TECHNICAL NOTES

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
MICHIGAN

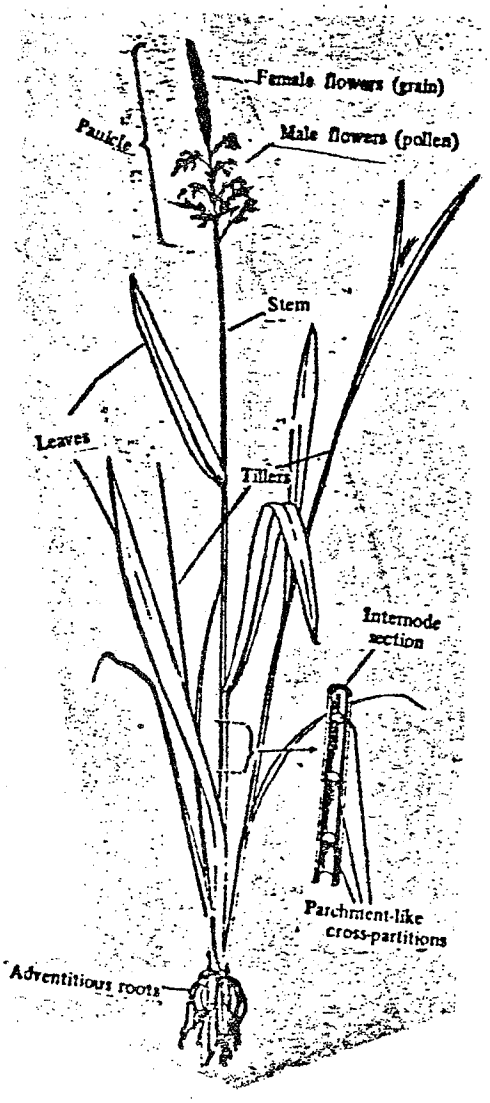
Biology #6
SUBJECT: Wild Rice Production in Constructed Paddies
DATE: April 25, 1980

TO: All Offices

FROM: Robert R. Ditson, State Resource Conservationist

General

Wild rice (Zizania aquatica L.) is being grown commercially in constructed paddies. This wild rice is the same type that grows naturally. It is mechanically seeded and harvested. Six to ten times the amount of wild rice can be harvested per hectare (acre) from constructed paddies than from natural stands. Commercially grown wild rice is processed and cleaned the same way as that harvested from lakes and rivers. It is a comparatively new adventure, considered a high-risk crop, but the prospects for its continued success are excellent where conditions are favorable. (See Biology Technical Note #2, Wild Rice Culture for Waterfowl Use, May 11, 1973, for plant description.)



Site Selection

Special care must be taken to comply with rules and regulations for implementation of Executive Order No. 11990, Protection of Wetlands, Federal Register, July 30, 1979.

A potential site for a wild rice paddy is one that is comparatively flat so water depths of 15 to 30 centimeters (6 to 12 inches) can be maintained. A preliminary topographic survey should be made. Some grading may be done but is expensive and may expose the subsoil which is undesirable. The site should allow for drainage of the paddy in late summer to permit use of harvesting equipment. The

site should be near an acceptable water source. Wells can be used but are expensive to drill as opposed to pumping from an established body of water. Often in areas of production, wells have an insufficient recharge rate. Water quality is important. Natural stands grow where the water has a pH of 6.8 to 8.8, a sulfate ion concentration of 10 parts per million (ppm) or less, and an alkalinity of 40-200 ppm. Wild rice grows well on soils ranging from peat to clay; however, an impervious layer of soil is needed beneath the topsoil so as to hold water and provide solid footing for heavy machinery. Many peat soils used have a pH ranging from 5.0 to 8.0. These soils are often low in phosphorus and potassium, and potential growers may need to add these elements.

