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# Analysing after effect of agriculture engineering operations on the quality of soil and water

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**Abstract**
Soil and water are two critical natural resources and agricultural production necessities. Nowadays, it is necessary to understand the fundamentals of many soil conservation strategies employed in agriculture. As a result, soil and water should be prioritised in terms of conservation, and appropriate procedures should be employed to assure their long-term viability and availability. Agricultural Engineering provides a distinct perspective on environmental management that is unavailable from other engineering or agricultural schools. On a wide range of fronts, including soil and plant habitats, surface and ground water quality, air quality, animal environments, and food safety, basic engineering principles are used to avoid, lessen, and repair unfavourable environmental impacts. In this study it is concluded that even on farms with minimal levels of mechanisation and chemical application, environmental controls should be implemented.

**Keywords:** agriculture, farming, engineering, practices, soil, water

## Introduction

Agriculture is a country's first step toward development. Any state's economic growth rate can be boosted more readily by maintaining enough food production. Engineering is a vital component of the agriculture sector that can help to overcome issues related with crop production, among other growth characteristics. Agricultural engineering made several technical breakthroughs to minimise drudgery and aid enhance labour productivity during the early years of the Green Revolution. Agricultural engineering is the study of the design, manufacture, use, and management of technical means and procedures for the production, storage, treatment, and processing of agricultural goods, plants, and animals, as well as post-harvest technology. Agricultural engineering and mechanisation aims to increase land and labour efficiency, serve to expand agricultural land, save resources (seed, fertiliser, water), improve product quality, protect the environment, save agricultural production sustainability, reduce hard work and drudgery, improve operators safety, create attractive jobs for men and women to prevent rural exodus, improve farm machinery management and multiform use, and improve farm machinery management and multiform use.

As a result, agricultural engineers all across the world are now using their engineering expertise and abilities to help their state's agriculture and food sector grow. Agricultural engineers are employing modern techniques, systems, and machines to produce better food and services in order to improve agricultural practises through the efficient use of machinery and farm power. Agricultural engineers design, manufacture, and install agricultural machinery, as well as construct farm structures, process, and store products for better food production. Agricultural Engineering is the foundation of agricultural progress, and its neglect poses a threat to any country's farm management system's long-term existence.

- **What Has Changed in the Field of Agricultural Engineering?**

Agriculture engineering is rapidly changing, with a slew of new game-changing innovations on the horizon. It's a fascinating career that's always changing due to quick technology advancements, so employees are likely to learn something new every day. Based on a report by Policy Horizons Canada, Business Insider identified 15 up-and-coming agricultural technologies in 2014, including the following:

- Agricultural robots, often known as 'agbots,' and robotic/driverless tractors are used for a variety of tasks, including harvesting and watering.
- Closed ecological systems are those that "do not rely on matter exchange outside the system" and instead transform waste products from within to maintain the life-forms that live there.

- Gene editing, which has resulted in the development of new food strains such as non-browning mushrooms and strawberries with a peach flavour. These are completely engineered, unlike genetically modified foods.

Some of these innovations have gone mainstream in the last five years, while others have become more scientifically and financially viable. And, given the various issues the sector is facing, they are more crucial than ever. Agricultural engineering guarantees that farming is carried out intelligently and efficiently in order to fulfil the demands of the world's rising population.

## 2. Research Methodology

### Experimental Design

The tests were set up in a complete block design with two tillage treatments: following second disc ploughing and no tillage from the adjacent forest. Three soil samples were taken from the location and three from the adjacent forest at random. Two water samples were taken from an earth pond on the farm and a creek 8 metres downstream from the farm's boundary.

### Techniques for collecting samples and samples

Three soil samples were gathered from the farm and three from undisturbed soils in the adjacent forest at random. Using a cutlass and a soil auger, each of the soil samples was obtained from a depth of 0 to 15cm.

Two water samples were taken, one from the farm (earth pond) and the other from an off-farm location (stream at the boundary). For the control, water samples were gathered from the location in a 1 litre container at the surface.

