EVALUATION OF NITROGEN PRODUCTS APPLIED ON FAIRWAY BERMUDAGRASS DURING THE SUMMER SEASON IN RIVERSIDE, CALIFORNIA

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I. SUMMARY

Fourteen nitrogen fertilizer treatments were evaluated for 5.25 months (May 10 to October 25) on a mature stand of Arizona common bermudagrass that was maintained as a fairway. A total of 4 lb. N/1000 ft.^{2} was applied: one treatment was applied at 4 lb.; 11 treatments were applied at 2 lb. in two applications; and two treatments were applied at 1 lb. in four applications. Visual turfgrass quality and clipping yields were measured on a biweekly schedule during the study.

Visual turfgrass quality ratings were significantly different among the nitrogen fertilizer treatments for each rating date. Among the 11 treatments applied two times at 2 lb. N/1000 ft.^{2}, one can note their differential capabilities in promoting long-term visual quality after their initial application.

Though this study was not designed to test number of applications and rates, these limited data suggest that in terms of seasonal visual turfgrass quality: quickly available nitrogen applied in four applications > slowly available nitrogen applied in two applications > slowly available nitrogen applied once.

Clipping yields were significantly different among the nitrogen fertilizer treatments for most harvest dates and accumulative clipping yield. However, the clipping yield differences were relatively small.

II. MATERIALS AND METHODS

A summary of this study is shown in Tables 1 through 4. Fourteen nitrogen fertilizer treatments were evaluated for 5.25 months (May 10 to October 25) on a mature stand of Arizona common bermudagrass maintained as a fairway. A total of 4 lb. N/1000 $ft.^2$ was applied: one treatment was applied at 4 lb.; 11 treatments were applied at 2 lb. in two applications; and two treatments were applied at 1 lb. in four applications.

Visual turfgrass quality and clipping yields were measured on a biweekly schedule commencing 2 and 3 weeks after initial treatment applications, respectively. Environmental measurements were collected from an on-site California Irrigation Management System (CIMIS) weather station (Table 4).

Table 1. Materials and Methods Outline.

Cultivar:
Arizona Common Bermudagrass

Location:
A mature field plot established at the UCR Turfgrass Research Project in 1989. The root zone was a native soil which is classified as Hanford fine sandy loam, pH =7.2, Olsen-P=16 ppm, X-K=98 ppm.

Experimental Design:
A randomized complete block design with 4 replications/treatment. Individual plot size was 5x4 feet = 20 $ft.^2$.

Nitrogen Treatments: (See Table 2).

Mowing:
Two times per week with a walk-behind reel mower; clippings removed. Mower height set at 7/10 inches or (5.6)/8.

Irrigation:
Applied to promote optimal turfgrass quality without over-watering. Irrigation rates were calculated in accordance with an on-site CIMIS station.

Measurements:
Visual turfgrass ratings were taken biweekly beginning 2 weeks after initial treatment applications, using a 1 to 9 scale with 1=poorest, 5=acceptable, and 9=best common bermudagrass.

Clipping yields were taken biweekly beginning 3 weeks after initial treatment applications. Yields were from 4 days of growth, and were collected with the same mower used for routine mowing. Clippings were dried for 48 hours in a forced-air oven maintained at 60 °C. Clippings collected represented an 11.6 $ft.^2$ subsample of the 20.0 $ft.^2$ plots.

Table 2. Nitrogen Treatments Evaluated.

Product	Analysis	Applications (lb. N/1000 ft.^{2})				Total N (lb./1000 ft.^{2})
		May 10	June 25	August 10	September 25	
UF/IBDU (40/60%)	34-0-0	2	--	2	--	4
Coated ammonium sulfate/IBDU	24-0-0	2	--	2	--	4
Coated ammonium sulfate/coated urea	27.9-0-0	2	--	2	--	4
Nutralene	18-3-5	2	--	2	--	4
Nutralene	20-4-6	2	--	2	--	4
TriKote	39-0-0	2	--	2	--	4
NW Special	23-5-10	2	--	2	--	4
Experimental	28-3-7	4	--	--	--	4
Poly Supreme	23-5-10	2	--	2	--	4
Polyon	42-0-0	2	--	2	--	4
Multicote	24-0-24	2	--	2	--	4
Multicote	12-0-43	2	--	2	--	4
K-Power (Miniprill)	13.75-0-44.5	1	1	1	1	4
Turf Supreme	16-6-8	1	1	1	1	4
Check	0-0-0	--	--	--	--	0

Table. 3. Calendar of the Nitrogen Product Evaluation Study.

