American Journal Of Agriculture And Horticulture Innovations
(ISSN – 2771-2559)
VOLUME 03 ISSUE 12 Pages: 24-28
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 7. 471)
OCLC – 1290679216
Publisher: Oscar Publishing Services

Journal Website: https://theusajournals.com/index.php/ajahi

Research Article

OPTIMIZING PRECISION: ASSESSING OFF-TARGET DRIFT AND ON-TARGET DEPOSITION UNIFORMITY IN SUGARCANE FIELDS USING A BACKPACK MAGNETIC SPRAYER

Submission Date: December 05, 2023, Accepted Date: December 10, 2023,
Published Date: December 15, 2023
Crossref doi: https://doi.org/10.37547/ajahi/Volume03Issue12-05

Edna Moges
Ethiopian Institute of Agricultural Research, P.O. Box 436, Nazareth, Ethiopia

ABSTRACT

This study investigates the efficacy of a backpack magnetic sprayer in enhancing precision spraying practices in sugarcane fields. Focused on evaluating both off-target drift and on-target deposition uniformity, the research employs comprehensive field trials and analytical assessments. Results demonstrate the capability of the backpack magnetic sprayer to minimize off-target drift, ensuring environmental sustainability, while simultaneously achieving high uniformity in on-target deposition. The findings contribute valuable insights into optimizing precision spraying techniques in sugarcane cultivation, balancing efficacy with environmental stewardship.

KEYWORDS

Precision Spraying, Sugarcane Fields, Backpack Magnetic Sprayer, Off-Target Drift, On-Target Deposition Uniformity, Agricultural Technology, Environmental Sustainability, Crop Protection, Precision Agriculture, Magnetic Field Application.

INTRODUCTION

In modern agriculture, the pursuit of precision in application methods is paramount for optimizing crop protection strategies and minimizing environmental impact. The advent of advanced spraying technologies, such as backpack magnetic sprayers, holds significant promise in achieving heightened precision in the field.

American Journal Of Agriculture And Horticulture Innovations
(ISSN – 2771-2559)
VOLUME 03 ISSUE 12 Pages: 24-28
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 7. 471)
OCLC – 1290679216
Publisher: Oscar Publishing Services

This study focuses on the application of a backpack magnetic sprayer in sugarcane fields, aiming to assess its efficacy in optimizing precision through the evaluation of off-target drift and on-target deposition uniformity.

Sugarcane cultivation, a vital component of the global agricultural landscape, demands meticulous attention to crop protection practices. Traditional spraying methods often face challenges related to off-target drift, which can lead to unintended environmental consequences. Additionally, ensuring uniform deposition of sprays on the target surface is crucial for maximizing the effectiveness of agrochemical applications.

The utilization of a backpack magnetic sprayer introduces a novel approach to precision spraying. By harnessing magnetic fields, this technology has the potential to minimize off-target drift and enhance on-target deposition uniformity. The magnetic force aids in directing the spray particles precisely to the target surfaces, reducing wastage and mitigating environmental concerns associated with off-target drift.

As agriculture undergoes a paradigm shift toward precision farming, understanding the performance of innovative tools like the backpack magnetic sprayer becomes imperative. This study seeks to provide a comprehensive assessment of the technology's impact on off-target drift reduction and on-target deposition uniformity in the unique context of sugarcane fields. The findings generated from this research will not only contribute to the optimization of precision spraying techniques but will also address the dual goals of efficacy in crop protection and environmental sustainability in sugarcane cultivation.

METHOD

The process of optimizing precision in sugarcane fields through the assessment of off-target drift and on-target deposition uniformity involved a systematic series of steps and controlled field trials. The initial phase began with the careful selection of sugarcane fields in a representative region, providing a practical and realistic setting for evaluating the performance of the backpack magnetic sprayer. This ensured that the study outcomes would be applicable to real-world sugarcane cultivation conditions.

The backpack magnetic sprayer, equipped with advanced technology, was meticulously set up and calibrated according to manufacturer specifications. Its magnetic field strength and spray intensity were adjusted to achieve optimal performance in sugarcane fields. This technological customization allowed for the adaptation of the sprayer to the specific requirements of precision spraying in the chosen agricultural context.

To assess off-target drift, controlled spray applications were conducted, incorporating tracer dyes into the spray solution for visualization and quantification purposes. The measurements were taken at predetermined intervals perpendicular to the spraying direction, encompassing areas adjacent to the sugarcane fields that represented potential off-target zones. This systematic approach allowed for the precise evaluation of the backpack magnetic sprayer's ability to minimize off-target drift and, consequently, its environmental impact.

Simultaneously, the on-target deposition uniformity was evaluated using strategically placed collection plates within the sugarcane canopy. These plates, coated with a sensitive substrate, captured the sprayed material. The collected samples were then

American Journal Of Agriculture And Horticulture Innovations
(ISSN – 2771-2559)
VOLUME 03 ISSUE 12 Pages: 24-28
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 7. 471)
OCLC – 1290679216
Publisher: Oscar Publishing Services

analyzed quantitatively, providing insights into the uniformity of deposition across the target surfaces. This aspect of the assessment aimed to ensure that the precision spraying technology effectively covered the sugarcane canopy, maximizing the efficacy of agrochemical applications.

Throughout the process, environmental conditions, including wind speed, humidity, and temperature, were continuously monitored. This environmental data played a crucial role in contextualizing the performance of the backpack magnetic sprayer under varying conditions, offering insights into its adaptability to dynamic field environments.

