MOWING AS AN ALTERNATIVE TO SPRING BURNING FOR CONTROL OF COOL SEASON EXOTIC GRASSES IN PRAIRIE GRASS PLANTINGS

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Abstract. The effects of spring mowing and burning were compared with an undisturbed control in a seven year old planting of five warm season prairie grasses: big bluestem (*Andropogon gerardi*), little bluestem (*Andropogon scoparius*), side oats grama (*Bouteloua curtipendula*), switchgrass (*Panicum virgatum*), and Indiangrass (*Sorghastrum nutans*). Cool season grasses present were quackgrass (*Agropyron repens*), meadow fescue (*Festuca elatior*), and Kentucky bluegrass (*Poa pratensis*). Biomass clippings were taken on each treatment twice during the growing season, on July 2-3 and August 20-22. Frequency studies were conducted on each treatment in autumn. Burning reduced total cool season grass production an average of 78% for both clipping dates, compared to the control. Mowing averaged a 48% reduction. Burned and mowed treatments exhibited significantly lower cool season grass production than the control for the July clipping. Total warm season grass production was 42% higher and 12% higher for the mow and burn respectively, for the July clipping. By late August, warm season grass biomass was highest on the burn and lowest on the mow. The differences found in warm season grass production between treatments were not significant for either clipping date. Frequency of big bluestem was higher on the burned than on the mowed or control plots. Little bluestem and side oats grama were more frequent on both the mowed and burned plots when compared to the control. Frequency of cool season grasses did not differ between treatments, except quackgrass was significantly less frequent in the burned plot. Quackgrass biomass was significantly lower on mowed and burned plots for the July clipping compared to the control. Four broadleaf weeds and one annual grass occurred at higher levels on the burned treatment, but were a minor component of total production.

INTRODUCTION

One of the most common problems in prairie establishment and maintenance in the Midwest is the control of exotic cool season perennial grasses. Cool season grasses generally begin growth a month earlier than most native prairie species and often cause severe competition problems in the early part of the growing season. This is particularly true in the Upper Midwest where cooler spring and summer temperatures predominate.

The use of fire is presently the prairie manager's most effective tool for controlling these undesirable grasses. Numerous studies of Midwestern prairies have documented the effectiveness of spring burning in reducing the vigor of cool season exotics while stimulating earlier growth and increasing flowering of warm season prairie species (Curtis and Partch 1948, Ehrenreich 1959, Hadley and Kieckhefer 1963, Svedarsky and Buckley 1975). Many investigations have been conducted to determine the causal factors that make spring burning so effective in this respect. The consensus is that the removal of dead mulch is the primary factor involved (Curtis and Partch 1950, Rice and Parenti 1978, Weaver and Rowland 1952). Denuding the soil surface increases the available light at ground level and encourages earlier and more rapid soil warming. The resultant higher soil temperatures favor the growth of warm season prairie species. This effectively lengthens their growing season while shortening that of cool season species (Henderson 1982, Hill and Platt 1975).

In addition to altering the soil environment, mid to late spring burning also causes physical damage to cool season grasses that have already initiated growth. Still-dormant warm season prairie species remain unharmed below the soil surface. This is particularly important in young plantings where prairie species are just becoming established and frequently experience strong competition from cool season exotics. A single well-timed burn can often tip the scales in favor of the prairie species and change the entire aspect of a planting.

Unfortunately, burning a prairie or a prairie planting is not always possible, due to insufficient fuel, local burning restrictions, or unfavorable spring weather. In such cases alternative management methods must be employed. The use of mowing to simulate the effects of burning is one option. A number of investigators report increased production in tallgrass prairies by mowing and raking at the end of the previous growing season or in spring before the initiation of new growth (Hulbert 1969, Penfound 1964, Vogel and Bjugstad 1968). An Illinois prairie mowed and raked in late April also showed a significant decrease in the production of two undesirable cool season grasses, Kentucky bluegrass (*Poa pratensis*) and smooth brome (*Bromus inermis*) (Old 1969).

