

# WILD RICE

D. Ehrensing and R. Karow

## What is wild rice?

Wild rice (*Zizania palustris*) is a tall, aquatic grass native to the Great Lakes region of the U.S. and Canada. It is not related to common rice. Wild rice is a summer annual that is commercially grown in shallow lakes or man-made paddies. Wild rice seed germinates in the spring and is harvested by boat or combine in late summer. After harvest, the large wild rice seeds are steamed, dried, dehulled, and cleaned to produce the dark brown grain that is marketed around the world.

Although wild rice has been hand-harvested in lakes for thousands of years, paddy production and combine harvesting is a recent development. Minnesota growers pioneered paddy production after World War II. Wild rice was introduced into California in the 1970's. The first commercial harvest in Oregon was in 1991, and the first processing plant in the state was built in 1994. There is a small, but steadily growing domestic and world market for wild rice.

Domestication of wild rice began only 30 years ago, so the crop still has many wild characteristics. Varieties suitable for paddy production are termed shatter-resistant; however, shattering losses are still as high as 30 percent. Lake varieties of wild rice are not shatter-resistant. Under normal harvest conditions, enough seed shatters to reseed most fields. Wild rice seeds also require several months of chilling to break dormancy before germinating. Chilling can be accomplished in the field or with cold storage.

## How is wild rice grown?

Most wild rice in Oregon has been produced in paddies constructed by diking existing fields that are considered marginal for other crop production due to poor drainage or heavy soils. In general, wild rice does well in fields with thin topsoil and heavy clay subsoils that minimize water and nutrient losses from the paddy. Dikes 24-30 inches high built on the contour have worked well for wild rice production. Costs for diking have ranged from \$200-\$500 per acre, depending on slope of the fields. Careful planning and design of paddies is essential for efficient production.

Although wild rice growers in some states pump large amounts of water, most Oregon growers store surface runoff in paddies to produce the summer wild rice crop. Maintaining water 18-24 inches deep in paddies during the winter controls invasive weeds and discourages waterfowl that eat wild rice seed. On heavy soils, this amount of water is

enough to sustain the crop and provide for evaporation from the paddy. A supplemental water supply from wells or ponds is good insurance against weather extremes or problems with dikes. Wild rice will not grow in water that has a high salt level.

Conventional wisdom indicates that wild rice seed must be held at a moisture content greater than 28 percent or germination will be significantly reduced. Seed also requires three to four months of chilling to break seed dormancy and allow germination. Seed is often stored in (or under) water, and then broadcast into the flooded paddy in spring using a boat-mounted spin spreader.

Contrary to conventional wisdom, shattered seed that has been allowed to completely dry in the fall in western Oregon fields has still produced thick rice stands the following spring. This observation and subsequent trials have confirmed that wild rice can be dried without killing the seed. Dry seed can be broadcast and harrowed into a field before fall rains fill the paddy. With this seeding method, seed dormancy is broken by chilling in the field without the added cost and problems of cold storage. Successful trials have been carried out in commercial paddies using this technique for three years.

A final plant population of 4 plants per sq ft is desired in seeded fields. As germination rate of seed is generally low, and only 50-60 percent of seeds that germinate establish plants, seeded populations generally range from 16 to 24 seeds per sq ft. Seeding rates in new paddies range from 100 to 200 lb/a depending on seed quality. Although wild rice will reseed itself, some commercial growers commonly overseed 50 lb/ac annually to ensure good stands.

Several varieties are available. 'Johnson' was the first shatter-resistant variety released and is tall and late-maturing. 'K-2' is medium in height and early- to-mid season in maturity. 'Voyager' and 'Meter' are early- maturing, shorter statured varieties developed by the University of Minnesota. Initial experience indicates that varieties like Voyager and Meter will perform best under Oregon conditions.

Wild rice seeds germinate rapidly as water begins to warm in spring. The first several leaves grow under water, but the plant soon produces floating leaves that can be readily seen on the water surface. All remaining leaves are large aerial leaves from 15-30 inches long and 0.75-1 inches wide. Plant stems can be up to 0.5 inches in diameter and plants can be 5 to 10 feet tall. Wild rice plants can have many tillers, and tillering is a function of stand density. Because

tillers mature at different rates, it is desirable to reduce tillering by achieving a fairly dense, uniform stand.

Wild rice heads are similar to those of oats and are called a panicle. The bottom portion of the wild rice panicle bears male flowers while the top part bears female flowers. Female flowers emerge and mature before male flowers, ensuring cross pollination. Like oats and barley, wild rice seed is not free-threshing and has an adhering hull which must be removed during seed processing. Seed is green in color when mature and is normally harvested at a moisture content of 35-40 percent.

