

Bermudagrass



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Fertilization of Oklahoma Bermudagrass

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Agro-Culture Liquid Fertilizers

A field experiment was conducted in 2006 near Shawnee, OK to evaluate different fertilizer formulations for growth enhancement effects on common bermudagrass. An established hay field was used for the small plot evaluations comparing N sources urea, 28-0-0-5S + *eNhance*TM, High NRG-N (27-0-0-1S) and High NRG-NR (24-0-0-1S). The *eNhance* is a nutrient material that is added to UAN solutions for nitrogen stabilization plus enhanced nitrogen efficiency. High NRG-N is a multi-form, stabilized, controlled release nitrogen solution. High NRG-NR is a urea-based nitrogen solution.

Plots were 4 feet by 20 feet. Prior to applications, the entire plot area was mowed to a height of approximately 4 inches to simulate a cutting. Liquid applications were made with a push type small plot sprayer with a ground driven pump to deliver the solution through either flat fan or stream type nozzles. The Liquid nitrogen treatments were combined with Pro-Germinator 9-24-3 and Sure-K to achieve the total application target rate. The dry fertilizer was a blend of urea and 15-15-15. The dry fertilizer application was made with a hand-held spinner type spreader which spread the granules evenly over the plot. Fertilizer applications were made on June 8 and harvested 42 days later on July 20. Harvest measurements were made with a lawn mower and a bagger. Bagged clippings were weighed using a gram scale. Samples from each plot were submitted to Midwest Laboratories of Omaha, NE for feed analysis. Plot application and harvest pictures appear below.



Bermuda grass plot layout.



Application of Liquid fertilizer to plots

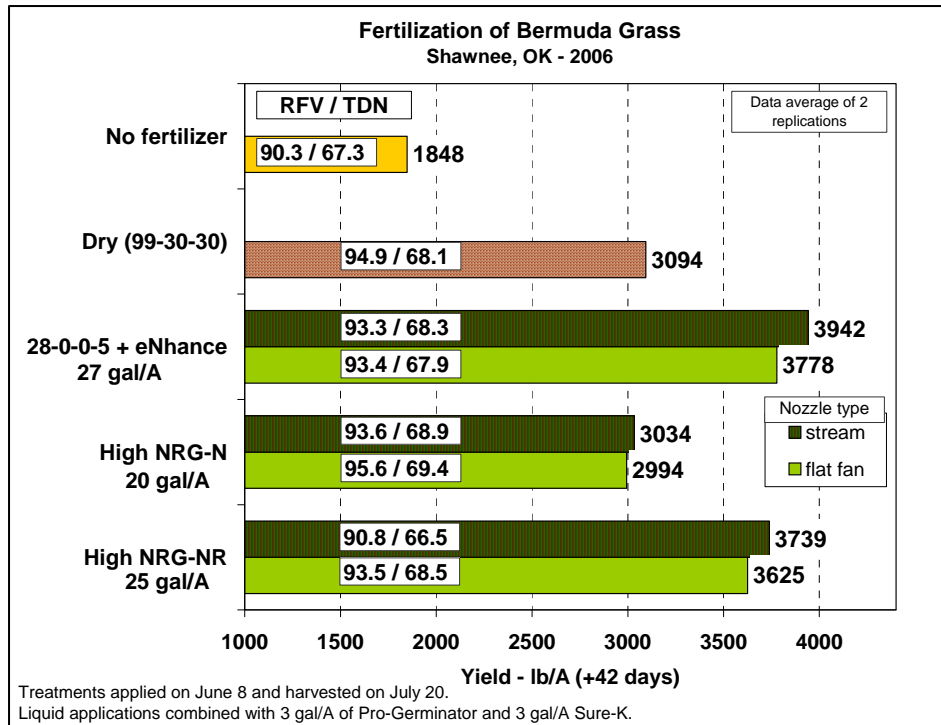


Application of dry fertilizer to plots



Mowing plots to determine yield

The target application rates in pounds per acre of nitrogen - phosphate – soluble potash was 100 – 30 – 30. These rates for the Agro-Culture Liquid Fertilizers were applied at rates said to be “equivalent” in performance based on higher nutrient usability and efficiency. There were two replications of treatments. As is often the case in Oklahoma, it was hot and dry following application. Although 3.5 inches of rain fell between application and harvest, nearly half of that was in one rainfall event. Daytime temperatures were regularly in excess of 90 degrees with six days over 100 degrees. Harvest data appear in the following chart.



