Research Report

Clipping small grains to increase subsequent grain yield

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Summary

Wheat is commonly grown as a dual purpose crop especially in the Southern Great Plains where the forage is grazed then allowed to mature into a grain crop. In Arizona, clipping a crop planted in October may increase tillering and grain yield. A trial was conducted at the Maricopa Ag Center where various small grain varieties were planted on October 12, 2015, cut for forage on January 10, 2016, and allowed to go to grain and compared with the same varieties planted on December 3, 2016 and not cut for forage. No differences in grain yield due to planting date and clipping were detected. However, the October 12 planting with clipping had larger kernels, greater grain protein, and higher stem density. The income from the sale of the forage was $99/acre based a yield of 2639 lb/acre and a forage value of $75/ton. The added cost per acre to produce this forage included $29 for water (6.27 inches water at $55/acre-ft) plus $34 for fertilizer (50 lb N/acre of urea at $433/ton). Therefore, even though grain yield was not increased by planting early and clipping, a net increase in revenue of $36/acre was realized from the sale of the forage.

Introduction

Wheat is commonly grown as a dual purpose crop especially in the Southern Great Plains where the forage is grazed then allowed to mature into a grain crop. Grazing can be detrimental to the subsequent grain crop if extended past the early jointing stage where the growing point is above ground. However, if properly managed, grazing may have negligible effect on subsequent grain yield or actually increase grain yield in the case of tall cultivars where lodging is reduced (Redmon et al., 1995). The advantage of a dual purpose crop is that forage can be harvested from the crop and grain yields maintained so that there can be a net revenue increase to the farmer. Also, the idea that clipping can increase grain yield is intriguing. We do not know how clipping spring wheat or barley in Arizona will compare to winter wheat in the Southern Great Plains. We hypothesize that clipping will increase tillering of the crop and potentially increase grain yield.

Procedure

A trial testing the effect of clipping on wheat and barley was established at the Maricopa Ag Center. The field was fallow the previous year and the soil texture is a sandy loam. Soil chemical properties from a sample taken before planting are listed in Table 1. Mono-ammonium phosphate (11-52-0) was applied preplant at a rate of 100 lb fertilizer/acre providing 11 lb N/acre and 52 lb P_2O_5/acre. Durum and barley varieties were planted in 40 ft x 720 ft strips separated by a 6.67 ft borders in benches 1-4 of Field 33. The seed was planted with a Great Plains grain drill with 7.5 inch spacing between rows. The seeding rate was approximately 150 lb/acre for the durum and 120 lb/acre for the barley. The experimental design was a randomized complete block with 2 planting dates (October 16 and December 3, 2015) and 6 varieties (Durum: Duraking, Kronos, WB-Mead, and Westmore, Barley: Baretta and Nebula), and 4 replications. Irrigation and fertilization dates are provided in Table 2. The field was sampled for forage yield on December 10 and growth stage was noted. Plant height and growth stage were noted on December 16. The entire area planted on October 12 was cut for forage by a commercial forage harvester on January 10, and forage yield averaged 2639 lb/acre on a dry matter basis at this time. Regrowth after the clipping on January 10 was noted on January 15 and February 8. The following data was collected for all plots: grain yield, test weight, seed weight, plant height, lodging, heading, flowering, physiological maturity, grain protein, HVAC, and stem density. Grain was harvested with a commercial combine on June 17 and yields are expressed on an "as is" moisture basis. Test weight was calculated from the weight of 1 pint of grain. Seed weight was determined from 200 seed. HVAC was determined from 10 g of seed. Grain protein was determined from total N multiplied by 6.25 for barley and 5.7 for durum and expressed on a 12% moisture basis. Physiological maturity is defined as when the glumes turn brown.

Results and Discussion

Forage yield for the October 12 planting averaged 1892 lb/acre on December 10 (Table 3). No yield differences were detected due to variety. The crop was between the 5-leaf and 1-node stages when sampled on December 10. On December 16, the crop was at the 7-leaf to 2-node stage and plant height varied from 12 to 18 inches depending on the variety. A commercial forage harvester cut the entire plots of the October 12 planting on January 10, and the overall yield for all varieties was 2639 lb/acre. The regrowth rating on January 15 was weakly correlated with eventual grain yield.

