

INTRODUCTION

Black polyethylene mulch helps control weeds and conserve soil moisture, but its residues can accumulate in agricultural soil. EcoMusa was developed from *Musa paradisiaca* peels as a possible alternative.

ABSTRACT

EcoMusa, a bioplastic mulch made from *Musa paradisiaca* peels, was tested as an alternative to commercial black plastic for weed control. Four treatments were compared over four weeks: uncovered soil, commercial black plastic, EcoMusa 1, and EcoMusa 2. EcoMusa reduced weed emergence by 47%-53% compared with uncovered soil, with results similar to commercial plastic. It also helped maintain soil moisture and reduced soil temperature by approximately 1-3 °C. These findings suggest that EcoMusa could helped control weeds, lower soil temperature, and reduce reliance on persistent agricultural plastics.

PROBLEM

The use of conventional black polyethylene mulch in agriculture contributes the accumulation non-biodegradable plastic residues and environment contamination. Therefore, there is a need to develop and validate biodegradable alternatives, such as Musa paradisiaca-based bioplastic mulch, that can effectively control weeds while reducing agricultural plastic waste.

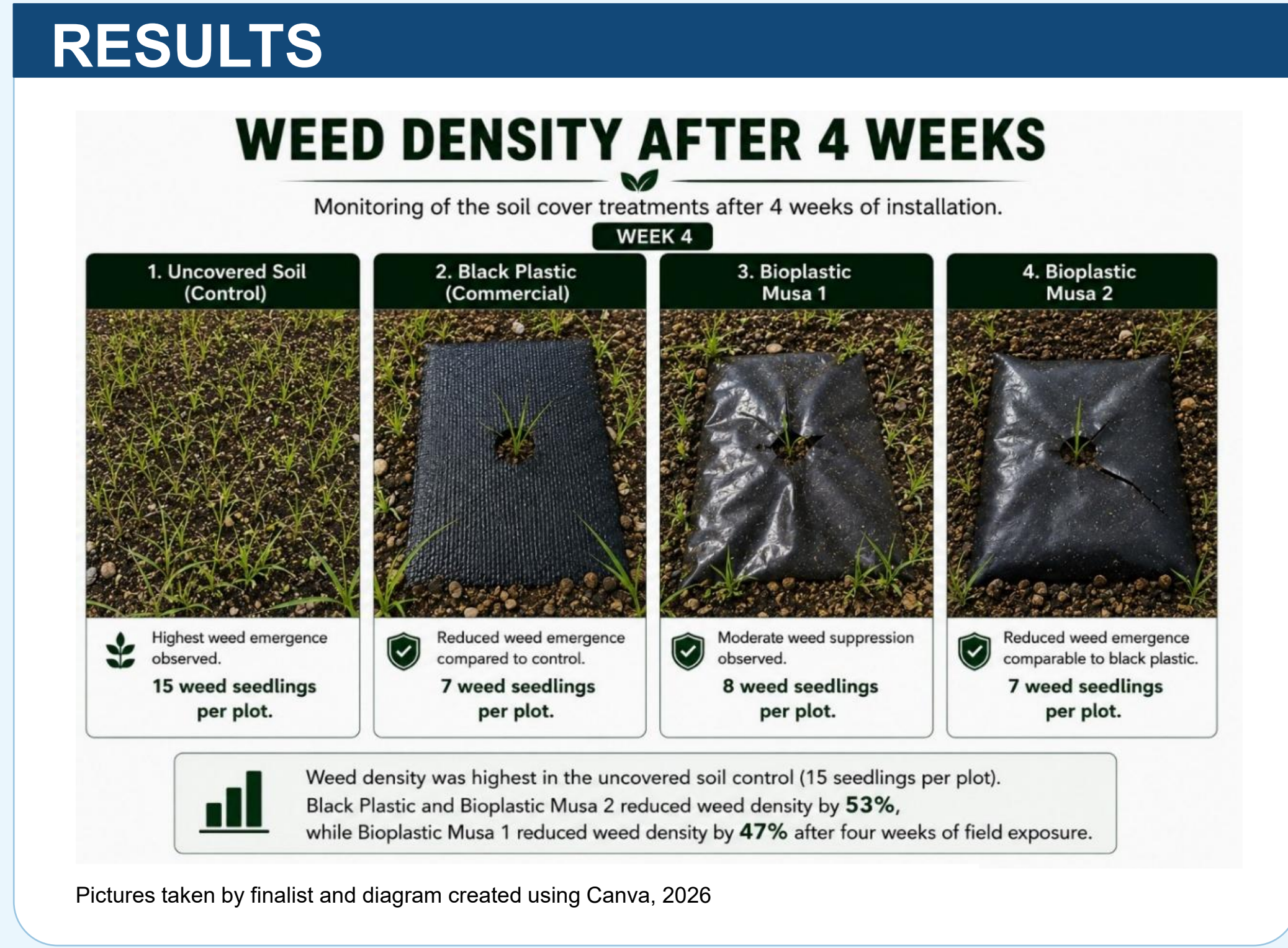
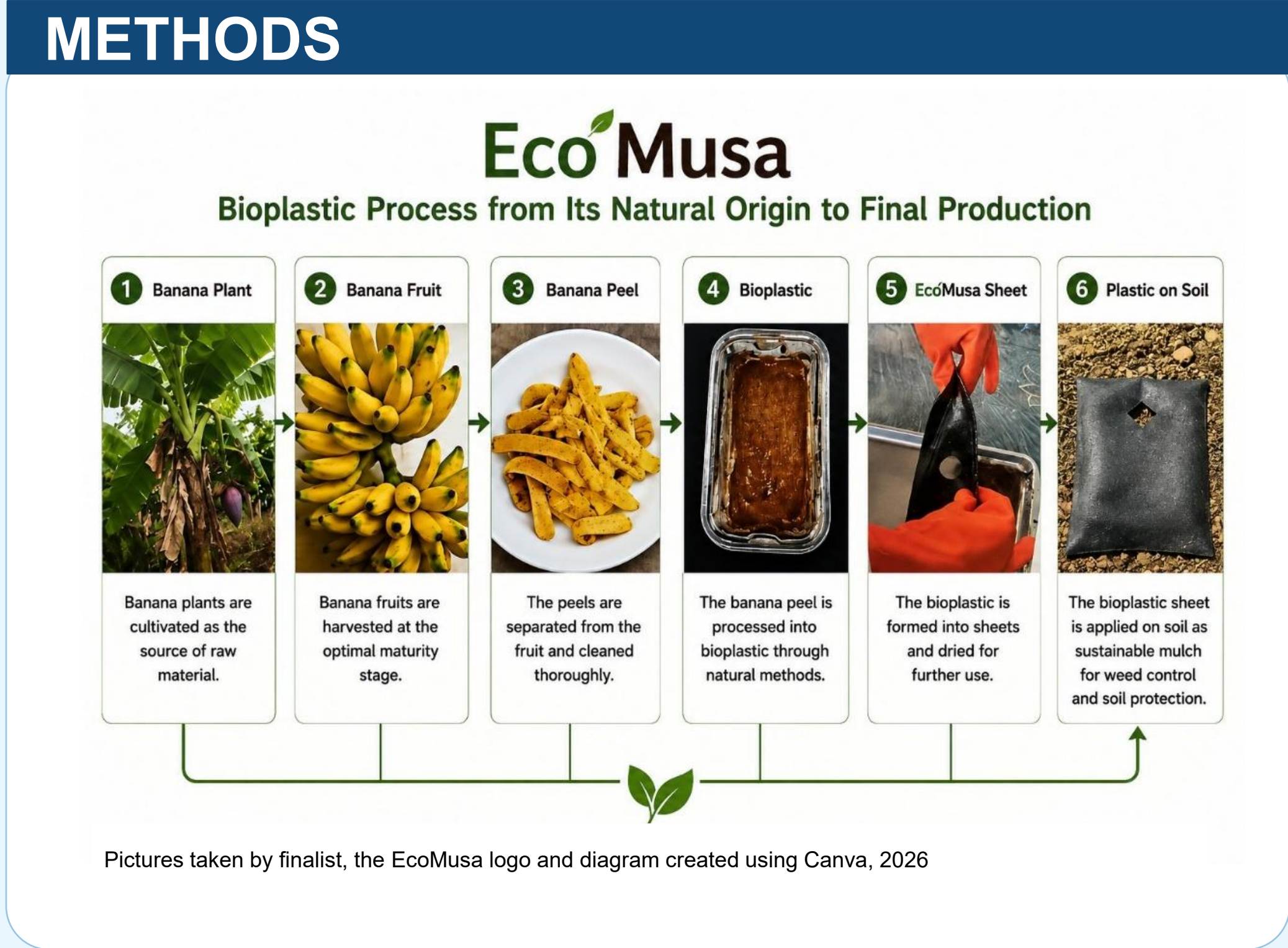
RESEARCH QUESTION

