Cereal Grain Forages for Dairy Cattle
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CEREAL GRAINS such as oats, barley, wheat and rye can provide supplementary pasture, hay or silage for dairy cattle and other ruminants.

Production Practices

Growing small grains for forage is similar in many ways to producing the crop for grain. In the following discussion, several important differences will be cited.

Variety Selection

Few small grain varieties have been developed for forage purposes only. *Wheeler* rye is one example, and should be chosen if a high-yielding forage rye is desired. Spring wheat and barley are not usually recommended for forage because they do not produce as much as oats.

Most varieties commonly grown for grain are good varieties for forage. Some research has suggested that awned or bearded varieites should not be grown for silage or hay because these barbed structures may irritate the mouths of livestock. If these varieties are used for pasture, however, or harvested before early heading for silage or hay, no problems should occur.

If you plan to harvest small grains before the soft dough stage a tall-growing variety may produce more forage than a short-strawed variety. The highest-yielding variety for grain is probably the best if harvested at the soft dough stage of maturity.

Planting Dates

Plant spring-sown small grains as soon as the land can be tilled. Winter small grain crops should be planted from mid-September to mid-October. If the primary purpose of the crop is fall pasture, planting should be done in early September. Planting wheat early, however, requires a variety resistant to Hessian fly such as *Ionia*, *Tecumseh*, *Arthur* or *Abe*. Also early planting of barley may result in a barley yellow dwarf.

Seeding Methods

Seed with a grain drill, using fertilization. Broadcast seeding followed by discing or seeding by air into standing corn can also result in fair to good stands, but these methods require increased seeding rates.

If the crop will be harvested at the soft dough stage for silage, use seeding rates similar to those used for grain. However, if these small grains are to be pastured or harvested early for wilted silage, then increasing seeding rates by ½–1½ bushels will often increase production and quality. Early harvest will prevent lodging.

Increase seed rates when planting late or when broadcast seeding. When oats are underseeded with a legume, you may need to use a lower seeding rate than used when planted for grain if legume establishment has been a problem with this seeding method.

Fertilization

The highest fertility and pH levels are required by barley—followed by oats, wheat and rye. Soil pH for small grains should be 6.0–7.0, with barley requiring the higher pH. Take a soil test to determine recommended rates of phosphate and potash. If a soil test is not possible use 60 lb of P_2O_5 and 60 lb of K_2O on soils of medium fertility. If soil fertility is low or high, rates should be adjusted upward or downward 20 lb, respectively. These rates are recommended to replace the nutrients used by the small grain and to maintain soil fertility.

Nitrogen requirements can vary with use. For silage, 60-70 lb of nitrogen in April or very early May is adequate. Manure or a legume plowdown crop before the small grain crop will reduce the amount of fertilizer nitrogen needed. If pasturing in the fall, an application of 20-30 lb of nitrogen at planting will increase fall growth. Another 40-50 lb early in the spring or following the first grazing is recommended. If small grains are undersown with a legume, reduce nitrogen rates by approximately one-half.

High rates of nitrogen used in the fall may result in leaching losses of the nitrogen and/or increased winter kill of the small grain. In the spring, lodging or nitrate toxicity may occur if there is too much nitrogen. Little or no use of nitrogen will result in poor protein levels in the forage and reduced yields.

Grazing Management

Grazing of winter cereals in the fall should not be excessive. If grazed, a stubble height of 3 inches must remain for winter protection. In the spring, grazing can begin each time the forage reaches a height of 8-10 inches. Remove cattle when a 3-inch stubble remains. If the small grain is to be harvested for grain and early pasturing is desired, grazing must be light and not continued after "jointing," or when the developing head is 1 inch above the soil surface. To find this developing head, split stems of several plants to the soil surface every 3 to 4 days to monitor the plants' growth. Excessive grazing or grazing of the forage at a late growth stage will severely decrease grain yields and straw production. Grazing of small grains in the spring will also result in a 1 to 4 day delay in maturity. Overgrazing of a small grain underseeded with a legume could harm the legume stand.

Immature pasture forages are high in protein (12 to 18%) and highly digestible, but low in fiber compared to forages in later stages of maturity. You may need to feed 5 to 10 lb of hay (or equivalent of other forage) and/or reduce the amount of grain fed to avoid a low milk-fat test. Remove cattle from the pasture two hours before milking to avoid off-flavors in the milk.

