

# Effect of Clipping on Survival of Crested Wheatgrass Seedlings

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**Highlight:** Seedlings of crested wheatgrass (*Agropyron desertorum* (Fisch. ex Link) Schult.) from spring plantings were clipped to a 1.3-cm stubble or to ground level in the year of seeding in 6 years between 1954 and 1970. Two to nine clipping dates per year, between May and August, were used. Seedling survival was measured in the fall of the year of seeding. Clipping to 1.3 cm reduced survival by 0 to 13%, but the reductions were considered to be of no practical consequence. Clipping to ground level reduced survival by 0 to 61%, and the reduction varied greatly between years, dates of clipping, and dates of clipping within years. There was no consistent relationship between date of clipping and survival. It was not possible to predict seedling mortality from date of clipping, or from number of tillers or height of seedlings at time of clipping. In 1970, when height measurements were made, plant height in September decreased for later dates of planting, and height of regrowth after clipping decreased with later dates of planting and later dates of clipping.

The general practice in range seeding is to protect the seeded stand from grazing or other disturbance for 1 to 3 years after seeding. Hull (1944) reported that full stands could be obtained under grazing, but vigor was likely to be low. The costs of preventing grazing of the seeded stand by livestock or other animals can be large, and an alternate source of feed may be needed for several years while the seeded stand is being established. Seedling damage by rodents, rabbits, insects, or hail may be difficult to prevent, and weed control (McGinnies, 1968) in the seedling stand may also entail seedling damage. I have observed a number of seedling stands that appeared to have been severely damaged by insects, hail, cattle, or rabbits; later, these stands recovered with no apparent adverse effects from the disturbance. Because of this apparent conflict with generally accepted recommendations, a series of studies in which seedlings were clipped to simulate herbage removal by grazing and other causes was conducted to determine the effects of this type of seedling damage on seedling survival.

## Methods and Materials

Separate experiments were conducted

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91 cm apart. Although this system produced exceptionally uniform stands, the planting required too much time. In 1967, 1968, and 1970, seeding was done with a cone seeder at a seeding rate of 26 seeds per meter of row. Seeding depth was 2 cm in all tests on a firm, fallowed seedbed. One planting was made in April of each year, except for 1970 when planting dates were April 10, April 24, May 8, and May 25.

In the 1964, 1965, and 1966 experiments, 1/3 of the seedlings to be treated on each clipping date were clipped to ground level with sharp scissors, 1/3 were clipped to a 1.3-cm stubble, and 1/3 were left unclipped. In 1967, 1968, and 1970, 1/2 of the seedlings to be treated on any particular date were clipped to ground level and the other half left unclipped. The dates of clipping for each year are shown in Tables 1 and 2. The location of each seedling was marked with a small pot-state at the time of treatment.

Survival was measured by counting seedlings that remained alive in September or early October of the seedling year. Seedlings from the 1965 planting were counted again in August 1966. In 1967 the number of leaves or tillers at time of treatment was determined before clipping. In 1970 the heights of the seedlings (tallest culm or upstretched leaf) at time of treatment and at the date of the final count in September, 1970, were measured.

The number of seedlings treated in the different years varied with the number of seedlings available for treatment, and the number available depended on seedling emergence and experimental design. Sta-

Table 1. Seedling survival (%) in the fall of the year of planting, for seedlings clipped to a 1.3-cm stubble and to ground level, expressed as percent of unclipped plants that survived.

Date of clipping	Year, date of seeding, and clipping treatment							
	1964 Apr. 16		1965 Apr. 22		1966 Apr. 16		1967 Apr. 4	1968 Apr. 5
	1.3-cm	ground	1.3-cm	ground	1.3-cm	ground	ground	ground
May 21-25	102	55**	—	—	93**	58**	93	—
26-31	—	—	98	92**	—	—	—	92**
June 1-5	—	—	—	—	—	—	—	—
6-10	—	—	—	—	—	—	—	—
11-15	—	—	—	—	100	75**	99	95*
16-20	—	—	—	—	—	—	—	91**
21-25	—	—	—	—	—	—	94	—
26-30	—	—	95**	48**	—	—	—	99
July 1-5	—	—	—	—	103	39**	83**	99
6-10	—	—	—	—	—	—	93	100
11-15	87**	50**	—	—	—	—	73**	—
16-20	—	—	—	—	—	—	—	98
21-25	—	—	—	—	101	94**	77**	100
26-31	—	—	—	—	—	—	97	—
Aug. 1-5	—	—	100	95**	—	—	—	—
6-10	—	—	—	—	—	—	—	100
11-15	—	—	—	—	—	—	—	—
16-20	—	—	—	—	100	99	—	—

\* = Differs significantly from unclipped, 5% level.

\*\* = Differs significantly from unclipped, 1% level.

**Table 2. Seedling survival measured September 11, 1970, for seedlings clipped to ground level on five dates, expressed as percent of unclipped plants that survived.**

Date of clipping (1970)	Date of planting (1970)				Mean
	Apr. 10	Apr. 24	May 8	May 25	
June 22	96	95	102	91	96
July 1	100	99	95	100	98
July 10	100	100	100	98	99
July 21	100	98	100	93	98
July 30	100	100	102	100	101
Mean	99	98	100	96	

tistical analyses were adapted to the planting designs used in the various years; analyses of variance or binomial confidence intervals were used for most tests.

