SIMULATED GRAZING TIMING AND REGROWTH OF ANNUAL CEREAL FORAGE COVER CROPS

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ABSTRACT

In recent years planting cover crops has grown in popularity. Producers are especially interested in the use of cover crops for grazing livestock and have been experimenting with new ways of grazing annual cover crops using cattle. During a 2017 Western SARE Farmer/Rancher-led project utilizing cover crops in a management intensive grazing scenario, significant regrowth from annual cereal varieties was observed. Based on these observations, a study was designed to evaluate the longevity and regrowth potential of five cereal forage varieties tested at two locations in Idaho. Grazing each variety was simulated using a forage harvester in a series where one set of plots was 'grazed' four times, the next set of plots grazed three times, two times, and once. Forage barley, forage oats, triticale, and winter wheat were planted at 120 lbs. to the acre and Italian annual rye grass was planted at 20 lbs. to the acre. Yield (lbs./acre DM) was measured and analyzed. From our preliminary data, it would appear that season-long grazing is possible with four out of the five varieties tested. This leads us to believe that cereals have much more regrowth potential than what we originally thought. However, further investigation into varieties and how they respond to livestock grazing is needed. In general, forage triticale needs to be grazed before it goes to boot, because once it does, it does not send up new tillers and is done growing for the season. In our study we planted two winter varieties which allowed for the plants to regrow instead of going to boot early in the season. Overall, barley, oats, winter wheat, and Italian ryegrass have the ability to be grazed at least four times throughout the growing season.

Key Words: cover crops, forage cereals, grazing

INTRODUCTION

Many growers are utilizing cover crops in their cropping systems with growing popularity. Because of the versatility of cover crops, growers are also experimenting with grazing cover crops using management intensive grazing. In management intensive grazing scenarios, cover crops are grazed multiple times throughout the growing season and producers are interested in which mix of species have the most longevity and potential for regrowth in this situation. The use of grazing in a cover crop system also provides added value to growers with benefits to soil health and additional income from leasing fields to livestock producers or added feed for their own livestock.

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The economics of grazing cover crops have yet to be clearly defined, but it is known that getting early establishment of fast-growing covers such as cereals and/or brassicas can boost financial return above the cost of cover crop seed (SARE, 2012).

Farmers have learned that using a management intensive grazing system gives them optimum returns on their investment for seed and infrastructure, leading to many months of continual grazing compared with a conventional grazing system that may only be grazed twice during a season. This has led to increased interest in utilizing forage cereal varieties that respond well to grazing and will continue to produce when being grazed multiple times throughout a growing season.

The varieties examined in this study are commonly recommended in cover crop mixes, but no publication to-date has discussed their longevity or regrowth potential at length. In a 2016 publication by the University of Idaho, the varying maturity rates of barley, triticale, and winter wheat were discussed, noting that Willow Creek winter wheat matured later than triticale and barley (Golden et al., 2016). The barley used in this study was a forage barley, which was used in the 2017 producer study where increased regrowth potential was observed. Additionally, cover crop grazing studies in North Dakota and Idaho have observed positive yields when using forage oats (planted at 15 lbs./acre) in a grazing mix (Brummer et al., 2015; Finkelnburg et al., 2016). Including oats and triticale also keeps the cost of mixes down as they can make up a large percentage of the mix while also providing high yielding production and cover.

The goal of this study was to determine which forage cereal varieties are best suited for intensive grazing and what potential they have for regrowth. The ultimate outcome will be to provide this information to producers. Producers will be able to use this information to make decisions about what cereal forage varieties would be best to incorporate into their seed mixes when using cover crops as a feed source for livestock.

