Examination of a new iron-based herbicide for broadleaf weed management

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Abstract: Few alternatives exist to using the chemical herbicide 2,4-D and its allies to reduce broadleaf weeds in turfgrass. This project examined the use of a new, iron-based product called Fiesta to manage broadleaf weeds under variable timing and number of application regimes. Efficacy of Fiesta varied by weed species, with weeds including henbit, ajuga, white clover, oxalis and motherwort controlled by one application, while ground ivy was controlled in one or two applications and other weed species required three applications for even partial control. Date of application (June/July or August/September) was found to influence degree of control in some cases. It was also shown that sunlight and temperature may influence efficacy of Fiesta as well.

Background and Justification: For decades professional turfgrass and landscape managers as well as consumers have relied on the chemical herbicide 2,4-D alone or in combination with other products to selectively manage broadleaf weeds. Alternative methods, including those that would be considered "organic," have for the most part been non-existent. The lack of alternative weed management options has presented one of the biggest challenges to those wishing to practice organic lawn care to date. This situation changed recently, however, with the introduction of iron-based herbicides, first into the Canadian market, and more recently in the United States. There products promise to control a long list of weeds in turfgrass while leaving grasses unharmed, yet there is little independent research to document these claims. Studies in Ontario, Canada, have shown that the products do have efficacy, but many things, such as the number of applications required for control, are not completely understood (personal communication with Pam Charbonneau, Ontario Ministry of Agriculture Food and Rural Affairs Turfgrass Specialist, April 2012).

The herbicide Fiesta (active ingredient Iron HEDTA 26.52%, 4.43% actual iron, produced by Neudorff North America), the focus of this study, became legal to use in New York State in 2011. Few studies of this or other iron products have been completed with the results widely distributed in the United States. Similarly, these products remain relatively unknown among the target market of end-users as well as Extension educators and others who share weed management information and responsibilities. This project will begin the study of Fiesta herbicide under New York State conditions and will share results with both professional and consumer audiences.

Objectives:

1. Under field conditions, examine the impact of Fiesta herbicide on turfgrasses and weeds under variable regimes of application timing and number of applications.
2. Under greenhouse conditions, examine the impact of Fiesta herbicide on a variety of weed species, under variable regimes of application timing and number of applications.
3. Summarize the results of the first year of research and present the findings via website reports and photos, and a Powerpoint presentation
4. Extend this project into 2013, because herbicide applications made in the autumn of 2012 cannot be completely evaluated until spring of 2013

Procedures and results for weeds in turfgrass – Rensselaer County (written by David Chinery):

Plots measuring 4 feet by 4 feet were established on two home lawn sites, one named Schodack and the other Brookview. Both had a mixture of Kentucky bluegrass and perennial ryegrass, with small amounts of fine fescue in the Brookview plots as well. Weeds at both sites included broadleaf plantain (*Plantago major*), ground ivy (*Glechoma hederacea*), henbit (*Lamium amplexicaule*) and white clover (*Trifolium repens*). Treatment dates and frequency are found in Table 1.

Table 1. Number of treatments and treatment dates

Treatment Name	Number of treatments	Treatment Dates
S12	2	June 8 , June 21
S123	3	June 8, June 21, July 5
S1346	4	June 8, June 21, August 24, October 9
S123456	6	June 8, June 21, July 5, August 24, September 12, October 9
S45	2	August 24, September 12
S456	3	August 24, September 12, October 9

Five ounces of Fiesta were mixed with one gallon of water, and this mixture was sprayed at the 10 gallons per 1,000 square feet rate for each application, as directed by the label. There were four replications of each treatment at each of the two sites, unless otherwise noted in the narrative below. A hand-held pressurized sprayer was used to make the applications. When observations and a treatment were made on the same date, the observations were made before the treatments. Broadleaf plantain was the most prevalent weed in the plots at both locations, so a detailed account of that species is given here, with shorter observations for other species.

