# Effects of Sunlight Reduction and Post-Harvest Residue Accumulations on Seed Yields of Kentucky Bluegrass [1]

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## ABSTRACT

**Kentucky bluegrass seed growers have recognized the necessity of complete removal of post-harvest residue to maintain seed productivity of this species from year to year. The residues restrict subsequent tiller growth and thereby seed yields are significantly reduced. Residue remaining on fields shades plants and thereby may restrict tiller growth and subsequent seed yield.**

**To explore this theory, polyethylene shade screens which excluded 30 and 67% of sunlight were placed over August field burned Kentucky bluegrass cv. Baron plants for 75 and 130 days. Other treatments included mechanical vacuum clipping at 2.5, 7.6 and 15.2 cm levels, field burning of residue and no residue removal.**

**Tiller numbers of artificial shaded plants and tillers from no residue removed plots were significantly less than from open-field burned plants. There were more tillers from plants of close (2.5 and 7.6 cm) residue removal than no residue removal but they were not significantly different from open-field burn plants.**

**The sheath lengths of plants from artificial shaded and no residue removed plots were greater than open-field burn plants.**

**Panicle numbers of plants from the 67% shaded plants were comparable to the plants of no residue removed plots. Panicle numbers from these artificial shaded plants were 41% less than open-field burned plants.**

**Seed yields of 67% shaded plants were 24% less than plants subjected to open-field burning.**

**It was concluded that light reduction due either to shading from post-harvest residue accumulations or by artificial means affected Kentucky bluegrass growth and development.**

*Additional index words:* **Artificial shading, tillering, panicles, field burning, *Poa Pratensis*, air quality.**

## INTRODUCTION

Idaho, Oregon and Washington produce approximately 95% of the Kentucky bluegrass (*Poa pratensis* L.) seed in the United States (USDA, 1979). Seed production of this species is enhanced by complete removal of post-harvest residue. This is best accomplished by open-field, early fall burning.

Field burning is the most rapid and economical means to remove post-harvest residue

Research in Idaho (Ensign, et al., 1978) has shown that mechanical vacuum clipping may maintain subsequent year seed yields, during the first or second seed year, with some cultivars. Where mechanical removal was practiced for several consecutive years, seed yields were reduced (Canode and Law, 1977).

Tiller elongation and growth has been shown to be affected by residue accumulation. Tillers under shade are elongated, poorly developed, erect, have narrow leaves, and lacking dark green color when grown in shade or heavy residue accumulations (Cordukes and Fisher, 1974), and (Canode and Law, 1979). Ensign, et al., (1974) also reported that early complete residue removal by open-field burning will produce larger healthy tillers than where residue is not removed. It has been assumed that burning will remove harvest residue from around the crown of the plants, allowing light penetration into the canopy and thereby promotes vigorous tiller growth and improved seed yields.

Idaho research was designed to compare the effects of excluding various amounts of sunlight and comparing these treatments to residue accumulations as they may alter plant growth and seed productivity. The effects of tiller number, sheath length, panicle number, and seed yield of 'Baron' Kentucky bluegrass were studied.

## MATERIALS AND METHODS

On a fifth year of seed crop residue, shading and residue removal treatments were established in a field of cultivar Baron Kentucky bluegrass within 3 x 6 m plots using a 7 x 9 randomized complete block design. The grass had been planted in 1974 in 30 cm rows on a Thatuna silt loam, fine-silty, mixed, mesic Ultic Argixerols near Tensed, Idaho.

Post-harvest residue was mechanically removed at heights of 2.5, 7.5, and 15.2 cm on 2 August 1979 with a rotary power mower at a vacuum attachment. A small propane burner was used to ignite plots which were burned on 14 August. One set of plots had no residue removal. All plots were fertilized with 168 kg/ha of N in the ammonium nitrate form on 29 August and immediately sprinkler irrigated with 10.6 cm of water.

Black polyethylene shade screens were superimposed over burned plots on 17 September 1979. Light intensities were reduced by 30% for 75 days, 30% for 130 days, 67% for 75 days, and 67% for 130 days. The shade screens were suspended 0.5 m above the ground on 2.4 x 3 m wooden frames. During October an additional 10.6 cm/ha of irrigation water was applied.

