Seeding Date Impact on Production of Three Cool-Season Forage Species Under Flood Irrigation

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IMPACT STATEMENT

Two seeding dates, late spring and early summer, were used to establish three cool-season perennial forage species. Plant and weed densities, as well as forage production were evaluated the year following seeding. This information may help Montana producers in deciding if an alternative seeding date may work on their operation.

SUMMARY

Spring is a busy time for many producers across Montana. Having the ability to spread out seeding dates may help to alleviate some of the stress of the spring workload. Additionally, weed pressure from winter annuals and cool season species is generally lower later in the growing season. However, inadequate moisture and high temperatures and evapotranspiration may limit seed germination and growth. To evaluate the impact of seeding date, two cultivars of three species of perennial cool-season forages were seeded: alfalfa, intermediate or pubescent wheatgrass, and meadow bromegrass. No differences were observed in herbage mass production the year following seeding between the two seeding dates in any of the entries. Plant density was higher on average in the summer-planted versus spring-planted plots. Additionally, no impact of seeding date was observed on weed count. A later seeding date may be a viable option for producers, provided there is adequate moisture, and seeds are not planted too late in the season to avoid frost damage.

INTRODUCTION

In the Northern Great Plains, spring seeding is the most commonly used time for perennial forage establishment. With historically plentiful spring moisture, most producers find it the best time to guarantee adequate stand establishment. However, in recent years, with increases in the number of irrigated acres (MT DNRC, 2008), altering timing of establishment may be a more feasible option.

Planting later in the season offers several advantages: it spreads out the workload, as many producers are very busy in the spring; it often has decreased weed pressure, with summer annuals being more prominent versus cool season annuals and perennials; allows for potential double cropping after an annual crop has been harvested; provides for an extra herbicide application prior to planting; and it can also allow for a "normal" harvest season the following year. There are also some disadvantages to summer seeding, including moisture shortage, which can lead to decreased germination and growth, as well as frost damage that may occur if stands are planted too late.

Previous studies performed many years ago have evaluated the impact of sowing date on stand performance. Blaser et al. (1956) measured the seedling growth rate and stand density of several species of grasses and legumes planted in March or August in Virginia. They found that species had significant effects on plant growth, as well as sowing date, but that species such as alfalfa produced adequate stands when compared to their spring seeded counterparts. Legumes most commonly had higher rates of growth with the later seeding date compared to the cool season grass species entered, likely due to their higher optimum temperature requirements.

Conversely, a study by Buxton and Wedin (1970) conducted in Iowa found that for all species evaluated, summer seeding of perennial forages often resulted in increased presence of weeds, and lower forage production the year following seeding compared to plots that were established in spring, or even established with a companion crop. It should be noted that in this study, the spring plots were hand-weeded during the growing season of the seeding year, likely resulting in lower weed counts and higher plant productivity the following year.

While there have been studies conducted in the past evaluating seeding date and impact on stand performance, many of them are several decades old, and have not been conducted in Montana. Therefore, the objectives of this experiment were to evaluate the impacts of seeding date on flood irrigated fields in southeastern MT, a semi-arid environment. We hypothesized that a later seeding date, coupled with adequate water availability, would not negatively impact stand establishment and production.

PROCEDURES

Plots were established at the NRCS Plant Materials Center in Bridger, MT. The experiment had four replications of each of the plots for both planting dates: a total of twenty-four plots for spring seeded and twenty-four plots for summer seeded. Spring seeded plots were established on June 12, 2015, and the summer seeded were established on July 27, 2015. An application of glyphosate at a rate of 20 oz/ acre was applied to all plots immediately prior to spring seeding, and an additional glyphosate application was placed on the summer seeded plots only immediately prior to planting.

The plot area was irrigated using flood irrigation. Each plot measured 1.8 m x 6 m. The cultivars used included two cultivars of alfalfa (*Medicago sativa* L.), ‘Shaw’ and ‘Cooper’, two cultivars of meadow bromegrass (*Bromus biebersteinii*) ‘Cache’ and ‘Macbeth’, and two cultivars of wheatgrass (*Thinopyrum intermedium*) ‘Manska’ and ‘Oahe’. Two cultivars of sainfoin (*Onobrychis viciifolia*) ‘Shoshone’ and ‘Delaney’ were also planted, but yield data is not included due to heavy wildlife predation concentrated in these plots only. Plots were seeded at a rate of approximately 10 pounds pure live seed per acre for ‘Manska’, ‘Oahe’, and ‘Cache’, 8 pounds pure live seed per acre for ‘Shaw’ and ‘Cooper’, and 30 pounds pure live seed per acre for ‘Delaney’ and ‘Shoshone’.

Plant and weed counts were taken on April 26, 2016 and June 9, 2016. Herbage mass production was evaluated on June 20, 2016 and August 15, 2016. Herbage mass was estimated by harvesting a 3’ wide strip down the middle of each plot. Herbage mass was weighed to obtain fresh weight, then subsamples were taken to determine dry matter percentage. Herbage mass production per plot was then estimated by multiplying the wet weight of herbage mass collected by the percent dry matter.

