

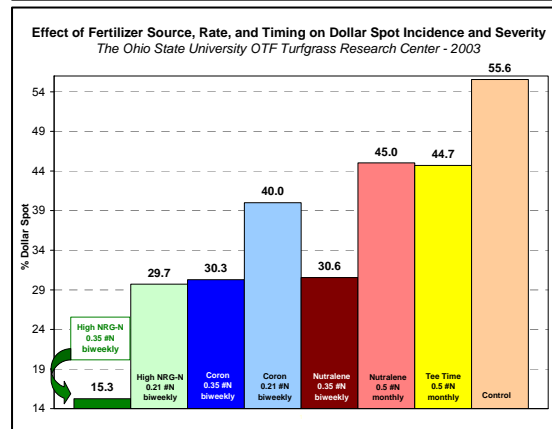
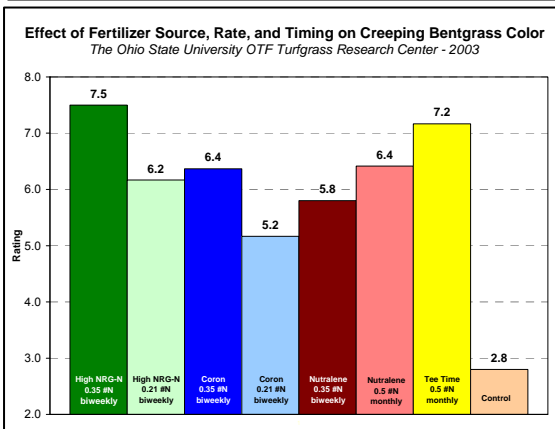
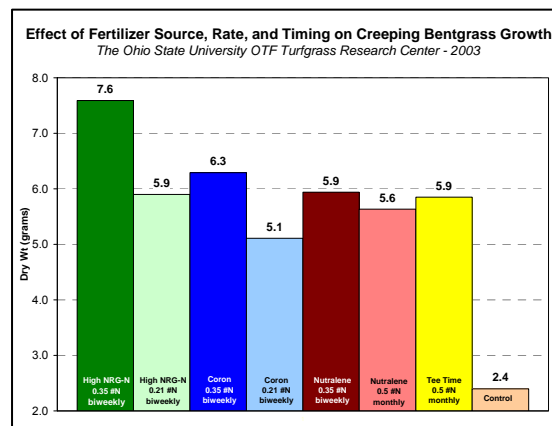
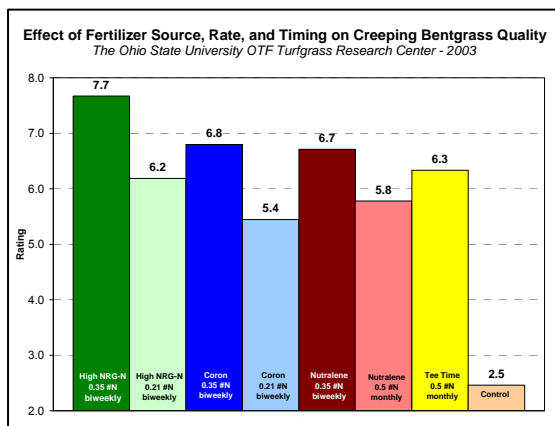
Turfgrass



- The Effects of Nitrogen Source, Rate, and Application Method on Creeping Bentgrass Quality, Growth, and Dollar Spot Incidence (Ohio-2003)
- Effect of Potassium Source and Rate on Creeping Bentgrass Quality and Growth (Ohio-2002)
- The Effect of Nitrogen Rate and Source on Creeping Bentgrass Quality (Ohio-2004)
- Lawn Fertilizer Recommendation
- Fertilizer Comparisons on Turfgrass (2005)
- Nitrogen Source Comparison on Turfgrass (2006)
- Fertilizer Effects on Turfgrass Color (2007)
- Response of Fertilizer on Turfgrass Color and Quality (2008)

Experiment: The Effects of Nitrogen Source, Rate, and Application Method on Creeping Bentgrass Quality, Growth, and Dollar Spot Incidence (Ohio State University)

Year: 2003

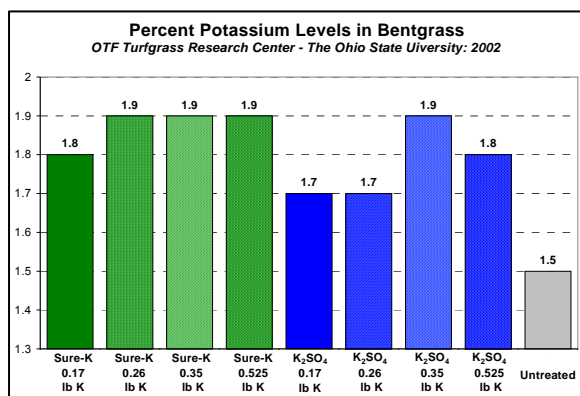
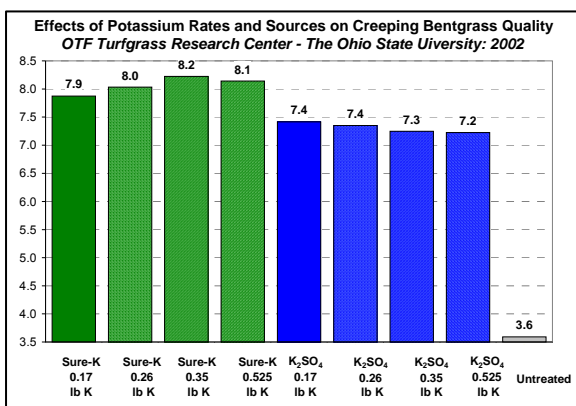


