and the distribution of soil organisms, impacting overall soil health.
9. **Improper Land Management:** Inadequate land management practices, including improper tillage, lack of cover cropping, and neglecting soil conservation techniques, can lead to soil degradation.
10. **Urbanization:** The expansion of urban areas often involves soil sealing, compaction, and contamination, contributing to the decline of soil health in those areas.

II. LITERATURE REVIEW/BACKGROUND STUDY

S.no	Author name	Paper title	methodology	Findings
1	P.K. Joshi (2001)	Preservation Farming	In terms of contemporary farming methods, conservation agriculture is a relatively recent idea. It sets itself apart from traditional farming. It makes the case that the Extensive soil tillage and crop residue burning are encouraged in conventional agriculture.	The technology of conservation agriculture will shape sustainable agriculture in the future.
2	P. Subbian, N. Saravanan, and S. Subbulakshmi (2009)	Conventional Tillage Vs Conservation Tillage	High water infiltration and healthy soil structure are specifically dependent on soil aggregates, particularly those that are water stable.	The constraints and appropriateness of employing conservation tillage techniques are determined by the characteristics of the soil and its natural surroundings
3	John Horowitz Kohei Ueda Robert Abel (2010)	Growing Practice Is Farming	Tillage is the process of plowing soil to remove weeds and pests and to get ready for a long-standing aspect of farmland cultivation is sowing. Reducing the frequency or intensity of soil tilling enables the soil to hold onto more organic matter, which "sequesters" carbon and prevents it from entering the atmosphere as carbon dioxide (CO ₂), a greenhouse gas, thereby causing global warming.	This streak of several years is the most broadly representative data available to evaluate the no-till practice over a number of years.
4	Peter Grace, Lydiah Gateira, Fabrice Clerck, Humberto Blanco-Canqui, and Cheryl Palma (2013)	Ecosystem services and conservation agriculture	A system of agronomic techniques known as conservation agriculture (CA) includes crop rotations, permanent organic soil cover created by keeping crop wastes, and reduced tillage (RT) or no-till (NT)	Compared to conventional methods, conservation agriculture creates the soil conditions that lead to less runoff and erosion and better water quality. Similarly, water-holding capacity
5	Dan TerAvesta,	No-till farming, conservation	International organizations are	Constant no-till corn, CA, and traditional

	Lynne Carpenter-Boggs, Christian Thierfelder, John P. Reganold. (2015)	agriculture, and soil water management	promoting conservation agriculture (CA). International and non-governmental organizations as a way to reduce the negative effects of climate change in southern and eastern Africa, reverse soil degradation, and overcome agricultural output limits.	tillage. In two different analyses, the effects of rotations on crop yield and soil-water relations were assessed.
6	Els Wynen and David Vanzetti	Organic agriculture: Evaluation and prospects for the future	Although our evaluation might be a little subjective, we have made an effort to ground it in sensible guidelines, such as allocating scarce research money as effectively as possible to maximize benefits. Naturally, this will rely on the goals that are promoted. Keeping in mind that the ultimate goal is for all farmers to adopt organic farming methods, we first examine the distinct goals that each stakeholder holds.	Currently, among other things, increased prices put off consumers. It would be advantageous to refocus research funding on lowering marketing expenses.
7	B. Suresh Reddy	Organic farming: Current state, challenges, and future directions.	Green Revolution (GR) technologies are fueled by agrochemicals, machinery, and legislation. It is well known that irrigation increases agricultural productivity and output. India has long been a leader in organic farming.	Encouraging organic farming involves carefully converting farms to organic practices, with the goal of minimizing yield loss.
8	Johannes Lehmann, Deborah A. Bossio, Ingrid Kögel-Knabner, Matthias C. Rillig.	The notion and potential of soil health in the future.	The ability of soil to continue functioning as a living ecosystem that supports humans, animals, and plants is known as soil health. It also links agricultural and soil research to policy, stakeholder demands, and sustainable supply-chain management.	The definition, background, and comparison of soil health with other soil concepts are provided in this perspective
9	Rattan Lal	Soil quality and agricultural sustainability	The population growth of developing tropical countries and the diversion of agricultural land to other purposes	Agricultural sustainability, soil quality, food security, quality restoration, long-term