RESULTS AND DISCUSSION

There was a significant impact of planting date on plant densities ($P = 0.039$; Table 1), with summer planting on average having higher plant counts compared to spring planting. There was no impact of variety, replication, or their interaction on plant count ($P > 0.05$). There was a trend for an effect of variety ($P = 0.052$) and replication ($P = 0.076$) on weed count, but there was no effect of planting date ($P = 0.231$) on weed count.

There was a significant impact of variety, harvest, and the interaction of variety*harvest ($P < 0.001$) on yield. There was no effect of replication ($P = 0.194$) or seeding date ($P = 0.522$) on yield. Harvest 1 had significantly higher yields for all varieties compared to yields in harvest 2.

This data shows that planting later in the season may be a viable alternative, provided there is adequate moisture for seed germination and growth. Similar to Blaser et al. (1956), alfalfa produced the most herbage mass compared to the other cultivars. It was interesting to note that the alfalfa plots also had higher weed counts compared to the other grass entries. This may be due to the fact that even though there was adequate growth, in many of the plots the alfalfa appeared to grow slower initially than the grasses, allowing more room for weed growth.

Table 1. Impact of cultivar on plant and weed densities.

		Plant Count plants/ sq ft		Weed Count plants/ sq ft	
Variety	Species	Spring[a]	Summer[b]	Spring	Summer
Shaw	alfalfa	4.0	3.8	0	0.38
Cooper	alfalfa	3.2	4.2	0.25	0.63
Oahe	wheatgrass	3.4	4.1	0.13	0
Cache	wheatgrass	3.3	3.6	0.13	0
Macbeth	bromegrass	3.2	3.7	0	0
Macbeth + biologic	bromegrass	3.3	3.2	0	0
Manska	bromegrass	2.3	3.7	0	0.25

[a,b] denotes significant effect of planting date

The data is not presented, but plant heights were significantly higher in the wheatgrass plots compared to alfalfa, which may have created a shading effect, decreasing weed pressure as well.

It was interesting to observe that there were no yield differences amongst cultivars for either of the plantings. There was an impact of species and harvest, which is expected based on previous research (Blaser et al., 1956; Rumbaugh et al., 1982; Wichman and Glunk, 2016; Berdahl, et al., 2001). It is known that alfalfa typically produces a majority of its seasonal production in the first harvest, from 30-75% (Caddel, et al., 1981). It is typical for cool-season forages to produce a majority of their herbage mass by early summer and again in the fall, compared to summer harvests due to water availability and the "summer slump". This was evidenced by the difference in harvest yield, from harvest 1 to harvest 2 for all species. An additional fall harvest was not taken in order to avoid any negative impacts on species persistence the following year due to decrease fall root carbohydrate reserves.

More research is needed before recommending a late summer seeding on dryland fields. However, this research demonstrates that under adequate irrigation, or with appropriate moisture timing, late summer planting can be a viable option for MT producers.

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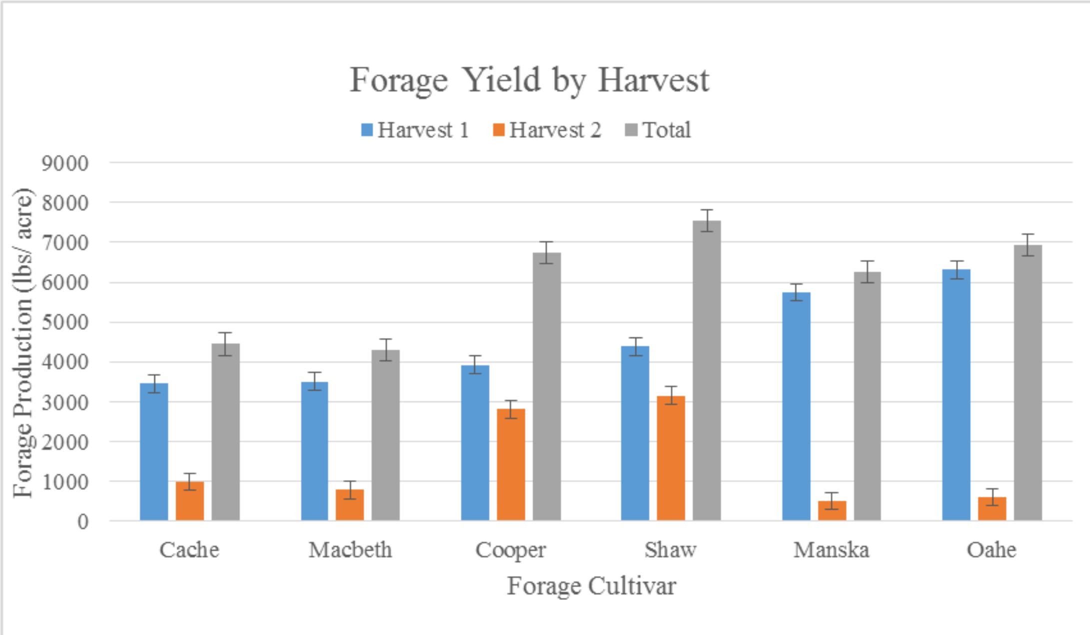

Figure 1. Effect of harvest and cultivar on forage yield production.