The literature indicates that mowing is a viable alternative to burning in the management of Midwestern prairies. This has important implications for vegetation managers and particularly for the urban prairie landscaper who is usually restricted by law from utilizing fire. This paper presents preliminary data comparing the effectiveness of mowing versus burning to control introduced cool season grasses and to encourage early spring growth of prairie species. Although conditions will vary from planting to planting, the ecological concepts presented here have applications in a variety of situations. Hopefully this information will help in effectively managing prairie plantings when the use of fire is precluded.

METHODS

The study area is located within the University of Wisconsin - Green Bay Cofrin Memorial Arboretum. Green Bay is situated on the northeasternmost edge of the original prairie-oak savanna region of Wisconsin. A variety of prairie species can be found in small remnants in the surrounding area.

The study area has a modified continental climate. The waters of Green Bay prevent the occurrence of extreme summer temperatures. Mean maximum temperatures for the summer months range from 24° to 27° C and daily maxima rarely exceed 35° C. The average frost-free growing season is 153 days. Mean annual precipitation is 71 cm, with sixty percent occurring during the growing season.

The soils in the study area are eroded Kewaunee sandy loams, overlying fine sandy clay loams. Measurements of texture, pH, and organic carbon were made of the topsoil and subsoil, to a depth of 60 cm.

In 1974, five warm season prairie grasses of Nebraska origin were planted in the study areas on 2.8 hectares of former agricultural fields. These grasses were "Champ" big bluestem (*Andropogon gerardi*), "Aldous" little bluestem (*Andropogon scoparius*), "Butte" side oats grama (*Bouteloua curtipendula*), "Nebraska 28" switchgrass (*Panicum virgatum*), and "Holt" Indiangrass (*Sorghastrum nutans*). The planting was left undisturbed for six years. Annual and biennial weeds were common in the first few years, but had almost disappeared by 1980. At this point switchgrass had become the dominant species and a mulch 20-30 cm deep had developed. Three introduced cool-season perennial grasses, quackgrass (*Agropyron repens*), meadow fescue (*Festuca elatior*), and Kentucky bluegrass had now become the pre-dominant undesirable species.

FIG. 1. Location of study area within the state of Wisconsin.

To evaluate the effects of burning and mowing on these species, three ten meter wide and fifty meter long transects were laid out in spring of 1980. Treatments were as follows:

CONTROL	(C) -	Not Burned or Mowed
MOW	(M) -	Mowed and Raked, May 1, 1980
BURN	(B) -	Burned, May 15, 1980

The control was left untreated. The mowed transect was cut with a flail mower, leaving a stubble approximately 5 cm high. The mowed material was removed using garden rakes. The burned transect was backfired two weeks after mowing. The fire essentially consumed all living and dead material on the plot.

To measure the response of individual plant species to each treatment, biomass clippings were taken on July 2nd and 3rd and on August 20-22. The July date was chosen to estimate maximum cool season grass production. The late August clipping was used to estimate maximum production of warm season grasses. Ten 0.1 m_2 quadrats were clipped every five meters along the control and mowed transects, and nine were clipped on the burn due to its slightly shorter length. The clipped plant material from each quadrat was separated by species, dried in an oven at 95° C for 24 hours, and weighed. All residual dead plant material was collected, dried and weighed. Analysis of variance was used to evaluate the results of the biomass studies.

Presence studies were conducted on October 31 and November 1, 1980 to compare frequency of all species in each treatment. One hundred samples were taken on each of the three treatments using a 0.1 m^2 quadrat. Chi-square calculations were used to determine differences in occurrences of each species by treatment.

RESULTS AND DISCUSSION

The most striking difference among the three treatments was the presence of a thick mulch on the control plot throughout the growing season. At the time of the early July clipping the control averaged 931 g/m^2 of dead litter. This compared to 147 g/m^2 on the mow (mostly stubble) and only 6 g/m^2 on the burn. In late August the control lost some mulch due to decomposition, but 659 g/m^2 still remained. The mow and burn each averaged 26 and 21 g/m^2 of litter at this time, respectively.

