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Foxtail Millet *in Colorado*

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Foxtail Millet in Colorado

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FOXTAIL millet, a crop of secondary importance in Colorado, is the best yielding fine-stemmed annual hay crop that can be grown on the nonirrigated lands of the eastern part of the State. Of all the forage plants tested, it has been exceeded in yield only by sorghum. In experiments at Akron² from 1925 to 1934, the 10-year average acre yield of foxtail millet hay was 1.7 tons, or about 70 percent as much as that of Black Amber sorghum. Foxtail millet also produced a creditable seed yield at Akron, averaging 6.8 bushels per acre from 1931 to 1938 as compared with 8.1 bushels for the highest yielding proso (grain millet). When seed is produced, the straw is of rather poor quality. The crop should be cut before it is ripe, unless seed is desired.

Foxtail millet is not recommended for the irrigated lands in Colorado because alfalfa and other crops produce more and better forage. It does not yield well at high altitudes, probably because millet needs warm weather during the growing season. At Fort Lewis, Colo., (elevation 7,610 feet) it has yielded only 52 percent as much hay as Sudan grass, 85 percent as much as Marrow Fat field peas, and 88 percent as much as oats.

Feeding trials at Akron show that for fattening lambs foxtail millet hay is slightly superior to sorgo ("cane") fodder if cut early, but slightly inferior if cut when the seed is ripe. When fed as the sole roughage it sometimes is injurious to horses but apparently is not harmful to other farm animals. The seed is slightly less palatable than proso and has about 83 percent the feeding value of corn or proso as shown by the Akron feeding results. For best results the seed should be ground finely before it is fed to livestock.

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²The United States Dry-Land Field Station, located in northeastern Colorado at an altitude of about 4,600 feet, is operated by the Division of Dry-Land Agriculture of the U. S. Department of Agriculture, in cooperation with the Colorado Experiment Station. The cereal experiments at this station are under the care of a representative of the Division of Cereal Crops and Diseases of the U. S. Department of Agriculture, also in cooperation with the Colorado Experiment Station. Millet experiments were carried on at this station by the representative of the Division of Cereal Crops and Diseases from 1908 to 1924, by J. F. Brandon and D. W. Robertson from 1924 to 1930, and by J. J. Curtis from 1930 to the present time.

Description

Foxtail millet (*Setaria italica* [L.] Beauv.) is one of the oldest cultivated crops of the world, having been grown in China as early as 2700 B. C. It was grown in the United States only rarely during the colonial days, but after 1849, when seed was distributed by the United States Patent Office, its culture became more general. It has been planted in Colorado for many years but has never ranked as a major crop.

Foxtail millet is an annual grass with slender, erect, leafy stems. Under eastern Colorado dry-land conditions the plants vary in height from 12 to 40 inches, depending upon variety and season. The seeds are small, convex in shape, and are borne in dense, cylindrical, bristly panicles. They are enclosed in thin, papery outer hulls which are removed in threshing, but most of the inner hulls remain attached to the seed. The inner hulls covering the threshed seeds of different varieties are of various colors, including creamy white, pale yellow, orange, reddish orange, green, dark purple, or mixtures of various colors.

Place of Foxtail Millet in Rotations

Millet is a short-season crop. At Akron, where the growing season averages 139 days, millet requires from 75 to 90 days to mature seed and from 55 to 70 days to reach a stage suitable for hay. Since it does not require the entire growing season to mature in eastern Colorado, it may be seeded any time between May 15 and July 1 when there is sufficient moisture in the soil to germinate the seed. It also can be used as a catch crop after winter wheat or early spring-seeded small grains have failed.

While foxtail millet usually is grown as a catch crop, it may be used as a regular forage crop if diversification is desirable. Some crops do not yield well when grown after foxtail millet. Over a period of 11 years (table 1) winter wheat averaged 12.4 bushels per acre after corn and 9.0 bushels after foxtail millet. Fallow, or late spring-planted crops, such as corn or sorghum, follow foxtail millet in the rotation much better than do fall or early spring-sown crops, such as wheat, oats, or barley. Late spring planting or fallowing after foxtail millet eliminates to a large extent the depressing effects upon yields of succeeding crops.