- All fertilizer sources and rates provided significantly higher turf quality scores than the control throughout the study. Initial turf quality response (May 29) among treatments was higher at the higher N application rates. High NRG-N at 0.35 lbs. N/M consistently resulted in higher turf quality ratings than all other treatments. High NRG-N at 0.21 lbs. N/M provided acceptable turf quality (i.e. ≥ 6.0) on 9 of the 13 rating dates with quality scores at least 1-2 units below the higher High NRG-N rate on all dates.
- There were several periods when dollar spot pressure was high. In general, all nitrogen treatments resulted in less dollar spot pressure than the control. Certainly dollar spot severity of $\geq 20\%$ would be unacceptable to most superintendents on fairways. The only treatment that provided $\leq 20\%$ dollar spot incidence throughout the season was High NRG-N at 0.35 lbs. N/M biweekly
- High NRG-N at the 0.35 lbs. N/M rate biweekly was the more efficient N treatment in this study. This is reflected in the latter treatments higher turf quality, color, and clipping yields. It is also reflected further in significantly less dollar spot relative to the other treatments with the same total N rate per year (i.e. 3.5 lbs. N/M). The superior efficiency of High NRG-N may be the result of better N utilization, foliar feeding, or both.

Experiment: Effect of Potassium Source and Rate On Creeping Bentgrass Quality and Growth (Ohio State University)

Year: 2002

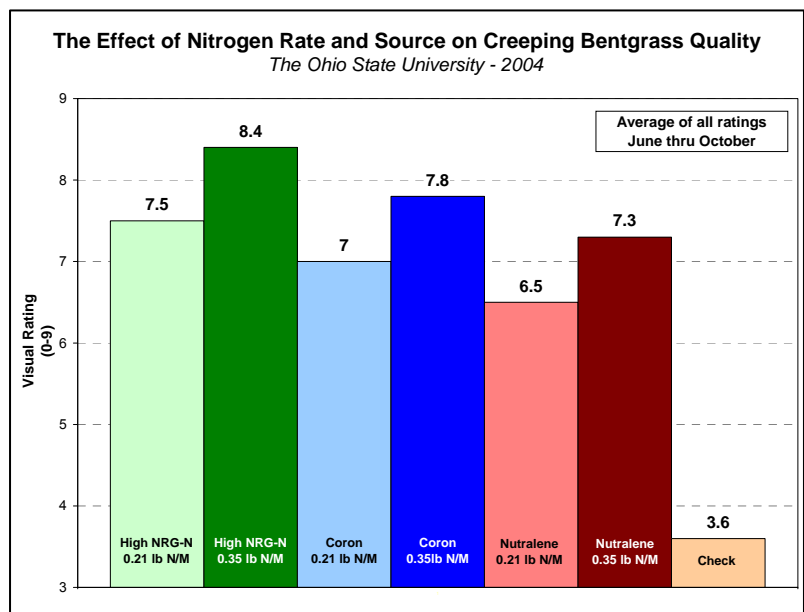
This study was established to evaluate Sure-K and Potassium Sulfate at four different rates to determine the best sources and rate of potassium to produce high quality bentgrass greens. Data was collected on turfgrass quality and tissue was tested for potassium levels.



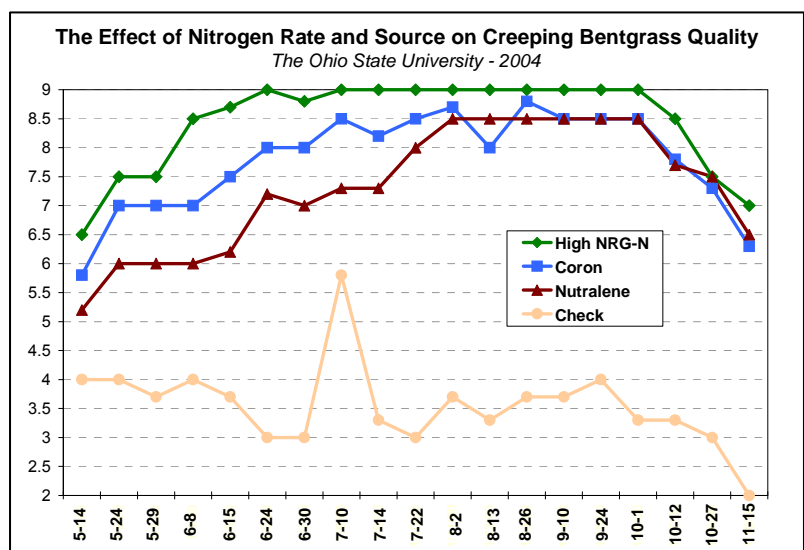
- Sure-K had higher quality ratings at all four rates compared to equal rates of Potassium Sulfate.
- Potassium levels found in the tissue were higher in the Sure-K treated plots than those that received Potassium Sulfate.
- No differences were seen amongst the four rates of Sure-K in both quality and potassium content found in the tissue.
- All treatments exhibited significantly higher turf quality than the control at all rating dates throughout the season.
- Beginning on June 20, the turf quality ratings were consistently higher by 1 to 1.5 units for all Sure K treatments compared to potassium sulfate through the July 19 rating date. There was no apparent effect of potassium rate on turfgrass quality with either potassium source during this same period.
- There was a trend for slightly lower turf quality with potassium sulfate compared to Sure K at the two highest K rates (i.e. 0.35 and 0.525). However, turf quality at the low K rate (0.17) was similar between K sources and turf quality was as high as that at any of the higher K rates.