Although soil temperatures were not taken in this study, it is presumed that the control plot experienced lower spring soil temperatures than the mowed and burned sites. Peet et al. (1975) found daytime surface soil temperatures on a burned Wisconsin prairie to be as much as 20° C higher than adjacent unburned areas in mid-May. Brown (1967) recorded daily mid-May soil temperature gains on a burned Wisconsin prairie that exceeded those of unburned areas by as much as 85%. Little difference in energy dynamics would be expected between the burned and mowed areas once the litter was removed. Old (1969) found that spring surface temperatures on mowed and raked plots did not deviate by more than 1° C from burned plots on an Illinois prairie. Steiger (1930) and Hulbert (1969) compared spring soil temperatures on burned prairies to mowed and raked prairies. No significant differences were found in their studies. Removal of mulch by spring burning or mowing results in more rapid soil warming at similar rates compared to mulched surfaces.

Warm Season Grasses

Total warm season grass production in early July was greatest on the mowed transect, with 283 g/m^2. The burn and control produced 224 and 200 g/m^2, respectively. Warm season grass biomass was 42% higher on the mow and 12% higher on the burn compared to the control, but no significant differences between treatments were found. Increased grass production on the mowed plot compared to the burned plot in July is attributed to mulch removal 14 days earlier on the mowed plot. This allowed the soil to warm up sooner and stimulated earlier growth of the prairie grasses. Studies in Wisconsin (Brown 1967), Iowa (Ehrenreich 1959) and Nebraska (Weaver and Rowland 1952) show that differences in soil temperature between heavily mulched, undisturbed prairies and burned or mowed and raked prairies tend to disappear by mid-June or early July. New plant growth on denuded areas shades the ground, equalizing soil temperatures and consequently, growth rates. The earlier mulch is removed, the greater the proportional advantage there is in the form of increased spring growth.

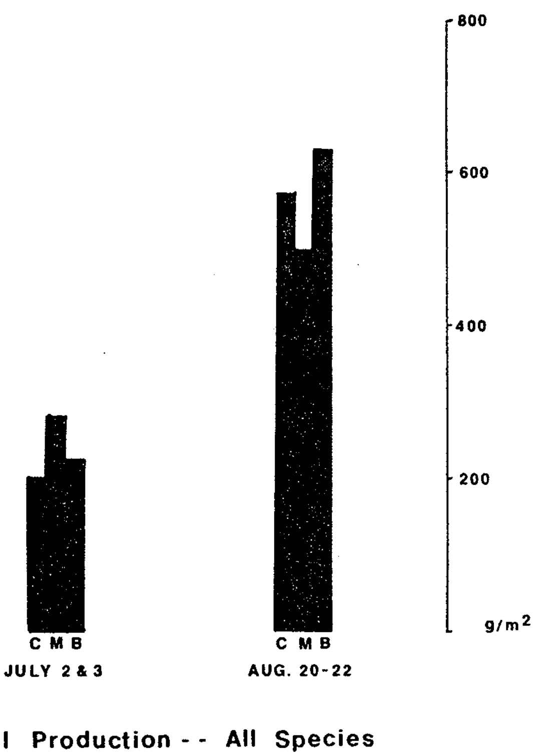

FIG. 2. Biomass, warm season grasses.

By late August, total warm season grass production was greatest on the burned treatment, with 632 g/m². The mowed plot exhibited the lowest production with 501 g/m², and the control was intermediate at 572 g/m². As in July, there was no significant difference between treatments. The mowed plot produced less than the control by late August, despite its larger crop of warm season grasses earlier in the season. Similar situations have been documented in states farther to the west. Ehrenreich and Aikman (1963) in Iowa and Hensel (1923a) in eastern Kansas found that plots that had mulch removed by spring burning showed higher spring and early summer production than unburned plots. During the latter part of the season, however, the unburned plots produced more than the burned, and total production by the end of the year was similar.

In a seven year study in eastern Kansas, Aldous (1934) found that native bluestem grasslands, burned in early spring, produced less total forage than unburned plots or plots that were burned later in spring. These results were attributed to lower soil moisture levels found in the early spring burned plots. The earlier removal of mulch contributed to greater moisture loss due to evapotranspiration and caused a reduction in infiltration of precipitation. This tended to limit growth of prairie grasses in the hot mid-summer months.