- Highest yield was obtained with the 27 gal/A rate of 28-0-0-5 + eNhance™, followed by High NRG-NR, then the dry and High NRG-N being very close to each other.
- There appeared to be a small advantage to the stream nozzles over the flat fan nozzles.
- Fertilization had minimal effects on hay quality expressed as Relative Feed Value and Total Digestible Nutrients. Perhaps nutrient effects were diluted over the larger biomass. The no-fertilizer check did have lower values, although only slightly so.
- The lower yield with the High NRG-N relative to the other liquid sources may have been due to slower release of nitrogen from its chelated form. Although more likely is the fact that a higher gallonage may be necessary to better achieve “equivalence”.
- It is our goal for future testing to continue with further evaluation of rates and multiple applications and cuttings.

The help of Mr. Jacob Nowakowski, Sales Account Manager for Agro-Culture Liquid Fertilizers is appreciated for the building of the Liquid plot applicator and for his field plot assistance on family farm ground.

Experiment: Fertilization of Bermudagrass
Location: Pilot Point, TX (2007)
Date of Application/Harvest: June 14 / July 10
Variety: Midland 99
Plot Size (replications): 5 ft x 25 ft (2)

Soil Test Levels (ppm)	
pH:	C.E.C.:
OM:	P1:
K:	

An experiment testing liquid fertilizers in established Bermuda grass was conducted at the Pilot Point, Texas research site. The grass was about 8 inches tall at time of application of fertilizers. Figure 1 shows arrangement of the plots. Applications were made with an experimental plot applicator shown in Figure 2 which was built by Sales Account Manager Jacob Nowakowski of McCloud, Oklahoma. This push sprayer used a ground driven pump and applied the fertilizers through TeeJet 3-hole fertilizer nozzles mounted in 10 inch spacing on the boom.



Fertilizer treatments were applied on June 14 and harvested on July 10 by mowing and weighing of clippings. Samples of clippings were sent to a lab for protein analysis.

This ground is very sandy with low pH, and should be limed. But grass stand is quite good. Soil test values are shown in Table 1.

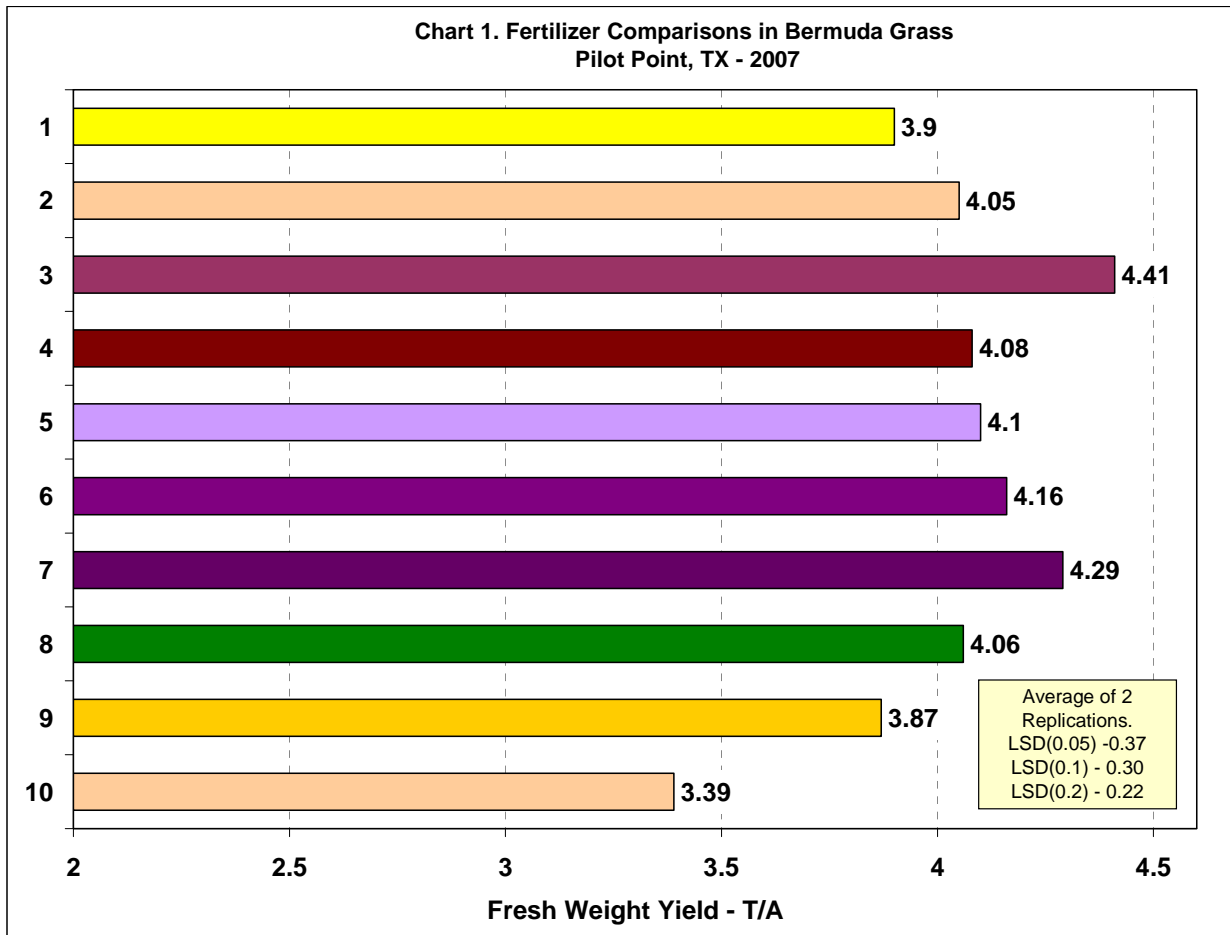
Table 1. Soil test values in Bermuda grass test plots. Pilot Point, TX - 2007								
% OM	pH	P1 (ppm)	K (ppm)	CEC	Percent Base Saturation			
					% K	% Mg	% Ca	% H
1.0	4.7	46	41	4.6	2.3	8.9	37.4	50.6
		Zn (ppm)	Mn (ppm)	Fe (ppm)	Cu (ppm)	B (ppm)		
		1.3	35	177	0.8	0.4		

