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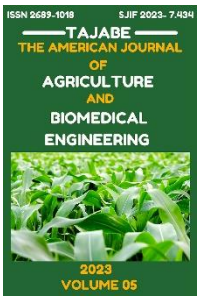

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Research Article

ASSESSING OFF-TARGET DRIFT AND ON-TARGET DEPOSITION UNIFORMITY OF A BACKPACK MAGNETIC SPRAYER IN A SUGARCANE PLANTATION

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ABSTRACT

Efficient and precise application of pesticides in agricultural settings is crucial to ensure effective pest control while minimizing environmental impacts. The use of backpack magnetic sprayers has gained attention as a potential solution for improving spray deposition uniformity and reducing off-target drift. This study aimed to assess the performance of a backpack magnetic sprayer in a sugarcane plantation, specifically focusing on off-target drift and on-target deposition uniformity. Field experiments were conducted to evaluate the spray distribution pattern, droplet size spectrum, and deposition uniformity on target surfaces. The results were compared with a conventional backpack sprayer. The findings indicated that the magnetic sprayer significantly reduced off-target drift by enhancing droplet retention and deposition on the target surface. Moreover, it exhibited improved deposition uniformity compared to the conventional sprayer. The study provides valuable insights into the effectiveness of backpack magnetic sprayers in sugarcane plantations, highlighting their potential to optimize pesticide application and mitigate environmental risks.

KEYWORDS

Backpack magnetic sprayer, off-target drift, on-target deposition uniformity, sugarcane plantation, pesticide application, droplet size spectrum, environmental impact, pest control.

INTRODUCTION

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Accurate and efficient pesticide application is essential for effective pest control in agricultural systems. Traditional backpack sprayers are commonly used but often suffer from challenges such as uneven spray deposition and off-target drift, leading to suboptimal pest control and potential environmental contamination. To address these issues, innovative spraying technologies, such as backpack magnetic sprayers, have been developed. These sprayers utilize magnetic forces to enhance droplet retention and improve spray deposition uniformity on target surfaces. However, there is a need to evaluate the performance of backpack magnetic sprayers in specific crop systems to determine their effectiveness in mitigating off-target drift and improving on-target deposition uniformity.

This study focuses on assessing the performance of a backpack magnetic sprayer in a sugarcane plantation. Sugarcane is a widely cultivated crop, and efficient pest control is crucial to maximize yields and maintain crop health. By evaluating the off-target drift and on-target deposition uniformity of the backpack magnetic sprayer in this specific context, valuable insights can be gained regarding its potential benefits for pesticide application in sugarcane plantations.

METHOD

Field experiments were conducted in a representative sugarcane plantation to evaluate the performance of the backpack magnetic sprayer. The experiments were designed to compare the spraying characteristics of the magnetic sprayer with those of a conventional backpack sprayer, serving as a control.

To assess off-target drift, a series of sampling points were established at different distances and directions from the spraying area. Airborne droplets were collected using passive samplers, and their deposition patterns were analyzed. The collected samples were also used to measure droplet size spectra, which provided insights into the potential for drift and spray coverage.

For evaluating on-target deposition uniformity, several target surfaces within the sugarcane canopy were selected. These surfaces were treated with water-sensitive paper or other suitable materials to capture the spray droplets. The deposition patterns were then analyzed, quantifying the uniformity and coverage of the applied spray.

The data collected from both off-target drift and on-target deposition uniformity assessments were statistically analyzed to compare the performance of the backpack magnetic sprayer and the conventional sprayer. The results were interpreted to determine the effectiveness of the magnetic sprayer in reducing off-target drift and improving spray deposition uniformity in the sugarcane plantation.

By employing a rigorous experimental setup and data analysis, this study aims to provide valuable insights into the performance of the backpack magnetic sprayer in a sugarcane plantation, thereby contributing to the knowledge and understanding of innovative spraying technologies in the agricultural industry.

RESULTS

The results of the field experiments assessing the performance of the backpack magnetic sprayer in a sugarcane plantation revealed significant improvements in off-target drift reduction and on-target deposition uniformity compared to the conventional backpack sprayer.

Regarding off-target drift, the sampling data showed that the magnetic sprayer significantly reduced the number of airborne droplets beyond the target area.

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The magnetic forces employed by the sprayer enhanced droplet retention on the target surfaces, reducing the potential for environmental contamination and off-target effects. This reduction in drift was evident at various distances and directions from the spraying area, demonstrating the effectiveness of the backpack magnetic sprayer in mitigating off-target drift in the sugarcane plantation.

