

# Pearl Millet

## Forage Production In North Dakota

R-1016, May 1991

**Kevin K. Sedivec**, Extension Rangeland Management Specialist  
**Blaine G. Schatz**, Associate Agronomist, Carrington Research Center

The acreage of crops planted for annual forage production in North Dakota is minor but increases dramatically at times of drought and when severe winter-kill of alfalfa occurs. Crops such as pearl millet, foxtail millet, proso millet, oats, sudangrass, sorghum, and sorghum-sudan hybrids can be planted as annual forages.

Pearl millet is a relatively new forage in the northern regions of the United States. However, it has been utilized extensively as a high quality grazing forage in the southern United States. It was introduced into South Dakota in the early 1980s and has received favorable consideration as a forage crop in North Dakota recently

### Description

Pearl millet (*Pennisetum typhoides*) is a tall, warm season, annual grass. It originated in Africa and India where it was used for both forage and grain. It was introduced into the United States in the 1850s and became established as a minor forage crop in the southeastern and Gulf Coast states. Pearl millet is also referred to as penicillaria, pencilaria, Mand's forage plant, cattail millet, bulrush millet, and candle millet.

Pearl millet may grow 6 to 10 feet tall during conditions of high temperatures and favorable moisture. Improved varieties or hybrids are generally leafier and shorter than older varieties. The solid stems are often densely hairy and usually 3/8 to 3/4 inch in diameter. Leaves are long, scabrous, rather slender, and may be smooth or have hairy surfaces. Leaves, as well as stems, may vary in color from light yellowish green to deep purple. A good stand of pearl millet will produce plants with relatively fine stems and profuse leafy growth. Pearl millet has a significantly higher leaf to stem ratio than other forages such as sudangrass, sorghum-sudan and foxtail millets.

The plant tends to tiller profusely under favorable climatic conditions and at times when it compensates for uneven stand establishment. Prop roots arise from the lower nodes to help support the maturing plant. Pearl millet contains one seed producing shoot but generally does not reach the heading stage of development under current harvest conditions or growing season in North Dakota. Regrowth potential after harvesting is comparable to sudangrass and much greater than foxtail and proso millets.

Pearl millet seed heads or inflorescence are often similar in size and shape to the common cattail that grows in marshes and wetlands. The head is stiff and compact, 1-1.5 inches in diameter, usually 6-18 inches long. Spikes produce from 870 to 3000 seeds per plant, averaging 1600. Seeds of pearl millet are much larger than the hulled seeds of other millets.

### Soils

Pearl millet, like most crops, thrives best on rich soils, but it is also suited for sandy soils. It tends to produce higher tonnage than the foxtail millets or sudangrass on sandy soils. The crop tolerates poor, infertile soils better than most other crops.

## Stand Establishment

Planting into a firm, mellow, moist seedbed is an important step in successful pearl millet production. Pearl millet seed is small, so shallow planting 1/2 to 1 inch deep into firm seedbed to obtain good seed-to-soil contact is critical. Field trials have shown that when a firm seedbed is lacking, poor emergence is common and stand failures occur.

Plant into a weed-free seedbed after all danger of frost is past. A soil temperature of 65 to 70 degrees Fahrenheit is recommended for faster germination and stand establishment. Pearl millet can be planted throughout the growing season if moisture is present for germination. Plant no earlier than late May, with early to mid June recommended. Planting date may depend on whether intended use is hay, silage or pasture. Normally, pearl millet can be grazed four to six weeks after planting.

Plant 15 to 20 pounds of seed per acres if solid seeding or broadcasting pearl millet. Seed 7 to 10 pounds per acre if planting in 30 to 42 inch rows. Heavier seeding rates should produce finer stems.

## Fertilization

Pearl millet will respond to fertilization much like annual grain crops. Adequate fertilizer is necessary to produce optimum yields of high quality forage. The fertilizer requirements for pearl millet are similar to other annual grasses such as oats, foxtail millet and sudangrass for forage production. Suggested levels would be 40 to 60 pounds of available nitrogen per acre, with the heavier applications in areas of good soil moisture. Apply 15 to 20 pounds of P<sub>2</sub>O<sub>5</sub> per acre on soils that test low phosphorus, generally less than 5 pounds per acre.

## Forage Harvesting

Pearl millet provides a wide range of alternative uses when utilized as an annual forage. It may be cut for hay, haylage, silage, green-chop or pasture.

### Silage

Pearl millet can provide a high tonnage silage with good nutritive value. Research data from the NDSU Carrington Research Extension Center showed pearl millet produced higher yields than corn and grain sorghum, and similar tonnage compared with sorghum-sudangrass (Table 1). Forage sorghum produced the highest tonnage in this trial.

