

Performance of fertilizer programmes with different N rates on Kentucky bluegrass turf – 2010 season.

K. Carey, A.J. Porter, K.S. Jordan and E.M. Lyons

Department of Plant Agriculture and the Guelph Turfgrass Institute,
University of Guelph, Ontario.

The objective of this research project was to determine the performance of the sponsor's fertilizer products on Kentucky bluegrass turf on a soil rootzone.

Data collected included the duration and strength of the color response following applications of the tested products, turf quality, uniformity, and density, and resistance of the turf to disease and other stresses.

MATERIALS/METHODS

The treatments consist of the sponsor's products at several rates and application programmes (Table 1). An unfertilized check treatment was also included. Treatments were applied to 1 x 2 m plots of Kentucky bluegrass turf maintained as a low-cut turf on the research ranges at the Guelph Turfgrass Institute (Figure 1). Plots were mowed at 40 mm, and irrigated to prevent stress. Treatments were replicated four times in

a randomized complete block design. Treatments were applied beginning May 25, 2010 according to the recommended programmes.

Color response of the turf to treatments was assessed regularly, both visually and using instrumental color (canopy reflectance – Greenseeker normalized-difference vegetation index). Uniformity of the color response was assessed visually. Plots were also rated for turf quality, density and uniformity. Other stresses were measured as they occur (disease, weed, drought). Spring greenup will be assessed in April 2011.

An anecdotal photographic record of the experiment was kept.

All measurements were analyzed by appropriate statistical analyses (general linear models).

Table 1. Treatments

Trt #	Description	Rate N Lb / 1000 sq.ft.	Application interval	Total applications	Total N / Yr
1	UTC	0.0	0	0	0.0
2	Urea	0.5	4 weeks	8	4.0
3	XCU 43-0-0 (100%)	0.85	8 weeks	4	3.4
4	Blend with 50% XCU	0.85	8 weeks	4	3.4
5	DURATION 4-month blend	1.5	16 weeks	2	3.0
6	POLYON 4-month blend	1.5	16 weeks	2	3.0
7	DURATION Season-Long blend	2.5	1 time	1	2.5
8	POLYON Season-Long blend	2.5	1 time	1	2.5
9	Poly-R	1.0	12 weeks	3	3.0
10	SCU 39-0-0 (100%)	1.0	8 weeks	4	4.0
11	Blend with 50% SCU 39-0-0	1.0	8 weeks	4	4.0
12	SCU 39-0-0 (100%)	0.85	8 weeks	4	3.4
13	Blend with 50% SCU 39-0-0	0.85	8 weeks	4	3.4
14	Uflexx	1.0	8 weeks	4	4.0
15	Umaxx	1.0	12 weeks	3	3.0
17	SurfKote	1.5	16 weeks	2	3.0



Figure 1. Plot area, June 28, 2010.

RESULTS

All treatments were applied without incident, and there was no discolouration or other adverse effects of any treatment.

Environmental data. Rainfall and temperature data were recorded at the Environment Canada weather station in the research ranges at the GTI (Figures 2 and 3). The season was wetter than average, with ~500 mm

of rainfall during the course of the experiment. Temperatures were slightly below normal for summer in Guelph, with only four days above 30°C.

Canopy reflectance – Normalized-difference vegetation index. There were significant differences in canopy reflectance readings among the treatments on all observation dates (Table 2.)

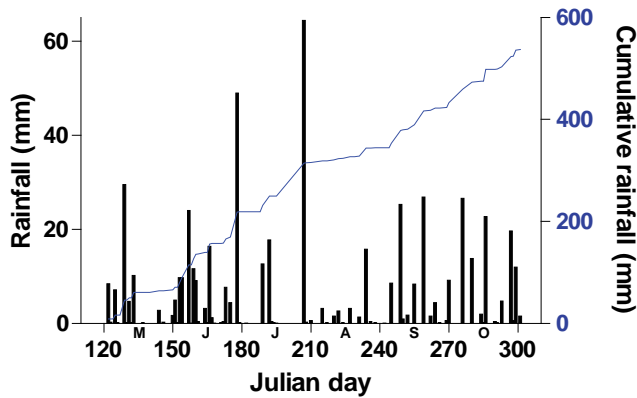


Figure 2. Daily and cumulative precipitation – summer 2010. Data are from the Environment Canada weather station at the GTI.