Grain yield was not increased by planting on October 12 and clipping on January 10 compared to a December 3 sowing with no clipping (Table 4). However, the October 12 planting had larger kernels, higher grain protein, and higher stem density. The higher stem density and larger kernels did not translate into higher grain yield. The October 12 planting was also earlier in heading, flowering, and physiological maturity by a little over 2 weeks compared to the December 3 planting.

The varieties differed in grain yield and other characteristics, but we were most interested in the interaction between variety and planting date. Variety by planting date interaction was not detected for grain yield, but was for test weight, lodging, and grain protein. The variety by planting date interaction was mainly driven by the difference in response of the barley and durum varieties to planting date. The barley varieties had higher test weight at the October 12 planting, but the test weight of the durum varieties was similar regardless of planting date. Barley lodged the least at the October 12 planting whereas durum lodged the most at this planting time. The durum varieties were about a percentage point higher in grain protein at the October 12 planting while the difference in grain protein between planting dates was not as great for the barley varieties.

In this study, we had another 6.27 inches of water in two irrigations and 50 lb N/acre invested in the October 12 planting compared to the December 3 planting. On commercial farms, the forage crop would require two irrigations as we did at the Ag Center, but one less irrigation would be required for the grain crop since the October 12 planting that was clipped matured about 2 weeks earlier than the planting on December 3 that was not clipped. The net result on commercial farms would be an additional irrigation of about 6 inches and at least 50 lb N/acre for planting small grains early, clipping, and then allowing the crop to go to grain.

In this study, the cost of the extra water 6.27 inches of water in the Maricopa-Stanfield Irrigation District is about $29/acre (assuming $55/acre-ft) and the cost of the extra fertilizer is about $34/acre (assuming urea at $433/ton) for a total extra cost of $63/acre. The income from the sale of the forage was $99/acre assuming a yield of 2639 lb/acre and a forage value of $75/ton. Therefore, even though grain yield was not increased by planting early and clipping, a net increase in revenue of $36/acre was realized from the sale of the forage.

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Reference

Redmon, L. A., G. W. Horn, E. G. Krenzer Jr., and D. J. Bernardo. 1995. A review of livestock grazing and wheat grain yield: Boom or bust? Agron. J. 87:137-147.

Table 1. Soil chemical analysis preplant for a small grain clipping trial at the Maricopa Ag Center, 2016.

Chemical measurement	Unit	Value	Unit	Value
Total Exchange Capacity	(meq/100 g)	22.46	---	---
pH	(pH)	8.2	---	---
Organic Matter	(%)	0.99	---	---
Estimated Nitrogen Release	(lb N/acre)	40	---	---
NO_3-N	(ppm)	65.3	---	---
NH_4-N	(ppm)	8.9	---	---
S	(mg/kg)	46	---	---
P	(mg/kg)	11	---	---
Ca	(mg/kg)	3320	(%)	73.91
Mg	(mg/kg)	292	(%)	10.83
K	(mg/kg)	557	(%)	6.36
Na	(mg/kg)	294	(%)	5.69
Fe	(mg/kg)	5	---	---
Mn	(mg/kg)	10	---	---
Cu	(mg/kg)	2.11	---	---
Zn	(mg/kg)	1.74	---	---

Table 2. Irrigation and fertilization schedule for the October 12 and December 3 plantings for a small grain clipping trial at the Maricopa Ag Center, 2016.

October 12 Planting			December 3 Planting		
Date	Irrigation	Fertilizer	Date	Irrigation	Fertilizer
	inches	lb N/acre		inches	lb N/acre
10/12/15	3.40	11			11
11/10/15	4.12	50			
			12/03/15	6.09	
01/15/16	4.85				
02/09/16	3.88	100	02/09/16	3.88	100
03/03/16	3.85	50	03/03/16	3.85	50
03/16/16	3.39	50	03/16/16	3.39	50
04/01/16	4.90	25	04/01/16	4.90	25
04/12/16	3.26		04/12/16	3.26	
04/22/16	3.99		04/22/16	3.99	
Sum	35.63	286	Sum	29.36	236

Table 3. Forage yield sampled on December 10, 2015 and other crop characteristics for various small grain varieties planted on October 12, 2015 in a small grain clipping trial at the Maricopa Ag Center, 2016. The entire field was cut on January 10, 2016 at the pre-boot stage and yield averaged 2639 lb/acre on a dry matter basis at this time.