Broadleaf plantain

Data for broadleaf plantain (bp) is presented in Table 2 for Schodack and Table 3 for Brookview. In general, 10 to 60% of the plantain in each plot showed blackened, necrotic foliage within 24 hours of a Fiesta application. It should be noted that for each of the treatment regimes, bp decreased more at Schodack than at Brookview. The one obvious difference between the two sites is sunlight – Schodack plots received about 6 hours of direct sun and two hours of filtered light per day in July and early August, while Brookview plots received virtually no full sun but

remained in bright shade all day. Increased leaf surface temperatures in the sunnier location might also play a part in response differences with Fiesta.

S12 plots were sprayed twice, on June 8 and on June 21. At Schodack, bp decreased by 12.1% by June 15, and by 94.5% by July 12, after the two treatments. Levels of bp remained low through the summer and into the fall, with 90.3% less bp in October than at the beginning of the trial. At Brookview, bp decreased more slowly, only declining by 44.5% by July 12. Levels of bp remained constant through the summer and into the fall, with 42.6% less bp in October than at the beginning of the trial.

S123 plots were sprayed three times, on June 8, June 21, and July 5. At Schodack, bp decreased by 5.9% by June 15, 95.3% by July 5, and by 100.0% by July 12, where it remained for the rest of the trial, meaning that bp was eliminated from these plots. At Brookview, bp decreased more slowly, to 18.8% by July 5, and to 88.8% by July 12. As time progressed, bp decreased even further, with 96.9% less bp by July 24, and 94.4% less on October 9.

S1346 plots were sprayed four times, on June 8, July 5, August 24 and October 9. At Schodack, bp decreased by 3.1% by June 15, 21,9% by July 5, and 99.4% by October 9. At Brookview, bp remained at its original levels on July 5 but decreased dramatically by July 12 after the second spray (applied right after the July 5 observations) to 69.7%. By October 9, bp decreased by 92.4%. With these applications, spread farther apart over time, the rate of bp decrease was slower than in the S12 and S123 plots, were the applications were made closer to each other.

S123456 plots were sprayed six times, on June 8, June 21, July 5, August 24, September 12, and October 9. At Schodack, bp decreased by 6.5% by June 15 and decreased by 99.4% by July 12, where it remained. At Brookview, bp decreased more slowly, by reaching 99.0% control only by October 9.

S45 plots were sprayed twice, on August 24 and September 12. At Schodack, bp decreased by 62.0% by September 12, and dropped by 100% by October 9. At Brookview, bp dropped by 40.9% by September 12 and by 83.1% by October 9.

S456 plots were sprayed three times, on August 24, September 12, and October 9. At Schodack, bp dropped by 46.8% by September 12, and by 99.6% by October 9. At Brookview, bp dropped by 40.9% by September 12 and by 83.1% by October 9. Although the plots were evaluated in November, bp was naturally going dormant and disappearing in the check plots, so complete evaluation of the impact of three treatments cannot be made until spring 2013.

In comparing the two treatment regimes, S12 was not as effective as S45, indicating that late summer/fall treatment timing is preferable. In comparing three treatment regimes, S123 and S456 achieved virtually the same level of control at the Schodack site, while S123 performed better at Brookview. Light levels seem to be a confounding influence on the level of control achieved. However, the three treatment regime cannot be fully evaluated until spring 2013.

Table 2. Percentage of broadleaf plantain in four replicated plots for six treatments on eight observation dates at Schodack