In tests at Akron the highest yields of foxtail millet were obtained on fallow, the lowest on Sudan grass stubble land, and intermediate yields on winter wheat and spring-seeded small grain stubble land. The hay and grain yields of foxtail millet on fallow and on the various types of stubble land are given in tables 2 and 3.

TABLE 1.—*Winter wheat yields after foxtail millet and after com at Akron, Colo., 1927-37.*

Years	Acre yield in bushels of winter wheat after:	
	Foxtail millet	Corn
1927	21.8	25.7
1928	14.8	24.0
1929	6.3	4.9
1930	11.5	27.8
1931	8.2	8.9
1932	6.1	5.4
1933	4.8	5.0
1934	1.0	2.1
1935	0	0
1930	16.8	23.2
1937	7.9	9.4
Average	9.0	12.4

It probably is a good farming practice to use fallow land for growing wheat, grain sorghums, or barley, and stubble land for growing foxtail millet and other forage crops. The yields of foxtail millet were low on Sudan grass stubble land at Akron and probably would be equally low on sorghum stubble land. It is advisable, therefore, to grow foxtail millet on small-grain or corn stubble land.

Preparation of Seedbed

As soon as weeds emerge in the spring, small-grain or corn stubble land should be worked with shovel-type implements such as the spring-tooth harrow or duckfoot cultivator, which leave the surface soil rough and open and in good condition to absorb spring rains and resist soil blowing. A disk pulverizes the soil and makes it susceptible to wind erosion; hence it is not recommended unless excessive weed growth or crop residues are present. In parts of southeastern Colorado, where the small-grain crop is harvested early, fall listing or otherwise roughening of the stubble land is a good practice, especially when it destroys weeds. In general, fall working after August 20 is not beneficial to succeeding spring-sown crops in northeastern Colorado. In the spring the land should be kept free from weeds until planting time.

Land with little or no crop residue should be worked in the fall with an ordinary lister or damming lister to help catch snow and check run-off and to resist soil blowing during the winter and spring. On sloping land such cultivations should be done on the contour.

Foxtail millet needs a firm seedbed, which makes it necessary to level listed fields 3 to 4 weeks before planting time. This cultivation, and any later cultivations to control weeds, should be done with implements that leave a cloddy surface which resists soil blowing.

TABLE 2.—*Hay yields of foxtail millet in pounds per acre on stubble land and fallow at Akron, Colo., 1925-39.*

Acre yield in pounds of air-dry hay on :					
Years	Winter wheat stubble land	Spring grain stubble land	Fallow	Sudan grass stubble land	Fallow
1925		733	4,667		
1926	.....	2,400	2,100		.....
1927	4,573	5,933	6,700		
1928	3,375	3,732	4,766		.....
1929	2,000	3,833	5,016		
1930	6,975	7,650	6,750		.....
1931	1,175	.....	.....	12	2,490
1932	3,275	.....	.....	958	3,244
1933	2,375		.....	2,010	3,816
1934	1,300			0	2,620
1935	1,760			1,161	2,797
1936	4,673		.....	1,222	3,970
1937	1,553		.....	1,016	4,395
1938	.....		.....	610	2,556
1939	.....	.....	.....	0	822
Average all years	3,003	4,047	5,000	776	2,968
Average 1927-1930	4,231	5,287	5,808	.....	.....
Average 1931-1937	2,302			911	3,333

TABLE 3.—*Seed yields of foxtail millet grown on fallow and stubble land at Akron, Colo., 1927-39.*

Acre yield in bushels on:				
Years	Spring grain stubble land	Fallow	Sudan grass stubble land	Fallow
1927	42.9	40.2		
1928	4.6	9.2		
1929	6.0	26.2	....
1930	42.9	50.4	....
1931	.....	....	0.1	14.5
1932	.....		0.8	10.0
1933	....		6.7	21.4
1934			0	13.2
1935			4.5	13.9
1936	.....		1.0	8.7
1937	.....		0.5	6.2
1938	.....	....	0	2.6
1939	.....	....	0	3.9
Average 1927-1930	24.1	33.0		
Average 1931-1939	.....	....	1.5	10.5

Preparation of fallow for foxtail millet should begin when the weeds emerge in the spring, usually about the middle of May. The initial working may be with the lister, plow, duckfoot cultivator, or damming lister. Two or three additional cultivations may be necessary during the summer. These should be made with shovel-type implements which leave the surface rough. If possible, all cultivations should be made on the contour. Fallow that is to be carried through the winter should be ridged and cloddy.