Most studies of tallgrass prairies on mesic soils show significant increases in total production of warm season prairie grasses in response to spring burning or mowing (Iowa - Aikman 1955, Hill and Platt 1975; Illinois - Hadley and Kieckhefer 1963, Old 1969; Missouri - Kucera and Ehrenreich 1962; Wisconsin - Brown 1967, Peet et al. 1975). Although other studies report that burning or mowing does not significantly increase production (Iowa - Ehrenreich and Aikman 1963; Kansas - Anderson 1964, Hensel 1923b; Missouri - Ehrenreich 1959), these investigations were conducted in climates more arid than Wisconsin. It is thus surprising to find no significant increase in production from burning or mowing in this study in Wisconsin.

An explanation of this phenomenon may be found in the nature of the soils on the study site. These soils did not develop under prairie, and do not possess the typical deep, rich profile of a prairie soil. The original surveyor's records of 1834 indicate that the study area was vegetated primarily by white and black oaks, with scattered openings (Ellis 1834). The soils are characteristic of those formed under woodland vegetation. The area had also been cropped for many successive decades prior to the planting of warm season grasses, and had experienced considerable erosion. The sandy loam topsoil is only 8 to 20 cm deep, and contains 0.84 to 1.06 percent organic carbon (Walkey Black method; Black 1965). The subsoil is a fine sandy clay loam, and possesses no more than 0.20 percent organic carbon.

Compared to a deep virgin prairie soil rich in organic matter, the soils in the study area have a shallow layer of topsoil and possess a relatively low level of organic matter. They would therefore have a lower nutrient base and less water-holding capacity than a well-developed mesic prairie soil. Almost all of the studies on the behavior of prairie grasses under the influence of burning and mowing have been carried out on native prairies that have never been plowed or cropped. The fact that this study took place on a considerably different soil could account for the failure of burning and mowing to cause significant increases in yields of warm season grasses.

In addition to soil conditions, the weather during the 1980 growing season was not optimal for plant growth. Only 4.5 cm of rain fell in May, 43% below normal. In the second half of May, when both the mow and the burn were exposed to the drying effects of the sun and wind, average daily temperatures were 3.2° C above normal. Precipitation was 21% above normal for June, but dropped back to 43% below normal for July (National Oceanic and Atmospheric Admn. 1980). Under these conditions, removal of mulch from the soil surface may not have been beneficial for plant growth. This could have been an additional factor in the failure of burning and mowing to significantly increase production of prairie grasses.

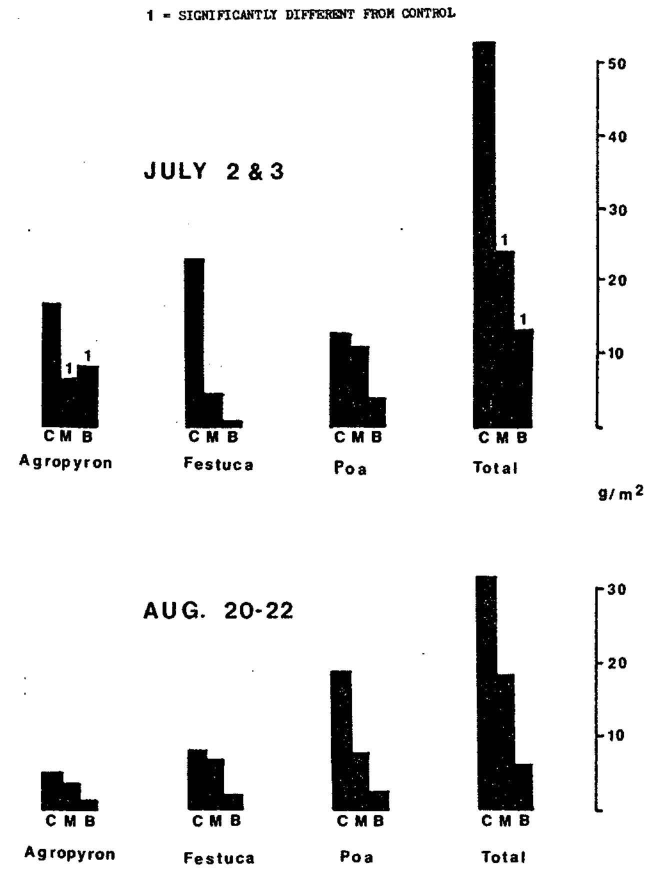

FIG. 3. Biomass, cool season grasses.