Will the Musa paradisiaca-based bioplastic, used as a soil cover (mulch), control weed growth in comparison with conventional black polyethylene?

HYPOTHESIS

If a biodegradable mulch based on *Musa paradisiaca* is used, then weed density will decrease in comparison with uncovered plots and will show effectiveness similarly to conventional black polyethylene.

Evaluation of the Effect of *EcoMusa*: Bioplastic Mulch Based on *Musa paradisiaca* for Weed Control (Phase II)



DATA ANALYSIS

Table 1. Weed Density
Weed Density (Plants per Plot)

Plot	Treatment	Weed Density (Plants per Plot)			
		Week 1	Week 2	Week 3	Week 4
1	Uncovered Soil (Control)	2	7	11	15
2	Black Plastic	0	2	5	7
3	Musa 1 (Bioplastic)	0	2	6	8
4	Musa 2 (Bioplastic)	0	2	5	7

Note: Weed density was recorded weekly for each treatment. Data are reported as the number of weed plants per plot.

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Table 2. Soil Microclimate
Soil Temperature (°C) Across 4 Sampling Points Over 4 Treatments

Plot	Treatment	Temperature (°C)			
		S1	S2	S3	S4
1	Uncovered Soil (Control)	34°	33°	36°	32°
2	Black Plastic	32°	31°	34°	31°
3	Musa 1 (Bioplastic)	32°	31°	34°	31°
4	Musa 2 (Bioplastic)	31°	30°	33°	30°

Note: Soil temperature was measured at four sampling points (S1-S4) for each treatment. Data are reported in degrees Celsius (°C).