Soil moisture readings were obtained by removing soil cores 2.5 cm in diameter and 15 cm in depth. The samples were weighed, air dried, and reweighed to determine the percentage of soil moisture. On 2 March 1980, five grass core samples, 9.5 cm in diameter and approximately 15 cm in depth, were removed from each plot. They were dissected and the number of large tillers per core counted. Sheath

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Table 1. Effect of residue removal and shading on soil moisture and Kentucky bluegrass yield components.[1]

| Treatment | Soil Moisture | Tillers | Sheath Length | Panicles | Seed Yeilds |
|---|---|---|---|---|---|
| | - - - % - - - | - - no. core$^{-1}$ - - | - - - - cm - - - - | - - no. m$^{-2}$ - - | - - kg ha$^{-1}$ - - |
| Open-field burned | 12.6 c | 20.9 a | 2.7 d | 5308 a | 1266 abc |
| 30% shade-75 days | 14.2 bc | 12.4 bcde | 3.2 cd | 4683 ab | 1399 ab |
| 30% shade-130 days | 14.2 bc | 14.8 bcd | 3.3 cd | 3898 bc | 1194 abc |
| 67% shade-75 days | 18.3 a | 9.8 de | 3.6 c | 3349 dc | 1339 abc |
| 67% shade-130 days | 18.3 a | 7.8 e | 3.5 c | 3145 dc | 966 d |
| Clip to 2.5 cm | 13.0 bc | 17.5 ab | 2.7 d | 5241 a | 1542 a |
| Clip to 7.6 cm | 12.9 bc | 17.0 abc | 3.0 dc | 4762 ab | 1304 abc |
| Clip to 15.2 cm | 15.4 b | 11.3 cde | 5.6 b | 3246 dc | 983 d |
| No residue removal | 15.4 b | 10.5 de | 6.3 a | 2447 d | 1079 d |

[1]Means within each column followed by the same leter are not significantly different at the 5% level of probability based on Duncan's Multiple Range Test.

length, measured from the crown to collar of first leaf was recorded in early April 1979. Panicle counts were recorded in the field on 19 June 1980. Seed yields were obtained by removing a 0.6 x 6.0 m swath of panicles from each plot on 10 July. These samples were then thrashed, cleaned, and weighed.

Data were analyzed as a randomized complete block design. Duncan's multiple range test was performed to separate treatment means.

## RESULTS AND DISCUSSION

### Soil Moisture

Since moisture was applied from August - October, the soil moisture level was adequate for excellent autumn tiller growth. The soil moisture was also significantly increased by 67% shading in the fall. The effect of artificial shading at the 30% level on soil moisture was comparable to the effect of clipping or not removing the residue (Table 1).

### Tillers

Tillering was suppressed most by 67% light exclusion. Shading at the 30% level restricted tiller development equal to clipping to 15.2 cm and the no residue removal treatment. Open-field burned plants gave the largest number of tillers per 9.5 cm diameter core (Ensign et al., 1974). Suppression of tillering as the result of reduced light agrees with Ryle (1961) and Sprietz and Ellen (1972).

### Sheath Length

Sheath lengths were longest where no residue was removed (Table 1). The open-field burned treatments and the short clipping to 2.5 cm produced short sheaths which were less than shading at the 67% light exclusion. Thus shading either with artificial screens or by excessive residue accumulation increased sheaf length. It is assumed that shading increased leaf and sheath elongation due to light exclusion as reported by Wilkinson, et al., (1975). He also reported a reduction in net photosynthesis by shading which would be expected to affect potential seed production.

### Panicles

Open-field burning and clipping to 2.5 cm produced the largest numbers of panicles. No-residue removal and 75% exclusion of the sunlight produced relatively less panicles. These results correspond with Ryle (1961) who reported that panicle numbers were reduced 15% by shading. These data indicate that residue accumulation may reduce light penetration into the canopy and cause a reduction in panicle numbers.

### Seed Yields

Seed yields of the 67% shaded, the clipped to 15.2 cm level, and the no residue removal plants were significantly less than open field burn plants. Seed yields of 67% shaded plants were less than 24% of the open-field burned plants.

Seed yields of the low residue clip (2.5 cm) were not different than the open-field burned plants. Thus, complete mechanical residue removal offers a possible alternative to field burning although such mechanical removal may not be economically feasible.

Seed yields seem to be reflected in the increase numbers of panicles as were observed in open-field burning and close mechanical clipping of residue.

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