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Water Use on Kurapia Groundcover

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KURAPIA® Utility Groundcover

The Bottom Line:

Three irrigation regimes (30%, 45% and 60% ET_0 replacement) and three irrigation frequencies were tested on Kurapia ground cover in a preliminary study between July and September 2019. While the best performing treatment was 60% ET_0 replacement divided into two irrigation events a week, it was not significantly different from either 30% or 45% ET_0 replacement with the same irrigation frequency. Surviving longer periods of drought is a known trait of warm-season species and a season-long study might show higher mean separation than was showed in these two months of study. None of irrigation treatments were enough to sustain high flowering of Kurapia, therefore different irrigation strategies need to be evaluated when flowering is preferable.

Justification & Objectives

Kurapia (*Phyla nodiflora*) is a low growing, herbaceous, perennial dicot groundcover belonging to the Verbenaceae family. Dense canopy and deep root system of this plant provide it with excellent drought tolerance. The objective of this study was to test different irrigation regimes and watering frequencies on Kurapia aesthetic appearance and its water use.

Materials and Method

Mature Kurapia established in 2015 was subjected to three different ET_0 (reference evapotranspiration) replacements (30%, 45% and 60%) and three different irrigation frequencies (biweekly, weekly and twice a week). Soil was a Hanford fine sandy loam. Experimental design was a randomized block with 3 replications. Plot size was 10 ft x 20 ft with no alleys. Irrigation timings were based on ET_0 from previous two weeks and calibration of hose used to hand water the plots was done weekly. Prior to initiating treatments on July 10th, soil was saturated for two weeks. Plots were evaluated for visual quality (1 [worst] – 9 [best]), flowering cover (%), flowering uniformity (%), green cover (%) and volumetric water content (VWC %) using time-domain reflectometry. All ratings with exception of visual quality and VWC were calculated using Digital Image Analysis.

Results

Due to soil saturation prior to initiating treatments, the values of all measured traits increased after 2 weeks. After that time, a slow drop in visual quality was observed until the end of the study, followed by regeneration after regular irrigation was restored on 9/16/2019. Although the lowest drop was noticed for treatments watered twice a week, the only significant difference was observed in the 8th week of the study between Kurapia watered twice a week at 60% ET_0 and Kurapia watered biweekly at both 30% and 45% ET_0 replacement (Table 1). Flowering cover increased for the first 4 weeks but separation among treatments started becoming evident by the 6th week of the study and was highest for plots watered at 60% ET_0 twice a week. The same

treatment also had the highest value of flowering uniformity. Significantly lower flowering cover was observed only on treatments watered weekly with 30% or 45% ET_0 replacement. By the end of the study, flowering cover dropped below 10% and mean separation was no longer observed (Tables 2 and 3). All treatments had similar green cover values 6 weeks after initiating treatments (73.1% - 77.8%), except treatment 4 (45% ET_0 replacement watered biweekly) where green cover was below 66%. Further separation was observed until the 8th week of the study with treatment 4 dropping to only 48% green cover. All plots irrigated twice a week either retained (30% ET_0 replacement) or even increased green cover (both 45% and 60% ET_0 replacement) between 6th and 8th week (Table 4). On average, higher VWC was observed on treatments watered twice a week (Table 5), but it is important to note that measurements were taken 3 days after most recent watering for those treatments, whereas for treatments watered biweekly the measurement was taken after 13 days. Overall, frequency of irrigation had a stronger impact on all measured traits compared to ET_0 replacement. While none of irrigation regimes were enough to sustain high flowering of Kurapia, only plots watered at 45% ET_0 replacement every two weeks were statistically different from plots irrigated at either 45% or 60% ET_0 replacement twice a week. Although watering of Kurapia as rarely as every two weeks is possible, while still maintaining relatively high green cover, it is not recommended when poor soil conditions, e.g., localized dry spots, occur which was most likely the case in this study. Although mowing of Kurapia was not a factor in this study (plots were mowed only prior to treatment initiation), both green cover and quality was affected by occurrence of dead flowers, since both of those traits were observed to be higher in alleys that were mowed once a month.

Acknowledgments

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Tables and figures

Table 1. Effects of irrigation treatments on Kurapia visual quality. Riverside, CA. 2019.