METHODS

In spring 2018, the research team planted 5 varieties of forage cereals to determine the potential regrowth and longevity of cereals that may be used as part of a cover crop mix. The varieties investigated were: forage barley, forage oats, triticale, winter wheat, and Italian annual rye grass. During the two-year study, planting occurred in Kimberly, ID on April 8, 2018 and April 9, 2019 and in Salmon, ID on May 1, 2018 and May 1, 2019. Plots were planted using a small plot 5' drill with 5" row spacing. Forage barley, forage oats, triticale, and winter wheat were planted at 120 lbs. to the acre and Italian annual rye grass was planted at 20 lbs. to the acre. Grazing of each variety was simulated using a forage harvester in a series where one set of plots was grazed four times (4X), the next set of plots grazed three times (3X), two times (2X) and once (1X). Harvest dates per location are displayed in Table 1. For each year and location, yields collected at each harvest and total yield (lbs./acre DM) for each variety within a grazing treatment were calculated. A mixed model was used to assess the effects of variety, harvest, year, and location on yield. All analyses were carried out using SAS 9.4.

This simulated grazing design demonstrated how grazing at different stages of maturity effected the regrowth and longevity of the cereal forages. The idea for this study came from input from

specialists, statewide stakeholders, and results from a research project at the Purdy Ranch in Picabo, Idaho. As technical advisors of a WSARE project on management intensive grazing of cover crops, our team made observations of significant regrowth from cereal varieties throughout the growing season. Observations were made by the operator of the field that they were able to intensively graze the cereal varieties up to 4 times without damaging the plants.

DISCUSSION

The objective of this study was to determine which varieties had the longevity and regrowth potential to best provide forage for season-long grazing. The four-time grazing strategy was the most similar to repeated season-long grazing, where harvests occurred approximately every 25 – 30 days. From our data, it would appear four of the five varieties tested were able to be harvested 4 times (Table 2). Forage barley, forage oats, winter wheat, and Italian ryegrass had harvestable forage at all four cuttings. On the contrary, triticale did not have harvestable forage by the fourth cutting in either year or location. Because the triticale was reproductive by its second and third harvest, its' ability to regrow may have been reduced.

There were no effects ($P > 0.05$) of location or year on harvest yields within each variety (Table 2). However, the 4th cutting and total yield for 4X were affected by year ($P \leq 0.046$; Table 3), where each of the five varieties produced greater 4th cutting yields and total yields, regardless of location, in 2018 than 2019. The two varieties that stood out to have the most consistent forage production throughout the entire growing season for 4X were forage barley and forage oats. While the other three varieties were slow to come on (winter wheat and rye grass) or peaked and dropped off early (triticale), both barley and oats had harvestable forage at the 1st through the 4th cuttings. As would be expected, both varieties peaked during the warm summer months at the 2nd and 3rd cuttings and became reproductive, but unlike triticale, their reproductive growth that did not hinder their ability to regrow. While the 4th cutting yield and total yield for barley and oats in 2018 were both greater ($P = 0.046$) than in 2019, there was no difference ($P > 0.05$) between the two varieties at any of the harvests or total yield in either year (Table 3).

Italian ryegrass was among the greatest total yield (5,257 lbs./acre DM) for 4X production in 2018 and fell in the middle for total production in 2019 (3,677 lbs./acre DM; Table 3). However, it should be noted that it also had one of the lowest 1st cutting yields of only 186 lbs./acre DM production. As the season progressed, the Italian ryegrass seemed to catch up and yielded 1,098 lbs./acre DM at the 2nd cutting, a 3rd cutting yield of 2,376 lbs./acre DM, and 978 and 636 lbs./acre DM in 2018 and 2019, respectively. Overall, Italian ryegrass seemed to be a good option due to its' potential for season-long growth but may take longer than the other varieties to come on. While the Italian ryegrass used in this study was not supposed to become reproductive in the first year, we observed that a certain percentage of each ryegrass plot had grown seed heads when not grazed/cut.

Triticale was the only variety tested that was not able to produce harvestable forage when harvested four times. Though triticale had the greatest yield during the second cutting, it sharply declined thereafter. As the triticale went reproductive prior to the second harvest, its' energy

stores for regrowth were likely depleted, resulting in a lower 3rd cutting yield and no yield for the 4th cutting after it stopped growing.

