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## EC86-111 Producing Proso in Western Nebraska

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# PRODUCING PROSO IN WESTERN NEBRASKA

L. A. Nelson<sup>1</sup>

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## PROSO - a Description

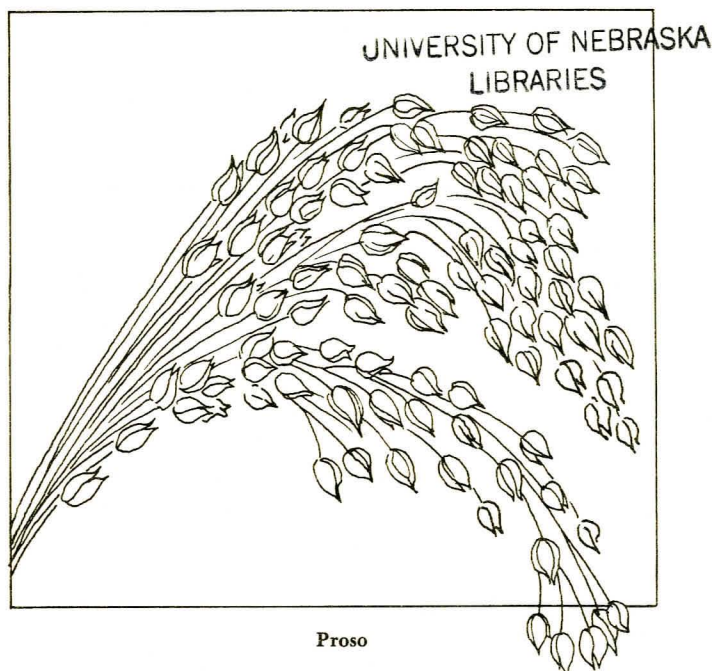
Proso, *Panicum miliaceum*, is a warm season grass capable of producing seed 60 to 90 days after planting. It has been called millet, hog millet, and yellow hog. It has been grown in many countries of the world including China, U.S.S.R., Afghanistan, Romania, Turkey, and India. Although it can be grown in most of the United States, primary production is in western Nebraska, South Dakota and northeastern Colorado.

Historically, Nebraska production has been quite variable and depended on such factors in the wheat crop as winter survival, government programs, and market price. The Nebraska proso crop has ranged from 35,000 to 60,000 acres annually for the past 10 years. The major proso producing area in Nebraska is Cheyenne County and counties adjacent to it.

Proso can be used in a crop rotation in several ways. As a continuous dryland crop, it can produce a grain crop on 14 to 16 inches of annual moisture. In a crop rotation it can be used to gain an extra cash crop every three years in a wheat-fallow rotation. Finally, it can be planted late as a catch crop to replace winter wheat which has been lost due to freezing, blowing, or hail. As a rotation crop, proso can have the advantage of enhancing weed control. It also can be grown as a cash crop when wheat acres are reduced by government programs to less than half of the total acres of the farm.

## Selecting a Field

Proso can be successfully grown on many soil types. It is probably better adapted than most crops to 'poor' land, ie. sandy, dry, low fertility soil. Conversely, proso responds less to high fertility and abundant water than



many other crops and may be a poor choice on 'good' land unless a late planting date makes it the only alternative. Proso has a great deal of tolerance to atrazine. This sometimes is important in fields where atrazine has been applied either for no-till wheat or where a planned crop was abandoned because of inclement weather.

Many times proso is planted in areas where a severe hail storm has destroyed the wheat. These hail storms usually occur after May 15 and an attempt is made to plant as soon as the soil is dry enough. Two problems seem to prevail under these circumstances. First, the wheat has taken a considerable amount of moisture from the soil profile and second, the decaying wheat residue interferes with proso growth. Generally, in a wheat-fallow rotation, it is desirable to plant the proso into the fallow that was intended for wheat planting in the fall, and spend the rest of the summer preparing the hailed wheat land for fall planting.