S12								
Replicate	7-Jun	15-Jun	22-Jun	5-Jul	12-Jul	24-Aug	12-Sep	9-Oct
1	55.0	50.0	50.0	5.0	2.0	8.0	8.0	8.0
2	40.0	35.0	20.0	2.0	1.0	1.0	3.0	3.0
3	40.0	35.0	20.0	2.0	1.0	1.0	0.0	0.0
4	30.0	25.0	20.0	5.0	5.0	2.0	2.0	5.0
Average	41.3	36.3	27.5	3.5	2.3	3.0	3.3	4.0
% change		-12.1	-33.3	-91.5	-94.5	-92.7	-92.1	-90.3
S123								
Replicate	7-Jun	15-Jun	22-Jun	5-Jul	12-Jul	24-Aug	12-Sep	9-Oct
1	45.0	45.0	45.0	2.0	0.0	0.0	0.0	0.0
2	50.0	45.0	25.0	2.0	0.0	0.0	0.0	0.0
3	40.0	40.0	40.0	2.0	0.0	0.0	0.0	0.0
4	35.0	30.0	25.0	2.0	0.0	0.0	0.0	0.0
Average	42.5	40.0	33.8	2.0	0.0	0.0	0.0	0.0
% change		-5.9	-20.6	-95.3	-100.0	-100.0	-100.0	-100.0
S1346								
Replicate	7-Jun	15-Jun	22-Jun	5-Jul	12-Jul	24-Aug	12-Sep	9-Oct
1	40.0	40.0	40.0	30.0	10.0	3.0	1.0	1.0
2	40.0	40.0	40.0	15.0	0.0	0.0	0.0	0.0
3	45.0	45.0	45.0	40.0	8.0	1.0	0.0	0.0
4	35.0	30.0	35.0	40.0	8.0	1.0	5.0	0.0
Average	40.0	38.8	40.0	31.3	6.5	1.3	1.5	0.3
% change		-3.1	0.0	-21.9	-83.8	-96.9	-96.3	-99.4
S123456								
Replicate	7-Jun	15-Jun	22-Jun	5-Jul	12-Jul	24-Aug	12-Sep	9-Oct
1	35.0	35.0	35.0	2.0	0.0	0.0	0.0	0.0
2	35.0	35.0	25.0	2.0	0.0	0.0	0.0	0.0
3	40.0	35.0	25.0	2.0	0.0	0.0	0.0	0.0
4	45.0	40.0	35.0	7.0	1.0	1.0	1.0	0.0
Average	38.8	36.3	30.0	3.3	0.3	0.3	0.3	0.0
% change		-6.5	-22.6	-91.6	-99.4	-99.4	-99.4	-100.0
S45								
Replicate	7-Jun					24-Aug	12-Sep	9-Oct
1	35.0					40.0	8.0	0.0
2	35.0					50.0	15.0	0.0
3	40.0					50.0	15.0	0.0

4	45.0					65.0	40.0	0.0
Average	38.8					51.3	19.5	0.0
% change							-62.0	-100.0
S456								
Replicate	7-Jun					24-Aug	12-Sep	9-Oct
1	55.0					70.0	30.0	0.0
2	40.0					55.0	15.0	0.0
3	40.0					55.0	40.0	0.0
4	40.0					55.0	40.0	1.0
Average	43.8					58.8	31.3	0.3
% change							-46.8	-99.6

Table 3. Percentage of broadleaf plantain in four replicated plots for six treatments on eight observation dates at Schodack

S12							
Replicate	7-Jun	22-Jun	5-Jul	12-Jul	24-Aug	12-Sep	9-Oct
1	25.0	25.0	20.0	3.0	1.0	1.0	1.0
2	40.0	40.0	35.0	20.0	25.0	25.0	15.0
3	65.0	65.0	55.0	55.0	65.0	70.0	70.0
4	25.0	25.0	15.0	8.0	10.0	10.0	3.0
Average	38.8	38.8	31.3	21.5	25.3	26.5	22.3
change		0.0	-19.4	-44.5	-34.8	-31.6	-42.6
S123							
Replicate	7-Jun	22-Jun	5-Jul	12-Jul	24-Aug	12-Sep	9-Oct
1	35.0	35.0	30.0	6.0	3.0	5.0	5.0
2	45.0	40.0	35.0	3.0	0.0	0.0	2.0
3	55.0	55.0	45.0	5.0	2.0	2.0	2.0
4	25.0	25.0	20.0	4.0	0.0	0.0	0.0
Average	40.0	38.8	32.5	4.5	1.3	1.8	2.3
change		-3.1	-18.8	-88.8	-96.9	-95.6	-94.4
S1346							
Replicate	7-Jun	22-Jun	5-Jul	12-Jul	24-Aug	12-Sep	9-Oct
1	40.0	40.0	40.0	20.0	8.0	8.0	5.0
2	20.0	25.0	20.0	1.0	0.0	0.0	1.0
3	55.0	55.0	55.0	15.0	10.0	8.0	3.0
4	70.0	70.0	70.0	20.0	5.0	8.0	5.0
Average	46.3	47.5	46.3	14.0	5.8	6.0	3.5
change		2.7	0.0	-69.7	-87.6	-87.0	-92.4

