



# Alternate Products to Control Silvery Thread Moss in a Creeping Bentgrass Putting Green

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## Introduction

Silvery thread moss (*Byrum argenteum* Hedw.) is a cosmopolitan weed of sand-based creeping bentgrass (*Agrostis stoloniferous* L.) putting greens. Once introduced, moss is problematic given a majority of putting green cultural practices are conducted not to benefit plant health, but to ensure fast ball roll speeds. Moss is worst in surface design features (ridges and knolls) and outer perimeter clean-up laps because scalping by mowers can exist due to low mowing heights. Once moss is established, creeping bentgrass is unable to compete given reduced nitrogen fertility and plant growth regulator use are necessary cultural practices for putting greens. Alternative ways to suppress moss are needed given repeat applications of a single postemergent herbicide (carfentrazone) is currently used for the suppression of slivery thread moss.

## Objective

- Evaluate moss suppression using alternatives vs the herbicide carfentrazone known as QuickSilver.

## Materials and Methods

### Field Research using Randomized Complete Block Design

- ‘SR1119’ plus ‘Providence’ creeping bentgrass nursery green approximately 25 years old.
- Location was North Shore Country Club, Glenview, Illinois in 2023 and 2024.

### 2023 Study

- Small plots used 3 ft x 3 ft
- Four treatments replicated 4 times

### 2024 Study (new location within green)

- Small plots used 4 ft x 5 ft
- Six treatments replicated 4 times

Table 1. Treatment list and description for 2023 and 2024 study.

No.	Treatments	Rate	Formulation	Analysis & Product Details	N Applied / 1000 sq ft	Company
2023 Study – 4 treatments						
1	Untreated	n/a	n/a	n/a	n/a	
2	Quicksilver ½ rate	3.35 fl oz /Acre	Liquid	Carfentrazone herbicide	n/a	FMC Corp., Philadelphia, PA
3	Castaway DG	15 lbs /1000 sq ft	Granular	1-0-0 tea seed meal fertilizer (saponin compounds)	0.15 lbs N per app. (1.2 lbs N total)	The Andersons, Maumee, OH
4	Fiesta	6 lbs /1000 sq ft	Fine Granular	8-0-1 fertilizer + sodium ferric EDTA (14% chelated iron)	0.48 lbs N per app. (3.8 lbs N total)	Neudorff North America, BC, CAN
2024 Study – 6 treatments						
5	Fiesta ½ rate	3 lbs /1000 sq ft	Fine Granular	8-0-1 fertilizer + sodium ferric EDTA (14% chelated iron)	0.24 lbs N per app. (1.9 lbs N total)	Neudorff North America, BC, CAN
6	Sodium bicarbonate	0.06 oz /1 fl oz	Wettable Powder	Arm & Hammer Pure Baking Soda	n/a	Church & Dwhite Co. Inc., Ewing, NJ

### Treatment Details

- Eight applications on 14-day intervals in 2023 (Jul 10, Jul 24, Aug 7, Aug 21, Sep 5, Sep 18, Oct 2, and Oct 13) and in 2024 (May 6, Jun 3, Jun 17, Jul 1, Jul 15, Jul 29, 12-Aug, and 26 Aug).
- Granular treatments were hand-applied to ensure uniform distribution across each plot – watered in.
- Quicksilver herbicide was applied using a CO<sub>2</sub>-powered backpack sprayer operated at 40 psi with XR TEEJET 8004VS nozzles using 2 gallons water carrier/1000 sq ft – not watered in.
- Sodium bicarbonate spot-applied using a sprayer bottle at 0.04 oz per 16 oz water – not watered in.

### Data (visual, except NDVI)

- Moss Infestation (% per plot)
- Moss Health/Color (1-4, with 4 green/healthy, 3 yellow, 2 brown, and 1 black/unhealthy)
- Turfgrass Quality (TQ) (1-9, 9 best and 6 acceptable)
- Normalized Difference Vegetation Index (NDVI) (GreenSeeker Handheld Crop Sensor, Trimble, Westminster, CO)

### Statistical Analysis

- Separate statistical analysis conducted for all data by date within each year (ARM statistical software, GDM Solutions, Inc.)
- Area Under the Progress Curve\* (AUPC) used to summarize data across one year. \*Estimated by the trapezoidal integration method (Madden et al., 2007).