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## Preparing the Field

Proso usually follows in the spring after wheat has been harvested. A firm moist seedbed is necessary to establish a good stand of proso that will compete with weeds. There are probably as many ways to get a firm moist seedbed as there are farmers growing proso. Some general guidelines follow. If a moldboard plow is used to bury the wheat residue, it must be done early in the spring to allow time for further tillage operations and rainfall to firm the soil. Use of the moldboard plow is the most expensive method of preparing a proso seedbed, but it is the easiest method of preventing weed competition.

A second method of eliminating wheat residue is by burning followed by a light disking and planting of the crop. Although the results are good and the cost considerably less than with plowing, the long term effects of burning coupled with local burning laws would make this an undesirable method of seedbed preparation. A third method is the stubble mulch method which uses such implements as sweep plows, rod weeders, mulch treaders, and field cultivators. The purpose of this method is to reduce the residue enough to allow conventional planting tools to seed it, but to leave enough residue on the surface to reduce soil and water erosion. The stubble mulch system is the most popular with farmers in western Nebraska.

The final method of seedbed preparation is the use of no-till. Proso fits this system well because of its atrazine tolerance. Use of atrazine allows a cheap residual herbicide to control weeds from wheat harvest until the proso crop is well established. A special no-till drill is probably necessary to drill proso into most wheat stubble. No-till is probably the least costly method. It allows the greatest moisture accumulation after wheat harvest and best protects the soil from wind and water erosion. Six years of research data by Nelson and Fenster (1983) show slightly higher yields with no-till than with moldboard plowing, burning, or stubble mulching (see Table 1), though these differences were not significant.

**Table 1. Grain yield of proso planted on land prepared by burning, plowing, stubble mulching, or not tilling.**

Yield pounds/acre			
Burn	Plow	Stubble Mulch	No-Till
1225	1249	1219	1292

Although the fertility requirements of proso are not high, it is generally recommended that 40 pounds per acre of nitrogen be applied when proso follows wheat.

If a full year of fallow precedes the proso, fertilizer is not recommended. This recommendation can be fine tuned by taking a soil sample and determining residual nitrogen in the soil.

## Choosing a Variety

A wider choice of proso varieties is available today because of the proso breeding efforts at Nebraska, Colorado, and Minnesota. These choices may be limited by a desire for a specific seed color or by no-till conditions. Nearly all proso grown in the major production areas is white. Red-seeded proso has some demand, but probably is best grown away from the usual production areas and with a contract or specific market identified. A yearly update of common varieties can be found in the Nebraska Cooperative Extension Publication, Proso Variety Tests. Similar publications are available from Minnesota and Colorado.

Several distinct types of proso are available. The first type is similar to the original common white and includes 'Panhandle' from Nebraska, 'Minco' from Minnesota, and 'Abarr' from Colorado. Although these varieties differ slightly in height, yielding ability, and maturity, they are quite similar. All have white seed and are readily marketed through normal channels in the proso growing areas. A second type with acceptable white seed is 'Minsum', which was developed in Minnesota as an early maturing variety with a very loose panicle type. Colorado developed a tall, late maturing variety 'Cope' which has acceptable white seed but should be planted early or further south. Nebraska released 'Dawn', a very short, very early variety with a tight panicle. It had a superior white grain but was inferior agronomically because of its height. Dawn should not be used to plant in no-till wheat stubble. A similar variety, 'Rise' is taller, better yielding, and has good quality white seed.

If red seed is desired, the two choices are 'Cerise', an early maturing variety from Nebraska, or 'Red Leonard', a tall late maturing variety from Colorado. Red Leonard has superior yield if planted early. Both have smaller seed size and would be less acceptable as a feed due to a higher tannin content. Bird seed manufacturers use small amounts of red proso to improve eye appeal of the final product.

