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Paddy Production of Wild Rice

Minnesota leads the world in wild rice acreage and production. Wild rice (*Zizania aquatica* L.) is a native Minnesota crop and is unrelated to common rice (*Oryza sativa* L.). Like common rice, it is an annual grass that grows in flooded soils. It is found in lakes or near stream banks, generally where the water is 6 inches to 5 feet deep. Most of the wild rice produced in Minnesota still is harvested from wild stands by the canoe and flail method. But in 1968, about 1,500 acres of wild rice were grown in paddies (fields) on privately owned land. Yields from these paddies averaged 300 pounds per acre of green wild rice (35-50 percent moisture), compared with 50 pounds per acre from wild stands.

PLANT DESCRIPTION

The grain sprouts under water in late April or early May, producing a single root and submerged leaves. In June, leaves that float on the surface of the water are produced. During this time, adventitious roots sprout near the first few nodes of the stem, and in early July leaves appear above the water. The heads appear by the end of July. The stem is hollow, but is partitioned with cross-walls at the nodes and at various intervals in the internodes. The head has female flowers at the top and male flowers at the bottom (figure 1). Female flowers usually are pollinated by another plant. The grain is approximately 1/2 inch long and 1/16 inch wide, although the size varies greatly from stand to stand. The grains ripen unevenly over a period of 10 days to 2 weeks, usually in late August and early September. When a grain is mature, it (and the hulls covering it) falls from the plant. Some types that retain the grain on the head when mature have been selected by the University's Department of Agronomy and Plant Genetics, but these types are not yet available for general commercial use.

ESTABLISHING A PADDY

Site Selection. A prospective site for a wild rice paddy should be reasonably flat so water depths of 6-12 inches can be maintained. Have a preliminary topographic survey made. You can do some grading, but it is expensive and may expose the subsoil, which is undesirable. The site should allow for paddy drainage in late summer to permit the use of harvesting equipment.

The site should be near a water supply. Most paddy operators pump their water from a lake or stream. Well water can be used, but such a system may be more expensive to develop. Water quality also may be important: Natural stands of wild rice grow in water with a total alkalinity of 40-200 parts per million (p.p.m.), a sulfate ion concentration of under 10 p.p.m., and a pH of 6.8-8.8. Permits from the Minnesota Department of Conservation are required to use surface or ground water for irrigation purposes. A layer of impervious soil is needed beneath the paddy so it will hold water and to provide solid

footing for heavy machinery. The amount of water loss that can be tolerated depends upon the quantity of water available for pumping. For information on the permeability of subsoil, contact the Soil Conservation Service.

Wild rice grows well on a wide range of soils from peat to clay. Soils with natural stands of wild rice often have low percentages of available potash and phosphate and a high organic matter content.

Land Preparation and Dike Construction. Brush and trees often must be cleared from an area to be developed. Plow or disc such sites after clearing. If the land is covered with sod, rototill it with a heavy-duty rototiller, since plowed sod often tends to float. After working the soil, have a detailed topographic survey made establishing contour lines at intervals of 1 foot or less (vertical distance).

Locate the dikes, which usually are constructed with a bulldozer, so a water depth of 6-12 inches can be maintained between them. A recommended paddy size is 25 acres or less. Internal dikes may be necessary to control wave action as well as water depth. If too many dikes are required, additional land leveling may be necessary. This can be accomplished with various types of earthmoving equipment such as graders.

The dikes around the field should be designed with a 3:1 side slope and should provide for 12 inches of freeboard. The minimum top width should be 6 feet in organic soils and 4 feet in mineral soils. It may be desirable to make the outside dike wide enough to provide an access road around the paddy. On organic soils, the dikes should be built 3-4 inches higher than the desired height to allow for settling. The inside dikes need be no more than 2 feet wide on the top and should follow the contour lines determined by the topographic survey.

Figure 1. Heads of wild rice. The upper compact portion, about 6-10 inches long, contains the female flowers, which produce the grain. The lower branched portion contains the male flowers, which produce pollen.



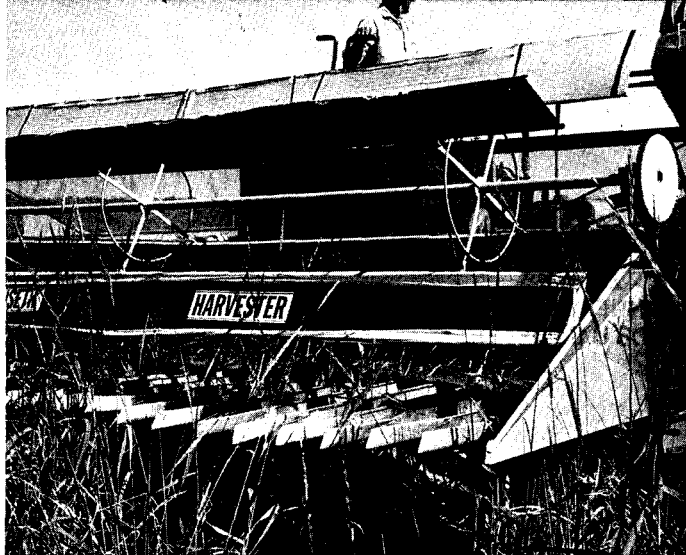


Figure 2. A wild rice harvester showing the long, narrow seed pans and the reel. The platform is 16 feet wide.



