Optimizing Irrigation Rates and Frequency for Perennial Ryegrass in Western Oregon

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The success of irrigation rates and frequencies depends heavily on environmental conditions and turfgrass selection (Feldhake et al., 1984; Leinauer and Devitt, 2013; Liu and Huang, 2002; Salaiz et al., 1995; Xu and Huang, 2003; Younger et al., 1981). Irrigation research on cool-season turfgrass in the coastal region of the Pacific Northwest, a cool-humid climate that receives minimal precipitation in the summer months (Fig. 1), is lacking. Therefore, the goal of this research was to determine the optimum watering frequency and rate that provides acceptable perennial ryegrass turfgrass maintained at 2.0 inches throughout the dry summer months in western Oregon.

Effects of Irrigation Frequency and Rate on Turf Quality and Percent Green Cover

Field research was conducted from 1 Sept. 2015 to 28 Aug. 2017 in Corvallis, OR, on a blend of ‘Clubhouse Mix’, ‘Replay’, and ‘Wicked’ perennial ryegrass (Lolium perenne L.). In 2016 and 2017, this stand of turfgrass received organic fertilizer 5-3-0 Milorganite (Milwaukee, WI) at a rate of 4.0 lb N/1,000 ft² per year. Throughout the duration of the study, the turfgrass was mowed weekly at a 2.0-inch height with clippings returned.

Experimental design was a 2×4×5 factorial in a randomized complete block design with four replications. Factors included year (2016 and 2017), irrigation frequency, and irrigation rate applied from 1 July to 1 September (Table 1). Overhead irrigation was applied to individual plots using four Rain Bird 1800 series pop-up spray heads (Rain Bird Corporation, Azusa, CA) with U-150 nozzles arranged in 5.0 ft × 5.0 ft square spacing with 90° nozzles pointed inward. Heads were operated at 30 psi and overspray was contained using 5.0 ft × 3.0 ft × 3.3 ft PVC (0.75-inch schedule 40) structure surrounded in plastic tarp. Irrigation frequencies included 2, 4, 8, and 16 applications per month, which equate to irrigation applied once every 2 weeks, once a week, twice a week, and four times a week, respectively. Irrigation rates included 2.0, 2.5, 3.0, 3.5, and 4.0 inches per month, which equate to 0.5, 0.625, 0.75, 0.875, and 1.0 inch per week. Presented data include turf quality and percent green cover at the peak of drought stress—28 Aug. 2016 and 2017. Turf quality was collected using the National Turfgrass Evaluation Program (NTEP) system of rating, 1–9 rating scale with 6 or greater being acceptable (Krans and Morris, 2007). Percent green turf cover was determined

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by collecting digital images, which were analyzed using Sigma Scan Pro (v.5.0, SPSS, Inc. Chicago, IL) (Richardson et al., 2001). Data variance were analyzed using SAS 9.2 Proc Mixed (SAS Inst. Inc., Cary, N.C.).

In 2016, irrigation frequency and rate resulted in significant turf quality and percent green cover differences observed at the peak of drought stress (Table 2). The 2.5, 3.0, 3.5, and 4.0 inches of irrigation per month produce the highest turf quality ratings while the 2.0-inch rate resulted in the lowest quality. In 2016, the evapotranspiration (ET) rate for the month of August was 5.1 inches (AgriMet Weather Station, Corvallis, OR), and 49% ET replacement provided acceptable turf quality (> 6). These findings confirm previous research on deficit irrigation conducted in other environments (Feldhake et al., 1984). In relation to different irrigation frequencies, two applications per month had the lowest turf quality rating, followed by four applications per month, and then eight applications per month while 16 applications per month had the highest.

In 2017, main effects of irrigation frequency and rate again resulted in significant differences in turf quality and percent green cover at the peak of drought stress (Table 2). In this year, 2.0 inches of irrigation per month had the lowest turf quality, followed by 2.5 inches per month, while 3.0, 3.5, and 4.0 inches per month had the highest ratings. In 2017, the ET rate of August was 7.8 inches, and 45% ET replacement provided acceptable turf quality (> 6). In regards to irrigation frequency, two irrigation applications per month had the lowest turf quality rating, followed by four applications per month, and then eight applications per month while 16 applications per month had the greatest. Regarding irrigation frequency, two irrigation applications per month had the lowest percent green cover while four and eight applications per month had a greater percentage and 16 applications had the greatest. Contrary to this trial, work conducted on other grass species suggest deep-and-infrequent irrigation promote more drought-tolerant turfgrass stands (Liu and Huang, 2002; Salaiz et al., 1995; Xu and Huang, 2003).

Table 1. Irrigation rates and frequencies applied from 1 July to 1 Sept. 2016 and 2017 in Corvallis, OR.

| Factor 1: Irrigation rate (inches per month) † | Factor 2: Irrigation frequency (applications per month)‡ | Irrigation per event (inches) |
|-----------------------------------------------|--------------------------------------------------------|-------------------------------|
| 2                                             | 16                                                     | 0.125                         |
|                                               | 8                                                      | 0.250                         |
|                                               | 4                                                      | 0.500                         |
| 2.5                                           | 2                                                      | 1.000                         |
|                                               | 16                                                     | 0.156                         |
|                                               | 8                                                      | 0.313                         |
|                                               | 4                                                      | 0.625                         |
| 3                                             | 2                                                      | 1.250                         |
|                                               | 16                                                     | 0.188                         |
|                                               | 8                                                      | 0.375                         |
|                                               | 4                                                      | 0.750                         |
| 3.5                                           | 2                                                      | 1.500                         |
|                                               | 16                                                     | 0.219                         |
|                                               | 8                                                      | 0.438                         |
|                                               | 4                                                      | 0.875                         |
|                                               | 2                                                      | 1.750                         |
|                                               | 16                                                     | 0.250                         |
|                                               | 8                                                      | 0.500                         |
|                                               | 4                                                      | 1.000                         |
|                                               | 2                                                      | 2.000                         |

† These irrigation rates equate to 0.5, 0.625, 0.75, 0.875, and 1.0 inches per week.
‡ These irrigation frequencies equate to irrigation applied once every 2 wk, once a week, twice a week, and four times a week, respectively.

In 2016, irrigation frequency and rate resulted in significant turf quality and percent green cover differences observed at the peak of drought stress (Table 2). The 2.5, 3.0, 3.5, and 4.0 inches of irrigation per month produce the highest turf quality ratings while the 2.0-inch rate resulted in the lowest quality. In 2016, the evapotranspiration (ET) rate for the month of August was 5.1 inches (AgriMet Weather Station, Corvallis, OR), and 49% ET replacement provided acceptable turf quality (> 6). These findings confirm previous research on deficit irrigation conducted in other environments (Feldhake et al., 1984). In relation to different irrigation frequencies, two applications per month had the lowest turf quality rating, followed by four applications per month, and then eight applications per month while 16 applications per month had the highest.

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applications per month, while 16 applications per month had the greatest percent green cover.

**Conclusion**

The 3.0-inch irrigation rate per month provided perennial ryegrass turf quality and percent green cover equivalent to 3.5 and 4.0 inches of irrigation per month in western Oregon. If practitioners are planning to utilize weather data to calculate irrigation rates, 45 to 49% ET replacement should be applied in this environmental zone. The highest irrigation frequency (16 applications per month) consistently produced the greatest perennial ryegrass turf quality and percent green cover, while eight applications per month consistently resulted in acceptable turf quality (> 6).

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