Crop	variety	12/10 Forage yield (dry basis)	12/10 Growth stage	12/16 Plant height	12/16 Growth stage	1/15 Regrowth rating	2/8 Regrowth rating
	---			inches		1-10	1-10
Barley	Baretta	1557	1-node	12	2-node	4	10
	Nebula	2013	5-leaf	16	1-node	3	10
Durum	Duraking	1783	6-leaf	16	8-leaf	7	10
	Kronos	2108	1-node	18	2-node	4	9
	WB-Mead	1776	6-leaf	16	7-leaf	9	10
	Westmore	2116	1-node	18	2-node	5	10
Barley	Avg	1785	---	14	---	4	10
Durum		1946	---	17	---	6	10
Avg	Avg	1892	---	16	---	5	10
$LSD_{.05}$		ns	---	---	---	2	ns
CV(%)		22.5	---	---	---	19.0	4.2

Table 4. Grain yield and other crop characteristics for a trial comparing various small grain varieties planted on October 12, 2015, cut for forage on January 10, 2016, and allowed to go to a grain crop thereafter with the same varieties planted on December 3, 2016 and not cut for forage in a small grain clipping trial at the Maricopa Ag Center, 2016.

Planting date	Crop	Variety	Grain yield	Test weight	Kernel weight	Plant height	5/6 Lodg-ing	6/13 Lodg-ing	Head-ing	Flower-ing	Matur-ity	HVAC	Protein	Stems
			lb/a	lb/bu	mg	in	%	%				%	%	per ft^2
Oct 12	Barley	Baretta	5873	49.2	42.7	29	3	3	2/24	2/26	4/04	---	13.1	72.4
		Nebula	4882	50.8	46.7	34	0	20	2/29	3/01	4/13	---	13.4	66.8
	Durum	Duraking	5266	59.8	42.1	35	55	60	3/06	3/12	4/28	99	14.7	71.9
		Kronos	4544	58.7	49.7	36	75	90	2/28	3/06	4/22	100	15.3	68.7
		WB-Mead	5423	60.5	45.6	34	10	28	3/06	3/11	4/25	100	15.2	63.9
		Westmore	3528	58.1	36.5	32	70	80	3/07	3/13	4/25	100	16.0	89.2
Dec 3	Barley	Baretta	4215	43.5	32.7	23	50	60	3/19	3/21	5/04	---	12.6	48.3
		Nebula	4173	47.2	39.4	26	20	43	3/17	3/19	5/04	---	13.2	56.3
	Durum	Duraking	5658	59.6	38.1	24	10	10	3/18	3/26	5/04	100	13.7	66.7
		Kronos	4743	60.0	47.7	31	73	75	3/12	3/19	5/06	99	14.4	59.9
		WB-Mead	4879	59.3	42.5	34	20	20	3/22	3/30	5/06	100	14.2	73.2
		Westmore	4334	60.1	39.0	32	65	70	3/16	3/22	5/06	100	15.3	68.7
Avg	Barley	Baretta	5044	46.3	37.7	26	26	31	3/07	3/09	4/19	---	12.9	60.3
		Nebula	4527	49.0	43.1	30	10	31	3/08	3/10	4/23	---	13.3	61.5
	Durum	Duraking	5462	59.7	40.1	30	33	35	3/12	3/19	5/01	100	14.2	69.3
		Kronos	4643	59.3	48.7	34	74	83	3/05	3/12	4/29	100	14.9	64.3
		WB-Mead	5151	59.9	44.1	34	15	24	3/14	3/20	4/30	100	14.7	68.5
		Westmore	3931	59.1	37.8	32	68	75	3/11	3/17	4/30	100	15.6	78.9
Oct 12	Avg	Avg	4919	56.2	43.9	33	36	47	3/02	3/06	4/19	100	14.6	72.2
Dec 3			4667	55.0	39.9	28	40	46	3/17	3/22	5/05	100	13.9	62.2
Avg	Avg	Avg	4790	55.6	41.9	31	38	46	3/09	3/14	4/27	100	14.3	67.1
$LSD_{.05}$			1241	3.0	6.1	---	28	26	---	---	---	0.6	0.9	18.9
CV(%)			18.0	3.7	10.0	---	51.8	39.3	---	---	---	0.4	4.2	19.6
Planting date (P)			ns	ns	**	---	ns	ns	---	---	---	ns	**	*
Variety (V)			*	**	**	---	**	**	---	---	---	ns	**	ns
P*V			ns	**	ns	---	**	**	---	---	---	ns	**	ns