S123456							
Replicate	7-Jun	22-Jun	5-Jul	12-Jul	24-Aug	12-Sep	9-Oct
1	60.0	55.0	40.0	8.0	10.0	10.0	2.0
2	25.0	25.0	20.0	1.0	0.0	0.0	0.0
3	60.0	50.0	40.0	1.0	10.0	5.0	0.0
4	65.0	65.0	40.0	6.0	5.0	2.0	0.0
Average	52.5	48.8	35.0	4.0	6.3	4.3	0.5
change		-7.1	-33.3	-92.4	-88.1	-91.9	-99.0
S45							
Replicate	7-Jun				24-Aug	12-Sep	9-Oct
1	55.0				55.0	40.0	5.0
2	30.0				40.0	20.0	2.0
3	20.0				20.0	15.0	3.0
4	65.0				65.0	55.0	3.0
Average	42.5				45.0	32.5	3.3
change						-27.8	-90.0
S456							
Replicate	7-Jun				24-Aug	12-Sep	9-Oct
1	25.0				25.0	10.0	3.0
2	25.0				25.0	15.0	2.0
3	20.0				20.0	15.0	3.0
4	30.0				40.0	25.0	3.0
Average	25.0				27.5	16.3	2.8
change						-40.9	-83.1

Ground ivy

Ground ivy (gi) was present in both the Schodack and the Brookview plots and totaled 2 to 10% of the total cover. One day after the first treatment, 10 to 60% of the gi had turned black and necrotic at the Schodack plots, while 0 to 40% had done so at the Brookview plots. Seven days after the first treatment, gi was almost gone from all plots, with less than 2% of the original cover remaining. By June 22, two weeks after the first treatment, gi was gone from all the plots, and further ratings could not be made. Gi did re-appear in the S12 and S123 plots at Brookview by October 9, however, when 1 to 8% was found. This was most likely not re-growth from plants judged to be previously killed, but gi creeping in from surrounding areas.

To further examine how Fiesta manages gi in June, three additional plots containing just ground ivy were established and sprayed once on June 21 at Brookview. One day after treatment, each leaf was about 20% blackened and necrotic. By July 5 (14 days after treatment), necrosis reached an average of 75%, and by July 12 (21 days after treatment), necrosis reached 98%. No growth of gi was observed in these plots during the remainder of the study.

For S45 plots, gi decreased by 91.7% three weeks after the first application at Schodack, while the decrease was only 18.2% at Brookview. Gi decreased by 100.0% after the second application at Schodack, and by 96.4% at Brookview. Low light levels at Brookview again seemed to slow control. For S456 plots, gi decreased by 82.1% three weeks after the first application at Schodack, while the decrease was only 23.3% at Brookview. Gi decreased by 100.0% after the second application at Schodack, and by 93.3% at Brookview. These three treatments regimes cannot be fully evaluated until spring 2013.

Henbit

Henbit (hb) was observed to be in the Schodack plots and totaled 2 to 20% of the plot cover. One day after the first treatment, 30 to 80% of the hb had turned black and necrotic. One week after the first treatment, hb was gone from the plots. Hb was not observed again in the plots until November 2, when 2 to 8% was seen in two S12 plots and 5% was seen in three S123 plots. We were unable to determine if these were new seedlings or re-growth from plants which disappeared and seemed to be killed in June.

White clover

White clover (wc) was found in very low levels (1 to 5%) in six Schodack plots and in low levels (5 to 10%) in 20 of the Brookview plots. One day after the first treatment, between 0 and 60% of the wc foliage was blackened and necrotic. This was surprising, since during the Fiesta application to clover foliage, the product beaded and appeared to roll off. One week after the first treatment, wc had disappeared from all of the plots at both locations.