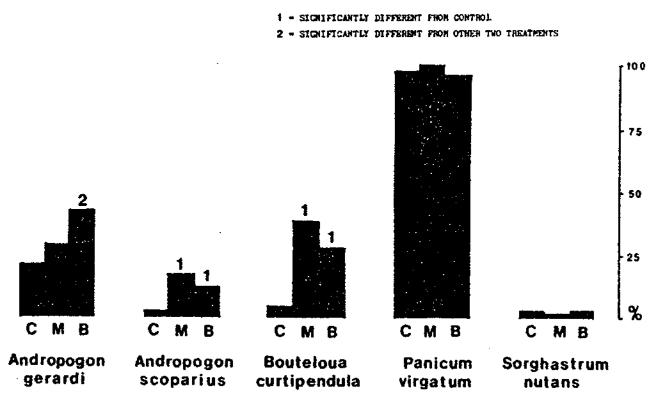

FIG. 4. Frequency, warm season grasses.

The frequency of three warm season grasses appeared to be influenced by the mowing and burning treatments. Big bluestem was significantly more frequent on the burned plot than on the control or mowed plot. Similar results have been documented on eastern Kansas tallgrass prairies (Anderson et al. 1970, Hulbert 1969, McMurphy and Anderson 1965). Little bluestem and side oats grama both exhibited significantly higher frequencies on the burned and mowed plots. Plants of these two species were not well-developed, however, and accounted for only a small percentage of total warm season grass biomass on any treatment. The accumulation of mulch over the years had undoubtedly suppressed

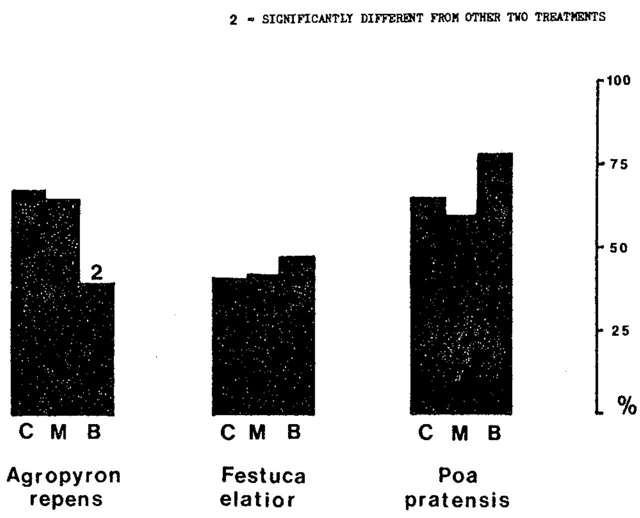

FIG. 5. Frequency, cool season grasses.

these mid-sized grasses (Penfound 1964, Weaver and Fitzpatrick 1934, Weaver and Rowland 1952). Almost no mid-grasses were sampled on the control plot. It seems unlikely that one year of mowing or burning would lead to such large increases in the frequency of any given perennial prairie grass. It is probable that the great majority of the mid-grasses found on the burned and mowed plots were remnants from earlier years, prior to the development of a thick mulch. The paucity of mid-grasses on the control raises the possibility that a large proportion of the plants sampled on the burned and mowed plots may have been in a state of dormancy, and were stimulated to renew growth by the removal of mulch.

Cool Season Grasses

Production of cool season grasses was highest on the control plot for both clipping dates. In early July the control averaged 53 g/m^2 compared to 24 g/m^2 for the mow (55% less) and 13 g/m^2 for the burn (75% less than the control). Analysis of variance showed that both the mowed and burned plots had significantly less production than the control for the July clipping.

Growth of cool season grasses is reduced during the summer in Wisconsin, and much of the spring growth dies back. Late August biomass surveys indicated a drop in total live standing crop on all three plots. Yields were 32, 18, and 6 g/m^2 for the control, mow and burn, respectively. Compared to the control, there was 44% less cool season biomass on the mowed plot and 81% less on the burned plot. Despite these notable reductions, large variations between quadrats obscured any statistical differences between treatments for the August clipping.

