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## Fall and Spring Forage Yield and Quality From Fall-Seeded Cereal Crops

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Cereal crops such as oats, barley, triticale, wheat, and rye may be a source of emergency fall forage and/or a source of forage the following spring. The choice of which species to plant depends on the importance or need for forage in the fall as opposed to forage in the spring.

Preliminary studies conducted in 1989 by UW agronomists compared 20 different combinations of spring oats, spring barley, spring triticale, winter triticale, winter wheat, and winter rye and are summarized in Table 1. Winter and spring species were seeded alone and in combinations. All species were seeded Aug. 16 at 3.0 bu/acre when seeded alone or at 1.5 bu/acre when seeded in combinations.

Table 1. Forage yield and quality for small grains planted on August 16 at Arlington, WI. And harvested in October. Means are averaged across varieties.<sup>1</sup>

Species	Height at Harvest	Fall Forage Yield	CP	ADF	NDF	RFV
<u>Solo species</u>	In.	t/a	%	%	%	
Spring Oats	20	1.2	10.0	23.4	44.6	148
Spring Barley	19	1.2	10.5	27.3	53.5	118
Spring Triticale	17	0.9	13.3	25.1	48.0	135
Winter Wheat	10	0.6	12.7	21.2	43.1	156
Winter Rye	5	0.1	15.4	158.5	33.9	211
Winter Triticale	6	0.3	14.6	17.4	37.6	186
<u>Winter +Spring</u>						
W rye/Sp oat mix	16	0.9	10.8	21.1	40.0	169
W wheat/Sp oat mix	16	0.9	10.4	21.3	41.0	164

### Recent Wisconsin Studies

In 1992 and 1993 these studies were expanded to include 32 different combinations of spring and winter-type cereals. Trials were planted at the Arlington and Marshfield Agricultural Research Stations on 18 Aug. and 19 Aug., 1992 and on 12 Aug. and 13 Aug., 1993 respectively, using seeding rates similar to the 1989 study, except when used in combination each component was seeded at 2.0 bu/acre. In all studies, fall forage was harvested in mid-October following killing frosts, and spring forage was harvested at late boot/early heading for each species. Table 2, 3, and 4 summarize fall forage yield and quality, spring forage yield and quality, and mile yield, respectively of these studies.

<sup>1</sup> Data from research conducted by M.A. Brinkman and K.A. Albrecht, Dept. of Agronomy UW-Madison.

**Results and Recommendations**

Table 2. Fall forage yield and quality of small grains seeded August 1992 and August 1993. Arlington and Marshfield, WI.

Specie	Fall Forage Yield		CP*	ADF*	NDF*
	Arlington	Marshfield			
	-----t/a-----		%	%	%
<u>Solo Specie</u>					
Spring Oat <sup>2</sup>	1.6	0.6	9.4	23.4	42.9
Spring Barley <sup>3</sup>	1.4	0.7	10.8	22.5	40.8
Spring Triticale <sup>4</sup>	1.1	0.5	12.3	24.8	41.2
Winter Rye <sup>5</sup>	0.4	0.3	18.3	17.5	32.2
Winter Wheat <sup>6</sup>	0.6	0.4	18.6	19.0	34.3
Winter Triticale <sup>7</sup>	0.3	0.2	20.2	15.7	32.0
<u>Winter + Spring</u>					
Winter Rye/Sp Oat	1.2	0.6	13.4	22.6	40.4
Winter Rye/Sp Barley	1.1	0.6	14.1	22.1	42.7
Winter Rye/Sp Triticale	0.9	0.5	15.2	22.1	39.5
Winter Rye/Sp grains (mean)	1.1	0.6	14.2	22.3	40.9
Winter Wheat/Sp Oat	1.2	0.5	13.9	22.3	40.5
Winter Wheat/Sp Barley	1.2	0.7	14.8	22.7	41.7
Winter Wheat/Sp Triticale	0.8	0.5	16.7	22.3	42.0
Winter Wheat/Sp grains (mean)	1.1	0.6	15.1	22.8	41.4
Winter Triticale/Sp Oat	0.9	0.5	12.0	21.8	39.8
Winter Triticale/Sp Barley	1.0	0.7	13.6	21.8	40.7
Winter Triticale/Sp Triticale	0.5	0.5	15.6	21.9	39.3
Winter Triticale/Sp grains (mean)	0.8	0.8	13.7	21.8	39.9
Overall Mean	1.1	0.6	14.1	21.6	38.1
LSD (0.10)	0.3	0.1	1.0	1.6	1.9

<sup>2</sup> Mean of Dane, Webster, Horicon, Prairie, Ensiler, and Bay varieties.<sup>3</sup> Mean of Chopper and Chilton varieties.<sup>4</sup> Mean of Plains and Companion varieties.<sup>5</sup> Hancock variety.<sup>6</sup> Mean of Cardinal and Argee varieties.<sup>7</sup> Enduro variety.