## Data Analysis - 2023

Source	10-Jul	17-Jul	24-Jul	31-Jul	7-Aug	14-Aug	21-Aug	28-Aug	5-Sep	11-Sep	18-Sep	25-Sep	2-Oct	6-Oct	13-Oct	20-Oct	28-Oct	AUPC
Moss %	NS	NS	NS	NS	NS	*	NS	*	*	NS	**	**	*	*	***	**	***	**
NDVI	NS	NS	NS	NS	NS	**	**	*	***	*	*	*	***	*	NS	*	***	***
Visual Quality	NS	NS	NS	NS	***	***	NS	NS	*	*	***	*	***	***	***	***	***	***

NS = not statistically significant, \* = significant at 0.05 level of probability (or p value of 0.05), \*\* = significant at p value of 0.01, and \*\*\* = significant at p value of 0.001. AUPC = Area Under Progress Curve

## Results – 2023

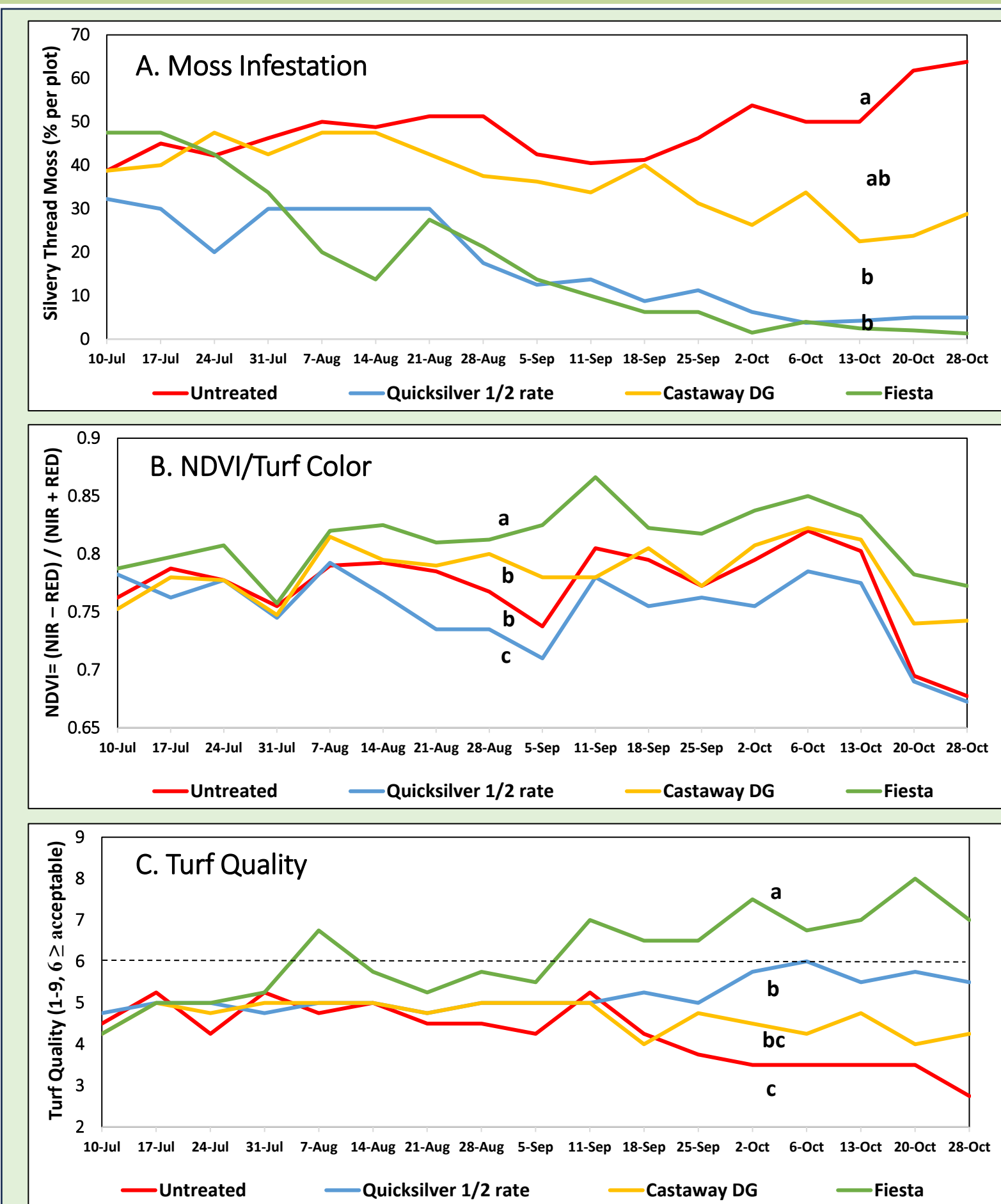


Figure 1. A) Moss Infestation, B) NDVI/Turf Color, and C) Turf Quality weekly ratings versus treatments to control moss on a nursery green during 2023. Different letters indicate significant differences using Area Under the Curve analysis, Fisher's LSD at P = 0.05.