Date	Activity
May 10	Initial application of treatments.
May 24 to October 25	Biweekly ratings of visual turfgrass quality.
May 31 to October 4	Biweekly measurements of clipping yields.
June 25	Second application of treatments applied four times.
August 10	Third application of treatments applied four times and second application of treatments applied two times.
September 25	Fourth application of treatments applied four times.
October 25	Study completed.

Table 4. Environmental Measurements from May 8 - October 29, 1994 in Riverside, CA.

Date	Accumulative Weekly ET_o (mm/week)	Accumulative Weekly Precipation (mm/week)	Average Solar Radiation (W/m^2/day)	Average Daily Temperature (ºC)	Average Daily Soil Temperature at 10.2 cm Depth (ºC)
5/08 - 5/14	26.38	4.00	221	17	20
5/15 - 5/21	26.95	5.00	227	15	19
5/22 - 5/28	29.48	0.00	234	18	20
5/29 - 6/04	37.35	0.00	269	22	22
6/05 - 6/11	39.53	0.00	302	21	23
6/12 - 6/18	36.46	0.00	280	20	23
6/19 - 6/25	47.75	0.00	327	26	24
6/26 - 7/02	42.89	0.00	295	26	26
7/03 - 7/09	40.64	0.00	300	22	25
7/10 - 7/16	41.65	0.00	298	23	24
7/17 - 7/23	35.48	0.00	256	23	24
7/24 - 7/30	41.62	0.00	286	25	24
7/31 - 8/06	44.54	1.00	285	26	24
8/07 - 8/13	44.88	0.00	273	29	25
8/14 - 8/20	42.66	0.00	277	27	25
8/21 - 8/27	37.28	0.00	261	24	24
8/28 - 9/03	35.84	0.00	254	23	23
9/04 - 9/10	39.16	0.00	252	25	23
9/11 - 9/17	32.50	0.00	208	21	21
9/18 - 9/24	29.47	1.00	214	21	22
9/25 - 10/01	26.20	0.00	182	23	22
10/02 - 10/08	22.95	3.00	159	18	19
10/09 - 10/15	26.82	0.00	188	20	19
10/16 - 10/22	23.44	1.00	159	17	17
10/23 - 10/29	17.28	0.00	141	17	17

ET_o = Reference evapotranspiration.

III. RESULTS AND DISCUSSION

Visual turfgrass quality ratings were significantly different among nitrogen fertilizer treatments for each rating date during the 5.25-month study (Table 5). Quality ratings were lower during the last 4 to 6 weeks due to late-summer/fall growing conditions. With the exception of the last 1.5 months of this study, most treatments resulted in quality fairway bermudagrass throughout the duration of the study. Among the 11 treatments applied two times at 2 lb. N/1000 $ft.^2$, one can note differences for how long they lasted after their first application (see Table 5 at 12 weeks). Had there been a longer duration between the two 2 lb. applications, these differences would likely have been even more pronounced.

Though this study was not designed to test number of applications and rates, these limited data suggest the following. In terms of seasonal visual turfgrass quality: quickly available nitrogen applied in four applications was better than slowly available nitrogen applied in two applications which was better than slowly available nitrogen applied once.

Clipping yields were significantly different among the nitrogen fertilizer treatments for most harvest dates and accumulative clipping yield (Table 6). Clipping yield production was considerably lower during the last phase of the study (17 weeks after initial applications and later) due to late-summer/fall conditions.

Differences among nitrogen fertilizer treatments for clipping yields are an indirect indicator of differences among nitrogen fertilizer treatments for nitrogen release. That is, more growth is the result of greater amounts of nitrogen being released and then absorbed by the

turfgrass. However, the clipping yield differences among the nitrogen fertilizer treatments included in this study were relatively small.

Visual turfgrass quality of Arizona Common Bermudagrass treated with 14 different nitrogen fertilizers treatments.