Experiment: The Effects of Nitrogen Source and Rate on Creeping Bentgrass Quality.
 (Ohio State University)
Year: 2004

Similar to the experiment run in 2003 the effects of nitrogen source and rate on creeping bentgrass quality were evaluated. The study was conducted at the OTF Turfgrass Research Center at The Ohio State University on an established stand of 'Lopez' creeping bentgrass. Nitrogen applications were made bi-weekly and two rates were tested 0.21 and 0.35 pounds on nitrogen per 1000 ft². Three nitrogen sources were evaluated: High NRG-N, Coron (30-0-0; methylene urea solution) and Nutralene (40-0-0; granular methylene urea). Applications were made bi-weekly beginning May 7th. Visual ratings were taken weekly. Results are on the following charts.



- All fertilizer provided consistently better turf quality than the check.
- 0.35 lb N/M provided better color than the 0.21 lb N/M with all three nitrogen sources.
- At each rate High NRG-N provided better turf quality.
- Highest quality rating was achieved with High NRG-N at 0.35 lb N/M



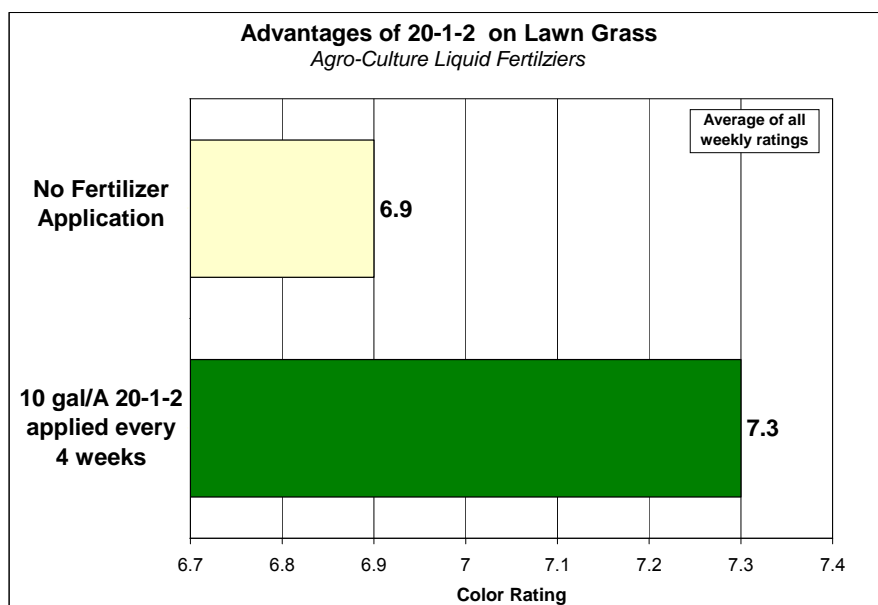
- This graph compares weekly ratings of the three nitrogen sources at 0.35 lbs N/M and the untreated check.
- Best initial green-up was seen with High NRG-N.
- At every rating High NRG-N received higher quality ratings than Coron and Nutralene.
- High NRG-N exhibited the most efficient responses and the highest quality among the other treatments.

Experiment: Lawn Fertilizer Recommendation

Agro-Culture Liquid Fertilizers current lawn recommendation is a blend of High NRG-N, Pro-Germinator, Sure-K and micronutrients. Mixing these products to make an analysis of 20-1-2 with micronutrients has worked well on lawns and on research plots at the North Central Research Station. By blending our *High-Performance* products we are able to provide homeowners a balanced, highly usable turf formulation with the micronutrients needed for a healthy, vigorous lawn. 20-1-2 provides professional results while applying an environmentally friendly, low salt, high performance product. A healthy lawn is not only more resistant to disease and pests, but also adds beauty and value to any home.

Apply 20-1-2 at 10 gal/A (30 oz/1000 ft²) with at least 40 gal/A of water (1 gal/1000 ft²). This will provide a half-pound of nitrogen per 1000 ft². Applications should be made every 4-6 weeks during the active growing season. For areas that have cold winters, final season application can be switched to 10 gal/A Sure-K. Sure-K will provide the plant with nutrients it need to help survive cold temperatures and make the plant healthier to better resist spring time diseases.

20-1-2 can be mixed with most broadleaf herbicide applications. A jar test prior to mixing is always recommended to insure compatibility.