**Table 1. Dryland annual forage production for silage comparing pearl millet with other annual forage crops at the NDSU-Carrington Research Extension Center.**

Forage Crop	Plant Height	Dry Matter Basis				70% moisture yield/ac
		ADF	NDF	Protein	TDN	
	inches		percent		tons	

Corn:

1988	57.3	33.1	59.1	12.7	64.7	8.26
1989	63.0	26.1	54.3	9.6	69.7	12.73
Forage sorghum:						
1988	50.7	32.2	62.2	11.7	63.7	8.84
1989	82.0	37.8	62.3	9.6	58.6	18.22
Sorghum-sudan:						
1988	63.3	34.4	65.7	10.8	62.1	9.69
1989	87.0	40.4	68.5	9.6	58.6	14.66
Grain sorghum:						
1988	31.3	30.0	60.1	10.8	65.3	7.56
1989	33.5	22.1	43.7	11.3	70.9	7.97
Pearl millet: (Hy-Pro)						
1989	61.5	38.7	48.3	15.0	51.9	14.10

Harvesting pearl millet for silage should occur as soon as frost occurs or when heads appear. Leave a minimum of 6 to 10 inch stubble if regrowth is desired for fall grazing.

Pearl millet is known as a forage capable of producing high contents of crude protein. Data from Carrington indicated crude protein of pearl millet was 15.0 percent, the highest among all crops tested in this trial (Table 1). Pearl millet generally does not produce grain in North Dakota and subsequently will have a lower total digestible nutrient (TDN) value and be lower in energy than corn and grain sorghum.

Corn, forage sorghum and grain sorghums continue to provide a good alternative for planting an annual crop for silage production. However, the lower production costs of pearl millet and farm program considerations may prove it to be an alternative for silage production.

## Hay

Pearl millet can provide excellent hay when properly cured. It is easier to cure than sorghum, sorghum-sudangrass hybrids and sudangrass. Pearl millet is more difficult to cure than the foxtail millets. A conditioner or crimper is recommended for proper curing. Research trials were conducted at the Carrington and Minot Research Extension Centers comparing pearl millet to other annual forage crops to evaluate hay production potential. Pearl millet has the potential to produce excellent yields of high quality forage, especially during growing seasons with favorable moisture (Table 2). Forage production was similar among all forage crops during the drought years 1988 and 1989.

**Table 2. Dryland annual forage production for hay comparing pearl millet with other annual forage crops at the NDSU-Carrington Research Extension Center from 1986-1989.**

Forage Crop	Plant Height inches	Dry Matter Basis				Dry matter yield/ac tons
		ADF	NDF	Protein	TDN	
Pearl millet: (Hy-Pro)						
1986	63.6	--	--	--	--	4.13
1987	76.0	--	--	--	--	7.63
1988	33.7	35.8	58.5	16.4	55.3	1.29
1989	30.2	40.2	62.0	16.3	50.2	2.09
Foxtail Millet: (Siberian)						
1986	39.6	--	--	--	--	3.27
1987	31.7	--	--	--	--	4.13
1988	27.6	38.3	66.2	12.6	52.3	2.15

1989	25.2	39.1	64.4	10.9	51.4	3.18
Proso						
Millet:						
1986	53.3	--	--	--	--	2.63
1987	44.0	--	--	--	--	4.36
1988	36.4	33.8	54.2	13.8	57.5	1.70
1989	30.4	43.8	65.0	10.8	46.0	2.94
Sudangrass:						
1986	85.0	--	--	--	--	3.81
1987	82.3	--	--	--	--	5.05
1988	46.7	30.1	60.6	11.6	65.2	1.86
1989	39.1	27.8	55.5	9.4	66.8	2.17
Sorghum-						
sudan:						
1986	89.1	--	--	--	--	4.51
1987	96.7	--	--	--	--	6.95
1988	46.9	33.1	62.1	11.1	63.0	1.63
1989	47.5	29.2	58.3	10.7	65.9	2.62

Once again, crude protein values were highest in pearl millet when compared to all annual forage crops for all years tested, averaging 16.4 percent for the two years (Table 2). Pearl millet had a TDN value higher than foxtail millets and proso millet but lower than sudangrass and sorghum-sudangrass.

A three-year demonstration comparing forage production of annual forages for hay was conducted at Minot in 1987-1989. Two pearl millet hybrids (Hy-Pro, Mil-Hy 100) were studied as well as proso millet, three foxtail millets varieties, three sudangrass hybrids, four sorghum-sudangrass hybrids, and three sorghum hybrids.

Hy-Pro pearl millet produced the highest three-year acreage yield among all forages at Minot (Table 3). MilHy 100 also performed well, producing a higher yield among all other annual forages with the exception of sorghum-sudangrass WS-20 and Highland 2. Only Siberian millet outproduced Hy-Pro pearl millet during the drought of 1989.