A target application rate of 100 lb of nitrogen per acre was applied. Treatments applied this rate of nitrogen or a reduced rate of nitrogen with eNhance or High NRG-N which should perform at reduced rates as well as conventional nitrogen at full rate. Additionally, with the low soil potassium level, it was thought that application of Sure-K and micronutrients would have an effect on yield.

A list of treatments applied in this test appears in Table 2.

Table 2. Fertilizer treatments applied for Bermuda grass. Pilot Point, TX - 2007

Trt.	Fertilizer	Rate/A	Actual lb-N/A
1	32% UAN	28.6 gal	100
2	28-0-0-5	33.3 gal	100
3	28-0-0-5 + eNhance	33.3 gal	100
4	28-0-0-5 + eNhance	26.6 gal	80
5	28-0-0-5 + eNhance + Sure-K	26.6 + 7.5 gal	80
6	28-0-0-5 + eNhance + Sure-K + Micro 500	26.6 + 7.5 + 0.5 gal	80
7	28-0-0-5 + eNhance + Sure-K + Micro 500	26.6 + 7.5 + 1 gal	80
8	28-0-0-5 + eNhance + Pro-Germinator + Sure-K + Micro 500	26.6 + 3 + 7.5 + 1 gal	80
9	High NRG-N	20 gal	57.2
10	Check	--	0



- All fertilizer treatments significantly increased yield over the check, showing that nutrient application was needed.
- Highest yield was with the 28-0-0-5 +eNhance at the 100 lb-N/A rate (trt 3), or at the 100% N rate. This was significantly higher (0.1 level of significance) than the same treatment without eNhance (trt 2). Addition of eNhance increased yield 9%.

- Surprisingly, addition of Sure-K and Pro-Germinator did not increase yield (trt 4 vs 5,6,7,8) in spite of the low soil potassium level and low level of several micronutrients. At such a low pH, the main yield factor must be nitrogen as the soil balance is such that it was unresponsive to additional nutrient application.
- High NRG-N was not efficient at the reduced rate of application compared to the other treatments. This has been seen before where there is a short lapse of time between application and harvest. Additionally, we saw in the corn experiment that High NRG-N was more effective when soil pH was adjusted.

Bermuda grass protein levels by treatment are shown in Table 3.