In this study, we also planted a winter variety of wheat in the spring. The winter wheat was able to regrow without going to boot early in the season. The addition of winter wheat into cover crop mixes is common throughout Idaho for similar reasons. Winter wheat performed similarly to Italian ryegrass in this study, where it had a low 1st cutting yield; however, it performed well as the season progressed and was still able to have harvestable forage by the 4th cutting (Table 3).

From the 4X plot data, it can be discerned that forage barley and forage oats have the most consistent growth season-long, and the greatest potential for regrowth in a management-intensive grazing situation. While Italian ryegrass and winter wheat had low yields early on in the season, oats and barley had some of the greatest yields throughout all four cuttings. However, while winter wheat and Italian ryegrass came on more slowly than barley and oats, their consistent 2nd, 3rd, 4th, and total yields made them competitive options when grazing takes place later in the growing season. It is unclear what caused winter wheat to perform so poorly at the 4th cutting and total yield in 2019 (Table 3). While grazing later in the season may fit for some producers, others may be interested in cover crops as a means to increase early grazing days. Triticale also had a low potential for season-long growth because it tended to go reproductive early in the season, depleting its energy stores for later growth. However, a note of thought would be to combine triticale and Italian ryegrass or winter wheat, as the triticale could contribute high yields early in the season followed by later season production from Italian ryegrass or winter wheat.

In the plots that were harvested three times at 35 – 40 day intervals, the yields across varieties differed ($P \leq 0.03$) by location for each of the three harvests (Table 3). The greatest ($P \leq 0.023$) yields were observed with forage oats and triticale in Salmon at the 1st and 2nd cuttings, but oats dropped off at the 3rd cutting and there was no harvestable forage for triticale at the 3rd cutting. A similar result was observed in Kimberly for triticale; however, the forage oats remained productive at the 3rd cutting in Kimberly. Italian ryegrass had measurable yield at all three cuttings at both locations. It came on slower in Kimberly, but had consistently high yields at each of the three cuttings in Salmon. Winter wheat came on more quickly but dropped off earlier in Salmon compared with Kimberly. Similar to 4X, both winter wheat and ryegrass took longer to come on and triticale dropped off after the 2nd cutting, in both locations. Across harvest dates, forage oats had the most consistent yield and regrowth potential ($P > 0.05$; Table 2) and had the greatest ($P = 0.050$) total yield for 3X (5,795 lbs./acre DM).

Similar to a typical haying scenario, our 2X plots were harvested approximately every 60 days. The greatest ($P = 0.004$) yielding variety was forage oats (8,471 lbs./acre DM), followed by triticale (7,354 lbs./acre DM; Table 3). Because winter wheat and forage barley were winter varieties planted in the spring, it was expected that they would have lower yields, especially since they are not typical varieties used for hay. Forage barley and Italian ryegrass both yielded over 5,000 lbs./acre DM, and winter wheat, while producing the lowest ($P = 0.004$) yield still produced 3,097 lbs./acre DM when grazed twice.

Finally, the 1X plots were harvested once after approximately 75 days of growth. Triticale was the greatest ($P < 0.001$) yielding forage cereal variety, as would be expected because it is commonly used for hay production (Table 3). Forage oats yielded of 4,208 lbs./acre, DM. Forage barley, Italian ryegrass, and winter wheat had the lowest ($P < 0.001$) yields but would still provide adequate forage for at least one grazing event (Table 3).

CONCLUSION

This project has demonstrated that forage barley and forage oats have the greatest potential to provide consistent season-long grazing when grazed four times. However, triticale would not be recommended in a management-intensive grazing scenario because it does not provide measurable yields later into the season. However, triticale may be the best option of the five if being grazed only twice. Italian ryegrass and winter wheat took longer to get established but were then able to produce forage throughout the season. We recommend planting forage barley or forage oats as the sole forage cereal variety in a mix, or mixing triticale with Italian ryegrass or winter wheat for best yield potential and longevity. Overall, these data may help producers to make decisions on what varieties would work best in cover crop mixes that meet their specific grazing goals.

