

Drone-Based Herbicide Applications for Managing Late-Season Burcucumber (*Sicyos angulatus*) in Corn

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Introduction

- Burcucumber (*Sicyos angulatus*) is a summer annual vine that germinates over an extended period, complicating its management throughout the growing season due to herbicide label limitations (Mann et al. 1981).
- Its vigorous growth negatively affects corn harvestability, as it can cause corn stalks to collapse or bind combine heads (Webb and Johnston 1981).
- Imaging drones can pre-map fields to generate prescription maps, allowing spray drones to apply herbicides precisely to infested areas (Hunter III et al. 2020).
- Further research is needed to evaluate herbicide options and application timings for effective burcucumber control using spray drones.

Null Hypothesis

There will be no difference among herbicides applied late-season for burcucumber management in corn.

Objective

To evaluate late-season burcucumber control in corn using herbicides applied with a spray drone at two corn growth stages: dent and physiological maturity (black layer).

Materials and Methods

- Location:** Crawfordsville, IN (on-farm)
- Plot Dimensions:** 21.3 m long x 12.2 m wide
- Application Dates:**
 - Dent:** Aug 15, 2025
 - Black layer:** Sep 8, 2025
- Experimental Design:** Randomized complete block, with four replications
- All treatments were applied 3.7 meters above the crop using a DJI Agras T50 (Fig. 5) equipped with dual LX8060SZ rotary atomizer nozzles, calibrated to deliver 28 L ha⁻¹ with a Coarse spray and an assumed swath of 9.1 meters.

Treatments:

Herbicide	Application Timing	Rate	Preharvest Interval
		g ai ha ⁻¹	days
None	-	-	-
2,4-D	Dent	1,108	7
Bentazon	Dent	1,121	None
Nicosulfuron	Dent	69	70
Topramezone	Dent	49	45
Carfentrazone	Black layer	35	3
Glyphosate	Black layer	841	7
Paraquat	Black layer	546	7
Sodium chlorate	Black layer	6,724	14

Data Collection and Analysis

- Burcucumber visual control was evaluated using a 0-100% scale relative to the nontreated.
- Aerial images were collected two weeks after black layer application using a DJI Mavic 3M (1 cm/pixel) to assess groundcover.
- Burcucumber biomass was collected from three plants per plot, three weeks after the black layer application.
- All data were analyzed in R using a generalized linear mixed model. Means were separated using Tukey's HSD test ($\alpha = 0.05$).