Methods of Seeding

A grain drill is nearly always used to seed foxtail millet. The 6-inch to 8-inch drills are preferable to the wider-spaced furrow drills because the closer spacing of rows helps the crop to compete with weeds. A vigorous harrowing may be useful in the elimination of weeds.

Foxtail millet has small seeds and requires shallow planting. If necessary in order to reach moist soil, it should be sown about 1 inch deep, or a little deeper. Otherwise it should be planted less than an inch deep. Moist soil promotes prompt germination before weeds get started.

Rate of Seeding

Foxtail millet seed should be sown at the rate of 25 to 30 pounds per acre to provide a thick stand that will enable the crop to compete with weeds. Satisfactory stands may be obtained with 10 to 15 pounds of seed per acre in a weed-free soil.

Date of Seeding

Foxtail millet should be planted as soon as possible after May 15 and before July 1 whenever there is sufficient moisture in the surface soil to germinate the seed and support plant growth. Conditions usually are favorable after a rain of three-fourths inch or more. Millet should be seeded as soon after the rain as the ground is dry enough to permit planting. Hay and seed yields from various dates of planting are given in tables 4 and 5.

Harvesting

A mower can be used for cutting foxtail millet hay. The best quality hay is obtained by cutting just before or when the first heads appear. Millet, as are many forage plants, is more palatable and nutritious at earlier stages of growth than when fully mature. It should be raked into windrows before it is thoroughly dry. After it is allowed to finish curing, it can be stored in stacks or bales.

When harvested for seed, the crop usually is cut with a binder or header and is windrowed. With this method there is less loss of seed than when the crop is mowed and raked. It should be allowed to stand in the field until the seed can be rubbed from the head in the

TABLE 4.—*Hay yields of foxtail millet sown on corn stubble on six dates at Akron, Colo., 1930-39.*

Seeding date	Acre yield in pounds										Average	Percent of May 15 yield
	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939		
May 15	6,500	2,430	2,139	1,660	0	2,702	3,220	2,100	2,380	300	2,352	100
June 1	7,200	1,002	2,729	1,200	0	2,256	1,370	2,050	2,220	570	2,126	90
June 15	6,600	0	2,236	2,930	0	1,490	2,022	2,240	2,090	240	1,985	84
July 1	5,000	0*	1,959	3,280	1,360	1,030	196	0*	1,810	0	1,464	62
July 15	**	0*	805	3,862	0*	0*	960	0*	2,430	0	895	47
Aug. 1	**	0*	**	1,302	**	**	0	0*	0*	0	217	11

*Failed to emerge.

**No seedings were made on July 1a, 1930, and on August 1 in 1930, 1932, 1934, and 1935.

TABLE 5.—*Seed yields of foxtail millet sown on corn stubble on six dates at Akron, Colo., 1930-39.*

Seeding date	Acre yield in bushels***										Average	Percent of May 15 yield
	1930	1931	1932	1933	1934	1935	1936	1937	1938	1939		
May 15	14.8	21.5	4.5	1.8	0	7.2	14.0	1.3	4.0	0.8	7.0	100
June 1	27.6	10.2	10.1	0	0	8.2	5.0	2.2	1.5	2.3	6.7	96
June 15	2.9	0	9.0	19.0	0	5.1	9.0	4.0	1.4	0.8	5.1	73
July 1	12.3	0*	11.3	12.8	6.6	6.7	1.4	0*	6.0	0	5.7	81
July 15	**	0*	4.3	24.1	0*	0*	6.3	0*	9.0	0	4.9	70
Aug. 1	**	0*	**	5.9	**	**	0	0*	0*	0	1.0	14

* **See notes on table 4.

***50 pounds = 1 bushel.

hand. At this stage the stems are dry enough to cause little if any trouble from molding in the bundle. Threshing can be done with an ordinary grain separator equipped with screens to handle the small seed, or when the crop is windrowed a combine with pickup attachment may be used.