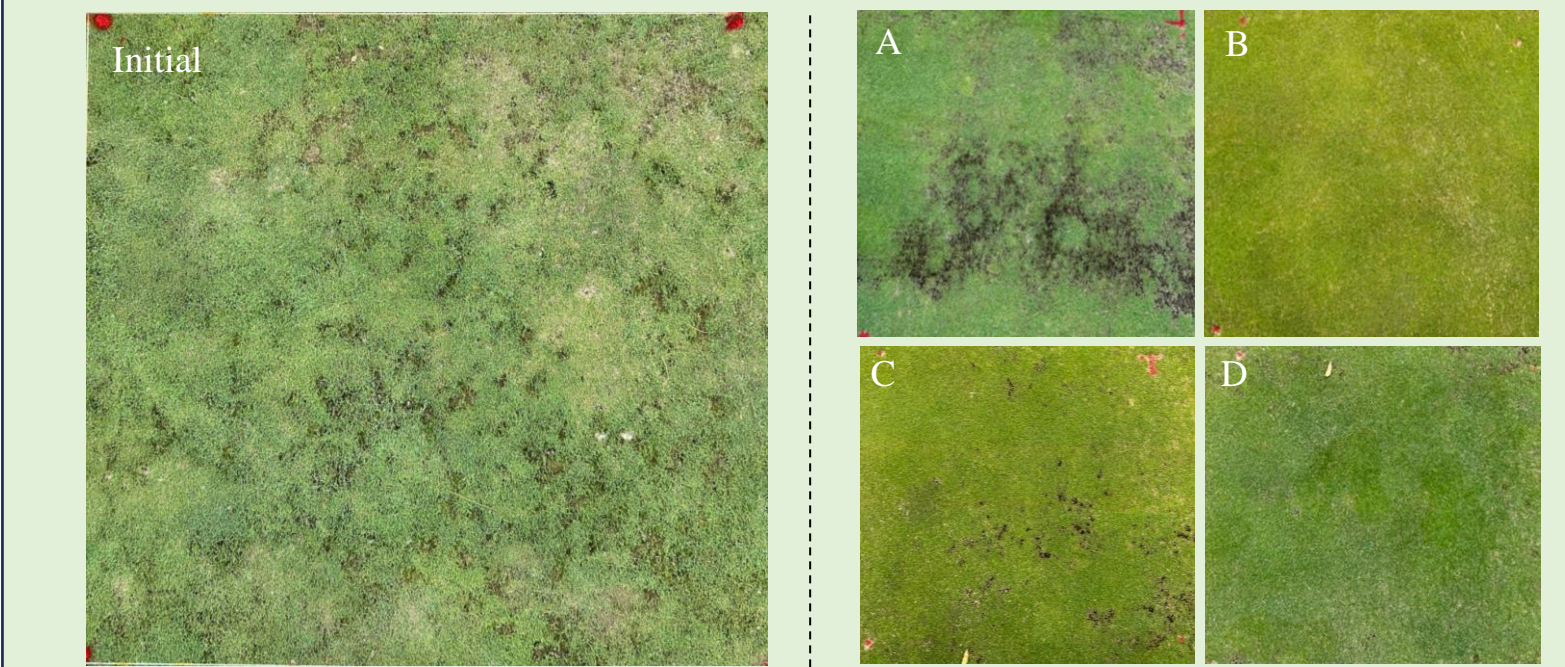


Figure 2. Initial moss infestation on a nursery green on Jul 10, 2023 (left) versus final levels in plots of A) Untreated, B) Quicksilver ½ rate, C) Castaway, D) Fiesta on Oct 28, 2023 (right).

### Untreated

- Moss increased from 38.7% to 63.8% from Jul to Oct in 2023. Fig. 1-A
- TQ unacceptable on all dates. Fig. 1-C

### Quicksilver ½ rate

- Moss was reduced from 32.2% to 5% from Jul to Oct in 2023. Fig. 1-A
- TQ unacceptable on all dates except Oct 6. Fig. 1-C
- NDVI lower than Fiesta, Castaway, and Untreated on few dates. Fig. 1-B

### Castaway DG

- Moss was reduced from 38.7% to 28.8% from Jul to Oct in 2023. Fig. 1-A
- TQ unacceptable on all dates. Fig. 1-C
- NDVI lower than Fiesta on few dates. Fig. 1-B

