# IRRIGATION CUTOFF EFFECTS ON KENTUCKY BLUEGRASS SEED YIELD

A.R. Mitchell, Grace Armah-Agyeman, C.L. Yang, and S.M. Griffith.

Abstract

*An experiment on two Kentucky bluegrass* (Poa pratensis) *cultivars was initiated to test the hypothesis that later irrigation cutoff would lead to more bluegrass seed yield. The cultivars 'Abbey' and 'Bristol' were selected for their nonaggressive and aggressive characteristics, respectively. Three irrigation treatments were imposed by cutting irrigation at weekly intervals in June. There was no difference in dry matter between irrigation treatments or cultivars. Seed yield was higher for 'Abbey' than 'Bristol'. Later irrigation cutoff did not significantly increase seed yield; hence, our hypothesis was not proven this first year. Although not significant, the lowest yield occurred at the earliest cutoff date. Because of the inconsistency of first year yield data, more tests are necessary to determine the optimum time to discontinue irrigation.*

## Introduction

Preliminary results from a 1995 study on the irrigation of Kentucky bluegrass seed suggested that seed yield may be affected by irrigation during the weeks prior to harvest (Mitchell and Griffith, 1996). Specifically, higher soil moisture after June 10 was associated with increases in seed yield of several hundred pounds per acre. The 1996 experiment, reported here, was initiated to specifically examine the effect of late-season irrigation on Kentucky bluegrass seed yield of different cultivars.

Cultivars of Kentucky bluegrass seed have been classified as aggressive and non-aggressive bluegrass according to their tillering characteristics. Aggressive cultivars have more active rhizomes, and typically produce less seed at an earlier date, than the nonaggressive cultivars. Because this growth characteristic may influence water use, both aggressive and non-aggressive types were included in this experiment, and the water use measured for each.

The objectives of this study were to determine effect of timing of irrigation cutoff on the yield and growth parameters of bluegrass seed for aggressive and nonaggressive cultivars. Our hypothesis was that later irrigation cutoff dates would increase seed yield.

## Materials and Methods

The experiment was conducted at the Central Oregon Agricultural Research Center, Madras, Oregon. Two cultivars were selected based on their contrasting aggressivity: 'Bristol' was the most aggressive (highly rhizomatous), and 'Abbey' was the least aggressive (less rhizomatous). The soil was a Madras loam (fine-loamy, mixed, mesic, Xerollic Duragid). The experimental design was a split-plot design with four replications, the two planted to main plots, and three irrigation treatments applied within subplots. As such, it was similar to the double-line-source sprinkler design describe by Frenkel et al. (1990). Each plot was 60-feet long and 15-feet wide, as shown in Figure 1. The 3-acre field was seeded on 23 August 1995 in rows 1-ft apart.

The trial was conducted according to standard practices for planting, weed control, pest control, irrigation, and fertilizer application. On 14 March 1996, fertilizer was applied at the rate of 140 lb N/A. A mixture of Gramoxone (paraquat dichloride, Zenena), and Round-up (glyphosate, Monsanto) was sprayed on 2 September to control weeds that had emerged prior to the seedlings. Buctril (bromoxynil, Rhone-Poulenc) was applied on 29 September to control broadleaf weeds. Round-up was applied with a wiping machine in two directions on 20 March 1996 to control volunteer wheat and barley. A mixture of Bronate (Rhone-Poulenc) and Banvel (dicamba, Sandoz) was applied 18 April 1996. To control rust, Tilt (propiconazole, Ciba) and elemental sulfur were applied on 31 May 1996.

Water was applied by sprinkler lines spaced 40 ft apart, with impact sprinklers at 30-ft intervals. The sprinklers were mounted on 18-inch risers and had nozzles with 9/64-inch diameters. Irrigation was carried out in the morning when the wind speed was low, in order to minimize non-uniform water distribution and to reduce evaporation. The quantity of applied water was measured after each irrigation as the amount captured in glass jars placed in the middle of each plot. To determine the time and quantity to irrigate, soil water tension readings were taken with sets of Watermark soil sensors (Eldredge et al. 1993) at two locations (`Abbey' and 'Bristol') and at two depths (6 inches and 18 inches).