**Table 3. Dryland annual forage production for hay comparing pearl millet hybrids (Hy-Pro and Mil-Hy 100) with other annual forage crops at the NDSU-Minot Research Extension Center from 1987-1989.**

Plant Species	Average plant height	Dry matter* yield/ac	70% moisture yield/ac (D.M.)
	(1987-1989)	(1989)	(1987-1989)
Pearl Millet:			
(Hy-Pro)	34.6	2.5	9.2 (2.76)
(Mil-Hy 100)	29.3	1.9	8.6 (2.58)
Foxtail Millet:			
(Siberian)	27.0	2.8	8.0 (2.40)
(German)	25.7	2.3	7.6 (2.28)
(Manta)	24.0	2.3	7.2 (2.16)
Proso Millet**:	33.0	2.5	6.2** (1.86)
Sudangrass**:	54.8	1.8	7.7 (2.31)
Sorghum-			
sudangrass**:	46.5	2.2	8.2 (2.46)
Sorghum**:	41.9	1.7	7.5 (2.25)

\*No data was collected in 1987, average is for only the two years 1988 and 1989.

\*\*Data is the average for all varieties tested.

Data across North Dakota would indicate that pearl millet appears to be an excellent choice of annual forage for hay production. Although curing may be difficult without the use of a crimper or conditioner, forage production and nutritive content is excellent. Planting of pearl millet can be recommended over sudangrass and sorghum-sudangrass hybrids for hay production due to the prussic acid toxicity potential and extreme difficulty in curing found in sudangrass and sorghums. Foxtail millets may also be a good choice for hay production but possess little regrowth potential. Pearl millet has excellent regrowth potential when properly harvested and when favorable climatic conditions exist.

Harvesting for hay should occur before heading or at about a 30 to 40 inch height. Use of a conditioner or crimper, if possible, is desired for proper curing. Leave a 6 to 10 inch stubble for best regrowth potential.

## Pasture

Pearl millet is similar to sudangrass for pasture potential. It was introduced to the northern regions of the United States as a pasturing type of annual forage. Pearl millet has excellent regrowth potential due to tillering responses to defoliation.

Prussic acid toxicity IS NOT present in pearl millet, which will make it more desirable than sudangrass varieties, hybrids and crosses. A period of four to six weeks of growth or height of 24 to 30 inches are recommended before grazing. Plants at this stage result in best forage production potential and minimize high nitrate levels. Plants grazed before this recommended time may have nitrate levels toxic to livestock. Drought stresses pearl millet, causing nitrate levels to be higher than normal. Test the forage for nitrate levels before grazing when stress situations occur.

Pearl millet makes excellent forage for beef cattle, dairy cows, and sheep. Potential for lower percent butterfat content in dairy cattle has been reported. Grazing studies with beef and dairy heifers indicate good animal performance. Allow cattle to graze until 4 to 6 inch stubble remains, then remove.

Allow 18 inches of regrowth before regrazing. Rotational grazing is recommended with pearl millet. Delayed planting dates for later grazed pastures may be desired to coincide with the proper plant height and maturity for each pasture grazed in the rotation schedule.

## Conclusion

Research data in North Dakota has shown pearl millet to be a very palatable forage producing high yields with outstanding crude protein content. It provides a good alternative crop for hay, haylage, silage, or pasture. Curing will be similar to sudangrass but longer and more difficult than foxtail millets. A crimper or conditioner is highly recommended. It makes an excellent annual pasture grass without the prussic acid poisoning potential commonly found in sudangrass and sorghums. Pearl millet tends to be more productive on sandy and infertile soils than other annual forages, but still performs best on fertile, moist soils.

---

**R-1016**, May 1991

---

County Commissions, North Dakota State University and U.S. Department of Agriculture cooperating. North Dakota State University does not discriminate on the basis of race, color, national origin, religion, sex, gender identity, disability, age, status as a U.S. veteran, sexual orientation, marital status, or public assistance status. Direct inquiries to the Vice President for Equity, Diversity and Global Outreach, 205 Old Main, (701) 231-7708. This publication will be made available in alternative formats for people with disabilities upon request, 701 231-7881.

**INFORMATION ACADEMICS RESEARCH EXTENSION PUBLICATIONS CALENDAR WEATHER DIRECTORY**

[Information for Prospective Students](#)

NDSU is an equal opportunity institution

This information may be photocopied for noncommercial, educational purposes in its entirety with no changes.  
Requests to use any portion of the document should be sent to [NDSU.permission@ndsu.edu](mailto:NDSU.permission@ndsu.edu).  
North Dakota State University Agriculture and University Extension  
Dept. 7070, Morrill 7, P.O. Box 6050, Fargo, ND 58108-6050