\* Quality analysis for Arlington fall harvest samples only.

### **Which small grain cereal provided the best overall forage?**

- Spring oat or spring barley produced the highest forage yields in the fall at 0.6 to 1.6 ton/acre depending on location (table 2). Early maturing varieties like Dane and Webster oat or Chilton barley gave the highest yields. Of the spring-type small grain species, spring triticale had the lowest fall forage yields at both locations.
- Fall forage yields of spring cereals were 3 to 5 times more than that of fall cereals (Table 2).

### **How will seeding mixtures of spring and winter cereals affect fall yields?**

- Seeding mixtures of spring and winter cereals resulted in lower fall forage yields compared to solo-seeded spring cereals, but higher yields than solo-seeded winter cereals (table 2).
- Early maturing spring cereal varieties like Dane oat or Chilton barley produced higher fall forage yields when seeded with winter rye, wheat or triticale than did later maturing varieties.

Table 3. Spring and total (fall +spring) forage yield and quality of small grains seeded August 1992 and August 1993. Arlington (ARL) and Marshfield (MSF), WI.

Specie	Spring Forage Yield		Total Fall + Spring Forage		CP*	ADF*	NDF*
	ARL	MSF	ARL	MSF			
	-----t/a-----		-----t/a-----		%	%	%
<u>Solo Specie</u>							
Spring Oat <sup>8</sup>	-----	-----	1.6	0.6	-----	-----	-----
Spring Barley <sup>9</sup>	-----	-----	1.4	0.7	-----	-----	-----
Spring Triticale <sup>10</sup>	-----	-----	1.1	0.5	-----	-----	-----
Winter Rye <sup>11</sup>	3.4	1.8	3.7	2.1	10.2	38.3	66.8
Winter Wheat <sup>12</sup>	3.1	2.0	3.7	2.4	9.5	31.1	58.4
Winter Triticale <sup>13</sup>	2.8	2.0	3.1	2.2	10.1	33.2	61.4
<u>Winter + Spring</u>							
Winter Rye/Sp Oat	2.3	1.2	3.5	1.8	11.5	35.9	63.4
Winter Rye/Sp Barley	2.0	1.2	3.2	1.8	12.4	35.0	62.3
Winter Rye/Sp Triticale	2.3	1.2	3.2	1.7	11.6	36.0	63.4
Winter Rye/Sp grains (mean)	2.2	1.2	3.3	1.8	11.8	35.6	63.1
Winter Wheat/Sp Oat	1.9	1.5	3.1	2.0	9.9	30.8	58.4
Winter Wheat/Sp Barley	1.8	1.2	3.0	1.8	10.8	30.0	57.8
Winter Wheat/Sp Triticale	2.3	1.5	3.1	2.0	9.7	31.9	60.0
Winter Wheat/Sp grains (mean)	2.0	1.4	3.1	2.0	10.1	30.9	58.7
Winter Triticale/Sp Oat	1.9	1.2	2.8	1.8	10.5	32.8	60.1
Winter Triticale/Sp Barley	1.7	1.2	2.7	1.9	11.6	32.0	59.7
Winter Triticale/Sp Triticale	2.2	1.2	2.8	1.8	9.8	33.6	62.0
Winter Triticale/Sp grains (mean)	1.9	1.2	2.7	1.8	10.6	32.8	60.6
Overall Mean	2.2	1.4	2.8	1.7	10.7	33.1	60.8
LSD (0.10)	0.5	0.3	0.5	0.3	1.5	1.4	1.9

(Date from Silveria, Wiersma, Maloney, and Oplinger)

**How will seeding mixture affect spring and total forage yields?**

-Seeding mixtures of spring and winter cereals provided slightly less total forage yield than sole-seeded winter rye or winter wheat, but equal to yields of winter triticale seeded alone (table 3). This practice provides the advantage of 0.5 to 1.2 t/acre of fall forage plus an additional 1.2 to 2.3 t/acre of spring forage depending on location.

<sup>8</sup> Mean of Dane, Webster, Horicon, Prairie, Ensiler, and Bay varieties.<sup>9</sup> Mean of Chopper and Chilton varieties.<sup>10</sup> Mean of Plains and Companion varieties.<sup>11</sup> Hancock variety.<sup>12</sup> Mean of Cardinal and Argee varieties.<sup>13</sup> Enduro variety.

\* Quality analysis for Arlington fall harvest samples only.

**How would a producer maximize total forage yields?**

- Winter rye or winter wheat has the highest total forage yield at 2.1 to 3.7 t/acre depending on location (table 3). Of this 80% to 90% of the total yield is from a spring harvest.
- Winter rye has the advantage of more winter hardiness and earlier harvest in the spring
- Winter wheat has the advantage of being grown for grain in the spring and marketed as a cash grain (2-year winter wheat grain yield in our study averaged 37 bu/acre at Arlington and 27 bu/acre at Marshfield).
- Seeding a spring cereal with the winter cereal in the fall reduces overall forage yields slightly, but this practice provides the advantage of both a fall and spring forage.