Mix to make Lawn Fertilizer 20-1-2

69.33% High NRG-N
1.33% 9-24-3
26.67% Sure-K
1.33% Manganese
1.33% Iron

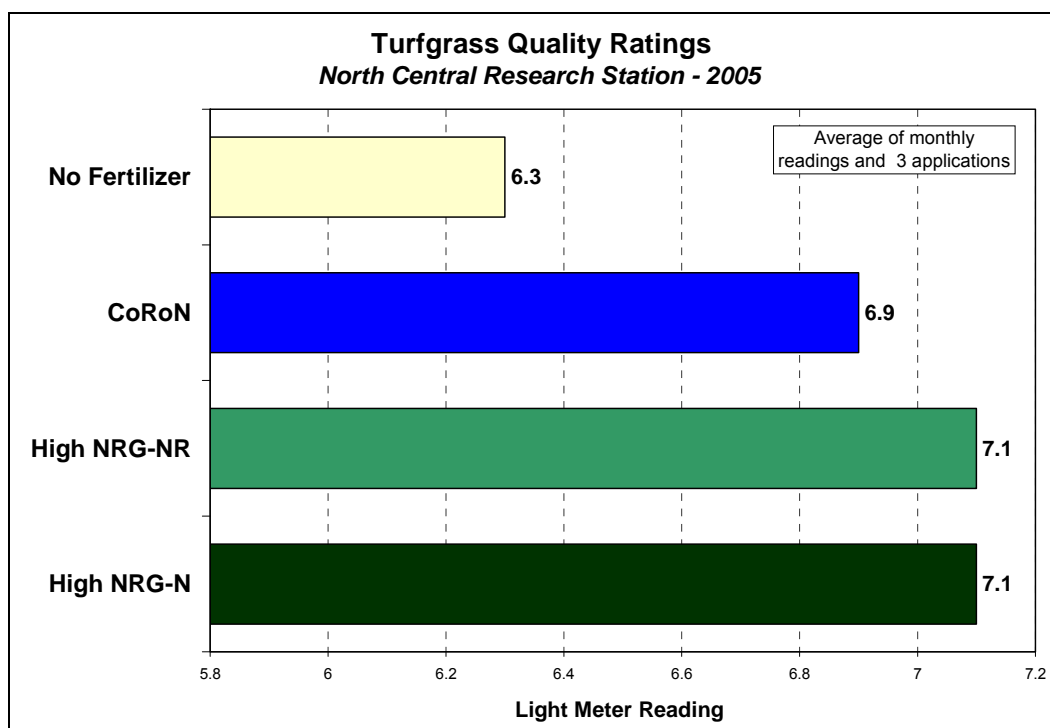
The above graph shows research done at the North Central Research Station. Fertilizer was applied every month and color ratings were taken weekly. Color ratings were taken with a Turf Color Meter, which uses different light rays to measure the color and health of the grass. Measurements are converted into a color rating which runs on a scale from 0-9, with better color getting a higher number. Significant color difference was seen with the application of 20-1-2. As always a major advantage to the Agro-Culture Liquid Fertilizers program is that other nutrients are available and can be added at any ration to this mix to cover specific needs for the area.

Experiment: Fertilizer Comparisons on Turfgrass (05-50)

Year: 2005

Nitrogen fertilizer comparison was done on established turfgrass at the North Central Research Station. Three nitrogen sources were compared: Agro-Culture Liquid Fertilizers High NRG-N and High NRG-NR were compared to a conventional nitrogen source CoRoN. Nitrogen was applied at 0.5 lbs nitrogen per 1000 square feet. Each mix also include 3.9 gal/A Sure-K, 0.4 gal/A Pro-Germinator, 18 oz/A Iron, and 19 oz/A Manganese. Applications were made monthly and applied with a tractor-mounted sprayer. Spray volume of 40 gal/A was used at 60 psi. Quality ratings were done 2 weeks after application with a turf color meter. This meter uses different light rays to measure the color and health of the grass. Averages of all ratings are seen on the graph below.

Product	oz of product to provide 0.5 lbs N/1000 ft ²
High NRG-N	33 oz/1000 ft ²
High NRG-NR	41 oz/1000 ft ²
CoRoN	32 oz/1000 ft ²



- Equal quality turf was achieved with both High NRG-N and High NRG-NR.
- CoRoN produced lower quality turfgrass as compared to Agro-Culture Liquid Fertilizers
- All fertilizer programs increased quality over the no fertilizer check.

Experiment: Nitrogen Source Comparison on Turfgrass
Year (Experiment Number): 2006 (06-211)
Plot Size (replications): 14 ft x 100 ft (3 reps)

Soil Test Levels (ppm)	
pH: 7.2	C.E.C.: 7.0
OM: 2.2%	P1: 66 ppm
K: 137 ppm	(5.0% BS)

Objective: Determine the most efficient type of lawn grass fertilization program. Another season of turfgrass research has been completed at the North Central Research Station. 2006 evaluated different nitrogen sources and equal rates to examine which product would provide the best turf color and quality along with testing the longevity of the products. Five nitrogen sources were used in this experiment:

- High NRG-N (27% N)
- High NRG-NR (24% N)
- 20-1-2: a combination of Agro-Culture Liquid Fertilizers
- CoRoN (28% N): Conventional Liquid Nitrogen source
- Scotts Turf Builder (29-3-4 with S and B): Conventional dry fertilizer
- An second treatment of 20-1-2 with the addition of eNhance for increased sulfur