To further examine wc, three additional plots containing primarily wc were established and sprayed once on June 21 at Brookview. These plots were in very sunny locations. One day after treatment, 100% of the wc foliage was necrotic. Wc did not re-appear in these plots during this study.

Ajuga

Ajuga (*Ajuga reptans*) (ar) is considered a desirable plant in landscape beds but can be a weed in turfgrass. On June 21, two plots containing primarily ar were established and sprayed at Brookview. The plots were in very shaded areas. One day after treatment, 1% of the foliage was necrotic, 2% showed marginal necrosis, and 97% had turned a darker green. By two weeks after the application (July 5), 90% of the ar had either disappeared or was heavily necrotic, with only 5% remaining. Three weeks after the application (July 12), 100% of the ar was judged to be completely necrotic. Ar did not return in these plots during the study.

Turfgrass

Kentucky bluegrass, perennial ryegrass and fine fescues were observed to become darker green in color within hours of Fiesta application. This darkening of the foliage lasted several weeks. A few plots at both locations were observed to show necrotic turfgrass on July 12, but it was unclear whether Fiesta applications played a part, because the necrosis was inconsistent. No rain was recorded for the period June 12 to July 12, so the necrosis was most likely drought-induced. After July 12, rain events occurred with enough frequency to keep all turfgrass species green to the end of the study.

Procedures and results for weeds in turfgrass – Monroe County (Walter Nelson)

The iron chelate HEDTA is active as an herbicide against some broadleaf lawn weeds. The brand Fiesta was applied to home lawn and lawn-like demonstration plots in Monroe County during the 2012 growing season. These were part of the broader demonstration with the product in the Capital region.

A sequence of six applications in several application regimes with Fiesta were made at three week intervals (4 weeks, depending on weather) beginning in early June and ending in mid-October. A summary of the effort was presented during the annual November NYS green industry conference in Rochester.

Two sets of three replications with one meter plots were established for the Fiesta applications. The indicator weeds included dandelion, narrow leaf plantain and ground ivy. Additional weeds observed included chicory, clover, motherwort and oxalis. The plots contained Kentucky bluegrass, perennial ryegrass, quack grass and one set also contained some tall fescue and orchard grass. An initial series of plots received a single application using the brand Iron-X, observing a similar weed population.

The material was applied per label using five ounces of material in one gallon of water and applied at a rate of 10 gallons per 1,000 sq.ft. The project protocol called for an application in mid-July. The plots were fully dormant during that period due to drought. Plots scheduled for treatment exhibited no change as a result of an application made at that time.

Broadleaf plants would discolor to black within a day of treatments. The degree of discoloration and duration was species dependent. Grass turned a richer green as a result of an application. This richer color lasted several weeks. It did not endure to the following application.

Finer rooted broadleaf plants (clover, ground ivy, motherwort, oxalis, plantain) were more adversely impacted than fleshy rooted dandelion. Ground ivy was nearly completely killed with a single application. The second application eliminated the plant. Oxalis and motherwort were removed with a single application. Plantain and dandelion were burned out in two applications but regrew after the drought. Dandelion recovery was complete. Twenty percent recovery of plantain was identified after August rainfall.

Plans are to submit a seminar application for a final report during the 2013 Green Industry Conference. A spring 2013 evaluation will be conducted of the plots. The lack of any response with the Iron-X material compared to Fiesta with an identical A.I. is puzzling. Does the Iron-X have a different carrier/spreader? Plans are to establish comparison plots with these materials in 2013. Its chemistry provides minimal (if any) volatility. The material Fiesta has potential as a broadleaf management material for some broadleaf plants in sensitive areas or where drift is of concern. Its cost is high and may deter its use.