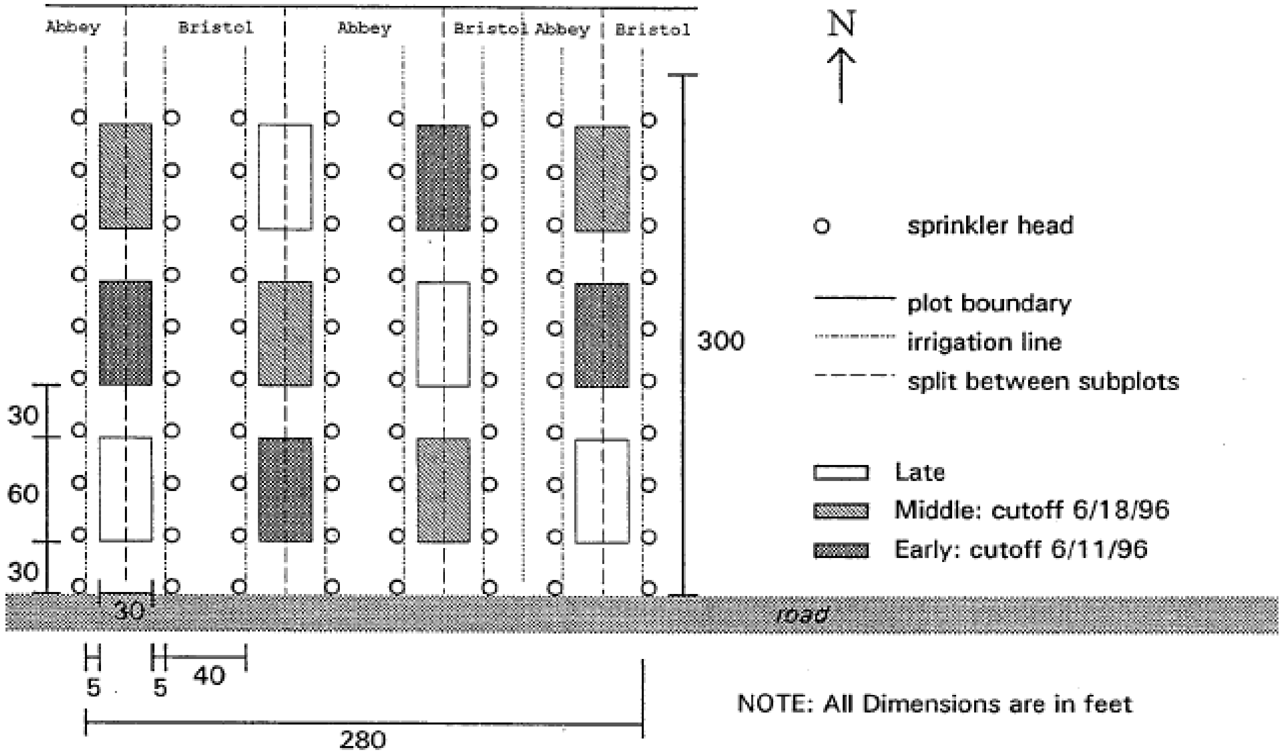


Figure 1. Plot map for 1996 irrigation experiment, Madras, Oregon.