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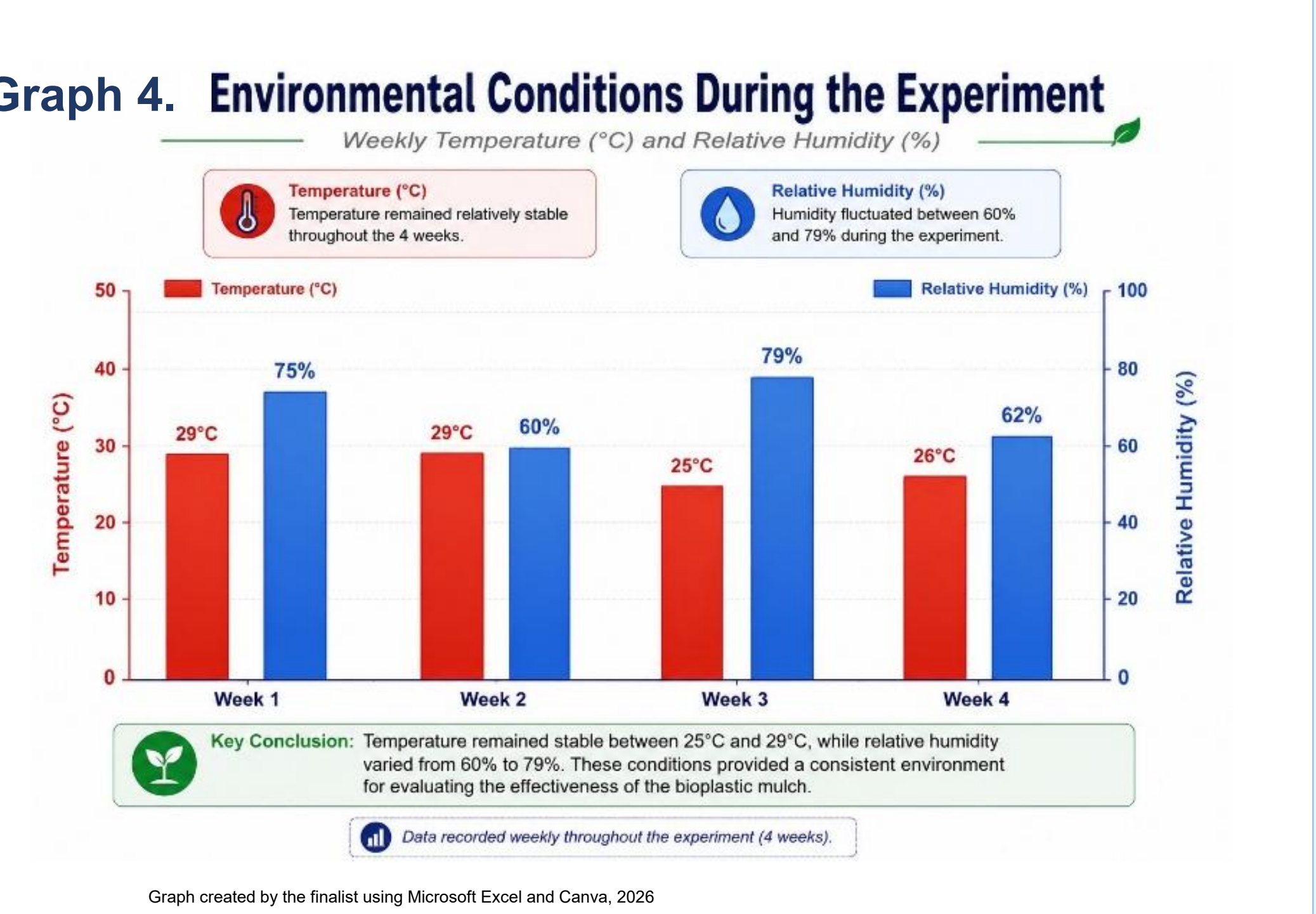