**What quality of forage can producer anticipate from fall-seeded cereals?**

- Solo-seeded spring oat, barley, and triticale or when planted in combination with a winter cereal had lower CP, but higher ADF and NDF values than winter cereals seeded alone at the fall harvest (table 2).
- Crude protein values for winter cereals harvested in the spring ranged from 9.5 to 12.4% (table 3).
- ADF and NDF values were much higher in the spring forage (table 3) compared to fall forage (table 2). Overall, fall forage provided the highest quality forage.

**How do small grain cereals compare to others forages?**

-Relative feed value or RFV (Table 4) is a unitless number than can be used to compare the forage quality of different forages. Dairy producers with high producing cows often look for alfalfa with a RFV of 124 or greater. Fall forage solo-seeded winter rye, wheat and triticale averaged 215. Solo-seeded oat, barley and triticale for fall forage averaged 26% lower. Mixed-seeded winter and spring cereals averaged 165 for fall forage. The following spring, the solo-seeded winter cereal forages averaged only 95, similar to mixed-planted winter cereal forages.

**How will these quality measurements relate to milk yield?**

- Solo-seeded winter cereal forage produced more milk per ton of forage than solo-seeded spring cereals, but because solo-seeded spring cereal forage yields were much higher, mile yield per acre was 2-3 times greater for spring cereals, especially for oat and barley (table 4).
- Mixed-seeded winter and spring cereal forage produced fall milk yields twice that of solo-seeded winter cereals, but were less than solo-seeded spring cereals (table 4).
- Spring milk yield per ton of forage and yield of milk per acre than solo-seeded wheat or triticale, but higher yields than rye.
- Comparing the mixed-seeded wheat, rye, or triticale with spring cereals, mixed-seeded winter wheat with either oat, barley or triticale would be expected to yield the highest total milk yield per acre followed by rye and then triticale.
- Overall total milk yield per acre were highest for solo-seeded winter wheat and winter wheat planted with either oat, barley or triticale.

Table 4. Fall and spring forage for relative feed value (RFV) and Milk yield per acre for small grains seeded August 1992 and August 1993. 2 year means Arlington, WI

Specie	Relative Feed Value		Milk Yield Per Acre		
	Fall	Spring	Fall	Spring	Total
<u>Solo Specie</u>					
Spring Oat <sup>14</sup>	155	-----	3277	-----	3277
Spring Barley <sup>15</sup>	164	-----	3172	-----	3172
Spring Triticale <sup>16</sup>	159	-----	2385	-----	2385
Winter Rye <sup>17</sup>	219	84	1008	1431	2439
Winter Wheat <sup>18</sup>	202	105	1511	4140	5651
Winter Triticale <sup>19</sup>	224	97	907	3017	3924
<u>Winter + Spring</u>					
Winter Rye/Sp Oat	166	92	2626	1869	4495
Winter Rye/Sp Barley	157	94	2545	1932	4477
Winter Rye/Sp Triticale	170	91	2025	1830	3855
Winter Rye/Sp grains (mean)	164	92	2399	1877	4276
Winter Wheat/Sp Oat	166	104	3752	2589	5341
Winter Wheat/Sp Barley	161	107	2628	2520	5145
Winter Wheat/Sp Triticale	158	100	1874	2756	4630
Winter Wheat/Sp grains (mean)	162	104	2418	2622	5040
Winter Triticale/Sp Oat	170	94	2171	2093	4264
Winter Triticale/Sp Barley	165	101	2393	1979	4372
Winter Triticale/Sp Triticale	171	95	1322	2278	3600
Winter Triticale/Sp grains (mean)	169	98	1962	2177	4079
Overall Mean	168	98	2459	2368	4827
LSD (0.10)	13	6	543	563	548

(Data from Maloney and Oplinger)

<sup>14</sup> Mean of Dane, Webster, Horicon, Prairie, Ensiler, and Bay varieties.<sup>15</sup> Mean of Chopper and Chilton varieties.<sup>16</sup> Mean of Plains and Companion varieties.<sup>17</sup> Hancock variety.<sup>18</sup> Mean of Cardinal and Argee varieties.<sup>19</sup> Enduro variety.

# RFV and Milk yield estimates from "Milk 91" Undersander, Howard and Shaver 1991. Also refer to: Forage Analysis Procedures. 1993. National Forage Testing Association. Undersander, Mertens and Thies.

## Summary

- To maximize fall forage and milk yield per acre, fall planting a spring oat or spring barley would be recommended.
- To maximize spring forage yield, fall planting a winter rye or winter wheat would be recommended. However, to maximize spring milk yield per acre a winter wheat or winter triticale would be recommended.
- To maximize both fall and spring forage and milk yield per acre, the practice of planting a mixture of an early maturing spring oat or spring barley with winter wheat would be recommended for Wisconsin producers.