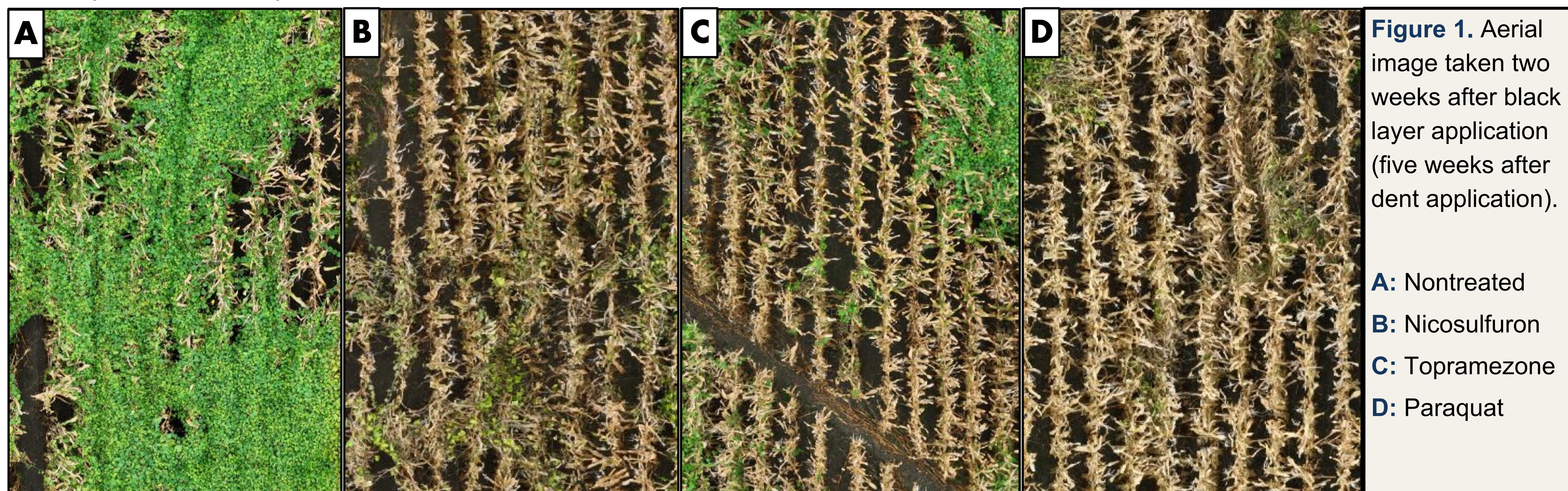


Figure 1. Aerial image taken two weeks after black layer application (five weeks after dent application).

A: Nontreated
B: Nicosulfuron
C: Topramezone
D: Paraquat

Visual Burcucumber Control (%)