Trt.	Fertilizer	Rate/A	% crude protein
1	32% UAN	28.6 gal	13.75
2	28-0-0-5	33.3 gal	13.4
3	28-0-0-5 + eNhance	33.3 gal	14.1
4	28-0-0-5 + eNhance	26.6 gal	13.8
5	28-0-0-5 + eNhance + Sure-K	26.6 + 7.5 gal	14
6	28-0-0-5 + eNhance + Sure-K + Micro 500	26.6 + 7.5 + 0.5 gal	13.55
7	28-0-0-5 + eNhance + Sure-K + Micro 500	26.6 + 7.5 + 1 gal	13.25
8	28-0-0-5 + eNhance + Pro-Germinator + Sure-K + Micro 500	26.6 + 3 + 7.5 + 1 gal	14.75
9	High NRG-N	20 gal	12.9
10	Check	--	12.25
			LSD(0.1) - 1.14
			LSD(0.2) - 0.86

- The check (trt 10) had the lowest crude protein level showing that protein level is strongly influenced by application of nutrition.
- Addition of eNhance to the 33.3 gal/A application rate of 28-0-0-5 (trt 3) numerically increased average protein level by five percent.



- Although addition of Pro-Germinator and Sure-K (trt 8) did not increase yield over that of 28-0-0-5 + eNhance alone (trt 4), it did significantly (0.2 level) increase the protein level by seven percent.

Pilot Point Bermuda grass plots at field day tour. Plots were harvested for yield determination shortly after this picture was taken.

Experiment: Fertilization of Bermuda

Grass in Oklahoma
Location: Shawnee, OK (2007)

Date of Application/Harvest: June 12 / July 27
Hybrid: Common Bermuda grass
Plot Size (replications): 5 ft x 20 ft

An experiment was established to evaluate fertilizer programs for Bermuda grass in Shawnee, OK. The site was an established pasture of common Bermuda grass. Soil test values from the site are shown in Table 1.

% OM	pH	P1 (ppm)	K (ppm)	CEC	Percent Base Saturation		
					% K	% Mg	% Ca
3	6.7	4	130	13.5	2.4	34.5	63
		S (ppm)	Zn (ppm)	Mn (ppm)	Fe (ppm)	Cu (ppm)	B (ppm)
		9	1.5	10	79	0.8	0.6

Of note from the soil test is the very low soil phosphorus level as well as that of several micronutrients and sulfur. A target application rate of 100 lb/A of nitrogen was applied. The grass was mowed several days prior to application to ensure uniformity. At time of application the grass was four inches tall. Treatments were applied with a custom built push-type plot sprayer, built by Sales Account Manager Jacob Nowakowski. It utilized a ground drive pump and a boom with flat fan nozzles mounted in 10 inch spacings to enable spraying close to the ground while achieving good coverage of the grass. Fertilizers were mixed with water and applied at a total spray volume of 52 gal/A. A picture of the plot sprayer appears below.



Jacob Nowakowski propels the plot sprayer through the Bermuda grass plots in Shawnee, OK.

Dry fertilizer, in this case urea, was applied with a hand-held spinner type spreader operated by hand turning the spinner. The spreader was held close to the ground to prevent movement of urea to the adjacent plots. The fertilizer was pre-measured and applied evenly over the plot.

A picture of the plot layout after application appears below.



Plot layout in the Bermuda grass fertilizer experiment.

This area of Oklahoma received abnormally high rainfall through the 2007 growing season. It was fortunate to have an official weather station within a few hundred feet of the plots. From application on June 12 to harvest on July 27, 13.53 inches of rain fell on the plots. Rain fell nearly every day the rest of June following application. Average of day and night temperature was in the mid to upper 70's.

Harvest was conducted using a 21 inch lawn mower and weighing the clippings on a gram scale.