Hay or Silage

Cereal forage can be harvested for dry hay, wilted silage (60% to 70% moisture) or low moisture silage (50% moisture) in semi-sealed silos.

When to Harvest

The protein and total digestible nutrient (TDN) content of cereal forages decrease with increasing maturity from the boot stage (before heads appear) to the dough stage of kernel development. The yield of dry matter per acre, however, increases 25 to 50% from the boot stage to dough stage (Table 1 and 2).

For optimum compromise between dry matter yield and animal production per acre, harvest oat forage when about 20% of the stems reach the flowering stage. In California experiments (Table 1), lamb production per acre at this stage was 35% greater than at the boot

Table 1. Yield, nutrient content and lamb production of oat hay harvested at various stages of growth (dry basis)

	Stages of growth						
Percent of stems	*59% Jointing*	*16% Flag leaf*	*21% Boot*	*1% Flower*	*18% Flower*	*44% Milk*	*42% Dough*
DM yield (lb)	1,800	4,000	5,400	5,600	7,400	9,400	9,100
TDN (%)	68	65	65	64	60	70	53
TDN yield/A	1,220	2,600	3,510	3,580	4,440	4,700	4,823
Crude protein (%)	24	19	18	16	14	12	12
Lamb production (lb/A)	350	400	480	500	750	540	620
Height of crop (inches)	15	23	27	30	38	44	46

Adopted from: California Agriculture 12(5):4,12, 1958. Actual yields may be considerably different than above depending on cropping conditions and oat varieties. Other data show similar results for various stages of maturity.

Table 2. Yields and composition of cereal grain forages harvested at various stages of growth

Forage	*Stage of growth*															*Source*
	Boot-early flower					*Milk*					*Dough*					
	Yield DM/A	*D.M.*	*Prot.*	*TDN*	*Crude fiber*	*Yield DM/A*	*D.M.*	*Prot.*	*TDN*	*Crude fiber*	*Yield DM/A*	*D.M.*	*Prot.*	*TDN*	*Crude fiber*	
	ton	*%*	*%*	*%*	*%*	*ton*	*%*	*%*	*%*	*%*	*ton*	*%*	*%*	*%*	*%*	
Oats	1.69	—	22.2	—	24.4	2.14	—	13.2	—	27.9	—	—	—	—	—	S. Dakota, 76
Oats	1.70	18.4	13.7	71.3	26.0	3.22	22.1	12.4	58.1	29.2	3.15	30.6	11.2	58.8	26.0	Arkansas, 61
Oats	3.0	—	16.0	64.0	24.0	4.7	—	12.0	50.0	29.0	4.5	—	12.0	53.0	53.0	Calif., 57
Oats	1.3	—	22.4	71.4	—	—	—	—	—	—	2.7	—	15.6	56.4	—	Nebraska
Barley (2 yr)	2.23	22.0	10.4	67.8*	32.1	3.06	36.3	9.7	67.9*	31.1	3.24	47.0	10.7	64.2*	—	Virginia
Barley	1.35	17.6	11.5	66.5	—	1.93	23.3	9.3	61.2	—	2.25	32.0	8.8	59.5	—	Virginia
Wheat	1.00	17.3	14.9	64.8	—	1.65	23.3	11.4	61.8	—	2.03	32.5	8.6	56.6	—	Virginia
Wheat	1.7	—	8.4	66.2	—	—	—	—	—	—	3.0	—	5.4	57.0	—	Nebraska
Rye	1.08	17.7	13.1	64.3	—	1.41	25.9	8.8	56.6	—	2.10	39.2	7.2		54.4	Virginia
Rye	2.5	—	9.8	62.9	—	—	—	—	—	—	3.7	—	6.0	51.2	—	Nebraska

**Digestibility*

or milk stage and 15% greater than when harvested when 42% of the heads were at the dough stage of maturity. Lignification of the fiber apparently occurs during the milk stage, reducing the forage nutritional value.

Grain development partially offsets the lower digestibility of the straw at the dough stage. These results suggest that if the situation does not permit harvesting at the 20% flower stage, harvest should occur at the dough stage in preference to the milk stage.

Similar results have been shown with other cereal forages. Most suggest harvesting wheat and barley at comparable stages, and harvesting rye slightly earlier.