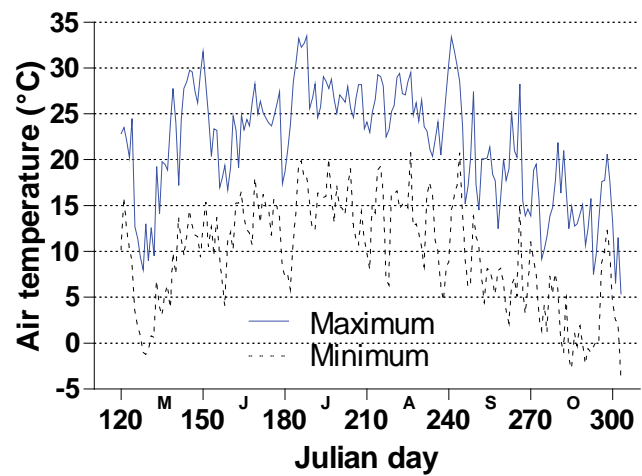


Figure 3. Daily maximum and minimum air temperatures – summer 2010. Data are from the Environment Canada weather station at the GTI.

The Greenseeker is very sensitive to NDVI variation, which reflects turf health (chlorophyll content, photosynthetic activity, growth rate), as well as stresses (phytotoxicity from treatments, drought stress, etc.). If the background variation of the untreated control plots is removed from the NDVI readings, the nitrogen release characteristics of the treatments is apparent (Figure 4). There was a strong response to the first application of most treatments, with the exception of the Duration and Polyon season-long blends. The maximum difference in NDVI of about 0.1 unit corresponds to a visual colour difference of about 3 rating points (from 6 to 9). Midseason applications to treatments produced less response than early or late season applications. There was about a 3 week difference between the faster responding treatments (e.g. SurfKote, and the slower ones (e.g. Poly-R). There was a midseason decline in colour response in all

treatments, but some (e.g. XCU and SCU 100% 1x) had less noticeable declines. In the case of the SCU, this is likely because the initial color response was smaller. The overall performance rank of the treatments as assessed by the whole season mean of NDVI values was: group 1 - Blend with 50% XCU, Blend with 50% SCU 39-0-0 1x, SurfKote, and XCU 43-0-0 (100%); group 2 - Blend with 50% SCU 39-0-0 .85x, Uflexx, and Urea; group 3 - SCU 39-0-0 (100%) 1x, Poly-R, and DURATION 4-month blend; group 4 - POLYON 4-month blend, SCU 39-0-0 (100%) .85x, and Umaxx; group 5 - Control; group 6 - DURATION Season-Long blend and POLYON Season-Long blend.

Visual ratings of colour, uniformity, and growth. There were significant differences in visual performance ratings among the treatments on most observation dates (Table 3.) The rank order of the treatments on dates when there were

Table 2. Canopy reflectance of treated plots.