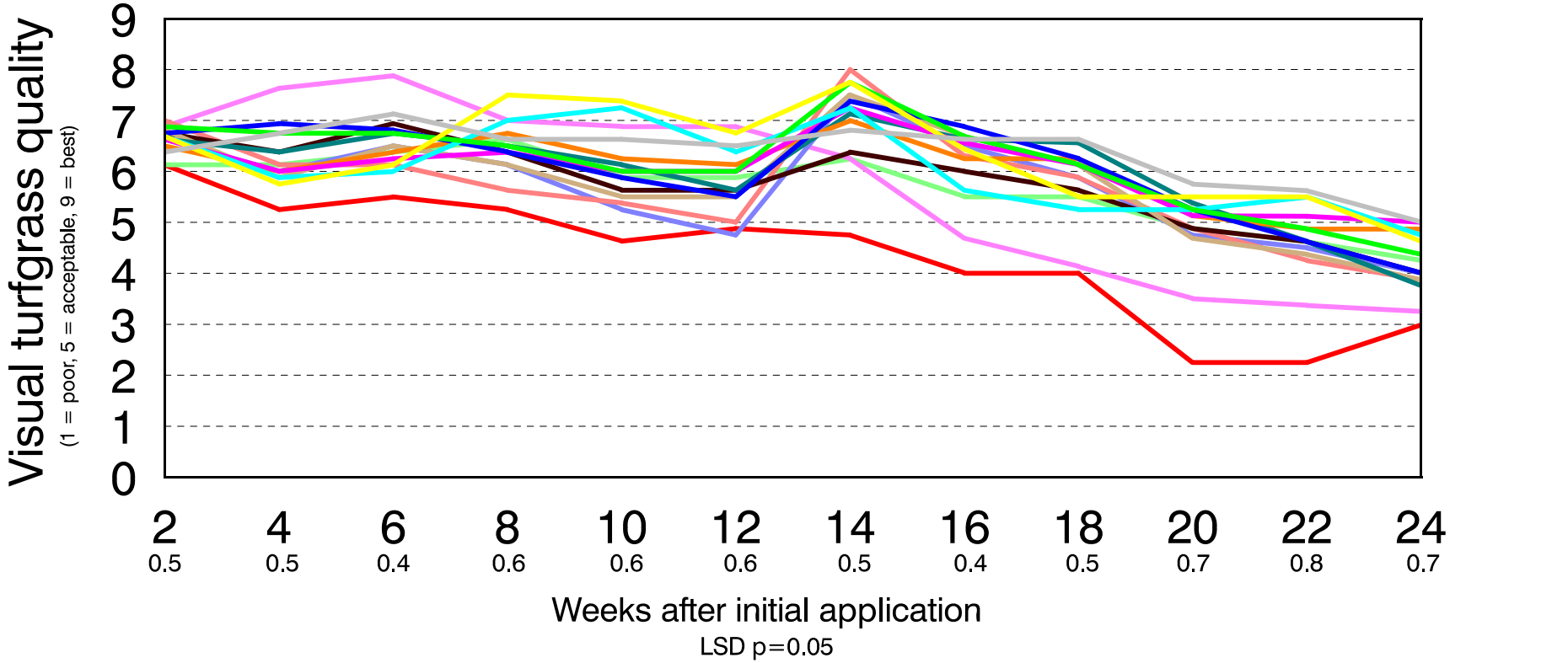
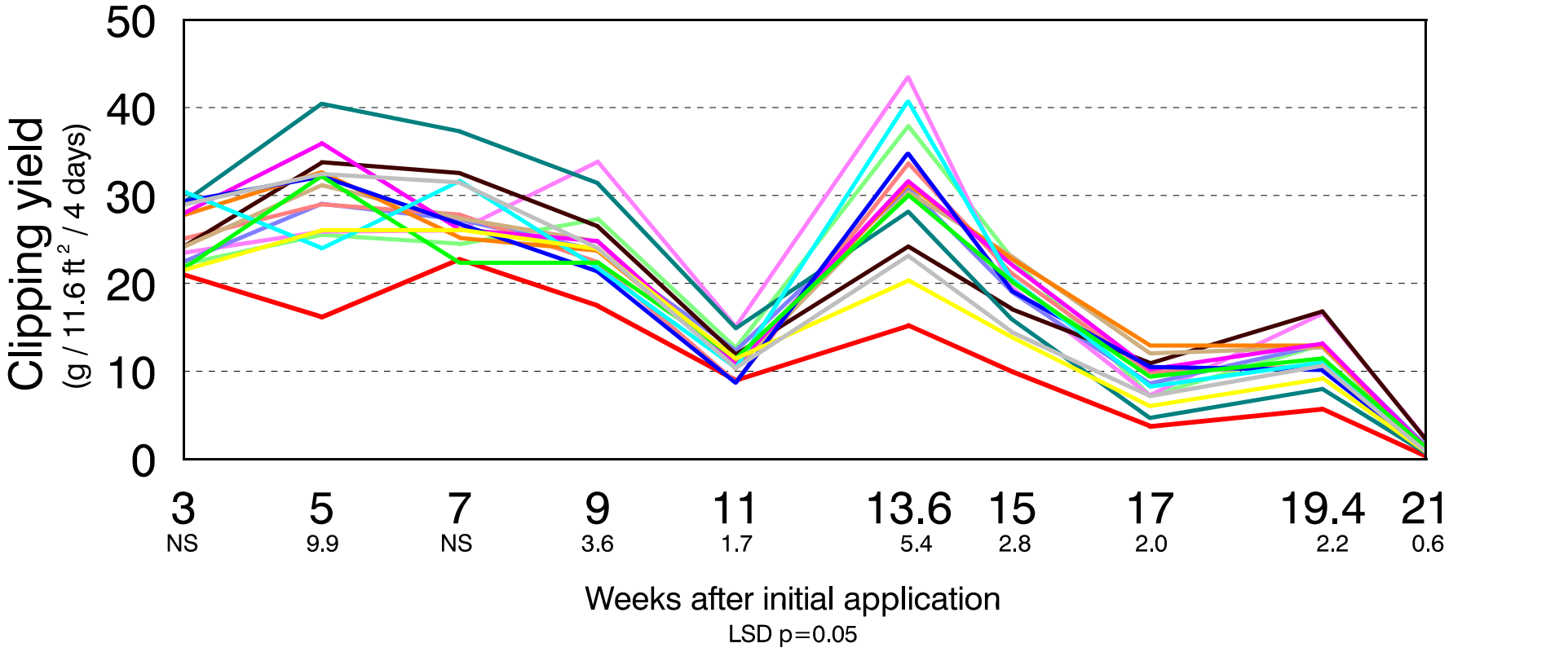


