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# MILLET as Livestock Feed

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Table 1. Average composition of proso

Weight per bushel (not legal wt.)	50 pounds
Crude protein	12.0 per cent
Crude fiber	8.0 per cent
Ether extract (fat)	4.0 per cent
Total Digestible Nutrients	75 per cent
Digestible Energy	1500 kilocalories/lb
Calcium	0.05 per cent**
Phosphorus	0.30 per cent*
Carotene (vitamin A source)	none**
Vitamin D	none**
Vitamin B <sub>12</sub>	none**
B-complex vitamins	
thiamine	3.0 milligrams/pound
niacin (nicotinic acid)	24.0 mg/lb*
riboflavin	0.7 mg/lb**
pantothenic acid	3.4 mg/lb**
Choline	358.0 mg/lb*
Critical Amino Acids:	
Lysine	0.23%**
Methionine	0.23%*
Threonine	0.35%**
Tryptophane	0.13%

\*inadequate for swine rations

\*\*grossly inadequate for swine rations

Proso or "Hog Millet" (scientific name *Panicum miliaceum*), also called grain millet and broom corn millet, is grown in North Dakota as a late-season crop. It is often seeded following tillage to control severe weed problems or when adverse weather conditions prevent early seeding. North Dakota grows more millet than any other state. Because the crop is grown and fed only occasionally in some areas, livestock producers may be less familiar with nutritional characteristics and proper methods of feeding millet than for other more commonly-used feed grains. Several trials conducted over a period of years by the North Dakota Experiment Station provide considerable information on how best to use millet as livestock or poultry feed.

## NUTRITIONAL CHARACTERISTICS:

Some varieties of millet grain are orange to red while others are nearly white. There is apparently no important difference in feed value between the different types of millets.

Millet or proso ranks about intermediate as an energy source among the cereal grains. It has many of the nutritional characteristics including deficiencies common to other grains.

As with other cereal grains one should expect 1/3 to 1/2 of the phosphorus of proso to be unavailable to swine or poultry, since it is in the form of phytin phosphorus. Include enough inorganic or highly-available phosphorus to provide at least 40 per cent of the needed total phosphorus in swine rations.

The primary and outstanding nutrient deficiency of proso is its lysine deficiency. Lysine is an indispensable amino acid, one of the essential building blocks of animal protein. Simple-stomach animals (non-ruminants) cannot manufacture their own lysine from any other nutrient, so the diet must furnish all needed lysine. Failure to supply adequate lysine

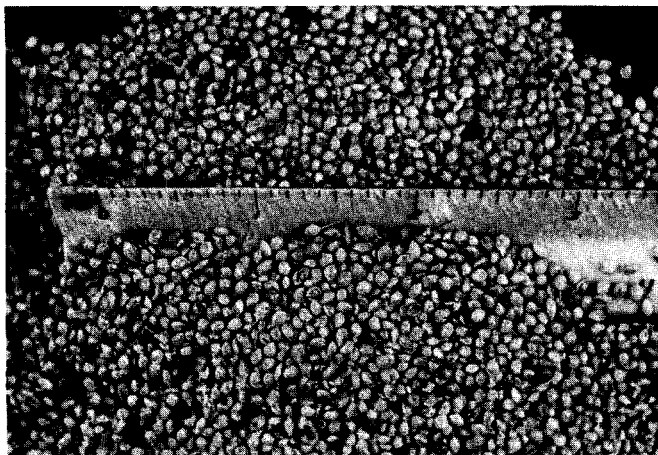
reduces the growth of young swine and chickens approximately in proportion to the dietary shortage.

Protein quality or lysine level is not a consideration in rations for cattle or sheep. When using proso as a substantial portion of the swine or poultry rations, give special attention to formulating the rations to provide adequate lysine. To improve the utilization of proso in non-ruminant rations, combine proso with other grains less severely deficient in lysine (oats, barley, hard spring wheat; not corn or durum) to lessen the shortage by "dilution." Use a supplement or protein source specially formulated to be high in lysine. Increase the proportion of supplement in the ration formula to provide the lysine not provided by proso.