Treatment	04/30	05/10	05/17	05/25	05/27	05/28	05/29	05/31	06/01	06/04
Blend with 50% SCU 39-0-0 .85x	0.479 ¹	0.604	0.537	0.553²	0.464	0.455	0.480	0.560	0.576	0.594
Blend with 50% SCU 39-0-0 1x	0.485	0.638	0.567	0.574	0.468	0.475	0.495	0.569	0.590	0.607
Blend with 50% XCU	0.475	0.621	0.568	0.575	0.472	0.478	0.505	0.567	0.591	0.611
Control	0.514	0.662	0.574	0.588	0.472	0.469	0.487	0.535	0.542	0.558
DURATION 4-month blend	0.468	0.599	0.519	0.524	0.476	0.426	0.434	0.510	0.521	0.549
DURATION Season-Long blend	0.497	0.639	0.549	0.590	0.465	0.454	0.488	0.542	0.548	0.560
POLYON 4-month blend	0.468	0.609	0.521	0.533	0.471	0.421	0.437	0.500	0.515	0.552
POLYON Season-Long blend	0.451	0.602	0.512	0.518	0.432	0.432	0.447	0.501	0.499	0.533
Poly-R	0.466	0.624	0.549	0.568	0.466	0.462	0.487	0.536	0.547	0.569
SCU 39-0-0 (100%) .85x	0.459	0.629	0.512	0.517	0.423	0.416	0.445	0.522	0.545	0.565
SCU 39-0-0 (100%) 1x	0.455	0.592	0.530	0.525	0.484	0.451	0.467	0.549	0.560	0.586
SurfKote	0.470	0.596	0.540	0.564	0.484	0.446	0.475	0.564	0.585	0.621
Uflexx	0.458	0.627	0.544	0.567	0.467	0.458	0.481	0.568	0.583	0.605
Umaxx	0.451	0.608	0.492	0.490	0.441	0.383	0.409	0.498	0.529	0.567
Urea	0.489	0.594	0.545	0.550	0.481	0.444	0.460	0.543	0.549	0.572
XCU 43-0-0 (100%)	0.493	0.624	0.562	0.569	0.475	0.475	0.498	0.555	0.568	0.578
msd p=0.05	0.017	0.023	0.021	0.022	0.026	0.020	0.017	0.018	0.014	0.012
	06/05	06/08	06/10	06/11	06/14	06/18	06/21	06/24	06/28	07/02
Blend with 50% SCU 39-0-0 .85x	0.530	0.630	0.596	0.563	0.554	0.621	0.586	0.634	0.639	0.675
Blend with 50% SCU 39-0-0 1x	0.518	0.614	0.593	0.586	0.565	0.626	0.572	0.626	0.647	0.672
Blend with 50% XCU	0.534	0.634	0.606	0.570	0.556	0.630	0.590	0.619	0.632	0.675
Control	0.466	0.579	0.523	0.488	0.494	0.550	0.518	0.573	0.570	0.617
DURATION 4-month blend	0.464	0.555	0.563	0.531	0.537	0.635	0.604	0.642	0.679	0.711
DURATION Season-Long blend	0.451	0.576	0.485	0.467	0.463	0.542	0.491	0.546	0.534	0.581
POLYON 4-month blend	0.472	0.569	0.579	0.543	0.552	0.644	0.605	0.654	0.658	0.693
POLYON Season-Long blend	0.445	0.529	0.474	0.463	0.464	0.523	0.491	0.547	0.553	0.608
Poly-R	0.483	0.565	0.524	0.499	0.499	0.573	0.566	0.622	0.630	0.678
SCU 39-0-0 (100%) .85x	0.493	0.593	0.571	0.546	0.541	0.622	0.582	0.621	0.637	0.674
SCU 39-0-0 (100%) 1x	0.495	0.585	0.568	0.534	0.530	0.607	0.546	0.587	0.618	0.662
SurfKote	0.542	0.651	0.640	0.615	0.594	0.650	0.597	0.642	0.658	0.681
Uflexx	0.532	0.639	0.608	0.576	0.555	0.624	0.579	0.621	0.619	0.646
Umaxx	0.488	0.603	0.581	0.555	0.540	0.631	0.578	0.610	0.639	0.668
Urea	0.499	0.590	0.574	0.541	0.519	0.568	0.562	0.606	0.653	0.692
XCU 43-0-0 (100%)	0.504	0.611	0.579	0.551	0.542	0.628	0.581	0.624	0.645	0.673
msd p=0.05	0.022	0.017	0.015	0.021	0.018	0.021	0.015	0.016	0.016	0.012

Table 2, continued.