Treatment	ET replacement	Irrigation frequency	7/10/2019	7/23/2019	8/5/2019	8/19/2019	9/3/2019	9/24/2019
1	30%	Biweekly	7.3 a	7.3 a	6.2 a	5.3 a	4.2 b	5.8 a
2	30%	Weekly	6.7 a	7 a	5.8 a	5 a	4.5 ab	5.8 a
3	30%	Twice a week	7 a	7.3 a	6.3 a	5.7 a	4.7 ab	5.2 a
4	45%	Biweekly	7 a	7.3 a	5.3 a	4.3 a	4.3 b	6.5 a
5	45%	Weekly	7 a	7.3 a	6.2 a	5.3 a	4.8 ab	6.2 a
6	45%	Twice a week	7 a	7.3 a	5.8 a	6.3 a	5.2 ab	6 a
7	60%	Biweekly	6.3 a	7.7 a	5.7 a	5.7 a	5.3 ab	7 a
8	60%	Weekly	7 a	7.3 a	6 a	5.7 a	5.2 ab	6.2 a
9	60%	Twice a week	6.5 a	7.7 a	6.7 a	6.3 a	5.8 a	5.8 a

Means followed by the same letter for a column are not significantly different (P=0.05).

Table 2. Effects of irrigation treatments on Kurapia flowering cover. Riverside, CA. 2019.

Treatment	ET replacement	Irrigation frequency	7/10/2019	7/29/2019	8/5/2019	8/19/2019	9/3/2019	9/24/2019
1	30%	Biweekly	7.7 a	19.5 a	22.1 a	12.8 ab	4.8 a	5.9 a
2	30%	Weekly	8.3 a	15.9 a	18.1 a	11.9 b	3.3 a	6.7 a
3	30%	Twice a week	7 a	19.3 a	21.9 a	16 ab	3.9 a	6.4 a
4	45%	Biweekly	10.7 a	15.8 a	16.5 a	13.2 ab	6.9 a	9.4 a
5	45%	Weekly	12 a	13.8 a	15.7 a	12.6 b	3.2 a	8.8 a
6	45%	Twice a week	10 a	17.5 a	20.4 a	15.4 ab	3.2 a	5 a
7	60%	Biweekly	8.1 a	17.8 a	21.1 a	14.8 ab	3.9 a	6.6 a
8	60%	Weekly	9.7 a	16 a	16.9 a	14.3 ab	4.2 a	8 a
9	60%	Twice a week	10.2 a	15.5 a	19.6 a	17.9 a	4.4 a	4.1 a

Means followed by the same letter for a column are not significantly different (P=0.05).

Table 3. Effects of irrigation treatments on Kurapia flowering uniformity. Riverside, CA. 2019.

Treatment	ET replacement	Irrigation frequency	7/10/2019	7/29/2019	8/5/2019	8/19/2019	9/3/2019	9/24/2019
1	30%	Biweekly	51 a	71 a	70 ab	78 ab	66 a	66 a
2	30%	Weekly	50 a	72 a	61 b	65 b	78 a	50 a
3	30%	Twice a week	54 a	77 a	77 ab	86 ab	55 a	70 a
4	45%	Biweekly	47 a	76 a	71 ab	71 ab	65 a	70 a
5	45%	Weekly	63 a	83 a	77 ab	77 ab	69 a	47 a
6	45%	Twice a week	23 a	77 a	74 ab	78 ab	74 a	67 a
7	60%	Biweekly	43 a	85 a	84 a	82 ab	83 a	61 a
8	60%	Weekly	61 a	84 a	75 ab	78 ab	61 a	48 a
9	60%	Twice a week	45 a	83 a	84 a	87 a	73 a	68 a

Means followed by the same letter for a column are not significantly different (P=0.05).

Table 4. Effects of irrigation treatments on Kurapia green cover. Riverside, CA. 2019.

Treatment	ET replacement	Irrigation frequency	7/10/2019	7/29/2019	8/5/2019	8/19/2019	9/3/2019	9/24/2019
1	30%	Biweekly	92.1 a	78.2 a	72.3 a	73.1 ab	60.3 ab	76.1 a
2	30%	Weekly	91.6 a	81.7 a	76.8 a	76.5 a	69.6 ab	71.7 a
3	30%	Twice a week	92.9 a	78.9 a	74.4 a	74.6 ab	74.4 ab	73.5 a
4	45%	Biweekly	88.9 a	81 a	75 a	65.9 b	48.3 b	73 a
5	45%	Weekly	87.8 a	82 a	76.2 a	76.1 a	67.2 ab	64.9 a
6	45%	Twice a week	89.7 a	79.5 a	74.3 a	76.4 a	80.3 a	76.3 a
7	60%	Biweekly	91.1 a	80.6 a	73.4 a	76.6 a	73.7 ab	80 a
8	60%	Weekly	90.1 a	80.7 a	76.5 a	77.8 a	72.2 ab	70.1 a
9	60%	Twice a week	89.1 a	82.1 a	76.2 a	75.9 a	84.3 a	78.2 a

Means followed by the same letter for a column are not significantly different (P=0.05).