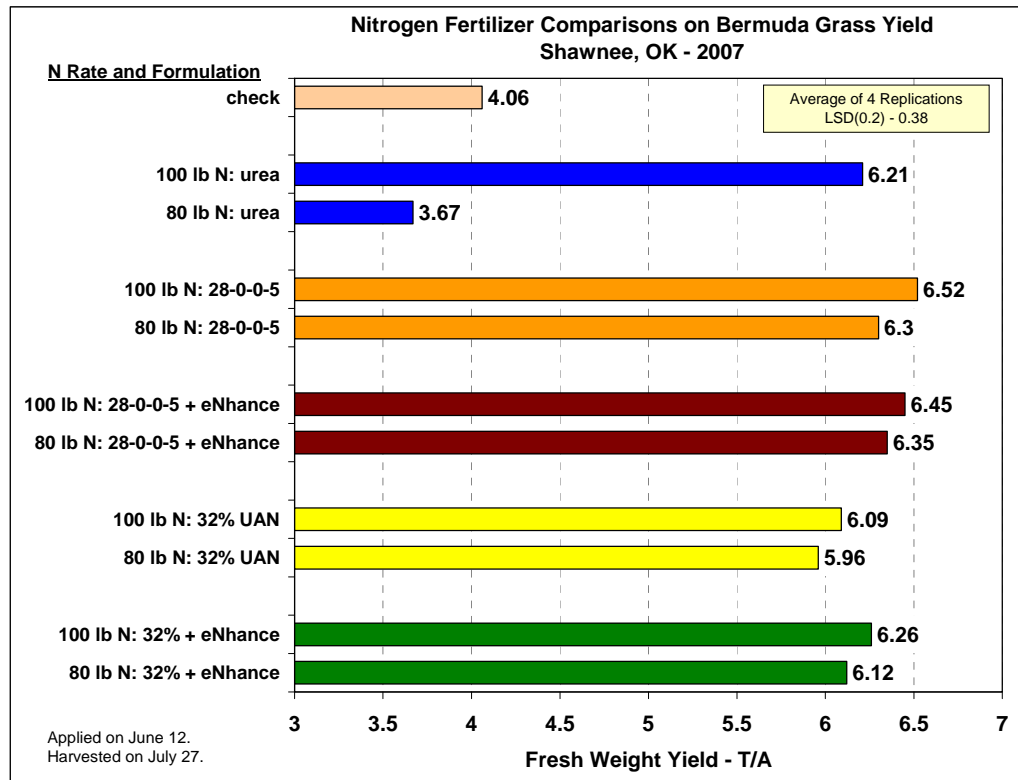


At harvest, grass plots are mowed and then the clippings are weighed for yield calculations.

As mentioned, the target rate of nitrogen application was 100 pounds per acre. Applications were made at this rate as well as at an 80% rate or 80 lb of nitrogen. Several different fertilizers were used. A 32% UAN solution and a 28-0-0-5 solution were used alone and in combination with eNhance, the additive made for addition to nitrogen solutions. Urea granules were a dry nitrogen

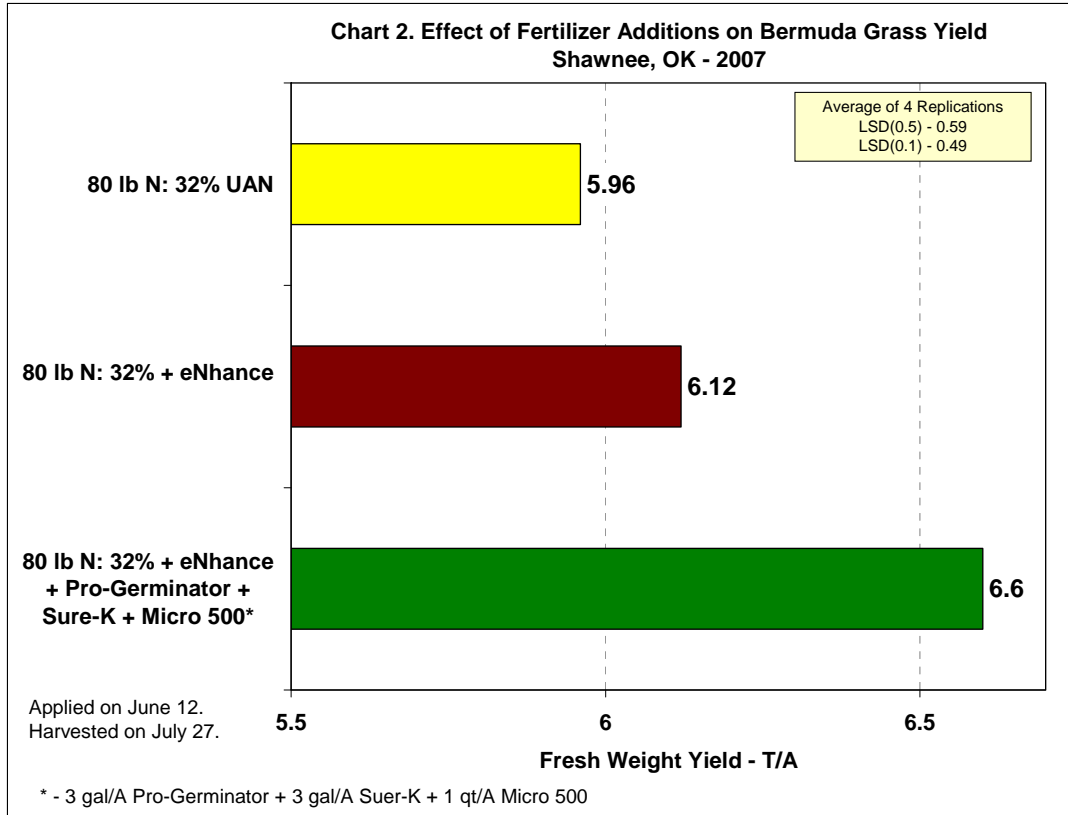
source also applied at the same rates. (In previous testing, it was found that application of eNhanse with urea was too difficult to be practical due to problems spreading the wet granules.)