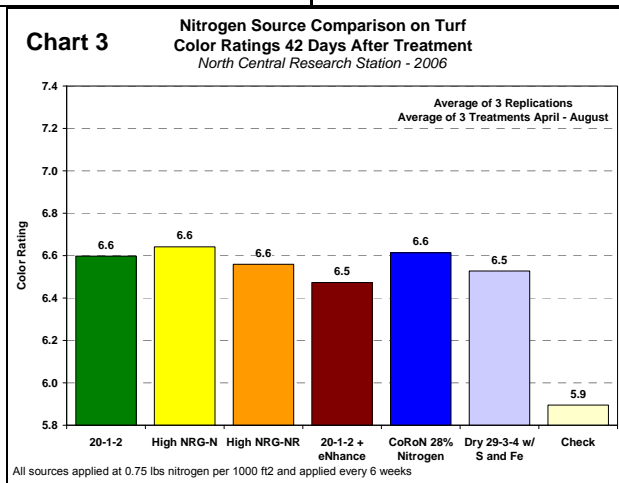
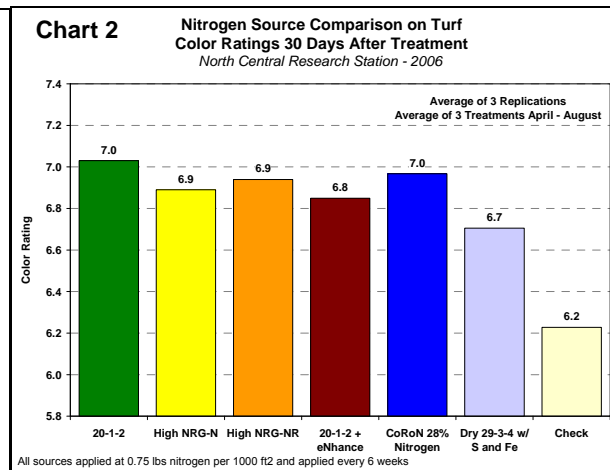
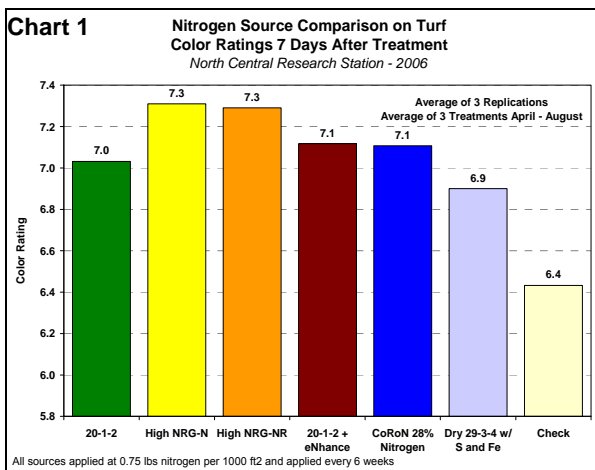
All products were applied at 0.75 lbs (actual) of nitrogen per 1000 ft² every 6 weeks. Beginning in April and continuing through August. Liquid fertilizers were applied with a tractor mounted sprayer and sprayed at 40 gallons per acre. Dry fertilizer was applied with hand spreaders. Irrigation was run within 24 hours if rainfall did not occur. Turf color was rated using a Turf Color Meter, 1 week (7 days), 4 weeks (30 days), and 6 weeks (42 days) after application. A rating of 7 and above is considered acceptable turf quality. Below, charts 1 – 3 show the average of all ratings made at the 3 listed timings.

Application Notes:

- Use caution when spraying grass when dew is present as injury is likely to occur in the tire tracks. (see picture below)
- Burn potential greatly increases in areas of over application, such as around buildings and trees.
- Agro-Culture Liquid Fertilizers can be mixed with most herbicides (if the herbicide's label permits); it is best to always do a jar test prior to mixing herbicides with fertilizers.



Applying nitrogen to turf while dew is present may cause temporary burn in the wheel tracks as seen in the picture to the left. Injury was seen 1 day after application.



Conclusions:

- All liquid nitrogen sources provided adequate turf color readings 1 week after application.
- High NRG-N and High NRG-NR gave the quickest green up and best color 1 week after application.
- 20-1-2 provided the most consistent color over the 6 weeks.
- The no fertilizer check provided inadequate turf color and quality throughout the entire season.
- By 4 weeks after application, turf color with most sources was just below the adequate level; this would be an indication for the next application to be applied. Agro-Culture Liquid Fertilizers' normal recommendation has been to make applications every 4 weeks.
- All liquid sources provided similar turf color ratings at the 4 week timing; the dry source was slightly lower.
- By week 6, turf color had greatly decreased with all sources, again proving that an application should be made before 6 weeks to keep high turf color and quality.
- Addition of eNhanse to the 20-1-2 program did not increase turfgrass color.

Experiment: Fertilizer Effects on Turfgrass Color
Year (Experiment Number): 2007 (07-211)
Plot Size (replications): 14' x 100' (3 reps)

Soil Test Levels (ppm)	
pH: 7.2	C.E.C.: 7.0
OM: 2.2%	P1: 66 ppm
K: 137 ppm (5.0% BS)	