			exacerbate the depletion. Because of this, the amount of irrigated land and grain harvested per person worldwide is steadily declining.	management, and the reluctance to embrace new technology.
10	Dr. C. Vijai and Mr. M. Elayaraja	India's organic farming industry	For developing nations, agricultural development policies should concentrate on boosting agricultural land production, cutting costs, and producing goods that are more efficient and cause little to no harm to the environment or to people.	It relies far more on composts made from natural sources, such as green waste, bone meal, and fertilizer waste, than it does on choosing not to use pesticides or fertilizers.
11	Paul Mäder Adrian Muller Julia Jawtusch Andreas Gattinger.	No-till agriculture.	It is defined as "as a framework for Crops are planted (seeded) into tilled soil by creating a narrow slot trench or band that is only deep enough and wide enough to allow for adequate seed coverage.	Originally, no-till farming was created as a technique for preserving the land and water resources as natural resources.
12	S.S. Rana	Organic Farming	Sustainable agriculture refers to the effective use of agricultural resources to meet evolving human requirements while preserving or improving the environment and protecting natural resources.	It is anticipated that organic food prices in India would decline, resulting in increased exports in the future.
13	John W. Doran.	Soil health and global sustainability	The task of creating agricultural management systems that are sustainable for people and the majority of other species is made more difficult by the need to take into account the systems' usefulness to humans, their efficiency in using resources, and their capacity to preserve environmental balance.	A farmer's concise definition of sustainable agriculture, "An agriculture that sustains the people and preserves the land," perfectly captures the complex and dynamic nature of sustainability.

14	Douglas E Romig, M Jason Garlynd, Robin F Harris, Kevin McSweeney	How farmers judge the quality and health of the soil.	Soil quality has been drastically modified in response to the demands of environmental and agricultural sustainability. Because of what it does not and cannot convey, the conventional understanding of soil quality, as determined by soil performance and productivity, is today deemed inadequate.	Farmers using traditional farming methods have gained recognition in the past ten years for their in-depth understanding of agroecosystems.
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III. Methodology

For this research paper 200 research paper were taken into consideration

Then out of this 200 paper 50 paper were selected that were the most relevant

Then the 14 paper that were the most suitable regarding our topic were studied thoroughly and we made a combine research paper taking information form the all.

IV. RESULTS AND ANALYSIS

1. Conservation Tillage:

Ease of Application: Moderate

Summary: Conservation tillage involves methods that reduce soil disturbance, such as no-till or minimum tillage, to conserve soil and water. It's moderately easy to apply, requiring adjustments to traditional tillage practices. Pros include reduced erosion, soil degradation, and cost-effectiveness. However, it may require specialized equipment and adjustments to farming techniques.

2. Conservation Agriculture (CA):

Ease of Application: Moderate to Difficult

Summary: Conservation agriculture aims to maintain a permanent soil cover, minimize soil disturbance, and diversify crop rotations. While the basic principles are straightforward, implementing CA effectively requires significant adjustments in farming practices and may be challenging for some farmers. Pros include improved soil health, reduced erosion, and enhanced water retention. However, it demands a holistic approach and careful management, which may be difficult for some farmers to adopt.

3. Organic Farming:

Ease of Application: Moderate to Difficult

Summary: Organic farming avoids synthetic inputs and focuses on soil health and biodiversity. While the principles are simple, transitioning to organic methods can be challenging due to the need for certification, availability of organic inputs, and adjustments in farming practices. Pros include environmental

sustainability, improved soil health, and reduced chemical inputs. However, it may require more labor and expertise, and there could be yield fluctuations during the transition period.

4. Conventional Tillage:

Ease of Application: Easy

Summary: Conventional tillage involves regular soil disturbance and may include practices like plowing and harrowing. It's the traditional method and is relatively easy to apply, requiring standard farming equipment. Pros include immediate weed control and soil aeration. However, it can lead to soil erosion, loss of soil structure, and increased fuel consumption.

In summary, conservation tillage and conventional tillage are relatively easier to apply compared to conservation agriculture and organic farming. Each method has its pros and cons, with conservation practices generally offering long-term benefits for soil health and sustainability, while conventional methods may provide immediate results but can have adverse effects on soil and the environment over time

V. CONCLUSION

On the overall after studying about all the practices of agriculture and how they impact on the soil and reading through the different research paper getting acknowledgement through the research paper from different authors helped us in getting to the result. All the information were based on secondary information all the agriculture practices are convenient but the most suitable one are the no till farming as it do not disturb the soil and maintain its quality and the second one is the organic farming it uses the most natural fertilizer to keep the soil the most fertile. So this is what this research paper includes.

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