Procedures and results for difficult to manage weeds (greenhouse study) – Albany County (Chuck Schmitt)

1. A collection of containerized weeds consisting of mugwort (*Artemisia vulgaris*), narrowleaf plantain (*Plantago lanceolata*), and Pennsylvania smartweed (*Polygonum pensylvanicum*) were established in 6 1/2" plastic azalea type containers of general purpose professional growing media, (Sunshine Mix #1), at the Schenectady County Horticulture Education Center in Schenectady on May 31, 2012.
2. The three weed species were treated with Fiesta herbicide two, three, four, or six times on the schedule below. The label rate of 5 ounces/ gallon was used at each application. The controls were sprayed with clear water. The mixture was sprayed on each container until the point of runoff. A hand-held, pressurized sprayer was used to make the applications.
3. All spray application where made when ambient temperatures were below 85 F. Early mornings, after sunset and rainy days were utilized as application periods.
4. The greenhouse structure used was a computer operated polycarbonate glazed wood framed structure with forced air roof ventilation. Plants were placed on expanded metal benches on top of bio-therm heating cables. No heat was provided to the plants.

Greenhouse Application Dates

	June 6	June 20	July 2	August 20	September 24	October 10
Treatments						
1	X	X				
2	X	X	X			
3	X		X	X		X
4	X	X	X	X	X	X
5				X	X	
6				X	X	X
7	Check/no application					

5. Weeds were transplanted from a garden bed into containers one week prior to beginning treatments on May 31, 2012. Treatments began June 6, 2012.

6. Weed condition and re-growth of the plants was evaluated at one hour, twenty-four hours and one week intervals after treatment and at monthly intervals after each herbicide application.

7. Daily greenhouse summer temperatures regularly exceeded 100 F. Boxed fan and roof ventilation was supplied on a 24 hour basis.

General greenhouse observations:
On the three weed species tested, no foliar damage was observed on any spray treatment at the one hour observation timing. After twenty-four hours damage began to be apparent on the leaf tissue that the spray concentrated on. Generally the leaf tips were damaged by the puddling and concentration of the spray. All flower stems were also damaged (girdled) by the spray material. The flowers of the narrowleaf plantain and the Pennsylvania smartweed were damaged.

Sunlight and temperature also played a significant role in foliage damage after treatment was applied. No damage to the plant foliage was observed one hour after application or even twenty-four hours after application if the following day was not sunny and warm. Damage became apparent several days after treatment. Plants that were treated and experienced a warm sunny day following treatment did have significant damage at the twenty-four hour observation.

Regrowth:
One week after each treatment, regrowth was observed on all plant species at each spray treatment except the narrow-leafed plantain which died after the 3rd treatment on July 2, 2012. Some regrowth was up to 4" in height/length. The three plant species react differently in a harsh but protected greenhouse environment than outside. At certain times, especially in the spring, all plants put on new growth and possibly a thicker cuticle layer due to the need to conserve moisture in the 100 F heat. This may be why, as treatments progressed, damage to healthy foliage often decreased or remained the same.

Mugwort:
After the first treatment on June 6 the healthy foliage of treated mugwort plants was decreased by 70%. This severe decrease in foliage caused these plants to send up new shoots from the roots. More shoot growth from under- ground rhizomes was observed on the treated plants that the untreated controls. After two sprays (June 6th and June 20th) the healthy foliage was reduced only 17% due to new growth and after the third spray healthy foliage was reduced only 20%.

Similarly, the fall applications reduced healthy foliage by 69% initially (August 2 application). Again the plants responded by increasing growth via underground stem proliferation but to a lesser degree than in June. After the second application (September 24) the healthy foliage was reduced by 61% and further reduced by 71% after the third fall application on October 10. Fall treatments seemed to be most effective due to a decrease in growth response by the plant. While a great reduction in healthy foliage was observed, no plants were killed by Fiesta.

The plants sprayed six times over the course of the season averaged 52% foliage reduction while the controls, due to a drought occurrence in late August, averaged a 45% reduction. By comparison the spring treatment that was sprayed twice (June 6 and June 20) fared much better, showing a 30% reduction in healthy foliage due to all the regrowth from the last treatment to the end of the experiment. Therefore, even though they also experienced the drought occurrence, they still fared better than the untreated control by 15%.

Narrowleaf plantain:
After the first treatment on June 6 the healthy foliage of treated narrowleaf plantain was reduced by 39%. Subsequent damage occurred after the second treatment on June 20, when healthy foliage was reduced by 62%, and following the third treatment (July 2) only 2.5% remained alive. Several plants were completely dead.