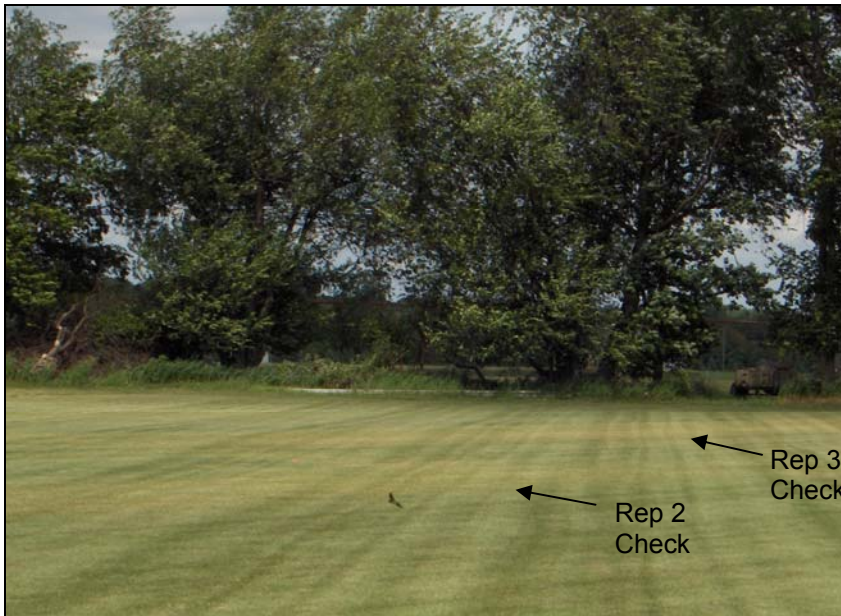
Turfgrass research in 2007, evaluated in Agro-Culture Liquid Fertilizers High NRG-N and High NRG-NR as sole nitrogen products compared to a blend of Agro-Culture Liquid Fertilizers. Treatment mixes along with application rates are listed below in Table 1. Unless otherwise noted, fertilizers were applied at a recommended rate of 0.75 pounds of actual nitrogen per 1000 sq ft. Applications were made every 4 weeks and were applied with a pull behind sprayer. All products were mixed with water and applied at a total spray volume of 40 gal/A at 45 psi. Scotts Lawn Care Fertilizer, a dry product, was applied at 0.75 lbs of nitrogen per 1000 sq ft. as a conventional standard; also a no fertilizer check was used in the comparison. Irrigation water was applied with a traveling gun irrigator twice a week, unless natural rainfall occurred.

**Table 1. Explanation of Turfgrass Fertility Treatments
 North Central Research Station - 2006**

Chart Labels		Fertilizer Rates and Sources oz/1000 ft ²
1	Check	
2	High NRG-N (0.75 lbs N/M*)	33 oz High NRG-N
3	High NRG-NR (0.75 lbs N/M)	41 oz High NRG-NR
4	20-1-2 (0.5 lbs N/M)	20 oz High NRG-N + 0.4 oz Pro-Germinator + 8 oz Sure-K + 0.4 oz Manganese + 0.4 oz Iron
5	20-1-2 (0.75 lbs N/M)	32 oz High NRG-N + 0.6 oz Pro-Germinator + 12 oz Sure-K + 0.6 oz Manganese + 0.6 oz Iron
6	ACLF Combo (0.75 N/M)	13 oz High NRG-N + 25 oz High NRG-NR + 1 oz Pro-Germinator + 4 oz Sure-K + 1 oz Micro 500 + .05 oz Iron
7	Scotts Dry (0.75 N/M)	2.59 lbs Scotts 29-3-4 8% S 2 % Fe

* M = 1000 ft²

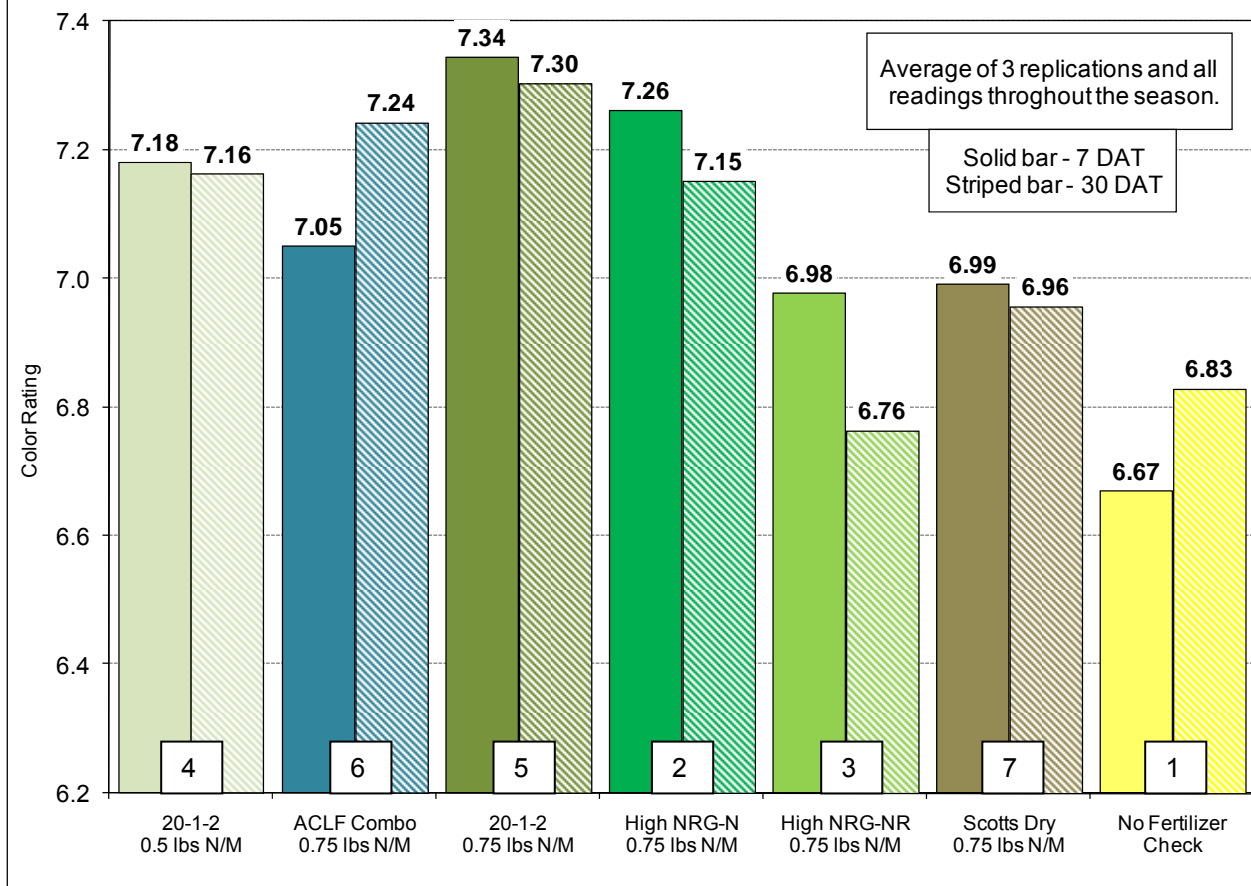
Color is the key indicator of the overall quality of turfgrass. Color directly relates to the fertility levels found in the grass, specifically nitrogen along with moisture status. To evaluate fertilizer performance on turfgrass color, ratings were taken 7 days and 30 days after application. Ratings were done with the TCM500, a color meter using red, blue, and green light to reflect off the turf and determine color quality. A rating of 7 is considered good turf quality. Chart 1 below, shows the average of all ratings down throughout the season over three replications. Results are reported at two timings, first at 7 days after treatment, which represents how fast the turf, responded to the fertility application. The second rating was taken 30 days after application, just prior to the next application being made. This rating shows how well the fertility program kept turf color over time.