### Operations and Equipment in Use at the Farm

These were;

- Tillage operation using disc plough and disc harrow (100-120 hectares)
- Planting operation using maize planter and soya bean planter
- Fertilizer application using fertilizer broadcaster/spreader (NPK; 15:15:15, urea 4600 i.e., pure nitrogen)
- Pesticides application using knapsack sprayer (phytozine)
- Harvesting operation using corn picker
- Soil erosion control using contouring and terracing

## 3. Results and Discussion

### Soil Properties

Table 1 shows the mean of soil chemical and physical parameters for samples collected from the two sites (site A and control site B). Both sites' soil samples were acidic, and the site's soil organic matter was minimal. The total organic carbon at the control site was higher than at the location. At the location, the proportion of available P was higher, while at the control, it was lower. The percentages of exchangeable bases were likewise generally lower at the site, with the exception of sodium, which had the highest proportion while the control had the lowest, i.e. potassium, calcium, and magnesium. The percentages of extractable micronutrients Mn and Zn were higher at the site, with the exception of Fe, which was lower. The control site had a larger percentage of exchangeable acidity than site A. The soils were sandy-loam soils at the sites.

**Table 1:** Mean Values of Chemical and Physical Properties Constituent of Soils (0 to 15cm) at the Two Experimental Sites (Site A and Control B).

| Soil Properties | Unit | At Site A | At Control Site B | % diff = $\frac{A-B}{A} \times 100$ |
|---|---|---|---|---|
| pH | | 5.43 | 5.29 | +2.75 |
| Soil Organic Matter | g/Kg | 29.76 | 40.02 | −34.44 |
| Total Organic Carbon | g/Kg | 17.26 | 23.19 | −34.45 |
| Available P | mg/Kg | 51.30 | 21.71 | +57.67 |
| Exchangeable K | cmol/Kg | 0.38 | 0.40 | −5.26 |
| Exchangeable Ca | cmol/Kg | 1.24 | 2.51 | −100 |
| Exchangeable Na | cmol/Kg | 1.27 | 1.22 | +3.92 |
| Exchangeable Mg | cmol/Kg | 0.95 | 1.39 | −45.24 |
| Exchangeable acidity | | 0.28 | 0.44 | −53.56 |
| Fe | mg/Kg | 55.45 | 64.75 | −16.77 |
| Zn | mg/Kg | 5.67 | 3.49 | +38.45 |
| Mn | mg/Kg | 202 | 86.60 | +57.13 |
| Moisture Content | % | 13.99 | 22.65 | −61.91 |
| Bulk Density | mg/cm3 | 0.42 | 0.38 | +0.10 |
| Porosity | % | 22.04 | 23.48 | −6.9 |
| Sand | g/Kg | 778 | 798 | −2.57 |
| Silt | g/Kg | 94 | 104 | −10.64 |
| Clay | g/Kg | 128 | 98 | −23.44 |
| Textural Class | | Sandy-loam | Sandy-loam | |

### Soil physical properties

In tillage trials, soil bulk density is arguably the most often measured soil quality parameter. The tractorized plot produced a larger percentage of dry bulk density (after second ploughing) than the no-tillage field (control site). This is to be expected, given the level of compaction and the strain on microorganisms in the soil, which causes death. Because of the pressure, soil compaction causes three issues. Microorganisms are killed, moisture is removed, and root penetration is difficult. These are variables that have an impact on plant growth and yield. Repetitive tillage, according to Ojeniyi and Agboola (1995), reduced soil quality and caused fast collapse of soil structure. High-intensity rainstorms in the tropics' sub-humid and humid regions likely to exacerbate tillage's loosening effects. Reduced porosity and a shift in pore size distribution are closely linked to intensive soil cultivation, which can increase soil bulk density. There was loose low porosity even in the site analysed, which had very moderate level mechanisation.