Burning reduced total cool season grass production an average of 78% for both dates compared to the control. Mowing averaged a 48% reduction. Burning caused a greater reduction than mowing because of two primary factors:

1. Burning is inherently more effective than mowing at removing above-ground growth. It essentially eliminated all organic material above the soil surface, while mowing left a 5 cm stubble which included some photosynthetic material.
2. Mowing was done on May 1, while burning occurred on May 15. This allowed the cool season grasses on the mowed plot two weeks longer to recover than those on the burn before the plots were sampled in early July.

Lower cool season grass production might be expected if mowing had been done at the same time as burning. The results of this study represent a conservative estimate of the relative effectiveness of mowing compared to burning in the control of exotic cool season grasses.

One method of evaluating the effectiveness of burning or mowing in prairie management is to compare the ratio of warm season to cool season grass production on each treatment. This number provides an index of the relative importance of the two with respect to each other. The ratio of warm season to cool season grasses is of greatest importance in spring and early summer, when cool season grasses are most active and present the most serious competition. Table 1 shows the relative effects of mowing and burning on the composition of the vegetation. Compared to the control, the ratio of warm season to cool season grass production in early July is more than three times higher on the mow and nearly 4 1/2 times higher on the burn. These ratios indicate that the effects of mowing and raking are similar to the effects of fire on the vegetation.

Quackgrass was the only cool season grass to exhibit a significant reduction in biomass due to treatment. Both mowing and burning lowered total production of quackgrass in the early July clipping. Meadow fescue and Kentucky bluegrass also appeared to be reduced by burning and mowing; however, great variability between quadrats resulted in large statistical variances that offset any differences in means between treatments.

Although total biomass production of cool season grasses was reduced by both burning and mowing, the frequency of individual species was practically unaffected by either of these treatments. Burning reduced the frequency of quackgrass, but mowing had no effect on the frequency of any of the cool season grasses. Major reductions in the frequency of any herbaceous perennial grass should not be expected from a single burning or mowing in any given year. Anderson and Bailey (1980) studied the effects of 24 years of spring burning in an Alberta parkland. Burning reduced the percent canopy cover but not the frequency of two major cool season grasses (*Festuca scabrella* and *Stipa spartea* var. *Curtiseta*). The frequency of both species actually increased with regular spring burning. These results show burning suppressed the growth of certain species but did not reduce their frequency. Similarly, cool season exotics cannot be eliminated from prairie plantings by burning or mowing, but their vigor can be reduced by creating conditions more favorable to warm season prairie species.

TABLE 1. Average biomass production by treatment and clipping date.

Clipping Date	Treatment	No. of Quadrants	Grams Dry Wt./M^2 Warm Season Grasses	Cool Season Grasses	Weeds	Total Living	Litter	Ratio of Warm Season to Cool Season Grasses
	Control	10	200.4	52.9	6.5	259.8	931.5	3.8
July 2-3	Mow	10	283.2	24.1	2.9	310.1	146.5	11.7
	Burn	9	223.6	13.2	6.5	243.3	5.8	16.9
	Control	10	572.1	31.8	20.9	624.8	658.7	18.0
August 20-22	Mow	10	500.6	18.4	0.5	519.5	25.6	27.2
	Burn	9	632.0	5.9	0.8	638.7	20.7	107.1

TABLE 2. Frequency of all species sampled on control, mowed and burned plots.

Species	% Frequency		
	Control	Mowed	Burned
Warm Season Grasses:	n=100	n=100	n=100
Andropogon gerardi	21	28	42
Andropogon scoparius	0	17	12
Bouteloua curtipendula	4	38	28
Panicum virgatum	98	100	96
Sorghastrum nutans	2	1	2
Cool Season Grasses:			
Agropyron repens	67	66	39
Dactylis glommerata	4	1	0
Festuca elatior	41	42	47
Poa pratensis	65	59	77
Weeds:			
Acalypha rhomboideus	1	0	0
Ambrosia artemisifolia	3	11	78
Aster sp.	1	3	22
Bromus japonicus	9	24	7
Capsella bursa-pastoris	23	22	31
Cirsium vulgare	3	4	0
Digitaria Ischaemum	0	0	8
Hypericum perforatum	3	0	1
Juncus sp.	0	0	1
Lotus purshianus	0	0	7
Oenothera biennis	2	0	0
Oxalis stricta	10	13	46
Panicum capillare	0	0	2
Polygonum aviculare	1	2	2
Potentilla simplex	1	0	0
Rudbeckia hirta	0	0	2
Setaria lutescens	3	9	37
Solidago sp.	0	2	0
Taraxacum officinale	3	7	26
Trifolium repens	1	6	4