	07/06	07/12	07/14	07/19	07/23	07/27	08/03	08/09	08/19	08/26
Blend with 50% SCU 39-0-0 .85x	0.615	0.668	0.577	0.668	0.655	0.627	0.643	0.628	0.542	0.559
Blend with 50% SCU 39-0-0 1x	0.626	0.683	0.551	0.674	0.653	0.621	0.636	0.604	0.550	0.567
Blend with 50% XCU	0.613	0.666	0.573	0.655	0.661	0.627	0.653	0.640	0.547	0.577
Control	0.573	0.630	0.551	0.627	0.646	0.585	0.609	0.610	0.503	0.527
DURATION 4-month blend	0.666	0.712	0.594	0.709	0.652	0.612	0.623	0.589	0.531	0.575
DURATION Season-Long blend	0.541	0.601	0.520	0.608	0.621	0.573	0.559	0.547	0.499	0.525
POLYON 4-month blend	0.645	0.695	0.595	0.695	0.653	0.607	0.583	0.564	0.516	0.557
POLYON Season-Long blend	0.548	0.617	0.532	0.614	0.606	0.592	0.604	0.576	0.501	0.544
Poly-R	0.634	0.690	0.598	0.676	0.662	0.614	0.593	0.590	0.539	0.560
SCU 39-0-0 (100%) .85x	0.605	0.671	0.573	0.668	0.645	0.610	0.608	0.591	0.513	0.558
SCU 39-0-0 (100%) 1x	0.612	0.662	0.565	0.658	0.654	0.639	0.642	0.609	0.564	0.586
SurfKote	0.626	0.693	0.593	0.692	0.663	0.615	0.621	0.590	0.526	0.558
Uflexx	0.615	0.664	0.560	0.649	0.650	0.615	0.651	0.591	0.529	0.558
Umaxx	0.616	0.679	0.580	0.679	0.646	0.604	0.595	0.554	0.508	0.592
Urea	0.647	0.691	0.594	0.691	0.663	0.613	0.630	0.584	0.552	0.593
XCU 43-0-0 (100%)	0.631	0.687	0.571	0.676	0.650	0.621	0.645	0.640	0.569	0.586
msd p=0.05	0.013	0.012	0.015	0.014	0.013	0.022	0.019	0.019	0.019	0.014
	08/30	09/14	09/18	09/20	09/23	09/27	10/04	10/11	Season mean	
Blend with 50% SCU 39-0-0 .85x	0.522	0.573	0.589	0.596	0.617	0.622	0.626	0.605	0.593 b	
Blend with 50% SCU 39-0-0 1x	0.520	0.586	0.603	0.610	0.636	0.633	0.639	0.627	0.599 a	
Blend with 50% XCU	0.538	0.578	0.601	0.605	0.623	0.623	0.630	0.615	0.600 a	
Control	0.488	0.537	0.550	0.544	0.545	0.549	0.519	0.507	0.553 f	
DURATION 4-month blend	0.521	0.568	0.576	0.576	0.591	0.583	0.595	0.596	0.582 c	
DURATION Season-Long blend	0.486	0.537	0.541	0.531	0.545	0.546	0.518	0.501	0.537 h	
POLYON 4-month blend	0.518	0.559	0.563	0.556	0.581	0.584	0.595	0.614	0.577 d	
POLYON Season-Long blend	0.502	0.540	0.554	0.547	0.558	0.555	0.541	0.522	0.534 h	
Poly-R	0.533	0.602	0.616	0.617	0.622	0.620	0.615	0.599	0.584 c	
SCU 39-0-0 (100%) .85x	0.515	0.558	0.570	0.580	0.598	0.595	0.612	0.600	0.576 de	
SCU 39-0-0 (100%) 1x	0.553	0.576	0.590	0.604	0.627	0.621	0.634	0.612	0.585 c	
SurfKote	0.512	0.551	0.564	0.577	0.607	0.619	0.631	0.626	0.598 a	
Uflexx	0.512	0.572	0.586	0.598	0.623	0.623	0.628	0.616	0.591 b	
Umaxx	0.566	0.592	0.596	0.591	0.592	0.589	0.563	0.540	0.572 e	
Urea	0.569	0.598	0.616	0.617	0.620	0.617	0.611	0.595	0.590 b	
XCU 43-0-0 (100%)	0.541	0.600	0.608	0.610	0.620	0.620	0.634	0.634	0.598 a	
msd p=0.05	0.015	0.012	0.013	0.012	0.011	0.012	0.012	0.013	0.004	

¹Normalized-difference vegetation index: mean of ~50 readings x 4 replicates; means within columns followed by the same letter are not significantly different (Tukey's HSD test, p=0.05).

²Readings in bold italic are the from closest date following treatment application for the particular treatment.