Table 5. Visual Turfgrass Quality of Arizona Common Bermudagrass Treated with 14 Different Nitrogen Fertilizer Treatments.[z]

Treatment (No. Applications)			Weeks After Initial Treatment Applications											
			2	4	6	8	10	12	14	16	18	20	22	24	Overall
Polyon	42-0-0	(2)	6.4	6.7	7.1	6.6	6.6	6.5	6.8	6.6	6.6	5.7	5.6	5.0	6.4
K-Power (Miniprill)	13.75-0-44.5	(4)	6.7	5.7	6.1	7.5	7.4	6.7	7.7	6.4	5.5	5.5	5.5	4.6	6.3
TriKote	39-0-0	(2)	6.9	6.7	6.7	6.5	6.0	6.0	7.7	6.7	6.1	5.2	4.9	4.4	6.2
Turf Supreme	16-6-8	(4)	6.7	5.9	6.0	7.0	7.2	6.4	7.2	5.6	5.2	5.2	5.5	4.7	6.1
NW Special	23-5-10	(2)	6.7	6.9	6.8	6.4	5.9	5.5	7.4	6.9	6.2	5.2	4.6	4.0	6.1
Coated ammonium sulfate/coated urea	27.9-0-0	(2)	6.6	6.0	6.2	6.4	6.0	6.0	7.2	6.6	6.1	5.1	5.1	5.0	6.0
Multicote	12-0-43	(2)	6.5	6.0	6.4	6.7	6.2	6.1	7.0	6.2	6.2	5.1	4.9	4.9	6.0
Poly Supreme	23-5-10	(2)	6.6	6.4	6.7	6.5	6.1	5.6	7.1	6.6	6.6	5.4	4.6	3.7	6.0
Multicote	24-0-24	(2)	6.8	5.9	6.5	6.1	5.5	5.5	7.5	6.7	6.1	4.7	4.4	3.9	5.8
UF/IBDU	34-0-0	(2)	6.7	6.4	6.9	6.4	5.6	5.6	6.4	6.0	5.6	4.9	4.6	4.0	5.8
Nutralene	18-3-5	(2)	7.0	6.1	6.1	5.6	5.4	5.0	8.0	6.3	5.9	4.9	4.2	3.9	5.7
Nutralene	20-4-6	(2)	6.6	6.0	6.5	6.1	5.2	4.7	7.5	6.5	5.9	4.7	4.5	4.0	5.7
Experimental	28-3-7	(1)	6.9	7.6	7.9	7.0	6.9	6.9	6.2	4.7	4.1	3.5	3.4	3.2	5.7
Coated ammonium sulfate/IBDU	24-0-0	(2)	6.1	6.1	6.4	6.6	5.9	5.9	6.2	5.5	5.5	4.9	4.6	4.2	5.7
Check	0-0-0		6.1	5.2	5.5	5.2	4.6	4.9	4.7	4.0	4.0	2.2	2.2	3.0	4.3
LSD *P*=0.05			0.5	0.4	0.4	0.6	0.6	0.6	0.4	0.4	0.5	0.7	0.8	0.7	0.2