Table 5. Effects of irrigation treatments on Kurapia soil volumetric water content. Riverside, CA. 2019.

Treatment	ET replacement	Irrigation frequency	7/10/2019	7/29/2019	8/5/2019	8/19/2019	9/3/2019	9/24/2019
1	30%	Biweekly	33.7 a	23.4 a	14 a	9.9 abc	16 ab	81.4 a
2	30%	Weekly	31.7 a	21.7 a	14.3 a	7.7 bc	11 b	64.9 a
3	30%	Twice a week	34 a	24.9 a	19.9 a	13.7 abc	21.9 ab	67.3 a
4	45%	Biweekly	28.2 a	19.9 a	10.6 a	3.5 c	7.6 b	65.5 a
5	45%	Weekly	25.9 a	18.6 a	11.8 a	7 bc	3.3 b	55.1 a
6	45%	Twice a week	30.3 a	23.4 a	17.8 a	14.9 ab	24.9 ab	73.6 a
7	60%	Biweekly	25.9 a	24.3 a	13 a	8.3 bc	5.7 b	68.3 a
8	60%	Weekly	25.1 a	23.2 a	17 a	12.3 abc	20.5 ab	56.8 a
9	60%	Twice a week	28.6 a	25 a	19.3 a	20.1 a	51.7 a	61.4 a

Means followed by the same letter for a column are not significantly different (P=0.05).

Table 6. Biweekly reference evapotranspiration (ETo) and amount of water (inches) replaced over subsequent 2-wk period for each ETo regime.

Week	Beginning date	End Date	Previous 2 weeks Eto (in)	Water replaced over 2 week period (in)		
				30% Eto	45% Eto	60% Eto
1	7/8/2019	7/14/2019	3.66	1.1	1.65	2.2
2	7/15/2019	7/21/2019				
3	7/22/2019	7/28/2019	3.64	1.09	1.64	2.18
4	7/29/2019	8/4/2019				
5	8/5/2019	8/11/2019	3.62	1.09	1.63	2.17
6	8/12/2019	8/18/2019				
7	8/19/2019	8/25/2019	3.4	1.02	1.53	2.04
8	8/26/2019	9/1/2019				
9	9/2/2019	9/8/2019	3.23	0.97	1.45	1.94
10	9/9/2019	9/15/2019				

Table 7. Gallons of water for 1000 ft^2 in each irrigation event

	Treatment:	1	2	3	4	5	6	7	8	9
	ET replaced	30%	30%	30%	45%	45%	45%	60%	60%	60%
	Irrigation events in 2 weeks	1	2	4	1	2	4	1	2	4
Date	7/10/2019	684.5	342	171	1026.5	513.5	256.5	1369	684.5	342
	7/12/2019			171			256.5			342
	7/16/2019		342	171		513.5	256.5		684.5	342
	7/19/2019			171			256.5			342
	7/23/2019	680.5	340.5	170	1021	510.5	255.5	1361.5	680.5	340.5
	7/26/2019			170			255.5			340.5
	7/30/2019		340.5	170		510.5	255.5		680.5	340.5
	8/2/2019			170			255.5			340.5
	8/6/2019	677	338.5	169	1015.5	507.5	254	1354	677	338.5
	8/9/2019			169			254			338.5
	8/13/2019		338.5	169		507.5	254		677	338.5
	8/16/2019			169			254			338.5
	8/20/2019	636	318	159	954	477	238.5	1271.5	636	318
	8/23/2019			159			238.5			318
	8/27/2019		318	159		477	238.5		636	318
	8/30/2019			159			238.5			318
	9/3/2019	604	302	151	906	453	226.5	1208	604	302
	9/6/2019			151			226.5			302
	9/10/2019		302	151		453	226.5		604	302
	9/13/2019			151			226.5			302