CITATIONS

Brummer, F., K. Sedivec, P. Nester, E. Gaugler, and C. Schaunaman. 2015. Annual cover crop options for grazing and haying in the northern plains. North Dakota Extension Service, Bulletin R1759.

Finkelnburg, D., K. Hart, and J. Church. 2016. Cover Crops demonstration project in North Central Idaho. Journal of NACAA, ISSN 2158-9429, Volume 9, Issue 1.

Golden, L., J. Hogge, S. Hines, J. Packham, and C. Falen. 2016. Cover Crops for Grazing Use in Idaho. University of Idaho Extension, Bulletin 901.

SARE. 2012. *When cover crops are grazed*. SARE Learning Center Bulletins. https://www.sare.org/Learning-Center/Bulletins/Cover-Crop-Economics/Text-Version-of-Cover-Crop-Economics/An-In-Depth-Look-at-Management-Situations-Where-Cover-Crops-Pay-Off-Faster/When-Cover-Crops-are-Grazed

RESULTS

Table 1. Harvest dates at Kimberly, ID and Salmon, ID occurring May – September in 2018 and 2019.

Kimberly				Salmon			
2018		2019		2018		2019	
Harvest #	Date	Harvest #	Date	Harvest #	Date	Harvest #	Date
4X - 1	31-May	*4X - 1*	3-Jun	*4X - 1*	14-Jun	*4X - 1*	27-Jun
4X - 2	26-Jun	*4X - 2*	1-Jul	*4X - 2*	12-Jul	*4X - 2*	24-Jul
4X - 3	24-Jul	*4X - 3*	29-Jul	*4X - 3*	9-Aug	*4X - 3*	21-Aug
4X - 4	21-Aug	*4X - 4*	26-Aug	*4X - 4*	6-Sep	*4X - 4*	18-Sep
3X - 1	5-Jun	*3X - 1*	13-Jun	*3X - 1*	27-Jun	*3X - 1*	8-Jul
3X - 2	10-Jul	*3X - 2*	18-Jul	*3X - 2*	1-Aug	*3X - 2*	12-Aug
3X - 3	14-Aug	*3X - 3*	22-Aug	*3X - 3*	5-Sep	*3X - 3*	16-Sep-19
2X - 1	14-Jun	*2X - 1*	20-Jun	*2X - 1*	2-Jul	*2X - 1*	15-Jul-19
2x - 2	13-Aug	*2x - 2*	19-Aug	*2x - 2*	3-Sep	*2x - 2*	17-Sep-19
1X - 1	26-Jun	*1X - 1*	1-Jul	*1X - 1*	17-Jul	*1X - 1*	24-Jul-19

Table 2. Least squares means of forage yields (lbs/acre DM) within each cereal variety harvested a different number of times in Kimberly, Idaho and Salmon, Idaho in 2018 and 2019[1].

	Number of Times Harvested											
	1X	2X		3X			4X					*P*-Value
Variety	1st	1st	2nd	1st	2nd	3rd	1st	2nd	3rd	4th	SEM	Harvest
Forage Barley	1,874	1,876[b]	3,748[a]	990[a]	2,084[a]	1,354[a]	538[b]	1,317[ab]	2,435[a]	477[b]	432.3	**0.006**
Forage Oats	4,208	3,591[a]	4,880[a]	1,762[a]	2,844[a]	1,010[a]	473[b]	1,878[a]	1,937[a]	459[b]	464.8	**<0.001**
Triticale	5,489	3,654	3,700	1,761[a]	2,293[a]	73[b]	695[bc]	2,431[a]	1,167[b]	0[c]	295.2	**<0.001**
Winter Wheat	1,746	1,343	1,754	763	1,245	1,713	255	1,182	1,978	510	365.3	0.069
Italian Ryegrass	2,424	1,448[b]	3,661[a]	714[b]	1,827[a]	1,951[a]	186[b]	1,098[b]	2,376[a]	807[b]	519.7	**0.001**

[1]Year*Harvest and Location*Harvest for each variety were not significant ($P > 0.05$)

[a-c]Means differ within number of times harvested ($P \leq 0.05$).