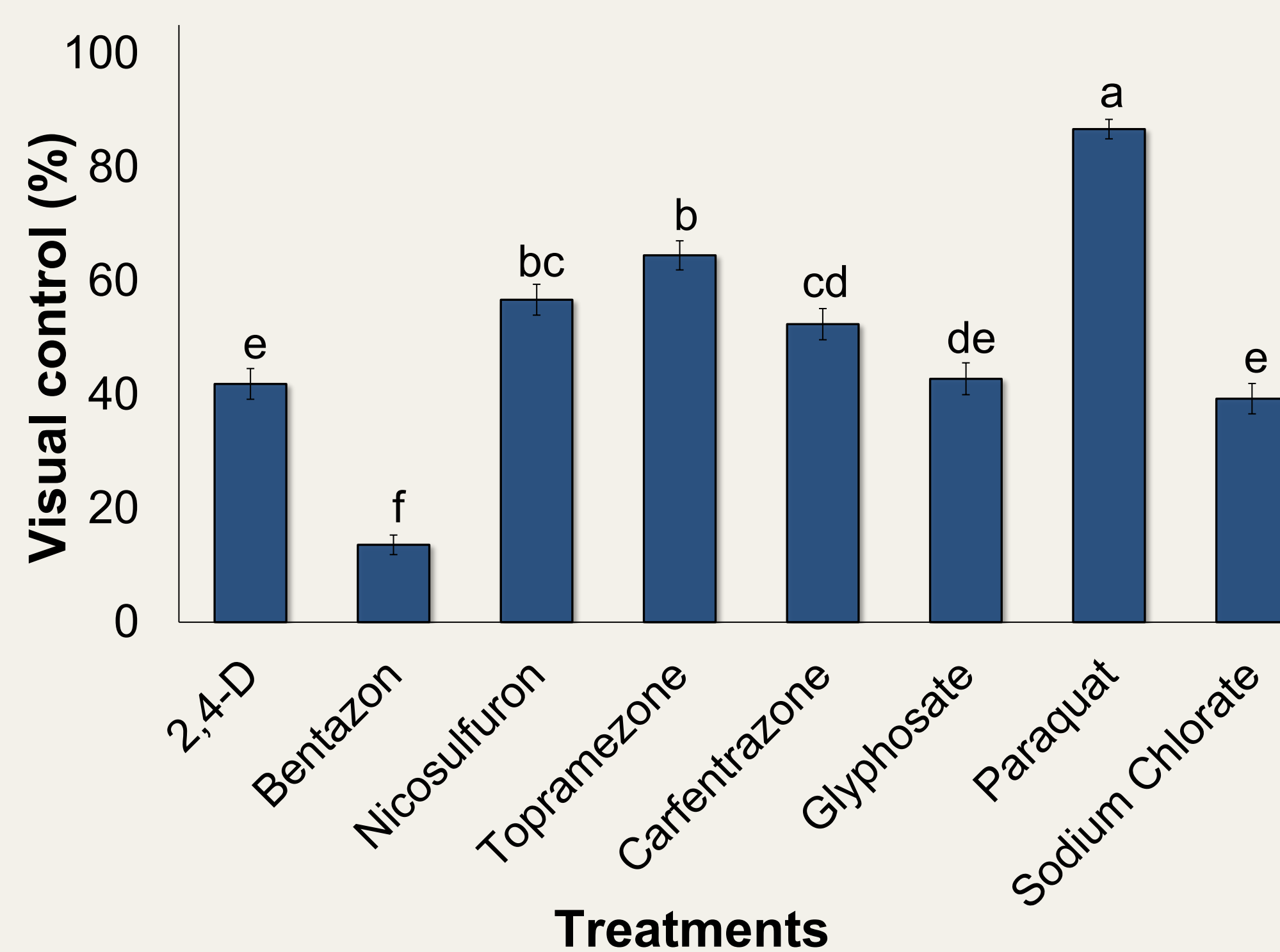


Figure 2. Visual burcucumber control (%) two weeks after black layer application. Means followed by the same letter are not different according to Tukey's HSD ($\alpha = 0.05$). Error bars represent the standard error.

Burcucumber Groundcover (%)