In rain-fed agriculture, soil moisture serves as a source of water for plants. Soil moisture is crucial for good seed germination and seedling emergence, as well as crop growth and yield. The soil moisture content in the no-tillage plot was higher than in the after-second-ploughing plot.

The biological productivity and hydrology of agricultural soils are influenced by soil porosity and organic matter content. Soil pores vary in size, shape, and continuity, and these features influence water infiltration, storage, and drainage, gas movement and distribution, and the ease with which growing roots can penetrate the soil. In this study, the No tillage plot had a larger percentage of total porosity (1.43 percent) than the after second ploughing plot, which had a lower percentage of total porosity. Tillage practises, reduced porosity by reducing organic matter and weakening soil structure.

**Chemical Properties of Soil**

The degradation of mineral rock into vital elements that plants can use is influenced greatly by soil pH. The soils studied had a high pH, and the order of increase was control less than site. The soils' significantly acidic composition can be linked to high cropping intensity (which results in the plants assimilation of the majority of the basic cations) and moderate rainfall (which causes leaching). Organic matter affects soil physical, chemical, and biological qualities as well as acting as a source of nutrients, increasing nutrient exchange sites and influencing pesticide destiny. The control group had a larger percentage of soil organic matter than the no-tillage group (SOM). Poor organic matter soils, particularly sandy soils, are low in boron and zinc. Organic materials can help keep iron in a soluble form by forming natural chelates. Because of the strong bonding of copper to organic matter, high organic matter concentration offers more accessible boron to plants, but it also reduces copper availability and may bind manganese into unavailable organic complexes. The location has a lower percentage of organic carbon than the control. The difference could be explained by the effect of continual cultivation, which accelerates the oxidation of organic materials. The findings corroborated those of Negassa (2001) and Malo *et al*. (2005), who found that cultivated soils had less organic carbon than grassed soils. Exchangeable bases (K, Ca, and Mg) were all reduced at the location, with the exception of Na, which had the highest percentage. The decline in the nutrient reserve of tilled soils (after second ploughing) could be attributed to the extensive destruction of soil structure during land preparation, which intensified soil erosion (soil wash), which preferentially removed colloidal fractions with high "enrichment ratios," resulting in a progressive depletion of its nutrient reserves. Low exchangeable Ca and Mg seen on tilled plots, according to Negassa (2001), could be attributed to leaching, soil erosion, and crop harvest. As a result of this research, it was discovered that accessible phosphorus was higher after the second ploughing. Because phosphorus availability and solubility are pH dependent, the soil pH may have altered the level of phosphorus availability. According to Ozubor and Anoliefo (1999), low pH soils cause phosphorus to react with aluminium and iron to generate complex compounds such aluminium phosphate (Al3 PO4) and iron phosphate (FePO4), which are fixed in the soil and unavailable to plants.

At the tillage location, the micronutrients Zn and Mn had the highest percentage, while Fe had the highest percentage at the control site. Zinc is required for the synthesis of tryptophan, a protein molecule required for the formation of auxins, growth hormones. Soil pH, soil texture, soil phosphorus, and meteorological conditions all influence the amount of accessible Zn in the soil. Zinc availability to plants reduces when soil pH rises, and soils with a pH over 6.5 become deficient. Low Zn concentrations in tillage plots, according to Negassa (2001), may be attributable to constant crop harvesting, organic matter oxidation, and topsoil removal through sheet and rill erosion, all of which are exacerbated by tillage activities. Manganese (Mn), like magnesium (Mg), aids in the transformation of enzymes. Soil pH, organic matter content, soil moisture, and soil aeration all influence the quantity of accessible Mn in soils. Iron is required for the manufacture of chlorophyll, the green pigment that aids in photosynthesis, but it is not a component of the chlorophyll molecule. The increase in soil pH causes a decrease in Fe in the soil solution. According to Eneji (1997), some micronutrient decreases can be attributable to soil organic matter loss, which has been shown to correlate very well with soil micronutrients.