Nitrogen fertilizers applied and fresh weight yields appear in Chart 1.



- Generally, the yields were very high due to the ample rainfall that occurred between application and harvest.
- All fertilizers yielded significantly higher than the check treatment except the 80 lb-N rate of urea (see next).
- There was no yield difference between the 80 and 100 lb nitrogen application rates for each N formulation except for urea. The low yield with the 80 lb-N/A rate was puzzling, but we are certain it was applied correctly.
- The yield with the 32% UAN was slightly lower than the other N solution treatment yields. This is possibly due to the low soil sulfur level, and the other solutions have sulfur as part of the formulation. The addition of eNhanse to the 32% UAN did have a slight yield increase.

The above treatments evaluated nitrogen applications only. The soil test showed low levels of P, K, and certain micronutrients. An additional treatment applied an 80 lb/A rate of nitrogen as 32% + eNhanse in combination with 3 gal/A of Pro-Germinator + 3 gal/A Sure-K + 1 qt/A Micro 500. Results of this application appear in Chart 2.



- The addition of Pro-Germinator + Sure-K + Micro 500 resulted in a significant yield increase over that of 32% UAN alone.
- This combination treatment resulted in the highest grass yield of all due to application of nutrients found to be deficient in the soil.
- If you are wondering why protein analysis was not reported, the persistent wet weather caused the samples to mold during the drying process.

Experiment: Fertilizer Comparisons in Bermuda grass

Location: Shawnee, OK

Year: 2008

Dates of Harvest: June 11 and July 21

Variety: Common Bermuda grass

Plot Size (replications): 6 feet x 20 feet (3 replications)

Soil Test Levels (ppm)

pH: 6.7 C.E.C.: 13.5

OM: 3% P1: 4 ppm

K: 130 ppm (2.4 % BS)

Objective: Compare different nitrogen fertilizer rates and sources for effects on Bermuda grass yield and quality to determine the optimum application.

An experiment was established in a Bermuda grass pasture for fertilizer evaluations. Liquid fertilizer applications were made with a custom-built push type sprayer built by Sales Account Manager Jacob Nowakowski. It was equipped with fertilizer (3-stream) nozzles mounted on a boom with 10 inch spacing to enable spraying close to the ground in ever windy Oklahoma. Dry fertilizers were applied with a drop-type spreader calibrated for intended application rates. Plots were harvested with a push type lawn mower where clippings were removed from the bag and weighed. Data is reported as fresh weight of grass per acre. Due to the large number of plot samples, complications developed in the drying process. However, additional samples were collected for submission to Midwest Laboratories of Omaha for determination of protein analysis. But it is not possible to accurately determine pounds of protein per acre since protein is expressed on a dry weight basis and yield is on a fresh weight basis. Should the project continue, better methods for sample handling will be used.

The first application was made on April 11 when the grass was coming out of dormancy. Prior to application, the entire plot area was uniformly mowed to a height of three inches. First harvest was on June 11 which was 61 days after application. It is fortunate that there is an official weather station located just a few hundred feet from the test site. During this period, there were 11 days where rainfall was recorded totaling 9.39 inches, which is above average for this area. Following harvest, the entire plot area was again uniformly mowed to a three inch height.