Figure 3. A wild rice paddy that has been harvested three times. A harvester track is in the center.

On very level land, place open drainage ditches inside the dikes on one or more sides of the paddy to facilitate water removal before harvest.

The final seedbed should be devoid of ridges and hollows to allow for good drainage before harvesting.

Fertilization. Several growers have reported that rice responds to nitrogen and phosphorus but not to potassium. These growers used 30-45 pounds of nitrogen (N) and 150-200 pounds of phosphate (P₂O₅) per acre. You should use ammonium forms of nitrogen, since nitrate forms are more readily lost by nitrification when the fields are flooded. Apply fertilizer in the fall or spring and incorporate it with a disc to a depth of 2-4 inches.

Seed Source and Handling. The least expensive way to obtain seed is to buy wild rice during harvest from a lake that has large seeded rice. You must have a wild rice buyer's license, obtainable from the Minnesota Department of Conservation.

The seed must be stored in water at 33°-35° F. all winter. You also can store it in bags surrounded by a wire cage beneath the ice in a lake. Remove the bags in the spring and keep them in water at 33°-35° F. until seeding time.

Contact your county agent for possible seed sources. One source from which you can purchase seed is the Wild Life Nurseries, P. O. Box 399, Oshkosh, Wisconsin 54901.

Any purchased seed should be checked for germination in the spring. Place a known number of seeds in a pan of water at room temperature. Check the germination percentage after 3 weeks; it should be 70 or higher. If it is lower, increase your seeding rate proportionately. You cannot check germination in the fall, since seed is dormant at that time.

Method, Date, and Rate of Seeding. Excellent stands have been obtained by broadcasting moist seed just before or just after flooding. One grower has modified a bulk fertilizer spreader so it will place the seed 1 inch below the soil surface. Seeding by airplane into a flooded paddy also has been successful. Paddies can be prepared in the fall and seeded and flooded in early April before the frost is out of the ground. Do not allow seed to dry below 27 percent moisture during the seeding operation, since germination can be reduced when seed is any drier.

Generally good stands have been obtained by seeding 40 pounds (about 50 percent moisture) per acre during the establishment year. Paddies reseed themselves after the initial seeding. As of now, we do not know how many years a paddy

will perpetuate itself.

Water Management. Water depth should be maintained at 6-12 inches. The capacity of the pump must be at least 25 gallons per minute for each acre, which allows application of 1 inch of water in 24 hours. After flooding, additional water will be required to maintain the paddy through the growing season. The amount of water required depends on the amount of percolation and evaporation.

Drain the fields in August when the grain is beginning to fill. Three weeks usually are sufficient for drying a field.

Harvesting. Wild rice does not mature evenly and the grains fall from the head as they ripen. So fields must be harvested about four times at intervals of about 3 days as the rice matures. This uneven maturing also requires that the plants not be cut off during the harvesting operation. Several growers have built their own harvesters and a commercially manufactured machine now is available (figure 2). This harvester is driven by two sets of tracked wheels. The unit is elevated about 6 feet above the ground to provide clearance over the rice. A tray with long metal troughs projecting from the front catches the kernels as a reel knocks them from the heads. The reel speed is just fast enough to dislodge only ripe seed.

Pests. Presently, no herbicides or insecticides are registered for use on wild rice. Keeping the water at least 6 inches deep in the shallowest portion of the field usually will control most weeds except cattails. To reduce cattail competition, rototill the paddies every fall after harvest.

Leaf spot (caused by *Helminthosporium*) inoculum can be reduced by burning paddies after harvest or by incorporating the plant material into the soil. Use extreme caution when burning on peat soils to prevent fires.

Wild rice worm (*Apamae* sp.) feeds on the ripening grain and has caused serious yield losses in some paddies.

Numerous species of water fowl and birds can cause problems. They consume the grains when seeded, destroy the seedlings, or eat the grains directly from the heads. Wild animals such as muskrat and deer also eat wild rice plants.

Mention of commercial names does not imply endorsement nor does failure to mention a name imply criticism by the Minnesota Agricultural Extension Service.

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