Irrigation is typically halted in mid-June to dry the crop preparatory to harvest. The irrigation treatments of the experiment were the dates of last irrigation: 10 June, 17 June, and 24 June, here referred to as 'early', 'middle', and 'late'. Irrigation was applied to all treatments on 30 April, 13 May, 16 May, 23 May, 29 May, 6 June, and 10 June. At this point, the 'early' irrigation treatment received no additional irrigation. This was accomplished by plugging the sprinkler nozzles with wooden golf tees. The 'middle' and 'late' irrigation treatments were irrigated on 11 June, 13 June, and 17 June, and the 'late' treatment was irrigated one last time on 20 June. On 24 June, it rained 0.30 inches, thus we considered that to be the final irrigation for the 'late' treatment.

Soil volumetric water content was measured in each plot by the neutron probe method. Access tubes were installed within each plot. Neutron probe readings were taken at 6-inch increments until limited by the underlying rock or duripan, which varied in depth from 18 to 30 inches.

Evapotranspiration (ET) was estimated using water balance equation

$$ET = I + P + \Delta S - D - R \quad [1]$$

where I is irrigation, P is precipitation, and $\Delta S$ is the difference in soil water storage between the initial and final measurement dates in March and July. Drainage from the profile, D, and runoff, R, were assumed to be negligible.

Beginning 18 June, the seed head moisture content of the grass was measured at least every other day in order to determine the time of swathing. This was done by taking samples of seed heads at random from each plot, weighing fresh, oven-drying at 105 °C for 3 hours until constant weight was achieved, and weighing again. Harvest occurred on 3 July for 'Abbey', when seed moisture content was 39 percent, and on 10 July for 'Bristol', when seed moisture content was 28 percent. The number of fertile tillers and the above-ground biomass were determined by hand-harvesting a 30-cm section of a row at three locations approximately 15 feet apart in adjacent rows along a diagonal, where the first location was selected at random. The three samples were bagged separately, and counted later, then dried and weighed to determine dry mass. Separate samples were collected for seed yield in the same fashion for three 1-$m^2$ samples at locations within the plot that were selected similar to the above description. Samples were threshed at the USDA-ARS National Forage Seed Production Research Laboratory, Corvallis, Oregon.

**Results**

The irrigation treatments were effective in creating different soil moisture regimes, as shown in Figure 2 for the top six inches of soil. The soil moisture differences between cultivars were small and insignificant; thus, data were grouped by irrigation treatment in Figure 2. Other depth increments of the soil behaved in similar manner (data not shown). The 'late' treatment exhibited a sharp increase in soil water content at the end of June that was due to the magnitude of the late irrigation and rain on June 24. By the time 'Abbey' and 'Bristol' were harvested on July 3 and 10, respectively, the treatments had different soil moisture regimes based on irrigation treatment.

The 'Abbey' cultivar had significantly (P 01) higher seed yield than 'Bristol' (592 to 154 lb/ac, respectively). These cultivars are known to differ considerably in seed yield under central Oregon conditions (Crowe et al. 1996). Overall, 'Abbey' also had significantly (P≤01) more fertile tillers than 'Bristol', with the differences varying by irrigation treatment (Figure 3). The dry matter (above ground biomass) was not significantly different between the cultivars with a mean of 3.62 t/ac.

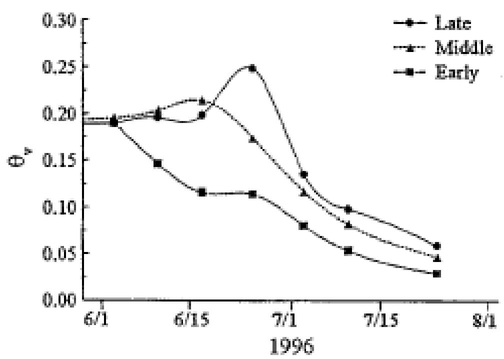


Figure 2. Volumetric water content in the top 6-inch layer of soil for three irrigation-cutoff treatments, Madras, Oregon, 1996.