Oregon growers have generally found fall fertilizer application most effective for wild rice production, but this technique relies on heavy clay soils in the paddy and dikes to minimize nutrient losses from leaching. Nitrogen fertilizer is broadcast at a rate of 70-75 lb/ac and lightly disked into the paddy prior to the onset of fall rains. Other nutrients such as P and K are usually not applied unless soil testing indicates a deficiency. Wild rice is susceptible to zinc deficiencies. Tissue testing is used in California to determine zinc status of wild rice, however, no cases of zinc deficiency have been reported in Oregon.

No herbicides are registered for use on wild rice, and the crop is susceptible to injury from a wide array of herbicides. Several native aquatic weeds have been a problem in Oregon when paddy water levels are less than 12-18 inches. Insecticides are commonly used in other states for midge and rice worm control, however, there have not yet been major pests in Oregon. Algal blooms are common in warm-climate paddy production and can quickly smother wild rice seedlings. Copper sulfate application may be required to control algae.

Diseases, especially *Helminthosporium* brown spot, are a significant problem in Great Lake paddy production but have been insignificant in northern California. Traces of *Helminthosporium* have been found in Oregon, but it is not known if the disease will become a serious problem.

Birds are a problem in all production areas. Bird damage can occur when seeds are germinating and emerging from the water (geese and ducks) or once grain is near maturity (black birds and other seed feeders). Bird control can cost over \$50 per acre. Black birds have not been a problem in Oregon to date, but are likely to become a problem as acreage increases.

Harvest usually occurs in Oregon from late-July to mid-September (about 120 days after germination). Research in Minnesota indicates that 2900 growing degree days (base 40° F) are required for wild rice to mature. For combine harvest, fields are drained 2 to 3 weeks prior to harvest to allow the soil to dry. Most fields have been harvested using rice combines brought from California, but conventional combines can be used if fields are dry enough. Grain is harvested near 40 percent moisture, and the decision to send the seed for processing or keep it for planting seed must be made

at the combine. Timely processing is critical. Processed seed is put in tote bins, covered with water, and allowed to ferment for several days prior to processing. Fermentation allows color and flavor development as well as degradation of hulls. In commercial operations, grain is then parched in gas-fired ovens, run through a dehuller, cleaned, size-sorted and packaged.

Wet grain yields (green rice) average near 1000 lb/a in Northern California, and yields in Oregon have been comparable, ranging from 1000 to 1700 lb/ac. Growers are paid on a green rice basis with price ranging from 45 to 70 cents per pound in recent years.

A sample production budget is shown in figure 1. The types of expenses shown are typical, but prices can vary significantly depending on individual circumstances. Wild rice is not a "get-rich-quick" crop, but may be a viable alternate crop for some growers.

Initially, Oregon growers had seed, processing and market access through the Fall River Wild Rice Growers Coop in Fall River Mills, CA. In 1994 a wild rice processing plant was constructed near Brownsville, OR to provide local processing and cleaning. This processing plant has the capacity to handle about one thousand acres of wild rice production and plant management is interested in helping to expand Oregon production. Other companies in the area are also investigating wild rice processing and packaging facilities. Growers interested in wild rice production should contact their local county extension agent to obtain additional information.

**Figure 1. Sample wild rice variable cost budget<sup>1</sup>**

	\$/acre
Site preparation (diking, leveling) <sup>2</sup>	100
Field preparation (disk 2X)	10
Seed (150 lbs initial + 50 lb/yr @ \$1 per lb) <sup>3</sup>	80
Broadcast seed	5
Fertilizer (150 lb urea @ 12¢ + \$4 appl)	22
Bird Control	25
Combine	75
Haul	10
Total variable expense	327
Income (1000 lb @ 60¢) <sup>4</sup>	600

<sup>1</sup> Assumptions - Field size is 5 acres. There are adequate P and K levels in soil. The paddy is rain fed (supplemental water with associated pumping costs will be needed in some situations). There is no need for insect or algae control (pesticide costs could be as much as \$50/a). Grain hauling boxes can be borrowed from the coop.

<sup>2</sup> Site preparation - \$500/A over 5 year period.

<sup>3</sup> Since rice reseeds itself, the \$150/A initial cost of seed is spread over 5 years. Annual overseeding at 50 lb/A

<sup>4</sup> Commercial yields have ranged from less than 300 to over 2000 pounds per acre.

Much of the information in this publication was taken from "Wild Rice Production in Minnesota", E.A. Oelke et al., Univ. of Minnesota Extension Bulletin 464, 1982.