**Analysis of Water**

Table 2 shows the average water analysis readings at the two sites. Although both water samples were alkaline, the pH of water samples taken at the control site registered higher values. The control's available P and K levels were likewise higher than the sites. During data collection, it was discovered that the turbidity level of the control water was higher than that of the site. This could be due to colloidal materials such as clay, silt, rock pieces, and metal oxides eroding from the farm site's soil to the water body downstream, or it could be due to leaching, drainage, and flow from the soil site to the water body downstream. Fertilizer ingredients can enter surface water through farm runoff or leak into ground water if improperly managed.

**Table 2:** Results of Mean Values of Water Analysis

| Properties | Units | At Site | At Control Site% Difference = $\frac{A-B}{A} \times 100$ | |
|---|---|---|---|---|
| Ph | mg/l | 7.1 | 7.5 | -5.63 |
| Available P | mg/l | 0.15 | 0.25-38.91 | |
| K | mg/l | 2.71 | 6.52-137.94 | |

**4. Conclusions**

Tillage techniques resulted in a decrease in soil macro and micro nutrients, according to the findings of this study. After the second disc ploughing plot, the declines were steeper. The decrease in soil organic carbon in mechanically tilled plots reflects the drop in Ca, K, and Mg due to fast break down and mineralization of the soil organic carbon. The loss of soil organic matter may be responsible for the decrease in several micronutrients (Fe, Zn, and Mn).

The findings of this study also showed that fertiliser applications, even at low levels, have a negative impact on the soil/water ecosystem. Though both the pH of the water samples from the locations were alkaline, the mean pH value of the water sample at the site was lower than that of the control. The control site's mean values of accessible P and potassium were higher than the site's. This could be due to colloidal elements such as clay, silt, rock fragments, and metal oxides being eroded from the soil site to the water body, or it could be due to leaching, drainage, and flow from the soil site to the water body downstream. It is established that even when low to moderate levels of automation are used, there is noticeable soil deterioration and water pollution. As a result, even in this category of farms, precautions must be taken. Hence, reorientation of Indian agriculture is very much important with quick adaptation of advanced agricultural engineering technologies to combat ongoing COVID-19 like pandemic situation.

## 5. References

1. Das Dwarika, Paramaguru, Pradosh Kumar, Kar S, Toppo, Rashmita. Agricultural Engineering Interventions for Sustainable Agriculture during the COVID-19 Pandemic Situation, 2020.
2. Arshad, Imran, Farooqui, Omair, Ali, Wajiha. Impact of Agricultural Engineering Practices on Farm Management: A Case Study of Gharo Model Farm, 2017, 2517-9586.
3. Abdullahi, Halimatu, Sheriff, Ray, Mahieddine, Fatima. Technology Impact on Agricultural Productivity: A Review of Precision Agriculture Using Unmanned Aerial Vehicles 2015;154:388-400. 10.1007/978-3-319-25479-1_29.
4. Jain KK. Agricultural Engineering interventions to increase the productivity and reduce the drudgery of women in agriculture in India, 2014.
5. Carravilla, Maria, Oliveira, José. Operations Research in Agriculture: Better Decisions for a Scarce and Uncertain World. Agris on-line Papers in Economics and Informatics, 2013, 37-46.
6. Bello, Segun. Agricultural Engineering: Principles and Practice, 2012.
7. Sindir, Kamil, Martinov, Milan, Škaljić, Selim *et al*. The role of agricultural engineers in sustainable rural development in SEE (South Eastern Europe) countries. Journal of Agricultural Sciences, 2008, 53. 10.2298/JAS0802151S.
8. Shirahatti SS, Ayyanagowdar MS, Polisgowdar BS. Computer based water allocation to water users' associations- a model for water management officials, Karnataka Journal of Agricultural Sciences. 2007;20(2):335-337
9. Senzanje, Aidan. Problems faced and advances made by agricultural engineers in southern and eastern Africa. Journal of Scientific Research and Development. Invited Overview Paper, 2003.