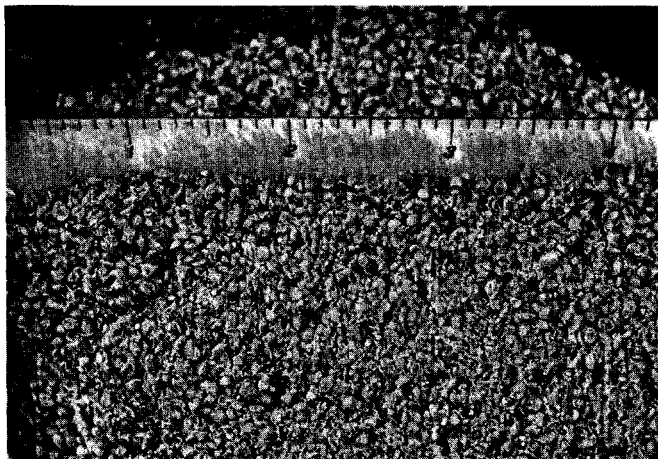
## PROCESSING OR PREPARATION

### Cattle

Grind millet to break all the kernels. It is difficult to break all the small kernels by rolling. Do not powder proso during grinding, as powdering will not improve intake or utilization over moderate grinding. Hammermilling with a ¼ inch screen makes a very acceptable product. Because of its higher fat content, millet tends to have more "body" when ground than most other grains, and does not powder so badly when hammermilled.



Millet seeds are small and poorly digested if fed whole.



Millet should be ground for feeding. This millet was processed through a hammermill with a one-quarter inch screen.

### Sheep and Lambs

Grind as for cattle. Fine grinding will not improve intake or digestibility.

### Swine

Grind using a 3/16 inch or finer screen. Hammermill screens with ¼ inch openings should be acceptable, but 3/16 diameter pores would be preferable. Pelleting proso-based rations for swine has given substantially less benefit (7 per cent feed saving) than is true for barley or oats-based rations. This modest improvement in feed conversion may not pay for pelleting. Gains on pelleted proso rations in the same comparison were 5 per cent faster than those on same rations in meal form. When proso is the main grain in the ration, pellets tend to crumble.

## NORTH DAKOTA TRIALS ON THE FEEDING VALUE OF MILLET

### Fattening Cattle

In an NDSU trial comparing barley and proso in high-grain rations for fattening steer calves, proso-fed steers gained 2.26 pounds daily while barley-fed steers gained 2.13 — about the same. Proso and barley were fed as the only grains in all-concentrate rations once the steers were started on feed. Proso-fed steers used 6.74 pounds feed per pound gain while barley-fed steers used 6.79 pounds, suggesting the energy value of the two grains was about equal. Barley fed in this trial weighed only 39.3 pounds per bushel while the proso used weighed 52 pounds per bushel. Some oats were used to start the cattle on proso. It was noted that using oats with the proso for a longer time might help keep cattle on feed better. Cattle started on proso as the only grain appear to take longer to get to full-feed. Use of oats reduces this period. Using a pound or two of hay daily also helps keep cattle consuming large amounts of proso. The proso-fed steers, which grew from 428 to 1,046 pounds, consumed an average of 13.8 pounds of proso and two pounds of a special supplement containing one pound of alfalfa daily over a 273-day period.

An earlier NDSU trial had shown barley and corn to be equally efficient as energy sources for fattening cattle. Another trial where crude fiber levels were comparable in all rations showed proso, barley, corn, and wheat to be equally effective as energy sources in finishing rations. Gains were the same and the same amount of each ration was required per 100 pounds gain.

Proso may work best in grain rations (perhaps for ruminants as well as non-ruminants) when combined with one of the common North Dakota feed grains, especially barley or oats.

Millet fed in combination with oats may be less laxative for beef cattle, dairy cattle, and lambs than millet as the only grain. Millet fed alone may have slightly more laxative tendencies than oats or barley. But millet will not cause trouble after cattle are on full feed.

Combine proso with oats for starting calves on feed, as they will go on feed faster that way. Once started on feed, proso as the only grain is satisfactory. Include at least a minimum of roughage, such as two pounds hay, eight pounds silage, or two pounds of excellent quality oat straw in the diet to avoid digestive disturbances and help keep cattle on feed. Proso is deficient in calcium for ruminants, as are all other feed grains. Remember this over extended feeding periods. Some calcium supplementation, such as 0.5 per cent of ground limestone in the grain mix may help if only small amounts of non-legume hay are fed. Proso should work equally well in growing rations or in finishing rations.