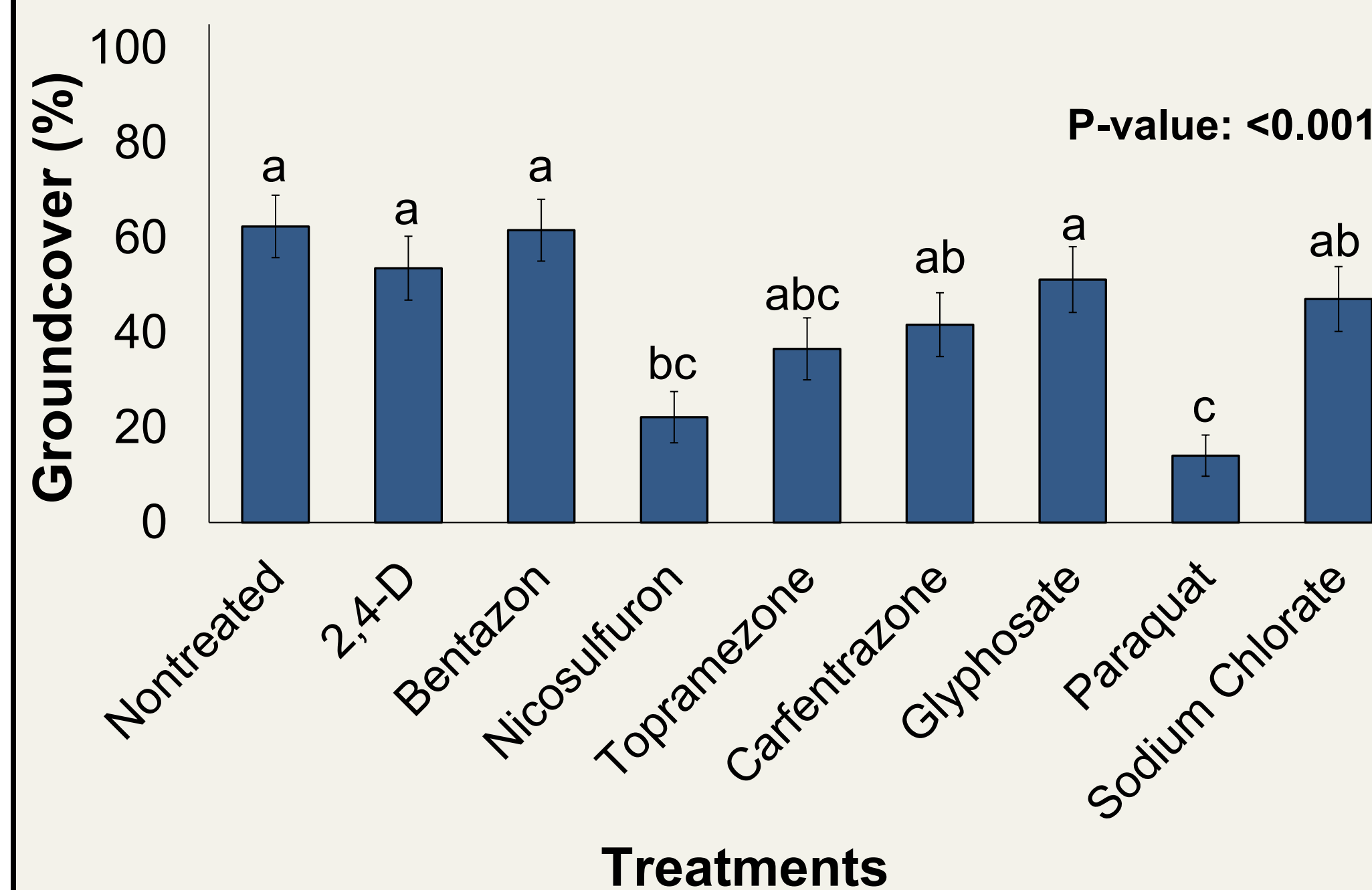


Figure 3. Burcucumber groundcover two weeks after black layer application. Groundcover was assessed using FieldAnalyzer (www.turfanalyzer.com). Means followed by the same letter are not different according to Tukey's HSD ($\alpha = 0.05$). Error bars represent the standard error.

Burcucumber Fresh Biomass (Kg)