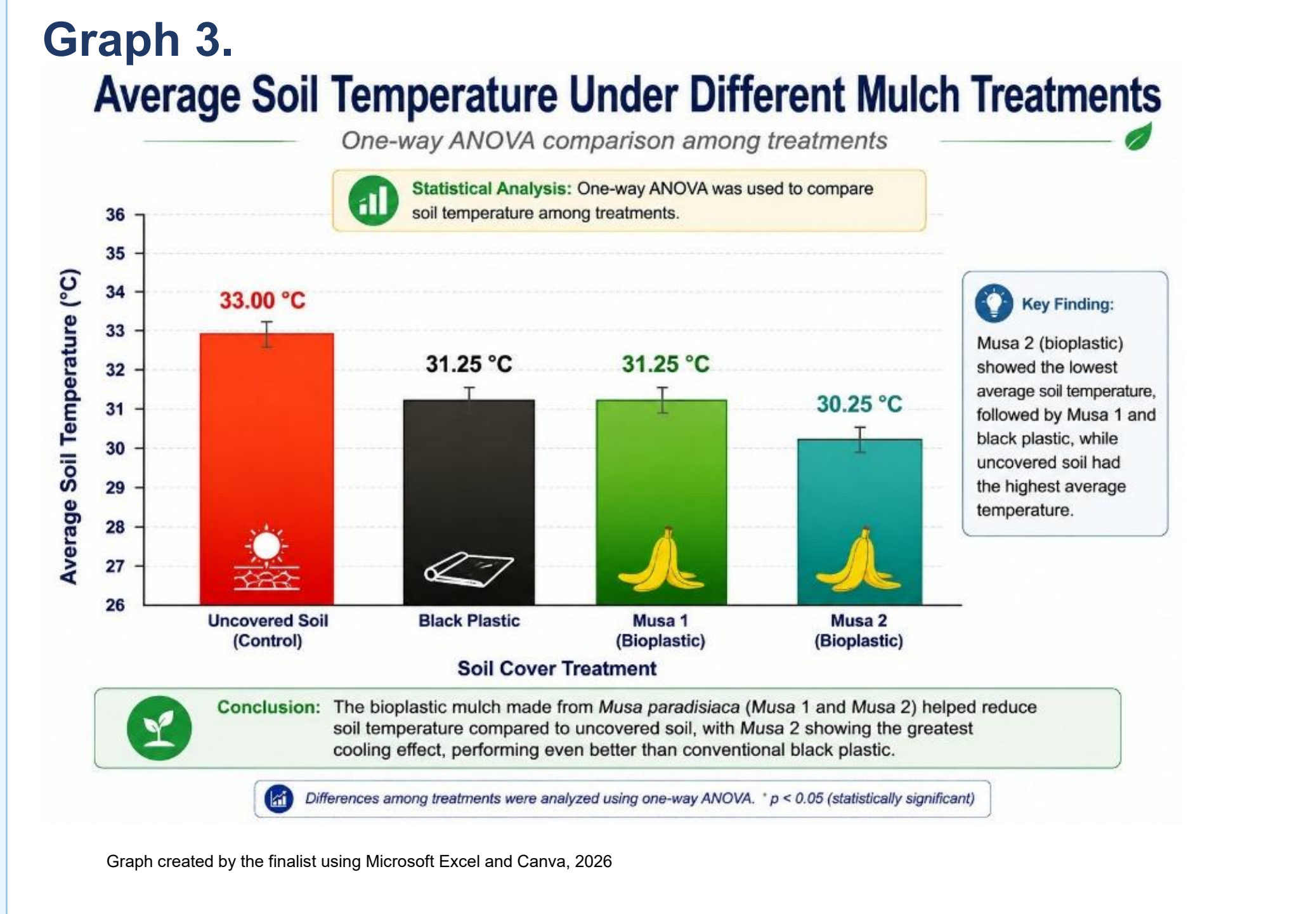
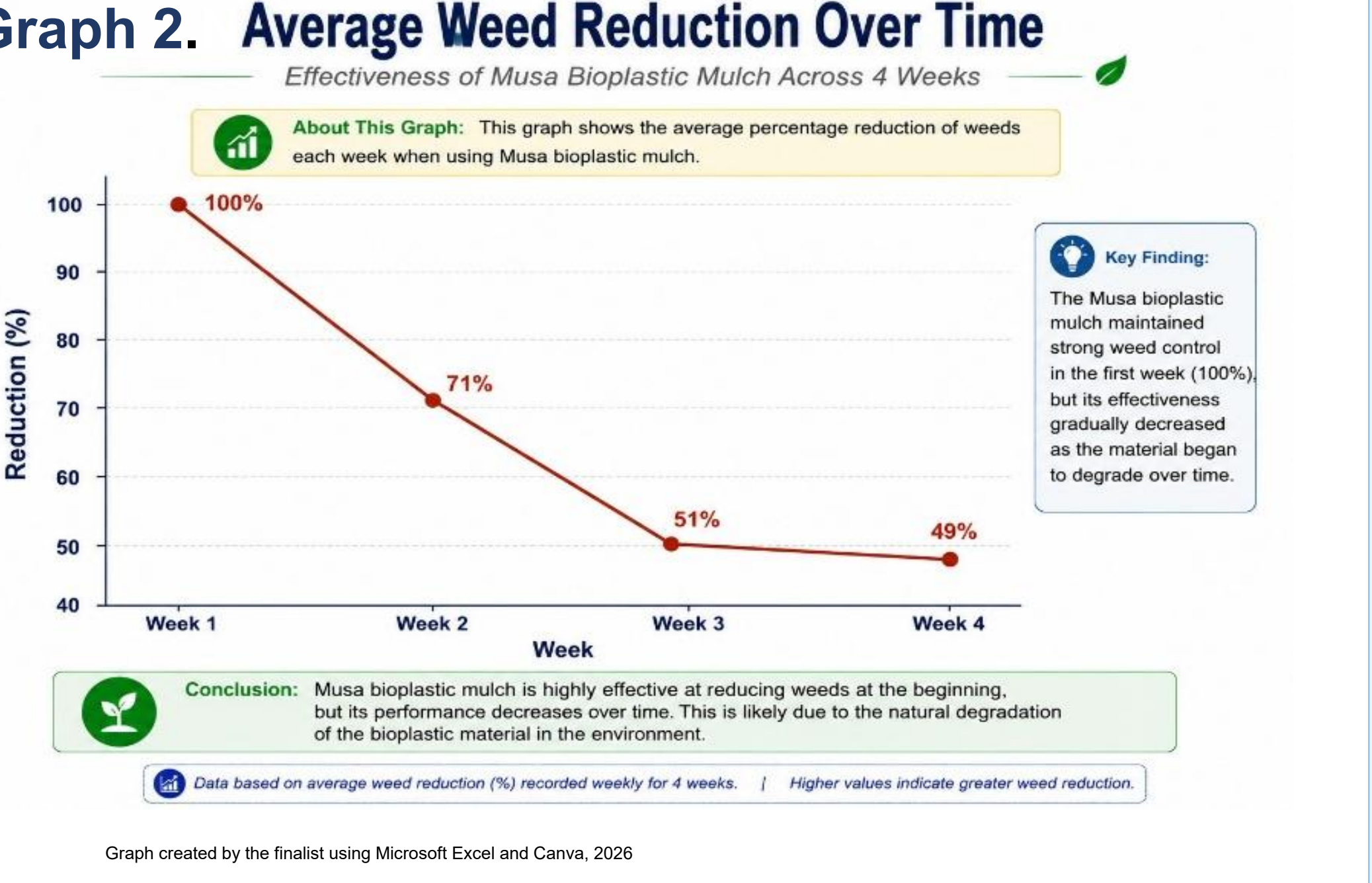
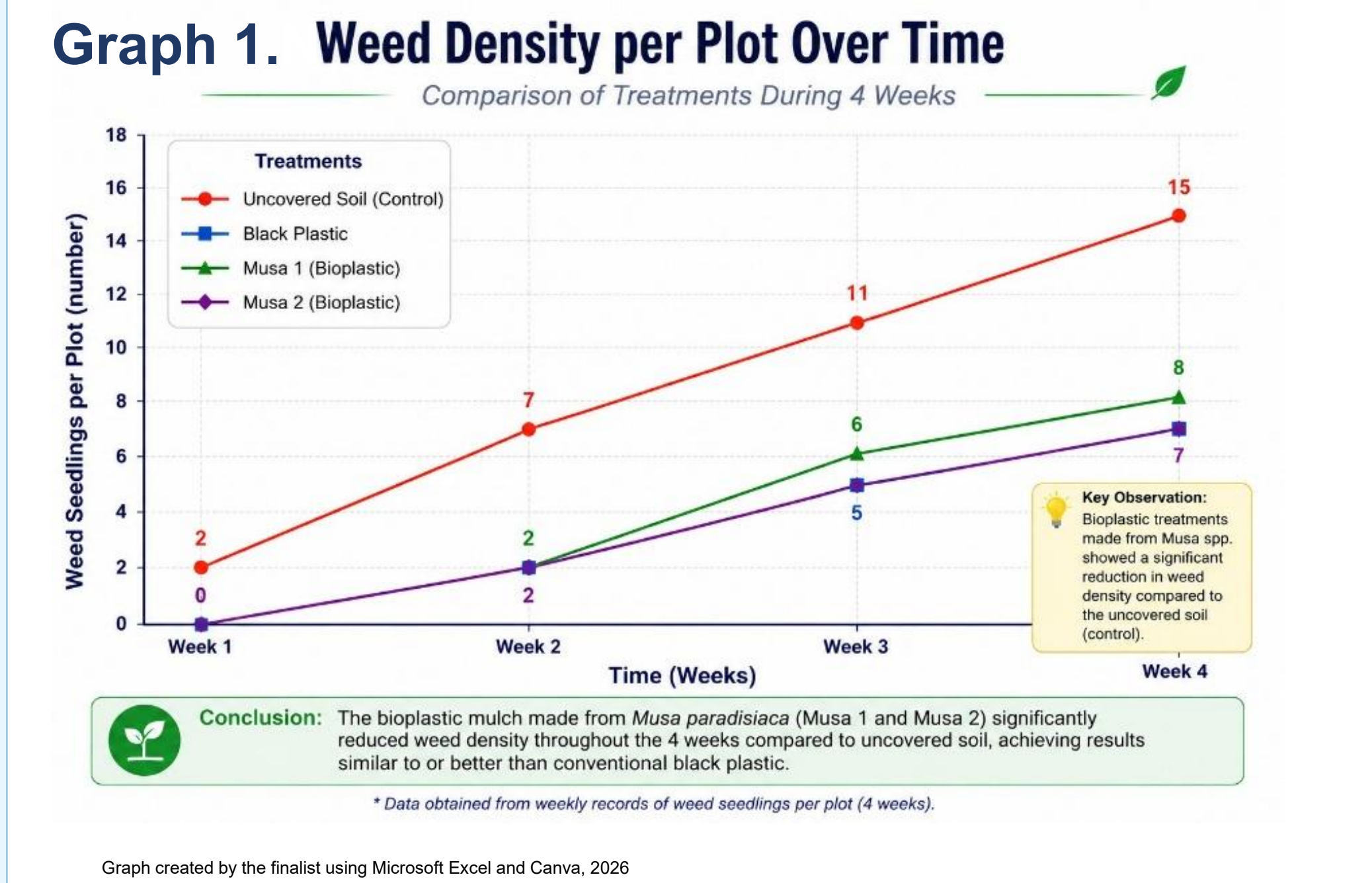
Table 3. Environmental Conditions
Weekly Temperature (°C) and Relative Humidity (%) During the Experiment