Table 3. Visual ratings of treated plots

Treatment	Colour					Growth			Uniformity
	06/18	06/28	07/29	10/04	Season mean	10/04	06/28	Season mean	06/28
POLYON 4-month blend	7.75 a ¹	8.25 a	7.25	8.00 a	7.81 a	2.75 abc	4.50 ab	3.63 abc	7.00
XCU 43-0-0 (100%)	7.50 ab	8.00 ab	7.50	8.25 a	7.81 a	3.25 ab	3.75 abc	3.50 abc	7.00
Blend with 50% SCU 39-0-0 .85x	7.00 abc	8.50 a	7.50	8.00 a	7.75 a	3.75 a	3.75 abc	3.75 ab	7.50
SurfKote	7.25 abc	8.25 a	7.00	8.00 a	7.63 a	3.75 a	4.50 ab	4.13 a	7.50
Urea	6.75 abc	8.50 a	7.00	8.25 a	7.63 a	3.25 ab	4.25 abc	3.75 ab	7.25
Blend with 50% SCU 39-0-0 1x	7.00 abc	7.75 abc	7.75	7.75 ab	7.56 ab	3.75 a	3.75 abc	3.75 ab	7.25
Uflexx	6.75 abc	7.75 abc	7.25	8.50 a	7.56 ab	4.00 a	3.25 abc	3.63 abc	7.50
Blend with 50% XCU	7.25 abc	7.25 abc	7.50	8.00 a	7.50 ab	3.25 ab	3.00 bc	3.13 abc	8.00
DURATION 4-month blend	7.25 abc	8.75 a	7.00	7.00 abc	7.50 ab	2.75 abc	5.25 a	4.00 a	7.50
Poly-R	7.00 abc	8.25 a	7.00	7.75 ab	7.50 ab	3.00 abc	4.00 abc	3.50 abc	7.00
SCU 39-0-0 (100%) .85x	7.00 abc	8.00 ab	7.00	8.00 a	7.50 ab	3.50 a	3.75 abc	3.63 abc	7.75
SCU 39-0-0 (100%) 1x	6.50 abcd	7.50 abc	7.50	8.00 a	7.38 ab	3.50 a	3.00 bc	2.89 abc	7.75
Umaxx	7.00 abc	7.50 abc	7.00	7.00 abc	7.13 abc	2.00 bcd	3.50 abc	2.75 abc	7.75
Control	6.25 bcd	7.25 abc	7.25	7.75 c	6.63 bc	1.25 d	3.00 bc	2.13 bc	7.50
DURATION Season-Long blend	6.00 cd	6.25 c	7.00	5.75 c	6.25 c	1.25 d	2.75 bc	2.00 c	7.75
POLYON Season-Long blend	5.25 d	6.25 c	7.25	6.25 bc	6.25 c	1.75 cd	2.25 c	2.00 c	7.50
msd p=0.05	1.41	1.73	NS	1.62	0.98	1.40	2.03	1.66	NS

¹ Visual ratings colour and uniformity 0 - 10, 10 = darkest green, best uniformity; growth 0 - 5, 5 = most growth. Means of 4 replicates. Means within columns followed by the same letter are not significantly different (Tukey's HSD test, p=0.05).

significant differences was very similar to the ratings, the statistical significance of the visual differences were not as large as with the NDVI data. Because of the coarser scale and less sensitivity of visual data.