Second applications were made on June 12, the day after harvest. Second harvest was on July 21 which was 39 days after application. During this period, there were 8 days with recorded rainfall totaling 4.19 inches.



Jacob Nowakowski applies liquid fertilizer to a test plot on April 11.



Jerry Wilhm applies dry fertilizer to a test plot also on April 11.



Test plots ready for harvest on June 11.



Jacob steers the plot sprayer to the next test plot on June 12.



Mowing of a test plot for yield determination on July 21.



Mowed clippings are weighed right away. Note mowed plot in back.

Nitrogen fertilizer comparisons. Three different nitrogen fertilizers were applied at rates of 80 and 100 lb of actual nitrogen per acre at the two application dates. The nitrogen sources were urea, 28% UAN and 28% UAN + eNhance. The eNhance is an additive to nitrogen solutions for the purpose of improved nitrogen performance. The use rate is 2 gallons per ton of 28% UAN. Treatment yields from both harvests in shown in Table 1.

<i>Table 1. Nitrogen rate and source comparison on common bermuda grass yield Shawnee, OK - 2008</i>				
lb-N/A	Fertilizer	June 11 T/A*	July 21 T/A*	Total T/A*
0	none	1.87	1.21	3.08
80	urea	2.88	2.70	5.58
80	28% UAN	2.76	2.57	5.33
80	28% UAN + eNhance	3.09	3.51	6.6
100	urea	3.03	2.94	5.97
100	28% UAN	3.19	2.76	5.95
100	28% UAN + eNhance	3.26	3.51	6.77
	<i>LSD(0.1)</i>	0.42	0.5	0.72
	<i>LSD(0.2)</i>	0.32	0.29	0.52

Fertilizers applied on April 11 and June 12.
* - Fresh weight

- Within each rate, the application of 28% + eNhance resulted in significantly higher total Bermuda grass yields than either the urea or straight 28% UAN.
- In fact, the 80 lb-N/A rate of 28% + eNhance produced significantly higher yields than the full 100 lb-N/A rates of urea or 28% at the (0.2) significance level.

Crude protein levels from the harvested grass plots appears in the following table.

<i>Table 2. Nitrogen rate and source comparison on common bermuda grass per cent crude protein (dry weight). Shawnee, OK - 2008</i>				
lb-N/A	Fertilizer	June 11 %	July 21 %	Average %
0	none	10.1	10.3	10.2
80	urea	12.9	13.8	13.35
80	28% UAN	12.3	13.4	12.85
80	28% UAN + eNhance	12.9	12.9	12.9
100	urea	12.9	13.3	13.1
100	28% UAN	11.9	12.8	12.35
100	28% UAN + eNhance	13.0	13.1	13.1
	<i>LSD(0.1)</i>	1.2	1.2	0.9
	<i>LSD(0.2)</i>	0.9	1.0	0.7