Wilting is necessary when forages are harvested for silage at boot to milk stage of growth. These forages contain 80-85% moisture. At the dough stage, the forages contain 60-70% moisture and can be ensiled without wilting.

The dry matter (or moisture) content of cereal forages changes rapidly during seed development. These hollow-stem forages pack poorly when too dry and may heat or mold, resulting in poor quality forage. Chop to ¼ to 3/8 inch theoretical cut for good packing of wilted silages, and cover the top with plastic after ensiling to reduce air penetration and spoilage. Silages should contain 60-72% moisture if stored in bunker silos, packed firmly with a wheel type tractor and covered with plastic and weighted.

Table 3. Oatlage versus alfalfa haylage for milk production

	Haylage	*Oatlage*
Feed intake		
Forage, DM lb.	22,3	23,3
DM % BW	1.58	1.75
Grain mix, lb	13.7	13.2
Milk/day, lb	41.1	39.6
Milk fat, %	3.6	3.8

Haylage 21% CP, oatlage (boot stage) 16.5% CP. (Minn.). Milk production diff. not significant.

Table 4. Effect of stage of maturity barley silage on milk production and feed intake

	Stage of growth		
	Bloom	*Milk*	*Dough*
Silage DM, %	33.8	26.4	37.8
Yield DM/acre, ton.	2.2	3.1	3.2
Dry matter intake			
Silage, % BW	1.24	1.54	1.53
Total.	2.77	3.04	3.04
Milk/day, lb	58.7	58.2	58.8
Milk fat, %	3.36	3.25	3.33
Body weight gain, lb.	.02	.86	.90

VA, J.D.S. 51:1801, 1968. Grain ration, 18% protein at 1:3. Bloom wilted, others not wilted.

Yield and Nutrient Content

Yields range from 1.5 to 2.5 tons dry matter per acre on light soils and 2.5 to 3.5 tons per acre on heavy soils. Varieties, stage of harvesting, soil fertility and available moisture will affect yields. Yields and nutrient content at various stages of maturity at several experiment stations are shown in Table 2.

Feeding trials have indicated milk production of cows fed small grain forages is comparable to that of cows fed alfalfa haylage and other forages when small grain forages are properly supplemented. Supplemental rations need to contain 16 to 20% crude protein and 1% or more calcium when cereal grain forages are fed as the sole roughage to lactating cows.

Immature, rapidly-growing forages are commonly low in magnesium and high in nitrogen and potassium. Grass tetany (hypomagnesemia) may occur when cattle are grazing such forages. A mixture of equal parts salt, magnesium oxide and finely ground grain, fed free choice, successfully prevents grass tetany. Providing added calcium in the diet is also necessary for lactating cows, because these forages are low in calcium content similar to corn silage.

Dough stage forages are low in carotene compared to forages at earlier stages of growth and may require supplementation with vitamins A and E when fed as the only forage for extended periods.

Dairy heifers fed good quality cereal forages grow normally with little supplementation other than salt fed free choice. However, low protein forages (less than

Table 5. Rye silage compared to alfalfa haylage and both for milk production

	Rye	*Alfalfa*	*½ Rye + ½ alfalfa*
Milk/day, lb	57.0	58.8	58.4
Persistency, %	89.0	93.0	92.0
Dry matter intake			
Forage, % BW	1.31*	1.49	1.50
Total.	2.82	2.92	2.89

**Significantly less (P < .05). 6 cows/treatment, 7 weeks, Huber et al., MSU, 1970. Rye at boot-early head stage, wilted, % DM.*

Table 6. Growth of dairy heifers fed wheat silage harvested at two stages of maturity

	Pre-bloom	*Soft dough*
Daily intake		
Silage DM, lb	15.1	13.3
Grain mix, lb	1.0	1.0
Daily gain, lb	1.75	1.51

J. Dairy Sci. 60:100 (Abstr.) 1977. Wilted to 32% DM (KY).

10%) may need additional supplementation, or need alfalfa as part of the ration for optimum growth.

Results of feeding trials are shown in Tables 3 through 6.

Summary

When properly managed, cereal forage crops (oats, barley, wheat and rye) provide high quality forage for dairy cattle. Harvesting for hay or silage when about 20% of the stems reach the flower (bloom) stage of maturity appears to yield the maximum animal production per acre. Milk production and growth of young cattle fed good quality cereal forage is comparable to other forages when properly supplemented.

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