The 'late' irrigation treatment did not produced the anticipated seed yield increase. 'Bristol' increased slightly with later irrigation, but not significantly. 'Abbey' was highest at the 'middle' irrigation cutoff, but any potentially significant differences were masked by the high variability in seed yield. High variability in plant stand and yield is not uncommon for first year Kentucky bluegrass plantings. The fertile tillers did not increase with later irrigation cutoff date—quite the contrary, they decreased. But, again, the lack of significance does not permit us to draw conclusions about the effect of irrigation cutoff timing.

**Discussion**

The results from the first year data did not show significant differences in seed yield due to irrigation cutoff dates two weeks apart. There may have been a trend toward lesser yield at the earliest irrigation cutoff date of June 10, but the high variability in first-year bluegrass seed yield limited the interpretation of the study. Although equal yield for irrigation treatments was not an anticipated result, it would nonetheless be important if supported by additional years' data, because it would mean that irrigation cutoff is not critical. The experiment needs to repeated for more seasons.

A seed germination test on the different treatments has yet to be conducted, but may provide information on the effects of the timing of irrigation cutoff.

Additionally, thermal and nonthermal treatment were imposed in early August 1996. Next year, we will have information on how the timing of the last irrigation interacts with thermal and nonthermal management.

**References**


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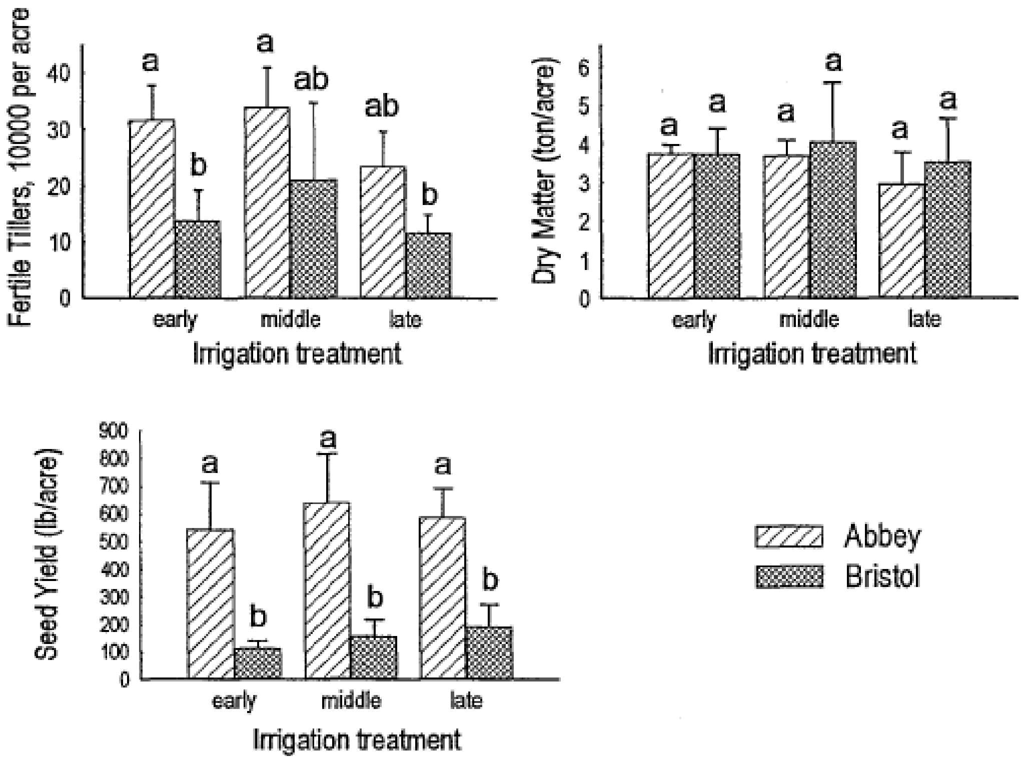


Figure 3. Fertile tillers, dry matter, and seed yield by cultivar and irrigation treatment, Madras, Oregon, 1996. Like letters indicate no significant differences (P≤05) based on Fisher's mean comparison test.