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"THE EFFECTS OF SOIL PH ON SOIL HEALTH AND ENVIRONMENTAL SUSTAINABILITY: A REVIEW."

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Abstract:

Soil pH is a critical factor that influences soil health and environmental sustainability. This literature review assesses the role of soil pH in soil health and environmental sustainability. Soil pH affects nutrient availability, microbial activity, and soil structure. The optimal pH range for nutrient availability, microbial activity, and soil structure is between 6.0 and 7.0. When the soil pH is too low or too high, these factors may be compromised, leading to poor soil health and reduced environmental sustainability. Soil pH can be managed through practices such as liming, fertilization, and crop rotation. Further research is needed to investigate the impact of soil pH on soil health and environmental sustainability in different soil types and regions.

Keywords:

Soil pH, Soil health, Environmental sustainability, Nutrient availability, Microbial activity.

Introduction:

Soil health and environmental sustainability are crucial for the well-being of the planet and its inhabitants. Soil pH is one of the important factors that influence soil health and environmental sustainability(Arshad, & Martin, 2002). Soil pH is the measure of the acidity or alkalinity of the soil, and it affects the availability of nutrients to plants, microbial activity, and soil structure. In this literature review, we will assess the role of soil pH in soil health and environmental sustainability (Pimentel,D., 2006).

(a)Soil pH and Nutrient Availability-

Soil pH has a significant influence on the availability of nutrients to plants. The nutrients that are essential for plant growth, such as nitrogen, phosphorus, and potassium, are most available to plants at a soil pH of between 6.0 and 7.0. When the soil pH is too low or too high, the availability of these nutrients decreases, and plants may suffer from nutrient deficiencies(Zhang, et al., 2016). For example, when soil pH is too low, aluminum and manganese become more soluble, which can be toxic to plants. In contrast, when soil pH is too high, iron, zinc, and other micronutrients become less available to plants. Therefore, maintaining a proper soil pH range is critical for nutrient availability and plant growth.

(b)Soil pH and Microbial Activity-

Soil pH also plays a crucial role in microbial activity. Microorganisms are essential for soil health as they decompose organic matter, fix nitrogen, and enhance soil structure. The optimal pH range for most microorganisms is between 6.0 and 7.5. When the soil pH is too low or too high, microbial activity decreases(Dong, W. et al,.2017), leading to a reduction in soil health.

For example, soil with a low pH may have reduced microbial activity, which can impact the decomposition of organic matter, leading to the accumulation of organic matter and the release of greenhouse gases(Gao, J.,et al.,2015). On the other hand, soil with a high pH may have reduced microbial activity, which can lead to poor nutrient cycling and the accumulation of toxic compounds.

(c)Soil pH and Soil Structure-

Soil pH also affects soil structure. Soil structure refers to the arrangement of soil particles and the spaces between them. The optimal pH range for soil structure is between 6.0 and 7.0. When the soil pH is too low or too high, soil structure may be compromised, leading to soil erosion and reduced water-holding capacity. For example, soil with a low pH may have reduced soil structure, leading to soil erosion and reduced water-holding capacity(Brevik, & Burgess, 2014). On the other hand, soil with a high pH may have reduced soil structure, leading to compaction and reduced water infiltration.

Literature Review:

Samiullah and Mohammad (2019) conducted a study to evaluate the impact of soil pH on soil health and environmental sustainability. The study concluded that maintaining the optimal soil pH range of 6.0-7.0 is crucial for promoting soil health and environmental sustainability. The study recommended using lime or other amendments to adjust soil pH as necessary. Li et al. (2018) investigated the impact of soil pH on microbial diversity and activity. The study found that soil pH is a critical factor that influences microbial diversity and activity. The study recommended maintaining the optimal soil pH range to promote microbial activity and enhance soil health.

Kumar et al. (2020) conducted a study to evaluate the impact of soil pH on nutrient availability and plant growth. The study concluded that maintaining the optimal soil pH range is crucial for nutrient availability and plant growth. The study recommended using fertilizers and other amendments to adjust soil pH as necessary.

Lal (2004) conducted a study to evaluate the impact of soil carbon sequestration on climate change. The study found that soil pH is an important factor that influences soil carbon sequestration. The study recommended maintaining the optimal soil pH range to enhance soil carbon sequestration and mitigate climate change.

In conclusion, maintaining the optimal soil pH range is crucial for promoting soil health and environmental sustainability. Soil pH affects nutrient availability, microbial activity, and soil structure. Soil pH can be managed through practices such as liming, fertilization, and crop rotation. Further research is needed to better understand the impact of soil pH on different soil types and regions.

Material and method:

We are searched various databases, including research hub (Google Scholar, Web of Science, Scopus, and other web) to identify relevant scientific articles and publications on the topic. The search was conducted using keywords such as soil pH, soil health, environmental sustainability, nutrient availability, microbial activity, soil structure, liming, fertilization, and crop rotation. The selected articles and publications were critically analyzed to extract relevant information on the role of soil pH in soil health and environmental sustainability.

The data obtained from the selected studies were synthesized and discussed to provide a comprehensive understanding of the topic. The results and discussion were based on the findings of the selected studies and were presented in a coherent and organized manner.

The material and method used in this literature review involved a thorough search and critical analysis of relevant scientific articles and publications on the role of soil pH in soil health and environmental sustainability.

Result and Discussion:

Soil pH is a critical factor that affects soil health and environmental sustainability. The optimal soil pH range for nutrient availability, microbial activity, and soil structure is between 6.0-7.0. When the soil pH is too low or too high, these factors may be compromised, leading to poor soil health and reduced environmental sustainability.

Nutrient Availability: Soil pH has a significant influence on the availability of nutrients to plants. The nutrients that are essential for plant growth, such as nitrogen, phosphorus, and potassium, are most available to plants at a soil pH of between 6.0 and 7.0. When the soil pH is too low or too high, the availability of these nutrients decreases, and plants may suffer from nutrient deficiencies.

Microbial Activity: Soil pH also plays a crucial role in microbial activity. Microorganisms are essential for soil health as they decompose organic matter, fix nitrogen, and enhance soil structure. The optimal pH range for most microorganisms is between 6.0 and 7.5. When the soil pH is too low or too high, microbial activity decreases, leading to a reduction in soil health.

Soil Structure: Soil pH affects soil structure, which refers to the arrangement of soil particles and the spaces between them. The optimal pH range for soil structure is between 6.0 and 7.0. When the soil pH is too low or too high, soil structure may be compromised, leading to soil erosion and reduced water-holding capacity.

Managing Soil pH: Soil pH can be managed through practices such as liming, fertilization, and crop rotation. Liming involves adding calcium carbonate or other alkaline materials to raise the soil pH, while fertilization involves adding nutrients to the soil to maintain the optimal pH range. Crop rotation involves alternating crops with different nutrient requirements to prevent soil nutrient depletion and maintain soil pH.

Conclusion:

In conclusion, maintaining the optimal soil pH range is crucial for promoting soil health and environmental sustainability. Soil pH affects nutrient availability, microbial activity, and soil structure. Soil pH can be managed through practices such as liming, fertilization, and crop rotation. Further research is needed to better understand the impact of soil pH on different soil types and regions.

In this paper also conclude-soil pH plays a crucial role in soil health and environmental sustainability. Maintaining a proper soil pH range is critical for nutrient availability, microbial activity, and soil structure. Soil pH can be managed through practices such as liming, fertilization, and crop rotation. Further research is needed to investigate the impact of soil pH on soil health and environmental sustainability in different soil types and regions.

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