The Visual Difference:

Turf color quality is very visible after application. The picture to the left was taken in early June, 10 days after treatment (2nd application of the season). The no fertilizer check is easily noticeable with its yellow appearance. This picture shows the check plot of both reps 2 and 3, surrounded by the various treated plots.

Chart 1. Fertilizer Effects on Turfgrass Color
North Central Research Station - 2007



Conclusions:

- All fertility programs provided better turf color at both 7 and 30 days after application compared to the no fertilizer check.
- Lowering the rate of 20-1-2 to 0.5 (trt 4) pound of nitrogen per 1000 sq ft. lowered the overall turf color at both timings, however, this blend of products at the lower rate still provided good turf quality, equal to the ACLF combo (trt 6) and High NRG-N (trt 2).
- High NRG-NR (trt 3) and the Scotts dry program (trt 7) did not provide adequate turf color at either timing.
- Both rates of 20-1-2 (trt 4 and 5) provided the longest color control, with little difference seen between the 7 and 30 day ratings.
- The ACLF combo (trt 6) which contained High NRG-NR did not provide the quick green up as seen with the products containing only High NRG-N as their nitrogen source, but it did however, provide nearly the best turf color 30 days after application.
- The best turf program for early green up along with consistent color over time was seen with the recommended rate 0.75 lbs N/1000 sq ft. of Agro-Culture Liquid Fertilizers mix of products to make a 20-1-2 (trt 5).

Experiment: Response of Fertilizer on Turfgrass Color and Quality
Year (Experiment Number): 2008 (08-204)
Variety: Bluegrass/Ryegrass/Fescue Mix
Plot Size: 14 ft. x 100 ft. (3 reps)

Soil Test Levels (ppm)	
pH: 7.4	C.E.C.: 7
OM: 2.2%	P1: 66 ppm
K: 137 ppm (5.0% BS)	

Objective: Comparison of nitrogen based fertilizer programs to increase color and quality of turfgrass.

The North Central Research Station has been working on turfgrass research programs for a number of years. The main nutrient when developing a recommendation for turf is nitrogen, due to its direct correlation with color and quality. Research in 2008 focused on comparing nitrogen sources High NRG-N and High NRG-NR with and without the addition of Micro 500. Also evaluated were three different combinations of ACLF products along with a Scotts Dry fertilizer and an untreated check. All products (except 20-1-2 low) were applied at 0.75 lbs of actual nitrogen per 1000 ft². 20-1-2 low was applied at 0.5 lbs N/1000 ft².

Applications were made every 4 weeks with a pull behind turf sprayer (see picture on the right). All treatments were mixed with water and sprayed at a total volume of 40 gal/A (just under 1 gal/1000 ft²). The first application was made in mid-April and continued through August with a total of 4 applications.