### Sheep

Lambs may not like proso as well as corn. Proso might best be combined with another feed grain for feeding to lambs. Roll or grind proso coarsely for lamb feeding

Early Colorado experiments indicated proso was about equal to corn or barley for lambs. An early Minnesota trial showed that ground millet gave considerably better results with fattening lambs than whole millet. No digestive disturbances were encountered. Ground millet was less valuable than corn.

An early South Dakota trial also showed it was necessary to grind millet coarsely to obtain satisfactory lamb performance. As an energy source, millet was essentially equal to corn, barley, hard red spring wheat, or durum in lamb fattening rations.

### Producing Dairy Cows

Dairy cows had ground millet as 40 per cent of their grain mix produced as much milk and made slightly more increase in body weight than pair-mate cows fed equal amounts of grain mixtures based on oats, corn, and barley. Actual consumption of millet per day was 8.5 pounds in one trial. Two trials were conducted; cows receiving millet as 40 per cent of their grain mix produced as well as those on control grain mixes in both trials.

### Swine

A series of trials at North Dakota State University studying nutritional characteristics of proso have pointed to low quality protein as the primary nutritional limitation of this grain for hogs. When the protein quality deficit was corrected, proso-fed hogs performed on a par with those fed balanced corn or barley rations.

Early trials conducted 30 years ago at NDSU showed pigs performed better on mixtures of half barley-half proso or half corn-half proso than on proso as the only grain when the same level of tankage was used in each ration. Pigs receiving proso as their only grain ate less per day, gained slower and required more pounds of feed per 100 pounds gain. Equal parts of proso and corn were about equal to corn as the only grain. Combining barley with proso raised daily gains from 1.13 pounds per day on proso alone to 1.32 for the combination. Protein supplementation in

these early trials was from a mixture of two parts tankage and one part linseed oil meal, now recognized as variable and poor sources of lysine, respectively.

It is now apparent these trials were discriminatory to proso, inasmuch as the rations were balanced to contain equal levels of crude protein. The difference in protein quality of the grains were not recognized at that time. Proso rations received only as much supplement as the barley rations, so consequently pigs fed proso gained less and were less efficient (1.13 pounds average daily gain vs 1.43 pounds of gain per day and 355 vs 332 pounds of feed per 100 pounds gain for proso as compared to barley). These differences occurred even though the hogs were on alfalfa pastures

Another trial conducted in the early 1950's with equal amounts of supplement in corn or proso rations gave the following results:

	Corn	Proso
Number of pigs	18	18
Average daily gain (lbs.)	1.72	1.86
Feed per Cwt. gain (lbs.)	376	367
Feed consumed per day (lbs.)	6.5	6.83
Days on trial	92	85

Both rations were supplemented with 9 per cent soybean oil meal and 2 per cent blood meal plus adequate minerals and vitamins. Cobalt supplementation aided gains slightly on either grain, and vitamin B<sub>12</sub> supplementation significantly improved gains on either corn or proso rations. Cobalt is part of the vitamin B<sub>12</sub> chemical structure. It is now recommended that B<sub>12</sub> be added to all hog rations unless they contain substantial amounts of supplements of animal origin.

A trial conducted in the late 50's using proso in pelleted rations gave disappointing results. Protein supplementation for pigs weighing only 38 pounds initially consisted of 1.5 per cent each of meat scraps and blood meal for all rations. Proso-fed pigs gained only 1.21 pounds per day and needed 424 pounds feed per 100 pounds gain. Those on barley pellets gained 1.65 pounds per day and used only 363 pounds feed per 100 pounds gain. Combining 20 per cent barley with the proso resulted in gains of 1.17 pounds per day and required 468 pounds feed per 100 pounds gain. Proso rations need more supplementation than provided by the 3 per cent protein concentrates included in these ration formulas.

Trials conducted in the early 1960's pointed out that pelleting does not alter the nutritive value of a proso ration as long as the protein content of the ration is sufficiently high. Including 14 versus 7 per cent soybean oil meal in the ration increased gains of 46 to 58 pound pigs from 0.55 to 1.38 pounds daily. The same difference was true for heavier pigs, but to a lesser extent, pointing out that pigs weighing 175 pounds or more could utilize the lower quality protein proso rations efficiently. The protein quality of the ration was unsatisfactory. Feed intake, gains, and feed conversion were poor regardless of whether proso was fed pelleted or ground.

