Fall Harvesting Alfalfa: Impact on Plant Density, Yield, and Quality

by Marisol Berti, Dwain Meyer, and Robert Nudell, North Dakota State University

INTRODUCTION

Fall harvesting alfalfa has been questioned in the past by producers in the northern United States. Many producers do not fall harvest because they are afraid that it will increase winterkill, especially on new stands. Previous work at Fargo, ND, suggested that alfalfa could be harvested in the fall 'when ready' (alfalfa regrowth under the canopy is 2-3" in height). The objective of this research was to determine the feasibility of a fall harvest 'when ready' and its effects on stand, yield, and quality of alfalfa.

PROCEDURES

Three experiments were planted in Fargo, ND. Experiment 1 was seeded May 18, 2004 (AmeriStand 201+Z and WSI 3.0); experiment 2 was seeded May 5, 2005 (AmeriStand 201+Z); and experiment 3 was seeded March 30, 2007 (DKA34-17RR); to beat the injunction placed on Roundup Ready[®] alfalfa. All experiments were seeded at 13 lb/ac with a double-disc-opener drill. Plots were 5' x 22' while harvest area was 38" x 18' in Experiment 2, 10' x 40' in Experiment 1, and 5' x 40' in Experiment 3. All experiments were designed as randomized complete blocks.

Experiments 1 and 3 had two treatments: a 3-cut system with no fall harvest and a 4-cut system with a fall harvest 'when ready.' Only two harvests were taken in the seeding year, one at 30% bloom and another in the fall 'when ready.' In years 1-4 of production, the 3-cut system was harvested at 26", late bud, and 30% bloom, and the 4-cut system had an additional harvest in the fall 'when ready.'

Experiment 2 had five treatments: T1, a 4-cut system harvested at 26", late bud, 30% bloom, and 50% bloom for the 1st, 2nd, 3rd, and 4th cuts, respectively; T2, a 3-cut system harvested at 26", late bud, and 30% bloom; T3, a 3-cut system harvested at mid-bud, 10% bloom, and 30% bloom; T4, a 4 cut-system harvested at 26", late bud, 30% bloom, and killing frost; and T5, a 4 cut-system harvested at 26", late bud, 30% bloom, and 'when ready.'

Forage yield was harvested with a Carter Flail harvester. Forage yield for Experiment 1 is reported for 2005 through 2008; Experiment 2 for 2006 through 2009; and Experiment 3 for 2008 and 2009. In 2009, the 4th harvest was not harvested for Experiment 2, because the season was cooler than usual and plants where not 'ready' for harvest in the fall. Fourth harvest for Experiment 3 was taken after killing frost on October 19, 2009.

RESULTS

Forage yield. Results indicate that a 4-cut system, including a fall harvest,

had significantly greater total forage yield in the first through third year of production. In Experiment 1, forage yield was significantly higher in the first (2005) and second (2006) year of production (Table 1).

In year one of Experiment 2, only T1, a 4-cut system, had greater forage yields than other treatments with no fall harvest, T2 and T3 (Table 2). The first and third year of production, all 4-cut systems (T1, T4, and T5) were significantly greater in forage yield than the 3-cut systems (T2 and T3). In 2009, since the 4th cut was not harvested, total forage yield was not different among treatments (Table 3), but tended to be greater in the 3-cut systems. The 4-year average forage yield for fall harvest treatments T1, T4, and T5 was 6.12, 6.19, and 6.00 tons/ac, respectively; while forage yields were 5.69 and 5.55 tons/ac for T2 and T3, respectively.

In Experiment 3, forage yield was 2.09 and 1.45 tons/ac in cuts 1 and 2, respectively, in the seeding year, and 1.85 tons/ac with the fall harvest for a total of 5.39 tons/ac (Table 4). Forage yields were 6.57 and 8.37 ton/ac for the no-fall harvest and the fall-harvested treatments, respectively. In 2008 and in 2009 the same treatments had yields of 6.81 and 7.51 ton/ac.

Stands were not significantly reduced in any of the treatments or experiments. Winter-kill was greater during the 2008-2009 winter than any other year, leading to a delayed first harvest in 2009 due to winter injury that slowed plant growth (Photo 1); however, surviving stand's forage yield was not significantly different among treatments.

Forage quality. In general, forage quality was higher for the 3rd and 4th cuts, compared to the 1st and 2nd cuts, in the first through third year of production as expected considering the maturity differences of the treatments. There were few differences in forage quality overall among treatments.



In Experiment 1, forage quality was not different for any of the quality components evaluated except for hemicellulose in the 3rd cut in 2006 and 2nd cut in 2007; however, relative feed value (RFV) was not significantly different. The 4th harvest quality had higher RFV than cuts 1-3 in 2006, but not in 2007.

In Experiment 2 in 2009, differences in quality in the 1st harvest were due to the 1st harvest on the 3-cut system taken off before it reached 26". The stands were at 10% bloom and had not reached the target height; the delay in growth was due to winter injury. The 4-cut system was harvested 8 days later than the 3-cut system, as winter injury slowed plant growth in the spring more than it did in the 3-cut system. As a result, harvest was delayed to the same maturity in the 1st harvest to not impact the yield in the 4-cut system; although, there was a difference in quality, indicating it should have been cut later.