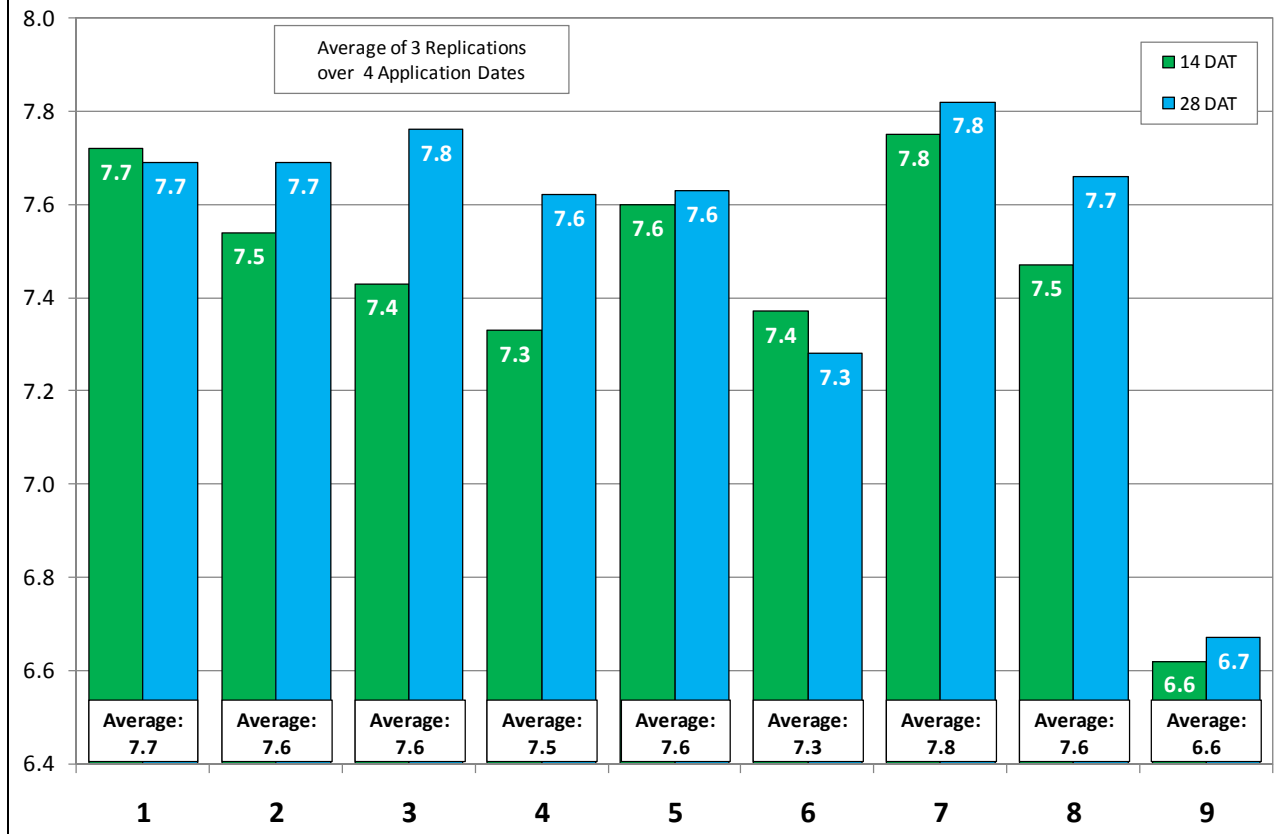
Treatments are listed in the table below.

Trt #	Fertilizer Program	High NRG-N		High NRG-NR		Sure-K		Pro-Germinator		Iron		Manganese		Micro 500	
		gal/A	oz/1000 ft ²	gal/A	oz/1000 ft ²	gal/A	oz/1000 ft ²	gal/A	oz/1000 ft ²	gal/A	oz/1000 ft ²	gal/A	oz/1000 ft ²	gal/A	oz/1000 ft ²
1	High NRG-N	11.3	33.2												
2	High NRG-N + Micro 500	11.3	33.2											1	2.9
3	High NRG-NR			14	41.1										
4	High NRG-NR + Micro 500			14	41.1									1	2.9
5	20-1-2	10.8	31.7			4.2	12.3	0.2	0.6	0.2	0.6	0.2	0.6		
6	20-1-2 low	6.9	20.3			2.7	7.9	0.1	0.3	0.1	0.3	0.1	0.3		
7	Special Mix	4.3	12.6	8.4	24.7	1.5	4.4	0.4	1.2	0.2	0.6			0.3	0.9
8	Scott's Dry	29-3-4 2% Iron applied at 2.586 lbs/1000 ft ²													
9	Untreated Check														

Evaluations were made 14 and 28 days after application with a TCM 500 (Turf Color Meter). The TCM uses red, green, and blue reflected light from the turfgrass and converts readings to a scale of 1 (dead turf) to 9 (high quality turf) to give an unbiased turf color and quality rating. Results appear on the chart below.

Response of Fertilizers on Turfgrass Color and Quality

North Central Reserach Station - 2008



Results:

- All fertilizer sources increased both the 14 and 28 day rating over the untreated check (trt 9).
- The Scott's Dry program (trt 8) produced similar average turf color and quality ratings compared to the Agro-Culture Liquid Fertilizers programs.
- The addition of 1 gal/A of Micro 500 did not improve turf color or quality above the standard application of High NRG-N or High NRG-NR (trt 2 vs trt 4).
- High NRG-N (trt 1) at the same rate of nitrogen per acre produced slightly higher average turf color and quality than High NRG-NR (trt 3). More significantly had quicker color and quality response in the earlier (14 day) rating. Yet, High NRG-N had a slightly lower level come the 28 day rating.
- As expected, lowest turf color and quality was seen with the low rate (0.5 lbs N/1000 ft²) of the 20-1-2.
- Highest turf color and quality was achieved with the Special Mix (trt 7). This mix contained both High NRG-N and High NRG-NR. As noted above, High NRG-N seemed to give a quick response to color and quality and High NRG-NR held color and quality longer. This mix with both products proved to provide the best of both worlds giving the highest ratings at both timings.

Trt #	Fertilizer Program
1	High NRG-N
2	High NRG-N + Micro 500
3	High NRG-NR
4	High NRG-NR + Micro 500
5	20-1-2
6	20-1-2 low
7	Special Mix
8	Scott's Dry
9	Untreated Check