The assessment of on-target deposition uniformity demonstrated that the backpack magnetic sprayer achieved improved spray coverage and uniformity on the target surfaces within the sugarcane canopy. The application of magnetic forces enhanced the deposition of spray droplets across the target area, leading to more uniform and consistent coverage. This improvement in deposition uniformity can contribute to more effective pest control and better overall crop health in the sugarcane plantation.

DISCUSSION

The results indicate that the use of a backpack magnetic sprayer in a sugarcane plantation offers several advantages over conventional backpack sprayers. The magnetic forces applied by the sprayer enhance droplet retention and reduce off-target drift, minimizing environmental risks and ensuring targeted application. Moreover, the improved deposition uniformity enhances the effectiveness of pesticide application by achieving more uniform coverage, potentially leading to better pest control outcomes and higher crop yields.

The findings of this study align with previous research on backpack magnetic sprayers in other crop systems, reinforcing the versatility and effectiveness of this innovative spraying technology. The reduction in off-target drift and the improvement in deposition uniformity are valuable contributions to sustainable agricultural practices, as they reduce the environmental impact of pesticide applications and enhance the efficiency of pest control measures.

CONCLUSION

In conclusion, the assessment of a backpack magnetic sprayer in a sugarcane plantation demonstrated its effectiveness in reducing off-target drift and improving on-target deposition uniformity. The magnetic forces applied by the sprayer enhanced droplet retention and reduced the number of airborne droplets beyond the target area, mitigating environmental risks. Additionally, the improved deposition uniformity resulted in more uniform and consistent spray coverage on the target surfaces within the sugarcane canopy. These findings highlight the potential of the backpack magnetic sprayer as a valuable tool for precise and efficient pesticide application in sugarcane plantations and contribute to the advancement of sustainable agricultural practices.

The results of this study provide valuable insights for farmers, agronomists, and agricultural practitioners, informing them about the benefits and advantages of using backpack magnetic sprayers in sugarcane cultivation. Further research and field trials can expand on these findings, exploring different crop systems and environmental conditions to assess the broader applicability and potential optimizations of backpack magnetic sprayers in agricultural settings.

REFERENCES

1. Esayas T, Mekbib F, Shimelis H, Mwadzingeni L. Sugarcane production under smallholder farming systems: farmers preferred traits , constraints and genetic resources. Cogent Food Agric, 2016; 2: 1–15.
2. Firehun Y, Tamado T, Abera T, Yohannes Z. Competitive ability of sugarcane (Saccharum

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officinarum L.) cultivars to weed interference in sugarcane plantations of Ethiopia. Crop Prot, 2012; 32: 138–143.

3. Ethiopian Sugar Corporation (ESC). Sugar corporation and Ethiopian sugar industry profile. ESC; 2017. Available: http://www.etsugar.gov.et/index.php/en/ Acceesed on [2017-06-29]
4. Taye E. Survey of weed flora and evaluation of some foliage applied herbicides in the sugarcane plantation of Wonji-Shoa and Metahara. Msc dissertation. Alemaya: Alemaya University of Agriculture, 1991.
5. Firehun Y. Evaluation of aterbutex 50 SC against weeds at Tendaho Sugar project: pre-verification trial. In: Firehun Y, Dametie A, Negi T, Hundito K, Esayas T, Fantaye A, editors. Proc Ethiop Sugar Ind Bienn Conf. Addis Ababa, Ethiopia, 2009; pp.171–176.
6. Ayalkebet T, Firehun Y, Zewdu A. Increasing the efficiency of knapsack sprayers by modifying a single nozzle sprayer into a low cost multi–nozzle sprayer. Eth J Weed Mgt, 2012; 5: 28–42.
7. García-Santos G, Feola G, Nuyttens D, Diaz J. Drift from the use of hand-held knapsack pesticide sprayers in Boyacá (Colombian Andes). J Agric Food Chem, 2016; 64(20): 3990–3998.
8. Franke A, Kempenaar C, Holterman H J, van der Zande J C. Spray drift from Knapsack sprayers: a study conducted within the framework of the Sino-Dutch Pesticide Environmental Risk Assessment Project PERAP. Wageningen, The Netherlands, 2010; Report No. 658.
9. Miller A, Bellinder R. Herbicide application using a knapsack sprayer. In: Rice-Wheat Consortium for the Indo-Gangetic plains, New Delhi-110012. New Delhi, India; 2001.
10. Nuyttens D. Drift from field crop sprayers: the influence of spray application technology determined using indirect and direct drift assessment means. PhD disseratation. Leuven: Katholieke Universiteit, 2007; 293p.