[z]Visual turfgrass quality rated on a 1 to 9 scale: 1=worst, 9= best, and 5=acceptable common bermudagrass. All treatments applied May 10. Second application for treatments applied 2 times was 13.1 weeks later. Second, third, and fourth applications for treatments applied 4 times was 6.6, 13.1, and 19.7 weeks later, respectively.

Clipping yields of Arizona Common Bermudagrass treated with 14 different nitrogen fertilizers treatments (g/11.6 ft^2/4 days).



The effect of N source on accumulative clipping yields of Arizona Common Bermudagrass.

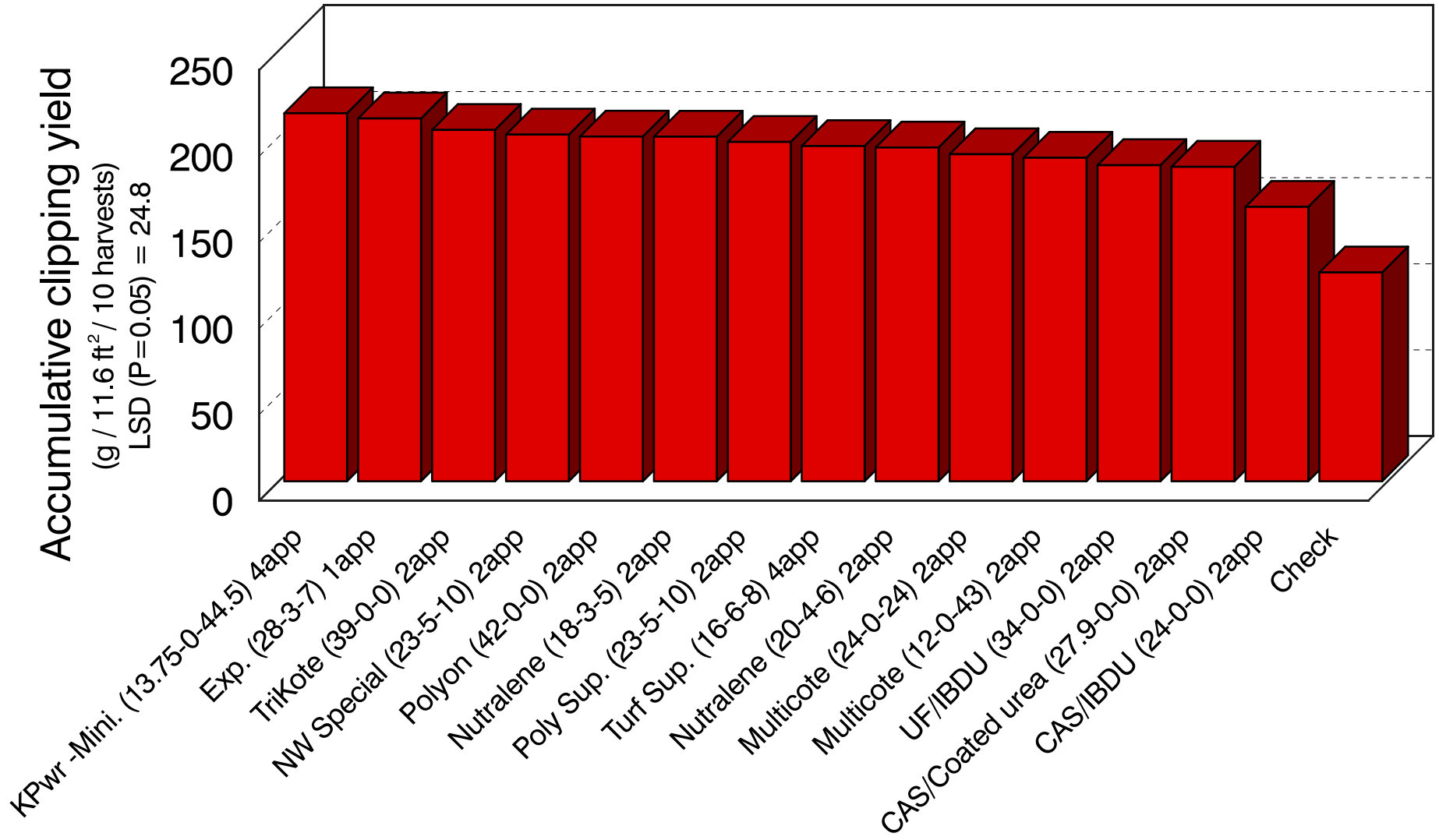


Table 6. Clipping yields of Arizona Common Bermudagrass Treated with 14 Different Nitrogen Fertilizer Treatments (2/11.6 ft.^{2}/4 Days).

Treatment (No. Applications)			Weeks After Initial Treatment Applications[Z]										Accumulative
			3.0	5.0	7.0	9.0	11.0	13.6	15.0	17.0	19.4	21.0	
K-Power (Miniprill)	13.75-0-44.5	(4)	23.48	25.90	26.07	33.86	15.08	43.45	19.55	7.27	16.61	2.40	213.66
Experimental	28-3-7	(1)	29.20	40.43	37.29	31.39	14.89	28.15	15.92	4.69	7.98	0.65	210.59
TriKote	39-0-0	(2)	27.97	35.97	26.12	24.80	10.68	31.62	22.12	10.21	13.19	1.29	203.97
NW Special	23-5-10	(2)	27.76	32.65	25.17	23.69	10.87	31.21	22.79	12.92	12.92	1.28	201.25