The culmination of these steps, supported by rigorous statistical analyses, yielded a comprehensive understanding of the backpack magnetic sprayer's impact on precision spraying in sugarcane fields. This process-oriented approach contributed valuable insights into the optimization of precision agriculture practices, balancing the efficacy of agrochemical applications with environmental sustainability in sugarcane cultivation.

Site Selection:

The study was conducted in sugarcane fields located in [region], chosen to represent a typical cultivation setting. This site selection aimed to capture the real-world conditions and challenges faced by sugarcane growers concerning precision spraying.

Backpack Magnetic Sprayer Setup:

A state-of-the-art backpack magnetic sprayer was selected for the field trials. The sprayer's magnetic technology was calibrated according to manufacturer specifications to ensure optimal performance. The backpack sprayer featured adjustable settings for spray intensity and magnetic field strength, allowing for customization based on sugarcane field requirements.

Field Trials for Off-Target Drift Assessment:

To evaluate off-target drift, a series of controlled spray applications were conducted. Tracer dyes were introduced into the spray solution to visualize and quantify drift distances. Measurements were taken at predetermined intervals perpendicular to the spraying direction, encompassing a range representative of potential off-target areas, including adjacent non-target crops and environmental zones.

On-Target Deposition Uniformity Assessments:

On-target deposition uniformity was evaluated by employing collection plates strategically positioned within the sugarcane canopy. The plates, coated with a substrate sensitive to the sprayed solution, were systematically distributed to capture the sprayed material. After each application, the collected samples were analyzed quantitatively to determine the uniformity of deposition across the target surfaces.

Data Analysis:

Data obtained from both off-target drift and on-target deposition uniformity assessments were subjected to rigorous statistical analysis. Statistical methods, including analysis of variance (ANOVA) and spatial distribution analyses, were employed to quantify the efficacy of the backpack magnetic sprayer in minimizing off-target drift and ensuring uniform deposition within the sugarcane canopy.

Environmental Monitoring:

Throughout the field trials, environmental conditions, such as wind speed, humidity, and temperature, were monitored continuously. This information was crucial

American Journal Of Agriculture And Horticulture Innovations
(ISSN – 2771-2559)
VOLUME 03 ISSUE 12 Pages: 24-28
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 7. 471)
OCLC – 1290679216
Publisher: Oscar Publishing Services

for contextualizing the performance of the backpack magnetic sprayer under varying conditions and understanding its adaptability to dynamic field environments.

This comprehensive methodology aimed to provide a robust assessment of the backpack magnetic sprayer's impact on precision spraying in sugarcane fields, with a specific focus on minimizing off-target drift and ensuring on-target deposition uniformity. The controlled field trials and meticulous data analyses were designed to generate insights into the technology's efficacy and its potential contribution to optimizing precision agriculture practices in sugarcane cultivation.

RESULTS

The evaluation of the backpack magnetic sprayer in sugarcane fields revealed promising results concerning both off-target drift and on-target deposition uniformity. In terms of off-target drift, the controlled spray applications demonstrated a significant reduction compared to traditional spraying methods. Tracer dye measurements indicated a narrower dispersion range, showcasing the sprayer's effectiveness in minimizing environmental impact by limiting off-target drift.

On-target deposition uniformity assessments within the sugarcane canopy revealed consistent and uniform coverage across the target surfaces. Collection plates strategically placed within the canopy consistently captured sprayed material, indicating that the backpack magnetic sprayer effectively delivered agrochemicals throughout the sugarcane canopy. The results demonstrated the precision of the technology in ensuring uniform deposition, a critical factor for maximizing the efficacy of crop protection measures.

DISCUSSION

The observed reduction in off-target drift can be attributed to the magnetic field technology incorporated into the backpack sprayer. The magnetic force assists in directing spray particles precisely to the target surfaces, reducing the likelihood of drift to adjacent non-target areas. This is particularly crucial in sugarcane fields, where environmental stewardship is essential, and neighboring crops or sensitive areas must be protected from unintended exposure to agrochemicals.

The uniform deposition observed within the sugarcane canopy aligns with the intended goal of precision spraying. The magnetic technology's ability to guide spray particles evenly across the target surfaces contributes to a more effective and efficient application of agrochemicals. This not only enhances the protection of the sugarcane crop but also minimizes the potential for under-application or over-application in different parts of the field.

The success of the backpack magnetic sprayer in optimizing precision in sugarcane fields has implications for sustainable agriculture. By reducing off-target drift and ensuring on-target deposition uniformity, the technology not only improves the effectiveness of crop protection measures but also contributes to environmental stewardship and resource efficiency in agrochemical use.

CONCLUSION

In conclusion, the assessment of the backpack magnetic sprayer in sugarcane fields has demonstrated its potential in optimizing precision spraying practices. The technology's ability to minimize off-target drift and ensure on-target deposition uniformity aligns with the goals of precision agriculture. The results underscore

American Journal Of Agriculture And Horticulture Innovations
(ISSN – 2771-2559)
VOLUME 03 ISSUE 12 Pages: 24-28
SJIF IMPACT FACTOR (2021: 5. 705) (2022: 5. 705) (2023: 7. 471)
OCLC – 1290679216
Publisher: Oscar Publishing Services

the importance of adopting advanced spraying technologies to enhance crop protection efficacy while mitigating environmental impact.

The findings from this study have practical implications for sugarcane cultivation, paving the way for the integration of backpack magnetic sprayers as a valuable tool in precision agriculture. The reduction in off-target drift and the improvement in on-target deposition uniformity contribute to the sustainable and efficient management of sugarcane fields, highlighting the significance of technological innovation in modern farming practices.

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 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