In Experiment 3 in 2009, there were no significant differences in quality among fall and no fall-harvest treatments. As always, the average quality of the 1st cut was much lower than the 2nd and 3rd cuts. As indicated, in 2009 winter injury delayed plant growth obligating harvest to a later maturity, hence, the RFV of the 1st cut was the lowest of all harvests (Table 5). The quality of the 3-cut system in the 1st harvest was slightly lower than the 4-cut system which could be due to an excess of overwintering stems from the last season in the 3-cut system. If plants receive winter injury to some extent, it is necessary to delay the 1st harvest in the spring. This is an important concept in the fall harvest management system.

Table 1. Forage yield with of	r without fall harvest.	Experiment 1.
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Harvest		Tedal					
Treatment/	2004	2005	2006	2007	2008	Totai	
		tons DM/ac					
No fall harvest	1.70	6.18	5.26	4.86	5.92	23.92	
Fall harvest	3.40	7.70	5.78	5.19	6.63	28.70	
LSD (0.05)	*	*	*	NS	NS	*	
+ C 1: 1-+ 05/10/20	0.4				·		

†Seeding date: 05/18/2004

 Table 2. Alfalfa forage yield with varying maturities at harvest. Experiment 2

	Harvest Year				06-09	06-09	
Harvest Treatment+	2006	2007	2008	2009	Total	Average	
	tons DM/ac						
26", LB, 30%, 50%	6.05	6.94	7.10	4.37‡	24.46	6.12	
26", LB, 30%	4.87	6.48	6.29	5.10	22.74	5.69	
MB, 10%, 30%	5.29	6.12	5.82	4.98	22.21	5.55	
26", LB, 30%, KF	5.55	6.85	7.68	4.67‡	24.75	6.19	
26", LB, 10%, WR	5.63	7.25	7.06	4.28‡	24.22	6.06	
LSD (0.05)	0.47	0.46	0.32	NS	-	-	
CV %	56	45	2.1	12.9	-	-	

†LB=late-bud; MB=mid-bud; KF=Killing frost; WR= 'when ready' ‡Only 3 harvests were taken due to the cool, wet environment delaying all harvests and wet soils preventing harvest after the killing frost.

Table 3. Alfalfa forage yield with varying maturities at harvest. Experiment 2

Harvest	Cut 1	Cut 2	Cut 3	Total		
Treatment/	nent†tons DM/ac					
26", LB, 30%, 50%‡	2.03	1.18	1.15	4.37		
26", LB, 30%	2.51	1.52	1.07	5.10		
MB, 10%, 30%	2.27	1.58	1.16	4.98		
26", LB, 30%, KF‡	2.17	1.54	1.18	4.67		
26", LB, 10%, WR‡	2.13	1.24	0.91	4.28		
LSD (0.05)	NS	NS	NS	NS		
CV, %	15.3	14.9	14.3	12.9		

†LB=late-bud; MB=mid-bud; KF=Killing frost; WR= when ready ‡Harvest after killing frost was not taken due to very wet soils.

Table	4.	Forage	yield	of	DKA34-17RR	alfalfa	harvested	or	not
harvest	ed i	n the fall	. Expe	rim	ent 3.				

	Year/Harvest Dates							
Harvest	2008							
Treatment/	6/16	7/15	8/14	10/9	Total			
		te	ons DM/a	с				
No fall harvest	2.40	2.64	1.52	-	6.57			
Fall harvest	2.41	2.36	1.64	1.95	8.37			
LSD (0.05)	NS	0.29	NS	-	0.48			
CV, %	8.8	6.0	11.6	-	2.7			
		2009						
	6/12	7/13	8/14	10/19	Total			
No fall harvest	3.33	1.98	1.50	-	6.81			
Fall harvest	3.04	1.94	1.38	1.13	7.51			
LSD (0.05)	NS	NS	NS	-	NS			
CV, %	15.4	7.2	13.8	-	10.9			

†Seeding date: 03/30/2007

Table 5. Alfalfa forage quality	of DKA34-17RR	harvested or	• not harvested	in the
fall. Experiment 3.				

Harvest	СР	ADF	NDF	NDFD	IVDMD	HEMI	RFV		
Treatment†	% of DM								
				Cut 1					
No fall harvest	17.1	33.9	43.9	62.8	60.8	10.0	133		
Fall harvest	18.9	29.0	37.2	70.9	67.1	8.2	166		
LSD (0.05)	NS	1.9	1.9	4.6	NS	NS	7		
		Cut 2							
No fall harvest	20.6	29.1	35.7	73.1	69.8	6.6	174		
Fall harvest	21.2	28.3	35.2	74.4	70.1	6.9	178		
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS		
		•	•	Cut 3					
No fall harvest	24.5	23.5	30.3	77.9	73.6	6.8	218		
Fall harvest	24.3	23.2	28.9	77.1	73.6	5.7	228		
LSD (0.05)	NS	NS	NS	NS	NS	NS	NS		
	Cut 4								
Fall harvested	23.0	21.3	27.7	80.4	74.8	6.4	244		

(NDF-ADF); RFV=relative feed value.