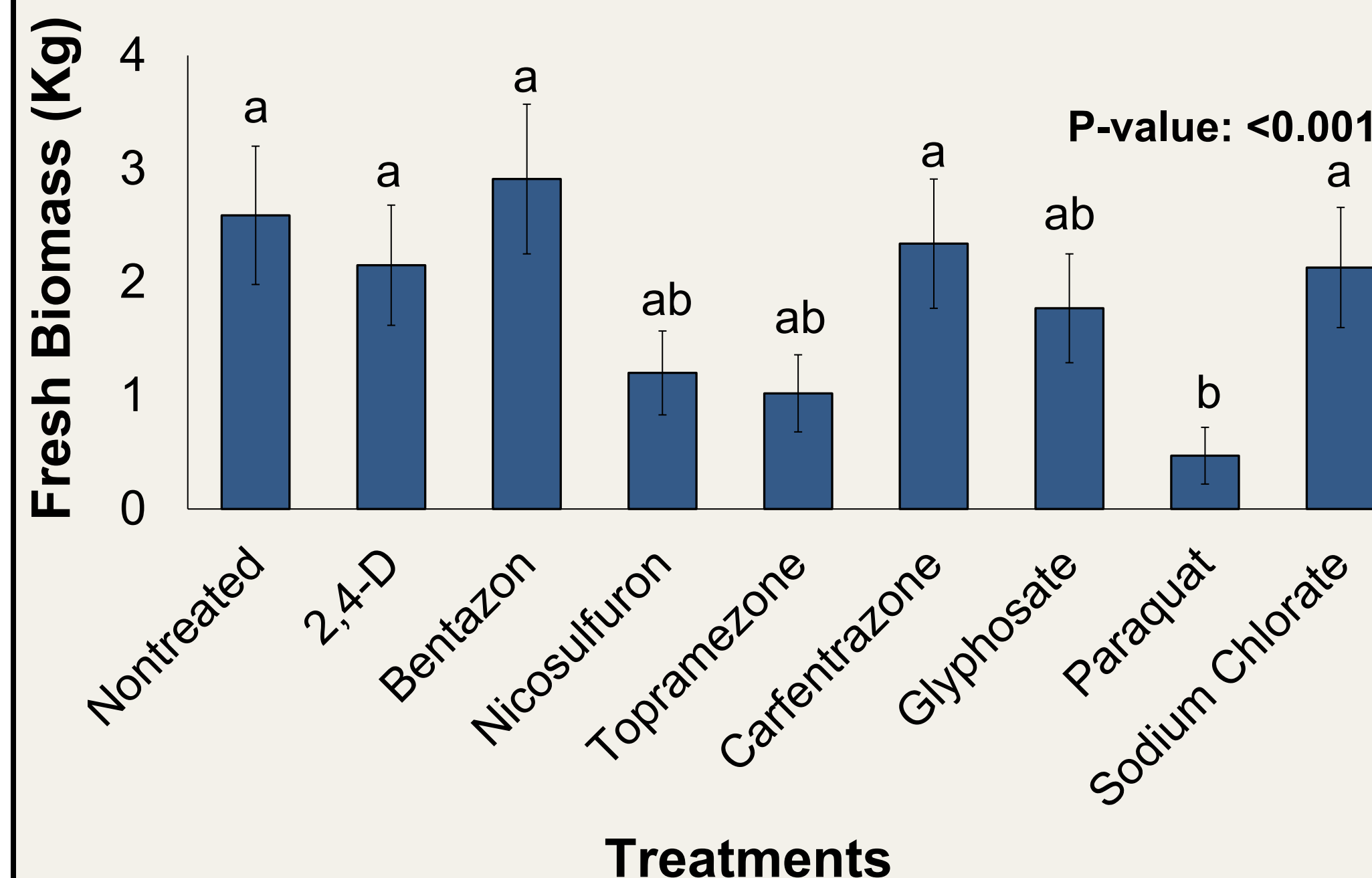


Figure 4. Burcucumber fresh biomass (Kg) per plant collected three weeks after black layer application. Means followed by the same letter are not different according to Tukey's HSD ($\alpha = 0.05$). Error bars represent the standard error.



Figure 5. DJI AGRAS T50. Source: DJI

Results and Discussion

- Paraquat provided the greatest control (87%), followed by topramezone (65%). All other herbicides provided less than 60% control, with nicosulfuron (57%) performing comparably to topramezone (Fig. 1; Fig. 2). **Reject the null hypothesis.**
- Similarly, Creswell et al. (1982) and Smeda and Weller (2001) reported that 2,4-D and bentazon were ineffective in controlling burcucumber.
- For groundcover, paraquat and nicosulfuron were the only treatments that differed from the nontreated (Fig. 3).
- Nontreated plants had 2.6 kg of fresh biomass. Paraquat was the only treatment that significantly reduced burcucumber fresh biomass (82% reduction; Fig. 4).
- A single burcucumber plant can accumulate from 3 to 86 kg of fresh weight in the absence of crop competition (Smeda and Weller 2001).

Practical Implications and Future Research

- By the time of the black layer application (the labeled paraquat timing – the most effective herbicide), infestations may have already spread, potentially causing corn stalk collapse and yield loss. Moreover, at this corn stage, burcucumber plants may have already produced a large number of seeds. Therefore, future efforts should focus on earlier management strategies to reduce seed production and viability, supporting long-term burcucumber control in corn.

Conclusion

Paraquat was the most effective herbicide for late-season burcucumber management in corn.

Innovation and Impact

This is the first study on spray drones for burcucumber control in corn, demonstrating effective weed management without the stalk damage caused by ground sprayers. Biomass and groundcover followed a similar trend, indicating that drone imagery can be a valuable tool for assessing weed control. These findings show that drone technologies can simplify field operations, provide reliable data, and build grower confidence in adopting digital agriculture tools.

Acknowledgments and Literature Cited

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