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EFFECT OF ORGANIC FERTILIZERS ON GROWTH AND YIELD OF CROP PLANTS: A COMPARATIVE ANALYSIS

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Abstract

Interest in organic fertilizers as substitutes for synthetic inputs has increased due to the growing need for sustainable farming methods worldwide. With an emphasis on tomatoes and maize, this study investigates the impact of several organic fertilizers on crop plant development metrics and yield. Recent research shows that, while often at a slower beginning speed than synthetic fertilizers, organic fertilizers considerably increase soil health, plant physiological characteristics, and productivity. Vermicompost and chicken manure regularly outperform other organic additions in terms of vegetative growth and fruit/grain output, according to data from controlled tests. Optimal results, however, rely on sustainable crop production and appropriate nutrient balance, which calls for customized management to satisfy crop-specific nutrient requirements and integration techniques. The viability of organic fertilizers is the conclusion drawn from this article.

Keywords: Crop growth, Crop yield, Plant nutrition, organic fertilizer, vermicompost

I. INTRODUCTION

Modern intensive agriculture depends largely on chemical fertilizers to improve crop yields, but this has led to environmental degradation, soil health loss, and long-term sustainability problems (Savci, 2012). An eco-friendly and renewable substitute is provided by organic fertilizers, which come from microbial, plant, or animal sources. They provide vital macro- and micronutrients and improve soil structure, water-holding capacity, and microbial biodiversity (Arancon et al., 2004). The current research on the effects of various organic fertilizers on important growth metrics and agricultural plant ultimate yield is summarized in this document. The key concept is that well-managed organic fertilizer may deliver yields equivalent to conventional systems while boosting soil ecosystem services.

II. LITERATURE REVIEW

Michael Blumenstein et al., (2017)

In recent years, one of the most popular research areas in computer vision and pattern recognition has been video-based human activity identification. Surveillance, robotics, healthcare, video searching, and human-computer interaction are just a few of its numerous applications. Crowded backgrounds, occlusions, different points of view, camera movements, and execution pace are some of the challenges that human action recognition in movies encounters. A considerable diversity of ways have been created to manage the issues over the decades. Research employs three primary types of datasets: RGB-depth videos, many perspectives, and single viewpoints. This article presents an overview of different state-of-the-art deep learning-based algorithms recommended for human activity recognition on the three types of datasets. Given the growing popularity and recent developments in video-based human action detection, this study offers insights into current patterns and potential topics for future research to benefit scholars.

Qaisar Abbas et al., (2019)

Because machine learning methods need real-time processing, real-time video object identification, tracking, and recognition are difficult tasks. In recent years, techniques based on deep learning have been employed to evaluate films; these techniques are more accurate but need more computing power. A current evaluation of the most sophisticated deep learning platforms and architectures for deep vision systems is offered in this paper. It brings attention to the problems and contributions made by numerous scientific studies. In particular, this book provides an initial description of the architecture of various deep learning models, such as AutoEncoders, deep Boltzmann machines, convolution neural networks, recurrent neural networks, and deep residual learning. Deep real-time video object identification, tracking, and recognition study are then highlighted to highlight the key trends in terms of processing cost, number of layers, and result accuracy. The challenges of using DL for real-time video processing are covered in the study's conclusion, along with some possible directions for DL algorithms in the future.

Athanasios Voulodimos et al., (2018)

One of the most prominent instances of how deep learning methods have surpassed previous state-of-the-art machine learning techniques in recent years is computer vision. This review article provides a brief overview of some of the most significant deep learning algorithms used in computer vision applications, including Convolutional Neural Networks, Deep Boltzmann Machines, Deep Belief Networks, and Stacked Denoising Autoencoders. Their applications in various computer vision tasks, including object identification, face recognition, action and activity detection, and human location estimate, are discussed after a brief overview of their background, structure, advantages, and limitations. Finally, a brief overview of the challenges involved in creating deep learning methods for computer vision applications is given.

Vijeta Sharma et al., (2021)

Research reveals a great deal of advanced research on many data kinds, including text, audio, and images, using deep learning techniques; nevertheless, video processing research has recently become a growing area of computer vision. Several research are ongoing on video processing applying computer vision deep learning algorithms, targeting specialized applications such as anomaly detection, population analysis, activity monitoring, etc. However, combined research has not yet been looked at.

This study aims to provide a Systematic Literature Review on video processing using deep learning by formulating relevant research questions to investigate the applications, functions, methodology, datasets, issues, and challenges. Ninety-three research papers from credible databases published between 2011 and 2020 are included in this exhaustive mapping. We categorize the deep learning technique for video processing as CNN, DNN, and RNN based. Video processing has significantly improved between 2017 and 2020, mostly as a result of deep learning techniques based on AlexNet, ResNet, and LSTM. The three primary areas of video processing research are behavior analysis, crowd anomaly detection, and human action identification. This SLR might be a helpful resource for researchers looking into new articles, available datasets, and deep learning techniques for video processing.

Yinglong Li (2022)

A technical tool with various potential applications, deep learning plays a crucial role in photo recognition. Given the theoretical and practical significance of image recognition technology in improving computer vision and artificial intelligence, this article will explore and investigate the use of deep learning in picture recognition. The three main deep learning learning models generative adversarial networks, recurrent neural networks, and convolutional neural networks are presented and compared in this study after an outline of the development of icon recognition technology. Finally, the research results of deep learning image recognition application sectors, such as face identification, medical image recognition, and remote sensing image classification, are analyzed and addressed. According to this paper's examination of the development trend of deep learning in the field of image recognition, the effective recognition of video photos and the theoretical reinforcement of models are the future growth areas.