Week	Temperature (°C)				Relative Humidity (%)			
	Week 1	Week 2	Week 3	Week 4	Week 1	Week 2	Week 3	Week 4
Week 1	29°C	28°C	29°C	29°C	75%	71%	60%	61%
Week 2	29°C	29°C	25°C	28°C	60%	61%	79%	78%
Week 3	25°C	28°C	26°C	28°C	79%	78%	62%	64%
Week 4	26°C	28°C	26°C	28°C	62%	64%	62%	64%

Interpretation: The average temperature during the experiment ranged from 25°C to 29°C. Relative humidity ranged from 60% to 79%, providing suitable conditions for the study.

Note: Data were recorded weekly throughout the 4-week experimental period.

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METHODS

Bioplastic Formulation

1. Extraction: Process *Musa paradisiaca* peels with distilled water in a blender, then strain and decant.
2. Mixing: Combine the extracted material with cornstarch, vinegar, glycerine, and distilled water.
3. Gelatinization: Heat the mixture while stirring until a viscous.
4. Sheet Formation: Spread the mixture evenly onto a non-stick surface.
5. Drying: Allow the sheets to dry before removing them and applying them to the soil.

Experimental Design

1. Treatments: Uncovered soil (control), commercial black plastic, EcoMusa 1, and EcoMusa 2.
2. Replicates: Three replicates per treatment, for a total of twelve plots.
3. Installation: Apply the plastics over moist soil.
4. Plots Size: 0.50 m × 0.50 m (0.25 m²), with 10 cm borders.
5. Duration: Four weeks, with weekly weed counts and soil temperature measurements.

CONCLUSION

- EooMusa reduced weed emergence by 47%-53%, compared with uncovered soil during the four-week study.
- Its weed-control results were close to these of commercial black plastic.
- The EcoMusa plots had lower soil temperatures by 1-3 °C lower and higher soil moisture than uncovered plots.
- Statistical analysis using ANOVA showed differences among treatments (p < 0.05) in weed density and soil microclimate regulation.

NEXT STEPS

2026-2027: Design biodegradable capsules made from EcoMusa bioplastic to transport and protect seeds and nutrients during space missions.

2027-2028: Evaluate whether EcoMusa bioplastic can serve as a thermal protection material for experimental crops in space.

REFERENCES

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