The reduction in quackgrass by burning and mowing found in this study agrees with visual observations made by the author. The effects of burning versus mowing and raking were compared on a different prairie planting at the University of Wisconsin - Green Bay Cofrin Memorial Arboretum. This planting of prairie grasses and forbs was five years old and thoroughly infested with quackgrass. In an attempt to control the quackgrass, part of the planting was mowed to a height of 2-3 cm and raked clean in late April. Another part was burned two days later. A control plot was left unburned and unmowed for comparison. At the time of mowing and burning, quackgrass was 15 to 18 cm high and the warm season prairie grasses had not yet emerged. A few prairie forbs such as yellow coneflower (*Ratibida pinnata*), black-eyed Susan (*Rudbeckia hirta*), and lupine (*Lupinus perennis*) had initiated growth.

By late June, the mowed and burned areas were visually indistinguishable from one another. Many prairie grasses and forbs were growing vigorously on both plots and flowered throughout the summer. Quackgrass regrew to a height of about 15 cm. No flowering culms of quackgrass were present on either the burned or mowed areas. In contrast, quackgrass was the dominant species on the control and flowered profusely. Prairie species were greatly suppressed on the control, and very few flowered that year. The similarity in effect between burning and mowing were striking; the numerical data presented in this paper agree with these observations.

WEEDS

A number of annual, biennial and non-grassy perennial weeds were present in the study plots. In the frequency studies, 15 different species were sampled on the burn, 14 on the control, and 11 on the mow (Table 2). Total weed production was small in all treatments because of the dominance of perennial grasses. Averaging the July and August biomass clippings indicated that weeds accounted for 3.0% of total biomass on the control, 1.4% on the burn, and 0.5% on the mow.

Frequency of weeds was highest on the burn, with 2.7 species-occurrences per quadrat (average number of different species occurring per quadrat). This compared to 1.0 for the mow and 0.6 for the control. The high frequency of weeds on the burned plot was not reflected in biomass production. The disturbance that resulted from burning created an environment that encouraged the proliferation of weeds but did not favor the development of robust individuals. Weed production on the burn was dominated by daisy fleabane (*Erigeron strigosus*) in early July, accounting for 81% of the weedy biomass. This situation changed in late August, when the fleabane had died back and 100% of the measured weedy biomass was produced by warm season annuals: ragweed (*Ambrosia artemisiifolia*), crabgrass (*Digitaria ischaemum*), witchgrass (*Panicum capillare*) and yellow foxtail (*Setaria lutescens*).

The control had the lowest number of species-occurrences per quadrat, but exhibited the highest total weedy biomass. Several large individuals of *Lotus purshianus*, a warm season annual legume native to the Great Plains and adventive in the Midwest, accounted for 45% of the weedy biomass measured on the control in early July, and constituted 96% of the late August measurements.

Frequency of weeds on the mowed plot was more similar to the control than the burned plot (Table 2). Total weedy biomass was lowest on the mowed treatment for both clipping dates (Table 1). Japanese brome (*Bromus japonicus*) was predominant in early July, with 54% of the total. By late August it accounted for 32% of total weed production and was secondary in importance to warm season annuals.

Six weedy species exhibited significant differences in frequency due to treatment. Burning strongly favored ragweed and yellow foxtail. These two species accounted for 89% of the total weedy biomass measured on the burn in late August. Burning also led to significantly higher frequencies of two perennial weeds, yellow weed sorrel (*Oxalis stricta*) and dandelion (*Taraxacum officinale*), and an aster that was found only in the vegetative state and could not be positively identified. None of these three contributed significantly to the total weedy biomass on the burned plot.