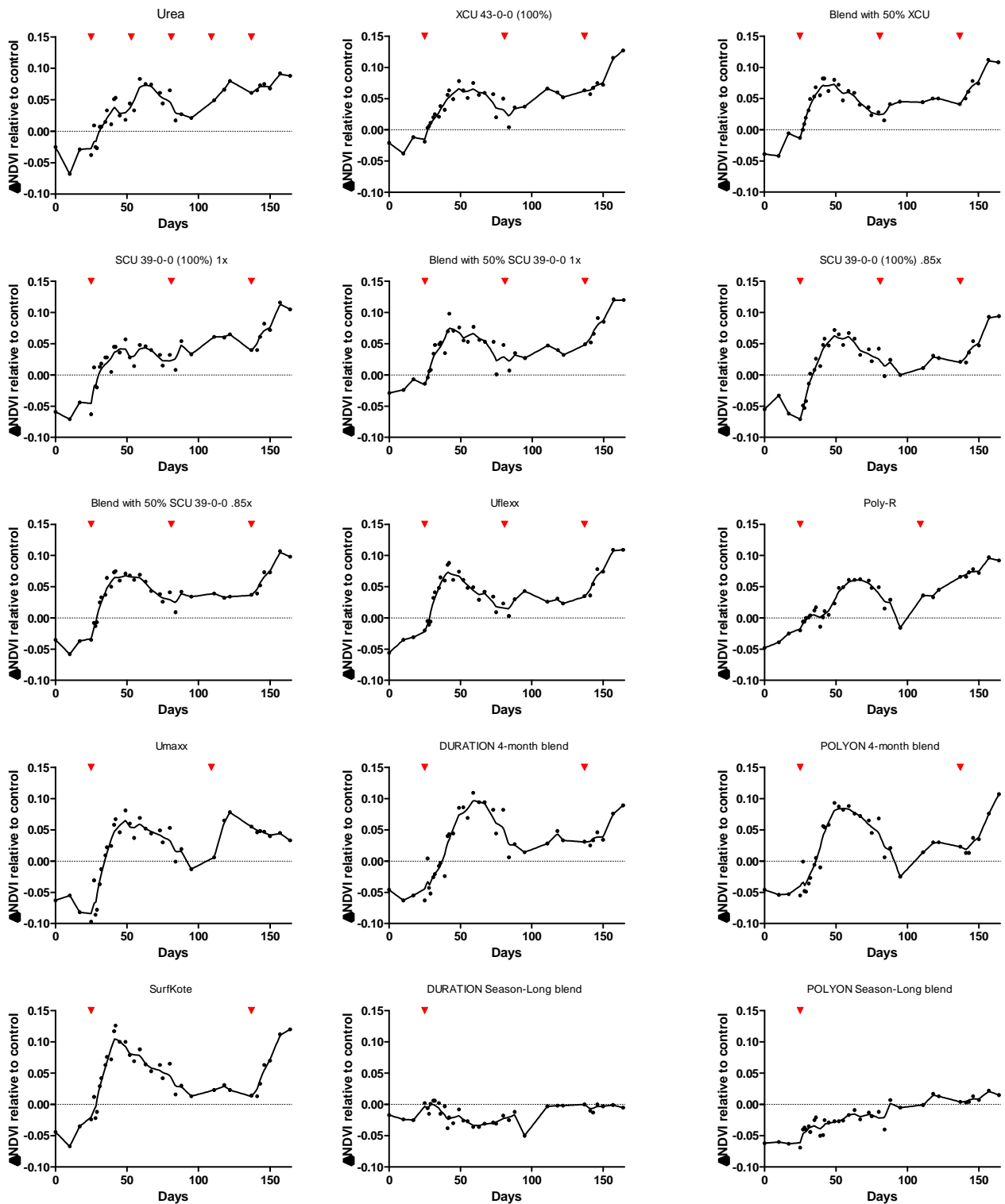


Figure 4. Increase in canopy reflectance in treated plots relative to untreated check. LOWESS spline curves indicate trends of mean values. All treatments had their first application at day 25 (May 25, 2010). Application dates are indicated by red arrows.

DISCUSSION AND CONCLUSIONS

There were significant differences among the fertilizer treatments in strength of colour response, speed of response and duration. None of the treatments avoided a summer decline in colour response but all remained better than the untreated control except for the two season-long blends of Duration and Polyon.

The general ranking of the treatments based on seasonal NDVI values was:

- group 1 - Blend with 50% XCU, Blend with 50% SCU 39-0-0 1x, SurfKote, and XCU 43-0-0 (100%);
- group 2 - Blend with 50% SCU 39-0-0 .85x, Uflexx, and Urea;
- group 3 - SCU 39-0-0 (100%) 1x, Poly-R, and DURATION 4-month blend;
- group 4 - POLYON 4-month blend, SCU 39-0-0 (100%) .85x, and Umaxx;
- group 5 - Control;
- group 6 - DURATION Season-Long blend and POLYON Season-Long blend.

Sponsor: **Agrium Advanced Technologies**