By comparison the fall treatments were less productive. After the first fall treatment (August 24), healthy foliage was reduced 55%. The plants responded by producing new foliage from the crown as the original leaves continued to be damaged. The second treatment on September 24

resulted in a 34% reduction and the third treatment on Oct a 32% reduction. The new foliage appeared to be less susceptible to damage by the Fe herbicide.

The plants sprayed six times over the course of the season averaged a 71% foliage reduction while the untreated controls, due to a drought occurrence in late August averaged only a 5% reduction. By comparison the spring treatment that was sprayed twice (June 6 and June 20) fared well showing a 9% reduction in healthy foliage due to all the regrowth from the last treatment to the end of the experiment. Based on these results, it is obvious that three applications in June/early July is the best way to control narrowleaf plantain.

Pennsylvania smartweed:
After the first treatment on June 6 the healthy foliage of treated Pennsylvania smartweed plants was reduced by 55%. This species also grew vigorously in response to the tissue damage by Fiesta. After the second treatment on June 20 the healthy foliage was reduced 41% and control was rated as a reduction of 29% after the third treatment on July 2.

The plants sprayed six times over the course of the season averaged a 58% foliage reduction while the controls, due to a drought occurrence in late August, averaged a 15% reduction. By comparison the June treatment that was sprayed twice (June 6 and June 20) showed a 19% reduction in healthy foliage due to all the regrowth from the last treatment to the end of the experiment. Therefore, the spring only application did not appear to be very different from the untreated controls. Late summer/fall treatments seemed to be most effective due to a decrease in growth response by the plant. While a great reduction in healthy foliage was observed, no plants were killed by Fiesta.

Conclusions:

The two sites at Schodack and Brookview indicated that plant response to Fiesta is greater in sunnier, warmer locations than in shadier, cooler locations. The various plant species also showed a variety of responses to Fiesta. Henbit, ajuga, white clover, oxalis and motherwort were controlled by one application in June. Ground ivy was largely controlled by one June application, and completely controlled with two applications. Two applications were needed to control ground ivy in late summer/fall.

Other weeds were tougher to manage. For broadleaf plantain, two June applications provided about 90% control in a sunny area, while three were needed for 100% control. Two late summer applications seemed to be slightly more effective. We will need to wait until spring 2013 to evaluation the late summer/fall regime.

Total control was not achieved for some of the toughest weeds. Mugwort was managed best by three applications in late summer and fall, but was not killed entirely. Three applications in June/early July were needed to manage narrowleaf plantain, when 97.5 % control was achieved. Late summer/fall treatments seemed to be most effective for management of Pennsylvania smartweed, but while a 58% reduction in healthy foliage was observed, no plants were killed by Fiesta.

Plots treated with a similar iron product (Iron-X), with the same level of active ingredient, did not have as great a response as plants treated with Fiesta. More investigation is needed to discover the reason for this difference.

While it may not manage all weed species, and multiple applications might be needed in some cases, Fiesta could certainly become a valuable tool to turfgrass managers who wish to use a product which appears to have a low environmental impact. Based on phone calls and questions received during lectures and diagnostic clinics, ground ivy is one of the most problematic weeds in turfgrass areas in the Capital District. Some turf managers have commented that they would be happy to tolerate other weeds if ground ivy could be reduced. Since Fiesta was shown to have good efficacy on ground ivy, it might provide a good product in these cases. Additionally, an herbicide scheme which used Fiesta to control the majority of the weeds but then spot-treated with a smaller amount of 2,4-D might also be possible.

Currently (December 2012) Fiesta is available for $100.16 per gallon from internet retailers. Using the same rates as we did in this study, the cost per square foot is $0.039, or $39.12 per 1,000 square feet. This cost is higher than for 2,4-D, which costs in the range of $0.014 per square foot or $14.64 per 1,000 square feet. This price differential may deter those who based herbicide decisions on price alone to use Fiesta. But the growing organic movement, in food as well as in landscape horticulture, most likely assures that some significant portion of turf managers would adopt Fiesta as a more desirable alternative despite the higher cost.