Injurious Effect on Horses

Foxtail millet hay fed to horses as the sole roughage may cause (1) increased action of the kidneys, (2) lameness and swelling of joints, (3) infusion of blood into the joints, and (4) destruction of the texture of the bone, rendering it softer and less tenacious so that the ligaments are often torn loose and so that the bones themselves break easily.⁴ When fed with other kinds of forage, up to one-third of the forage ration may be foxtail millet without danger of injury to horses. It may be fed to cattle or sheep without danger.

⁴U. S. Department of Agriculture Farmers' Bulletin No. 703.

Yields of Varieties

The hay and seed yields of varieties grown on fallowed land and Sudan grass stubble land at Akron are given in tables 6 and 7.

The highest yielding varieties for hay were Siberian, German, and Goldmine. During the period from 1931 to 1939, when crop failures were common in the region, all varieties grown averaged more than a ton of hay per acre on fallowed land.

TABLE 6.—*Hay yields of six varieties of foxtail millet and of barnyard millet grown on fallow and Sudan grass stubble land at Akron, Colo., 1931-39.*

Variety	Acre yield in pounds									Average	Percent of Dakota Kursk
	1931	1932	1933	1934	1935	1936	1937	1938	1939		
	Fallow										
Dakota Kursk	2,550	2,490	2,880	1,914	2,537	4,125	4,350	3,060	1,170	2,786	100
White Wonder	1,650	3,370	4,038	2,664	2,760	3,615	3,738	2,550	861	2,805	101
Siberian	3,750	3,345	3,616	3,205	3,376	4,035	4,876	2,641	925	3,308	119
Goldmine	3,000	3,255	4,060	2,958	3,196	4,109	4,795	2,342	807	3,169	114
Hungarian	1,500	3,676	3,804	2,169	2,206	3,690	3,872	2,010	480	2,601	93
German		3,330	4,495	2,808	2,709	4,245	4,740	2,730	686	3,218	114
Average											
all varieties	2,490	3,244	3,816	2,620	2,797	3,970	4,395	2,556			
Barnyard		2,580	3,474						3,027		113
	Sudan Grass Stubble Land										
Dakota Kursk	60	615	1,960	0	1,018	729	1,391	795	0	730	100
White Wonder	0	1,080	1,999	0	1,276	990	825	660	0	759	104
Siberian	0	750	2,238	0	1,320	1,335	1,110	570	0	814	112
Goldmine	0	924	2,160	0	1,216	1,410	945	600	0	806	110
Hungarian	0	1,125	1,909	0	911	1,365	855	555	0	747	102
German		1,254	1,794	0	1,225	1,500	970	480	0	903	111
Average											
all varieties	12	958	1,249	0	1,161	1,222	1,016	610	0		
Barnyard		390	1,249							820	64

The highest yielding varieties for seed were Dakota Kursk and White Wonder.

Barnyard millet was grown for 2 years and produced good yields of hay, but it was too late to produce fully mature seed.

Siberian millet is recommended on the basis of good yields of both hay and grain, but White Wonder, Dakota Kursk, Goldmine, and others are nearly equal to Siberian. Dakota Kursk was grown on fallowed land at Akron (table 8) in 30 of the 31 years from 1909 to 1939 and averaged 1.91 tons of hay per acre. It failed to produce hay only 1 year (1924) and it yielded more than a ton per acre in 26 of the 30 years it was grown. The highest yield was 3.38 tons in 1930. These data show that failures of foxtail millet, hay on fallowed land are to be expected only 3 or 4 percent of the time.

TABLE 7.—Seed yields of six varieties of foxtail millet and barnyard millet grown on fallow and Sudan grass stubble land at Akron, Colo., 1931-39.