Currently, there are few producers of certified proso seed in Nebraska. The best guide to finding them is the Nebraska Seed Book published by the Nebraska Crop Improvement Association. It is available from local Agricultural Extension agents. Similar publications are available in other states.

## Planting the Crop

The goal of the planting operation is to place the proper amount of seed firmly into a moist soil bed at the best time so the proso can produce seed and have the



greatest advantage over competing plants. Usually, not all these goals can be met and the least damaging compromises must be made.

The best planting date for proso can vary greatly with circumstances. Proso can produce a seed crop in western Nebraska when planted as early as May 15 or as late as July 5. If good weed control is practiced, the earlier date will produce better yields. Earlier planting also takes better advantage of spring rains. Later planting gives proso a better potential for competing with weeds without herbicides. Factors such as condition of seedbed, timing of rains, and in the case of a catch crop, the timing of hail or frost can influence the best date for planting proso.

A wide variety of seeding rates can be used without undue influence on yield. Generally, higher rates are seeded to avoid the necessity to reseed after a heavy rainstorm. Recommended rates can be as low as eight pounds per acre, but rates of 20 pounds per acre are more common. A rate of 12 pounds per acre would be very adequate with a good drill that minimizes the chance of crusting. Proso will thin itself if planted too thick and a thin stand will tiller profusely and compensate when the stand is uniform.

The equipment used to seed proso is usually dictated by what is used for other crops. The most common drill is one used for winter wheat, usually a deep furrow or hoe opener type. This is not the most desirable type since it is difficult to maintain a shallow depth with it. When a hoe drill is used, the rate is set high (20 lb/a) and the depth is quite shallow. The packer wheels can be very beneficial if planting into a loose seedbed, but that combination is most susceptible to crusting from a heavy rainstorm. The most desirable drill for planting proso where stubble is not a problem is a double disk drill. It can place the seed into a shallow slot and firm the soil well around it. It leaves very little furrow to wash in and crust in the event of a heavy rainstorm. The final drill type would be one designed for no-till wheat. It may be a necessity if proso is to be planted into no-till conditions. Regardless of the type of equipment used, it is necessary to have the seed firmly packed into 1/2 to 3/4 inch of soil. Nelson and Fenster (1983) showed that choice of drills did not greatly affect yield if a good job of seeding was accomplished. Nelson (1977) found that drills with narrow row spacings gave a yield advantage over wider row spacings.

### Emergence Problems

One of the most critical periods when growing proso is the two weeks after planting. During this period a light rain can be helpful while a heavy rain can be destructive. The effects of a superior drill become most apparent at this time. A seedbed that is firmly packed around the seed can encourage the germination process even when conditions appear quite dry. The absence of

a deep furrow near the seed will also prevent burying the seed too deep with a heavy rain and allow an implement such as a rotary hoe to break the crust around the seed if necessary.

The stand should be checked periodically during the two weeks after planting. The density of stand within the row is important. If there are fewer than 10 plants in a foot of row, weed competition could become a problem and thought should be given to replanting, especially if it is still early in the season. Another important part of stand is uniformity. If there are large skips or gaps in the field, yield will be reduced and weed problems encouraged. A stand which is marginal can best be preserved with a strong weed control program.

During the periodic checking of stand, a problem of poor secondary root development is sometimes observed. This usually occurs later than two weeks after planting. The proso plants have the appearance of being attached to the soil by only a thread of root. This condition is related to a loose seedbed and occurs most often in moldboard plowed fields. The only cure for this condition is a rain shower which allows the secondary roots to begin growing into the soil surface. Replanting would not be likely to help since the condition is caused by a loose dry soil surface.

### Combatting Weeds

Weeds can be a serious problem in proso. There are three levels of weed control and the producer should decide before planting which level to use. The first level is to do nothing and let the proso fend for itself. The second level is to wait until the proso is in the two- to five-leaf stage and use a herbicide if broadleaf weeds are present. The third level is to apply atrazine immediately after the crop is seeded.