### Fiesta

- Moss was reduced from 47.5% to 1.3% from Jul to Oct in 2023. Fig. 1-A
- TQ acceptable only in the fall beginning on Sep 11. Fig. 1-C
- Fiesta plots saw both greener color and greater shoot density. Fig. 1-B and Fig. 2-D

## Data Analysis - 2024

Source	20-May	3-Jun	11-Jun	17-Jun	24-Jun	1-Jul	8-Jul	15-Jul	22-Jul	29-Jul	5-Aug	12-Aug	19-Aug	26-Aug	3-Sep	9-Sep	AUPC
Moss %	NS	NS	NS	**	***	***	***	***	***	***	*	*	*	*	***	***	***
NDVI	NS	***	*	***	***	*	NS	NS	*	*	*	*	*	*	*	*	***
Visual Quality	NS	NS	*	***	***	*	***	***	*	*	***	***	***	***	***	***	***
Moss Health	NS	NS	***	***	***	***	*	*	***	***	***	***	***	***	***	*	***

NS = not statistically significant, \* = significant at 0.05 level of probability (or p value of 0.05), \*\* = significant at p value of 0.01, and \*\*\* = significant at p value of 0.001. AUPC = Area under Progress Curve

## Results – 2024

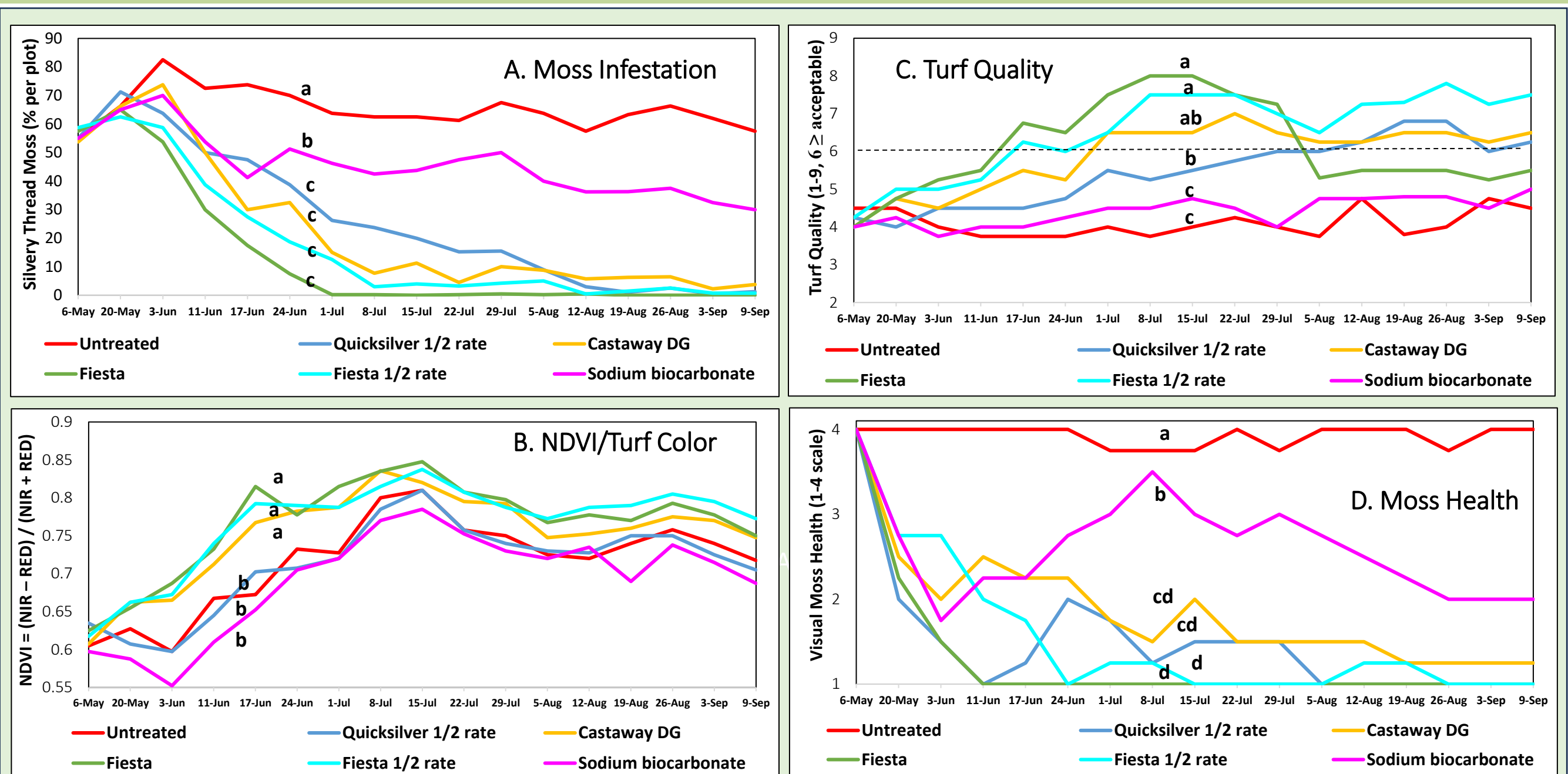


Figure 3. A) Moss Infestation, B) NDVI/Reflectance, C) Turf Quality, and D) Moss Health versus treatments to control moss on a nursery green in 2024. Different letters indicate significant differences using Area Under the Curve analysis, Fisher's LSD at P = 0.05.

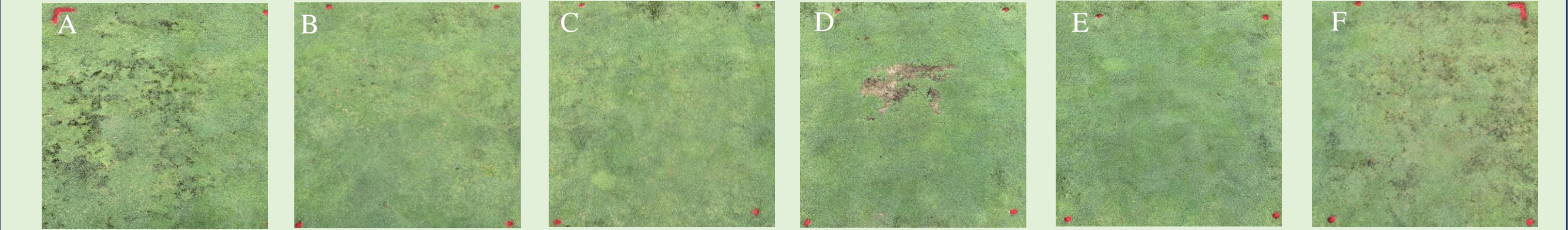


Figure 4. Moss levels present in plots of A) Untreated, B) Quicksilver ½ rate, C) Castaway DG, D) Fiesta, E) Fiesta ½ rate, and F) Sodium bicarbonate on Aug 26, 2024.

### Untreated

- Moss was 55% or higher. Fig. 3-A

### Quicksilver ½ rate

- Moss was reduced to 1.2% by Sep 9 and appeared unhealthy/black on most dates Figs. 3-A and 3-D
- TQ acceptable by Jul 29. Fig. 3-C

### Castaway DG

- Moss was reduced to 3.7% by Sep 9 and appeared unhealthy/brown on most dates. Figs. 3-A and 3-D