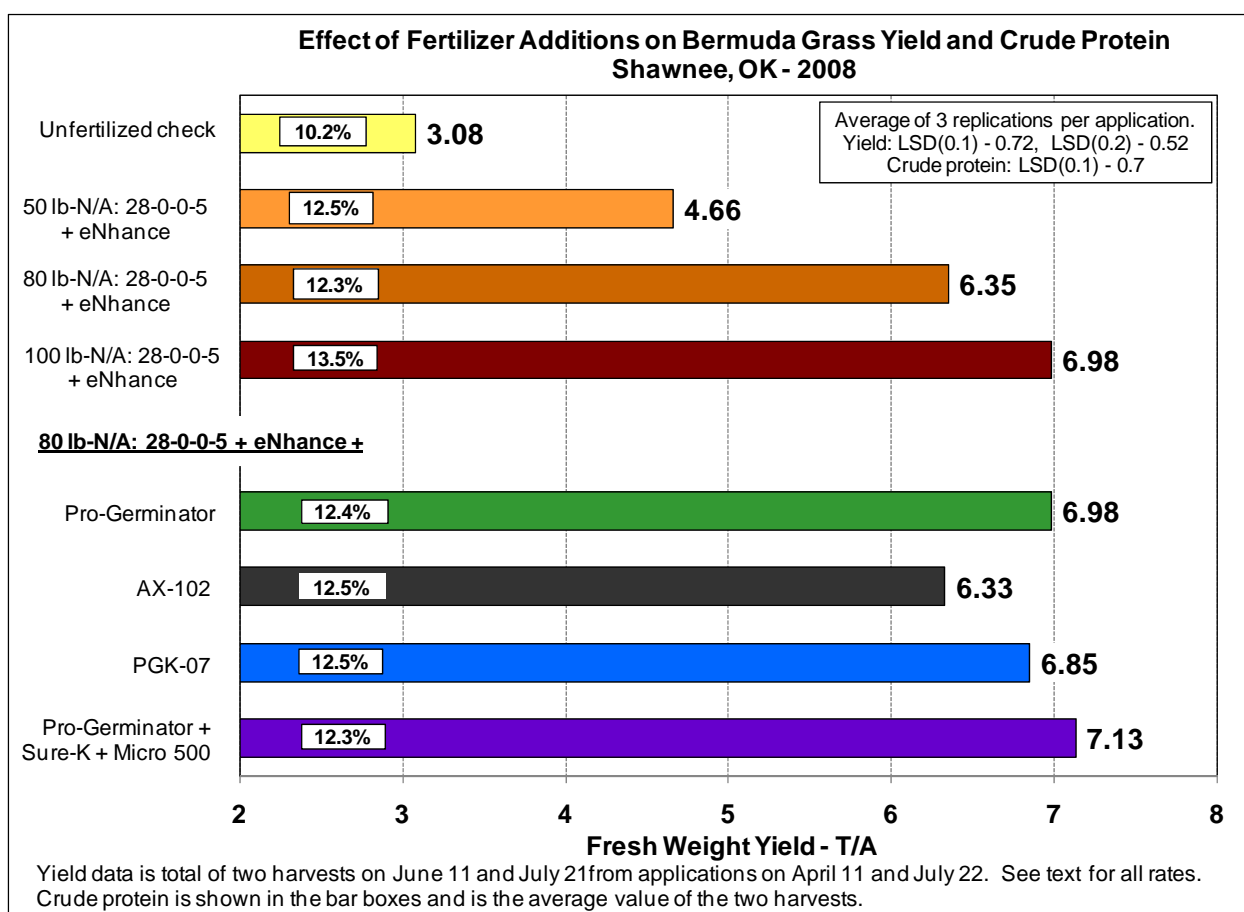
Fertilizers applied on April 11 and June 12.

- All fertilizer treatment significantly increased Bermuda grass crude protein compared to the check.
- All of the nitrogen treatments produced similar crude protein levels except for the 100 lb-N/A rate of 28% UAN which was unusually lower on the June 11 harvest.
- Considering that the 28% + eNhance application produced the highest yields, it would be expected that this treatment would produce more pounds of protein per acre.

Effects of additional fertilizer inputs on Bermuda grass yield and crude protein. An additional set of treatments was included in this study. A popular Bermuda grass treatment is the application of 80 lb-N (or 26.7 gallons) per acre as 28-0-0-5 + eNhance. This treatment was applied alone and in combination with:

1. 4 gal/A of Pro-Germinator
2. 8 gal/A of AX-102, an experimental fertilizer from Agro-Culture with a 4-11-1 analysis
3. 4 gal/A of PGK-07, an experimental fertilizer from Agro-Culture with an 8-22-5 analysis
4. Pro-Germinator + Sure-K + Micro 500, at 4 gal/A + 3 gal/A + 1 qt/A, respectively.
5. Additionally, the straight 28-0-0-5 + eNhance was applied at a reduced rate of 50 lb-N/A and also at 100 lb-N/A, to test rate effects

Total yield from the two harvests appears in the following chart.



- There was a significant increase in yield as the nitrogen rate increased from 0 to 50 to 80 and 100 lb-N/A.
- Addition of 4 gal/A of Pro-Germinator to the 80 lb-N/A rate of 28-0-0-5 + eNhance resulted in a significant yield increase at the 0.2 level, and was equal in yield to the 100 lb-N/A rate of 28-0-0-5 + eNhance. However, the protein level was not affected. Addition of the other test materials did not significantly increase yield as the Pro-Germinator did.
- Addition of Pro-Germinator + Sure-K + Micro 500 resulted in a yield similar to that of the addition of the Pro-Germinator only. This follows the very low phosphorus soil test level where response is likely due to the Pro-Germinator.