Polyon	42-0-0	(2)	24.18	33.79	32.54	26.49	11.90	24.20	17.06	10.89	16.83	2.25	200.13
Nutralene	18-3-5	(2)	30.47	23.97	31.68	21.75	10.39	40.69	20.49	8.25	11.04	1.29	200.03
Poly Supreme	23-5-10	(2)	24.16	31.17	27.40	24.73	10.28	30.38	23.08	12.04	12.73	1.01	196.99
Turf Supreme	16-6-8	(4)	22.19	25.54	24.46	27.36	12.64	37.91	22.88	7.20	13.03	1.44	194.64
Nutralene	20-4-6	(2)	29.30	32.19	26.77	21.33	8.70	34.75	19.15	10.50	10.09	0.97	193.75
Multicote	24-0-24	(2)	25.08	28.99	27.83	22.35	8.81	33.67	21.15	9.92	10.66	0.98	189.44
Multicote	12-0-43	(2)	22.47	29.05	27.24	23.70	12.33	30.88	19.02	8.59	13.05	1.51	187.84
UF/IBDU	34-0-0	(2)	28.95	32.45	31.45	23.98	10.36	23.13	14.46	7.17	10.69	0.86	183.51
Coated ammonium sulfate/coated urea	27.9-0-0	(2)	21.69	32.18	22.35	22.41	11.44	30.06	20.20	9.39	11.52	1.33	182.56
Coated ammonium sulfate/IBDU	24-0-0	(2)	21.51	26.05	26.12	23.86	11.44	20.36	13.87	6.04	9.23	0.77	159.26
Check	0-0-0		21.00	16.14	22.74	17.44	8.96	15.22	9.97	3.71	5.72	0.30	121.21
LSD *P*=0.05			NS	9.89	NS	3.58	1.74	5.37	2.79	2.04	2.23	0.62	24.84

[Z]All treatments applied May 10. Second application for treatments applied 2 times was 13.1 weeks later. Second, third, and fourth applications for treatments applied 4 times 6.6, 13/1, and 19.7 weeks later, respectively.