Level one requires some special management decisions. The two necessary ingredients to successfully grow proso without herbicides are to have the field weed-free by tillage just prior to planting and to plant late in the season into a warm moist seedbed so the proso can make rapid growth. The later planting date may reduce yields but will require less cash outlay for herbicides.

Level two should also be planted into a weed-free seedbed, but can be planted earlier in the season since such broadleaf weeds as redroot pigweed and lambs-quarters can be killed later. If these weeds are not present when proso reaches the five-leaf stage, spraying will not be necessary. Recommendations and labels change slightly, but currently the best herbicide to use for post emergence weed control is a combination of 1/8 pound per acre Banvel and 3/8 pound per acre 2,4-D.

Level three requires the fewest management decisions and is the most effective. This level consists of applying 3/4 pound per acre atrazine broadcast within three or four days of planting the field. This treatment should



effectively control all weeds except a few grassy species. In the case of no-till stubble that received an atrazine treatment after the wheat was harvested the previous fall, it is still a good idea to apply 1/2 pound per acre after planting. This treatment will also give some weed control in the fallow period following proso harvest.

### **Insect and Disease Problems**

Proso is not greatly affected by most insects or diseases. One insect that attacks proso is the grasshopper. The heaviest damage from grasshoppers occurs after wheat harvest when they move from the mature wheat to the green proso fields. Proso will not harbor the wheat curl mite, so it is one of the few crops that is safe to have green when planting winter wheat. One of the few diseases found on proso is head smut, *Sphacelotheca destruens*. Nelson and Kerr (1984) have found that seed treatment is a good way to prevent head smut.

### **Harvesting Proso**

Proso produces enough plant material to be considered as a forage crop. It would have to be harvested soon after the seed begins to fill to avoid loss of seed during harvest. Proso has not been used extensively for forage because the pubescence on the stems and leaves causes some irritation to livestock and the thick stems make it harder to cure than plants such as foxtail millet.

Harvesting proso for grain is the most common practice. Since proso shatters easily when ripe, it is quite risky to allow the grain to completely mature and dry while standing. Dawn was the first variety of proso that showed some promise of being harvested by direct combine, although there is a great risk in allowing it to reach safe storage moisture while standing. Any small wind will cause considerable shattering. Thus, it is recommended that swathing be done when most of the head has lost its green color. Threshing can then be delayed until the grain is below 13% moisture. Attaining a 13% moisture level can be a challenge during some years since humidity is high, dew frequent and temperatures lower during September.

Proper setting of the combine is important for proso harvest. Cylinder speed should be about 20 percent slower than for wheat harvest or about 850 rpm. The

most detrimental problem for marketing proso is when the hulls have been removed and only the yellow colored inner berry is left. A good rule of thumb is to leave as many of the loose outer glumes on as there are hulls removed.

### **Marketing Proso**

The bulk of proso sold in the cash trade is marketed through elevators in the three or four countries where it is grown most extensively. This grain is cleaned further, processed and used for bird seed. Both domestic and wild bird seed is packaged by adding other grains for color and nutrition. Some of the proso goes through a dehulling process and enters both human and animal channels. Some is exported and some has specialty uses such as in mushroom production.

In a period of increased acreage, more grain is produced than the markets can absorb. This excess also includes grain produced outside the traditional marketing area. The primary market for this grain is in the livestock industry. A number of studies have been conducted to show the value of feeding proso to livestock. In general, all this research has shown proso to be a good livestock feed for cattle, swine, and poultry. The limitation for cattle is that proso should contribute no more than half the grain in the diet. For swine and poultry, it should be supplemented with lysine, similar to most other cereal grains. When feeding proso to livestock, some processing is necessary, mostly to crack the hard shiny seed coat to allow for better digestion. The economics of raising proso for livestock feed depends on yield levels and production costs relative to other feed grains.

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