Atiq ur Rehman et al., (2023)

Over the last several years, the task of identifying videos has been significantly more successful. Interest in the topic has grown, especially since deep learning models were developed as a useful tool for automatically classifying movies. In order to recognize the importance of the video classification problem and to provide a summary of the efficacy of deep learning models for this job, this paper offers a very comprehensive and concise evaluation of the topic. The scientific literature has a number of reviews and survey studies related to video classification. Nevertheless, the present review articles have certain limitations and do not cover the most recent state-of-the-art developments. This article summarizes the key findings based on the available deep learning models to provide a current and concise perspective.

Future research directions are also discussed in connection to the primary outcomes. This research mainly focuses on the kind of network architecture adopted, the evaluation criteria to measure the success, and the datasets used. To make the review self-contained, a detailed description and summary of the latest deep learning methods as well as the development of deep learning approaches for automatic video classification are provided. Furthermore, a thorough grasp of both the traditional approaches and the more contemporary deep learning architectures is provided. In order to measure the technical development of these approaches, the benchmark-based key issues are stressed. The research also covers the benchmark datasets and the performance evaluation matrices for video classification. The paper offers fresh research directions to address the challenging video classification problem, according to the brief, comprehensive, and concise summary.

III. MATERIALS AND METHOD

A meta-analysis of peer-reviewed research from 2000 to 2023 that was gathered from sources including Google Scholar, ScienceDirect, and JSTOR served as the basis for this review. Included were those studies with stated averages and standard deviations and distinct control groups. Data were retrieved to compare impacts among fertilizer kinds and crops.

An example of an experimental design from a reviewed study: -

- **Crop:** Tomato (var. Roma)
- **Treatments:** T1: Control (no fertilizer), T2: 100% NPK (chemical), T3: Vermicompost (10 t/ha), T4: Poultry manure (10 t/ha), T5: Farmyard manure (15 t/ha)
- **Parameters measured:** plant height (cm), leaf number, fruit yield per plant (kg), soil organic carbon (%)
- **Duration:** 90 days from transplanting to final harvest.

IV. RESULTS

Effect on Growth Parameters

Although responses varied by kind, organic fertilizers enhanced all assessed growth metrics when compared to the unfertilized control. The most strong vegetative growth was generated by vermicompost and chicken manure.

Table 1: Effect of Different Fertilizers on Tomato Plant Growth (60 Days After Transplanting)

Treatment	Plant Height (cm)	Leaf Area (cm^2)	Chlorophyll Content (SPAD)
Control (No fertilizer)	42.3 ± 3.1	210 ± 18	32.5 ± 1.8
100% NPK (Chemical)	68.7 ± 4.5	410 ± 25	48.2 ± 2.1
Vermicompost	65.2 ± 3.8	398 ± 22	46.8 ± 1.9
Poultry Manure	63.8 ± 4.1	385 ± 20	45.3 ± 2.0
Farmyard Manure	58.4 ± 3.5	350 ± 19	42.1 ± 1.7
Values are mean ± standard deviation (n=20). Adapted from Kumar et al. (2020).			

Effect on Yield

High-quality organic fertilizers may meet or even surpass conventional fertilizer yields, according to yield statistics.

Table 2: Tomato Fruit Yield under Different Fertilizer Regimes

Treatment	Fruit Yield (t/ha)	Fruit Number/Plant	Average Fruit Weight (g)
Control	15.2 ± 1.5	12.5 ± 1.8	85 ± 6
100% NPK	38.5 ± 2.2	24.3 ± 2.1	112 ± 8
Vermicompost	36.8 ± 2.0	23.8 ± 1.9	108 ± 7
Poultry Manure	35.1 ± 1.8	22.6 ± 2.0	105 ± 6
Farmyard Manure	30.4 ± 1.7	20.1 ± 1.7	102 ± 5
Source: Patel & Singh (2021).			

V. DISCUSSION

The findings show that, in comparison to unfertilized controls, organic fertilizers in particular, vermicompost and chicken manure significantly increase plant growth and output. better nutrient availability, the synthesis of plant growth regulators in vermicompost, and better soil physical characteristics are all thought to contribute to the growth promotion (Arancon et al., 2004). For high-quality organic amendments, the yield difference between organic and chemical treatments is often negligible, confirming the results of Seufert et al. (2012) that well-managed organic systems may provide yields that are close to conventional.

The delayed release of nutrients from organic sources may initially restrict growth rates but offers longer-term sustenance, minimizing leaching losses and boosting nutrient-use efficiency (Mäder et al., 2002). One important advantage is the rise in soil organic carbon, which helps mitigate climate change by sequestering carbon.

The bulkiness, inconsistent nutrient content, and delayed action of organic fertilizers provide difficulties that need for careful planning and often higher application amounts. For yield stability and sustainability, an integrated nutrient management strategy that combines organic and reduced-rate synthetic fertilizers may be the best option (Bhogal et al., 2018).

VI. CONCLUSION

In addition to providing major advantages for soil health, organic fertilizers have a good effect on agricultural plant development and output. Vermicompost and chicken manure are among the most effective organic additions. A practical move toward integrated systems that use precise mineral nutrition in addition to organic fertilizers as a cornerstone is advised in order to satisfy the needs of an expanding population. Future study should concentrate on optimizing application timing, rates, and mixes for particular crop-soil-climate variables to enhance the effectiveness of organic fertilizers.

VII. REFERENCES

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