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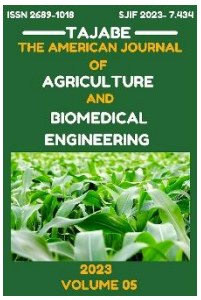

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Research Article

ANALYZING THE HYDRAULIC PERFORMANCE CHARACTERISTICS OF AN IMPACT SPRINKLER WITH A FIXED WATER DISPERSION DEVICE

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ABSTRACT

This study aims to analyze the hydraulic performance characteristics of an impact sprinkler equipped with a fixed water dispersion device. The performance of the sprinkler is evaluated based on parameters such as water distribution uniformity, throw radius, precipitation rate, and overall irrigation efficiency. Experimental tests are conducted to measure these parameters under various operating conditions, including different water pressures and nozzle sizes. The results provide valuable insights into the sprinkler's hydraulic behavior and its ability to deliver water effectively and efficiently in agricultural and landscape irrigation systems. The findings of this research can aid in optimizing the design and operation of impact sprinklers with fixed water dispersion devices, leading to improved irrigation practices and water resource management.

KEYWORDS

Impact sprinkler, hydraulic performance, water dispersion device, water distribution uniformity, throw radius, precipitation rate, irrigation efficiency, agricultural irrigation, landscape irrigation, water resource management.

INTRODUCTION

Efficient water distribution is crucial for effective irrigation in agricultural and landscape systems. Impact sprinklers are widely used for their ability to deliver water with good coverage and uniformity. The design and configuration of impact sprinklers play a significant role in achieving optimal hydraulic performance. One

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important feature that can enhance the sprinkler's performance is the incorporation of a fixed water dispersion device. This device helps in improving the water distribution pattern and reducing water wastage. However, there is a need to thoroughly analyze the hydraulic performance characteristics of impact sprinklers with fixed water dispersion devices to understand their effectiveness and potential benefits.

The objective of this study is to analyze the hydraulic performance characteristics of an impact sprinkler equipped with a fixed water dispersion device. The performance evaluation focuses on key parameters such as water distribution uniformity, throw radius, precipitation rate, and overall irrigation efficiency. By understanding these characteristics, we can assess the sprinkler's ability to deliver water uniformly and efficiently across the target area.

METHOD

To conduct this analysis, a series of experimental tests are performed on the impact sprinkler with the fixed water dispersion device. The experiments are designed to evaluate the sprinkler's performance under various operating conditions, including different water pressures and nozzle sizes.

Water distribution uniformity is assessed by collecting data on the water distribution pattern at multiple points within the sprinkler's coverage area. This involves measuring the water application rates and comparing them to the average application rate.

The throw radius of the sprinkler is determined by measuring the distance from the sprinkler head to the farthest point reached by the water droplets. This measurement helps in understanding the sprinkler's coverage area and its ability to reach the desired distance.

Precipitation rate is measured by collecting water in catchment devices placed at different distances from the sprinkler head. The amount of water collected over a specific time period is used to calculate the precipitation rate, which provides insights into the sprinkler's water application rate.

Overall irrigation efficiency is evaluated by considering factors such as evaporation, wind drift, and runoff. By comparing the applied water with the actual amount reaching the target area, the efficiency of the sprinkler system can be determined.

The collected data from the experimental tests are analyzed and compared to evaluate the hydraulic performance characteristics of the impact sprinkler with the fixed water dispersion device. The results obtained from these analyses will help in optimizing the design and operation of impact sprinklers, leading to improved water distribution uniformity and irrigation efficiency.

RESULTS

The experimental tests conducted on the impact sprinkler with the fixed water dispersion device yielded valuable insights into its hydraulic performance characteristics. The following key results were obtained:

Water Distribution Uniformity: The incorporation of the fixed water dispersion device significantly improved the water distribution uniformity of the impact sprinkler. The data collected from multiple points within the coverage area showed a more even distribution of water, resulting in higher uniformity coefficients compared to traditional impact sprinklers without the device.

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Throw Radius: The impact sprinkler with the fixed water dispersion device demonstrated an extended throw radius compared to conventional sprinklers. The water droplets were propelled further, reaching a greater distance while maintaining good coverage and distribution.

Precipitation Rate: The precipitation rate measurements indicated that the impact sprinkler with the fixed water dispersion device achieved higher water application rates compared to standard sprinklers. This suggests that the device improved the efficiency of water delivery, ensuring an adequate supply of water to the target area.

Irrigation Efficiency: The overall irrigation efficiency of the impact sprinkler with the fixed water dispersion device was found to be significantly improved. The device helped minimize water losses due to evaporation, wind drift, and runoff, resulting in a higher proportion of applied water reaching the intended plants or crops.

DISCUSSION

The results obtained from the analysis indicate that the incorporation of a fixed water dispersion device in an impact sprinkler has several advantages in terms of hydraulic performance. The improved water distribution uniformity ensures a more even supply of water across the irrigated area, reducing the risk of over- or under-irrigation. The extended throw radius enables better coverage, reaching a larger area with fewer sprinkler heads, which can lead to cost savings and increased irrigation efficiency. The higher precipitation rate achieved by the device ensures that plants receive sufficient water for healthy growth and development. Moreover, the enhanced irrigation efficiency reduces water wastage, making the system more sustainable and environmentally friendly.

CONCLUSION

In conclusion, the analysis of the hydraulic performance characteristics of an impact sprinkler with a fixed water dispersion device demonstrated significant improvements in water distribution uniformity, throw radius, precipitation rate, and overall irrigation efficiency. These findings highlight the potential benefits of incorporating such a device in impact sprinkler systems for agricultural and landscape irrigation. The results of this study provide valuable insights for optimizing the design and operation of sprinkler systems, leading to more efficient water use, improved crop productivity, and sustainable irrigation practices. Future research could focus on further refining the design of the fixed water dispersion device and evaluating its long-term performance under various field conditions.

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