### Results and Discussion

Seedling counts of the 1965 study made in August, 1966, showed no seedling mortality from October 1965 to August 1966. Based on these counts and a previously reported study (McGinnies, 1966), it was concluded that in this region the fall seedling counts represented establishment. There was essentially no winter mortality, and almost all mortality during the first year occurred during the spring and summer immediately after seeding. Clipping to ground level in 1965 had a slight but significant effect on plant height in 1966. Plants clipped to ground level had an average height of 41 cm in 1966, and the height of unclipped plants was 44 cm. Plants clipped to 1.3 cm in 1965 averaged 42 cm high in 1966, but did not differ significantly from either unclipped plants or those clipped to ground level.

Clipping seedlings to a 1.3-cm height had little or no effect on survival in 1964, 1965, or 1966 (Table 1). Therefore, this treatment was discontinued after 1966.

Clipping to ground level caused reductions in seedling survival (Table 1), but the effects of ground-level clipping varied with year and date of treatment and were frequently erratic among dates within a particular year. In all years, the greatest reduction in seedlings resulted from a clipping date sometime during the period of mid-June through mid-July, but some clipping dates during this same period showed no significant reduction in survival. Clipping in August caused little or no mortality, while clipping late in May caused slight to large reductions in survival. Clipping to seedlings to ground level must be considered a hazard to seedling establishment, because in 3 of the 6 years, clipping at some date during the

seedling year reduced survival by 50% or more.

The 1970 plantings were made on four dates (April 10, April 24, May 8, and May 25) to provide seedlings of different sizes and ages to evaluate effects of size and age on survival. The only significant reductions in average survival ( $P > 0.05$ ) were associated with the June 28 treatment date and the May 25 planting date. In no instance did clipping to ground level reduce survival by as much as 10% below that of the unclipped plants (Table 2). Survival averaged 97% for all unclipped and 95% for all clipped treatments. Survival exceeded 90% for all combinations of treatment dates and planting dates, except for the June 22 treatment date with the May 8 and May 25 planting dates, and the July 1 treatment date with the May 25 planting date. Thus, the younger seedlings, clipped or not clipped, had the higher mortalities. This appeared to be related to the "normal" summer mortality. Because survival rates were so high, it was not possible to correlate plant height at the time of clipping with survival of the clipped seedlings.

The earlier the planting date, the taller the seedlings were on the date of treatment, and for the unclipped plants, the earlier the planting date, the taller the plants were on September 11 (Table 3). These relations appeared to be entirely a function of the amount of growing time between planting and measurement. Both date of treatment and date of planting had highly significant effects on the amount of regrowth that occurred between date of treatment and September 11 (Table 3). Regrowth consisted of both new tillers and elongation of the clipped leaves. The older and taller the plant at the time of clipping and the greater the amount of time between clipping and September 11, the taller the regrowth was.

### Conclusions

Crested wheatgrass seedlings can withstand clipping to 1.3 cm with little or no seedling mortality. Because there was seldom any damage of consequence from clipping to a 1.3 cm stubble, there is no reason to think that mowing to this height (or a higher stubble) for the purpose of weed control would be detrimental to the seedlings at any period.

In many instances, depending on the individual year and date within that year, seedlings can also be clipped to ground level with little or no seedling loss, but

**Table 3. Height (cm) of seedlings at date of treatment and on September 11, 1970.**

Treatment and date (1970)	Planting date (1970)				Mean
	Apr. 10	Apr. 24	May 8	May 25	
Height on treatment date <sup>1, 2</sup>					
June 22	16.9	13.1	9.9	6.6	11.6
July 1	24.7	17.2	12.8	8.7	15.8
July 10	32.3	22.8	15.6	10.2	20.2
July 21	36.4	27.6	22.1	12.6	24.7
July 30	41.7	33.6	24.7	11.7	27.9
Mean	30.4	22.9	17.0	10.0	
Height of unclipped seedlings on Sept. 11, 1970 <sup>3</sup>					
June 22	41.4	35.4	23.1	17.6	29.4
July 1	43.0	33.6	26.8	19.0	30.6
July 10	45.1	36.1	27.6	16.8	31.4
July 21	43.0	34.6	29.3	16.6	30.9
July 30	42.8	37.3	28.7	15.7	31.1
Mean	43.1	35.4	27.1	17.1	
Height of regrowth of clipped seedlings on Sept. 11, 1970 <sup>4</sup>					
June 22	25.3	21.9	20.9	14.8	20.7
July 1	24.0	22.0	20.0	14.2	20.0
July 10	22.6	21.8	17.9	14.9	19.3
July 21	20.9	17.3	16.3	12.5	16.8
July 30	17.8	16.5	15.6	11.9	15.4
Mean	22.1	19.9	18.1	13.7	

<sup>1</sup> Average height for both treatments before clipping.

<sup>2</sup> LSD<sub>0.01</sub> Planting date = 6.5; LSD<sub>0.01</sub> Treatment date = 7.3.

<sup>3</sup> LSD<sub>0.01</sub> Planting date = 3.6; LSD<sub>0.01</sub> Treatment date = n.s.

<sup>4</sup> LSD<sub>0.01</sub> Planting date = 2.1; LSD<sub>0.01</sub> Treatment date = 1.9.

under certain unpredictable conditions, clipping to ground level can cause a high seedling mortality. It has not been possible to predict the effects of clipping to ground level on seedling survival from seedling height, age, or leaf number at the time of clipping. The effect of time of clipping was erratic, except that no substantial damage was ever produced by clipping in August.

When these results are applied to "field conditions," consideration must also be given to some other factors that may influence seedling survival. These factors include: (1) soil disturbance is commonly associated with grazing or mowing; (2) plants may be clipped or grazed more than once during a season; and (3) some plants may be pulled from the ground by the grazing animals.

### Literature Cited

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