- TQ acceptable by Jun 24. Fig. 3-C

### Fiesta

- Moss was reduced to 0% by Sep 9 and unhealthy/black on all dates. Figs. 3-A and 3-D
- TQ acceptable by Jun 11, but mower scalping on Aug 5 significantly reduced TQ. Fig. 3-C

### Fiesta ½ rate

- Moss was reduced to 0.7% by Sep 9 and unhealthy black on all dates. Figs. 3-A and 3-D
- TQ acceptable by Jun 17. Fig. 3-C

### Sodium bicarbonate

- Moss was reduced to 30% by Sep 9. Fig. 3-A
- TQ unacceptable due to phytotoxicity. Fig. 3-C

## Discussion

As expected, Quicksilver (carfentrazone) provided silvery thread moss control in a creeping bentgrass putting green. However, repeated use of carfentrazone without rotation may increase the likelihood of herbicide tolerance by certain moss biotypes. We found two fertilizer products, Fiesta and Castaway DG, are promising alternatives for moss control in creeping bentgrass putting greens. Rate of Fiesta is critical because too much nitrogen will risk excessive growth and scalp injury by mowers. A popular spot treatment, sodium bicarbonate, was found to be phytotoxic and is not recommended. Castaway DG is interesting because it contains a low nitrogen tea extract (saponins) that can provide moss control with repeat applications. A programmatic approach integrating QuickSilver with alternatives is now possible.

## Conclusion

Quicksilver (Carfentrazone) provides the best overall moss control. Alternate products such as granular Fiesta ½ rate and Castaway DG offers great moss control and provide nutritional benefits. Sodium bicarbonate (baking soda) is an ineffective way to control moss, primarily in golf greens, due to associated phytotoxicity.