Table 3. Least squares means of forage cereal variety yields (lbs/acre DM) compared across each harvest within different number of times harvested in Kimberly, Idaho and Salmon, Idaho in 2018 and 2019.

Number of Times Harvested	Variety										SEM	*P*-Values		
	Forage Barley		Forage Oats		Triticale		Winter Wheat		Italian Ryegrass			Variety	Variety* Year	Variety* Location
1X	1,874^{c}		4,208^{b}		5,489^{a}		1,746^{c}		2,414^{c}		229.0	**<0.001**	0.094	0.085
2X														
1st	1,876^{b}		3,591^{a}		3,654^{a}		1,343^{b}		1,448^{b}		301.1	**0.006**	0.646	0.185
2nd	3,748^{ab}		4,880^{a}		3,700^{b}		1,754^{c}		3,661^{b}		324.4	**0.009**	0.072	0.273
Total Yield	**5,624^{bc}**		**8,471^{a}**		**7,354^{ab}**		**3,097^{d}**		**5,109^{c}**		502.9	**0.004**	0.576	0.189
3X														
Location	*Salmon*	*Kimberly*	*Salmon*	*Kimberly*	*Salmon*	*Kimberly*	*Salmon*	*Kimberly*	*Salmon*	*Kimberly*				
1st	1,051^{cd}	929^{cd}	2,425^{a}	1,099^{cd}	1,848^{abc}	1,673^{bc}	1,055^{c}	471^{d}	1,193^{c}	235^{d}	206.3	0.008	0.081	**0.025**
2nd	1,620^{bc}	2,547^{b}	3,871^{a}	1,817^{bc}	2,913^{ab}	2,420^{bc}	1,374^{c}	1,117^{c}	2,522^{b}	1,132^{c}	299.1	0.023	0.500	**0.013**
3rd	1,306^{b}	1,404^{b}	483^{bcd}	1,536^{ab}	0^{d}	146^{cd}	764^{bcd}	2,664^{a}	1,286^{bc}	2,615^{a}	322.2	0.012	0.809	**0.033**
Total Yield	**4,142^{b}**		**5,795^{a}**		**4,368^{b}**		**3,990^{b}**		**4,459^{b}**		314.8	**0.050**	0.500	0.071
4X														
1st	538^{ab}		473^{abc}		695^{a}		255^{bc}		186^{c}		86.0	**0.040**	0.157	0.512
2nd	1,317		1,878		2,431		1,182		1,098		550.4	0.466	0.983	0.805
3rd	2,435		1,937		1,167		1,978		2,376		852.9	0.833	0.503	0.457
Year	*2018*	*2019*	*2018*	*2019*	*2018*	*2019*	*2018*	*2019*	*2018*	*2019*				
4th	706^{a}	249^{cd}	673^{abc}	246^{cd}	0^{d}	0^{d}	724^{a}	296^{bcd}	978^{a}	636^{abc}	111.4	0.007	**0.041**	0.140
Total Yield	**5,880^{a}**	**3,655^{b}**	**5,504^{ab}**	**3,991^{abc}**	**4,737^{ab}**	**3,850^{bc}**	**5,111^{ab}**	**2,738^{c}**	**5,257^{ab}**	**3,677^{bc}**	554.1	0.575	**0.046**	0.363

$^{a-d}$Means differ across varieties for each harvest within number of times harvested ($P \leq 0.05$).