Variety	Acre yield in bushels									Average	Percent of Dakota Kursk
	1931	1932	1933	1934	1935	1936	1937	1938	1939		
Fallow											
Dakota Kursk	20.1	9.3	12.4	12.0	16.0	16.8	9.3	4.2	6.0	11.8	100
White Wonder	9.3	13.8	28.5	13.5	17.4	10.5	6.3	3.3	3.9	11.8	100
Siberian	13.8	9.6	20.9	16.1	16.7	4.5	5.6	1.7	3.8	10.3	87
Goldmine	16.2	10.5	20.0	14.1	13.7	6.0	5.9	1.9	3.3	10.2	86
Hungarian	12.9	11.0	24.6	10.2	10.4	9.6	4.9	3.0	3.0	10.0	85
German		5.7	21.8	13.2	9.3	4.8	5.4	1.2	3.4	8.1	75
Average											
all varieties	14.5	10.0	21.4	13.2	13.9	8.7	6.2	2.6	3.9		
Barnyard		0.9	10.8							5.8	54
Sudan Grass Stubble Land											
Dakota Kursk	0.3	0	8.3	0	5.0	1.4	1.6	0	0	1.8	100
White Wonder	0	1.8	9.5	0	5.0	0.8	0.6	0	0	2.0	111
Siberian	0	0	5.4	0	5.4	0.3	0.3	0	0	1.3	72
Goldmine	0	0.6	4.5	0	3.8	1.1	0.3	0	0	1.1	61
Hungarian	0	1.5	6.8	0	3.7	1.4	0	0	0	1.5	83
German		0.9	5.7	0	3.5	0.8	0.2	0	0	1.4	70
Average											
all varieties	0.1	0.8	6.7	0	4.5	1.0	0.5	0	0		
Barnyard		0.3	2.0							1.4	33

Description of Varieties

Siberian

Siberian foxtail millet is a medium-early variety requiring an average of 84 days to mature at Akron. It has medium-sized stems, 12 to 36 inches in height under Akron conditions, and bears a medium-sized head that is not lobed. The head has purple bristles. The seed is oval to elliptical and is pale orange.

Dakota Kursk

Dakota Kursk is an early variety requiring an average of 77 days to mature at Akron. Under Akron conditions it has slender stems 12 to 34 inches tall. The head is small, has long purple bristles, and usually is not lobed. It develops lobes in exceptionally good years. The seed is oval to elliptical and is a little darker orange than Siberian.

Goldmine

Goldmine is medium early in maturity, requiring an average of 86 days to mature, and is of about the same height as Siberian. It has medium-sized stems, and the heads are medium large and not

TABLE 8.—*Hay yields of Dakota Kursk foxtail millet grown on fallow at Akron, Colo., 1909-39.*

Year	Pounds hay per acre	Year	Pounds hay per acre
1909	4,615	*	*
1910	5,292	1926	1,867
1911	2,700	1927	6,066
1912	5,040	1928	4,600
1913	4,420	1929	5,333
1914	5,360	1930	6,750
1915	4,000	1931	2,550
1916	4,350	1932	2,490
1917	5,200	1933	2,880
1918	2,750	1934	1,914
1919	3,760	1935	2,537
1920	3,670	1936	4,125
1921	3,150	1937	4,350
1922	4,500	1938	3,060
1923	6,188	1939	1,170
1924	0		
		30-year average	3,823

*Dakota Kursk was not grown in 1925.

lobed. The bristles are pale yellow. The seed is oval to elliptical and is pale yellow.

Hungarian

Hungarian has oval- to elliptical-shaped seeds which vary from pale yellow to purple or black. It is medium early in maturity, requiring an average of 85 days to mature, and has grown to a height of 11 to 35 inches under Akron conditions. The head is small, not lobed, and has long, purple bristles.

White Wonder

White Wonder has stout stems and is early in maturity, requiring an average of 79 days to mature. It attained a height of 14 to 33 inches at Akron. It has pale yellow seeds. The head is lobed, except in the more unfavorable years.

German

German millet has a large, lobed head with long bristles which are green to purple. The seed is pale yellow and round. The stems are stout and have been 12 to 40 inches in height at Akron. It is medium to late in maturity, requiring an average of 88 days to mature at Akron.

Summary

Foxtail millet is one of the leading annual hay crops on the non- irrigated lands of eastern Colorado. It is palatable to all classes of livestock, but if fed to horses it should not exceed one-third of the forage ration.

The seed of foxtail millet has a feeding value of about 83 percent, of that of corn, but it should be ground finely before feeding.

Experiments indicate that foxtail millet should be planted with a grain drill immediately after a good rain between May 15 and July 1. Twenty-five to 30 pounds of seed per acre are recommended.

The Siberian variety is recommended because of high hay yields, but it also produces good yields of seed. However, other foxtail millets such as Dakota Kursk, White Wonder, Goldmine, and German closely approached Siberian in yield tests at Akron.

For good-quality, palatable hay, foxtail millet should be cut before or at first heading.