The only weedy species to be favored by mowing was Japanese brome. Because it germinates fairly early in the spring, it fared better on the mow than on the burn due to the earlier and less drastic removal of vegetation by mowing. Fire likely destroyed most seedlings and created warmer soil conditions that presumably discouraged further germination.

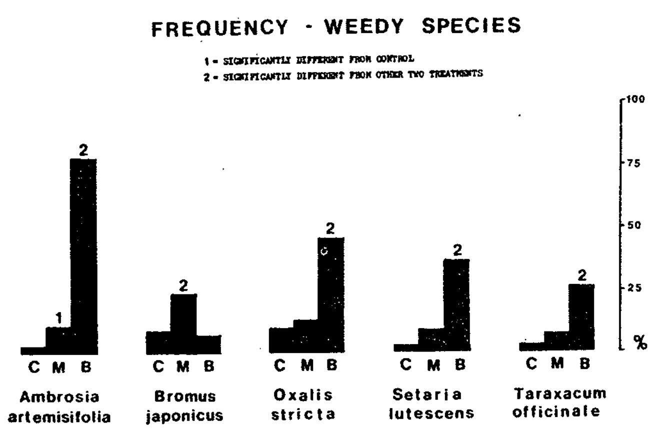

FIG. 6. Frequency, weedy species.

The thick mulch on the control plot apparently inhibited germination of most weeds, resulting in their low frequencies. The light mulch that remained on the mowed plot also reduced soil disturbance compared to the burn, and created less favorable conditions for germination of weed seeds. Other studies have shown that burning results in an increase in the number of weeds, particularly of the genus *Ambrosia* (Curtis and Partch 1948, Hopkins et al. 1948, Nagel 1983). Hensel (1923a) documented that weeds were more abundant on burned plots in the first two years of annual burning in a four year study in eastern Kansas. Weeds declined rapidly on burned plots in the third and fourth years, however, at which time they were found in lower numbers than on unburned plots. (It should be noted that most standing plant material was removed at the end of the growing season in Hensel's study to simulate the effects of grazing, and a thick mulch was not allowed to develop on the unburned plots).

Long-term investigations conducted on Kansas bluestem pastures have also documented that weedy biomass production on late-spring burned plots is lower than that on unburned plots when measured at the end of the growing season (Aldous 1934, Owensby and Anderson 1967). These results are similar to those obtained in this study, in which the end-of-season production of weeds on the control plot was many times that of the burn or mow (Table 1).

It is important to note that the study area in this investigation was dominated by perennial grasses that had developed a thick sod over a six year period. Their monopolization of the soil environment and foliar zone inhibited the development of many large, robust weeds. This is seldom the case, however, in young prairie plantings. The slow-growing native perennials typically do not occupy a large percentage of the soil during the first few years following seeding. Above-ground development of prairie grasses is restricted by annual weeds and cool season grasses, which account for a greater percentage of the total biomass. The mulch layer in a young prairie planting usually does not provide sufficient fuel to carry a fire. In the absence of burning, cool season grasses often attain dominance over prairie species by the second or third year. These early years are critical in determining the future composition of a prairie planting, but management options tend to be limited. In such situations, mowing in middle to late spring can be used to remove mulch and cut back undesirable cool season grasses. Good results can be obtained by using a heavy duty lawnmower, set as low as possible, with a bag attachment to collect the clippings. On large areas, a tractor-mounted rotary chopper can be used to cut standing material and blow it into a wagon for easy removal. This provides the vegetation manager with an alternative to burning to accelerate the growth of warm season prairie species in their early stages of development, and to reduce the accumulation of mulch in mature plantings when the use of fire is not feasible. Mowing also tends to create an environment that is less favorable for germination and growth of weeds compared to burning.

This study represents only one year of data collection, and the results must be viewed as preliminary. Follow-up investigations must be conducted to evaluate the long-term effects of mowing and burning on the vegetation.

ACKNOWLEDGEMENTS

Gratitude is expressed to Dr. David Jowett for his assistance with the statistics, to Dr. Keith White for his constant inspiration, to Cynthia Hypki for her insight and patience, and to Roseann Wallander for her invaluable assistance with data collection and processing.

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