Land Preparation

Brush and small trees many times need to be cleared from the area to be developed. Often it is convenient to do this in the winter. Vegetation can be sheared with a bulldozer. If the area is covered with sod, rototill in the spring to prepare the land. Rototilling is preferred to plowing since the plowed organic soils have a tendency to float when flooded. After working the soil, a detailed topographic survey should be made to establish contour lines for dikes providing a 15- to 30-centimeter (6- to 12-inch) water depth.

Often the slope of the land limits diked areas to 10 hectares (25 acres) or less. Where the slope does not limit the areas, drainage often requires open ditches at intervals within a field. Proper intervals depend on soil types and drainage factors.

FIRST YEAR STAND ESTABLISHMENT

Preparation of the Seedbed

Fields should be prepared in the summer or fall prior to the first crop. This allows time for preparation and decomposition of sod or other materials. Rototilling 10 to 15 centimeters (4 to 6 inches) deep is most satisfactory. The completed seedbed should be devoid of ridges and hollows to assure good drainage.

Fertilization

Soil tests cannot always indicate nutrient levels after soils are flooded; however, these tests can help to determine fertilizer needs. Peat soils are generally low in phosphorus and potassium. If this is the case, 11 kilograms per hectare (60 pounds per acre)each of phosphate (P_2O_5) and potash (K_2O) should be applied in the fall or at the time the seedbed is being prepared. The fertilizer should be incorporated 5 to 10 centimeters (2 to 4 inches) deep with a disc or rototiller. Nitrogen should not be applied the first year unless the field was previously cropped. During succeeding years, only 6 to 7 kilograms per hectare (30 to 40 pounds per acre) should be applied when plant internodes begin to elongate. Generally this is the first or second week of July. Ammonia nitrogen, such as ammonium nitrate, is most desirable.

Seed Sources and Handling

New plantings should be made with types most resistant to shattering. Seed is available at harvest time from established growers. If seed is stored, it should be placed in water to assure later germination. Seed for fall planting is usually placed in stock tanks filled with water. Seed stored for spring planting can be put into 189-liter containers (50-gallon drums) and numerous small holes punched in each container to allow for water circulation. Place the containers in pits 3 meters (10 feet) deep and fill the pits with water, making certain that mud is not allowed to cover the seed. Oxygen is required for seed respiration during storage. Poor germination will result if the water freezes. Seed can also be stored in water-filled tanks, kept at 0.5° to 1.7° C. (33° to 35° F.), and the water changed every 2 to 3 weeks.

Seed dormancy prevents germination until after three months of cold storage. After dormancy, germination can be determined by placing a known number of seeds in a container of water at room temperature; however, optimum germination occurs at slightly lower temperatures of about 17.2° C. (63° F.). Seed of high quality will have at least 70 percent germination in three weeks. Planting weed-free seed will help to avoid weeds.

Method and Date of Seeding

After draining surface water from the seed, mix the moist seed with oats. Seed with a bulk fertilizer spreader or an airplane. Seeding in the fall is successful when seed is incorporated 3 to 8 centimeters (1 to 3 inches) into a prepared seedbed with a harrow. If seed is left uncovered during the winter, germination can be reduced by cold temperatures. Wild rice will not emerge from depths greater than 10 centimeters (4 inches). Seed that is incorporated will not necessitate flooding fall-seeded fields. Seeding flooded fields in early April by airplane is also successful. If seeding is done by airplane, then the rate should be increased 15 to 20 percent since many seedings float to the surface of the water.

Rate of Seeding

Generally when using a bulk fertilizer spreader, 4 to 6 kilograms per hectare (25 to 30 pounds per acre) of seed is the right amount providing the seed contains 50 percent moisture. Higher seeding rates will sometimes cause lodging. To prevent reduced germination, seed should not be allowed to dry below 27 percent moisture during seeding operations.

Water Management

15 to 30 centimeters (6 to 12 inches) of water is pumped into fields in early April. If water depths are greater than 46 centimeters (18 inches), lodging increases. A pump capacity of 23 to 31 liters per minute per hectare (15 to 20 gallons per minute per acre) is recommended. A constant flow is not necessary. Water is added only to compensate for percolation, evaporation, and transpiration.

Fields can be drained in August when the grain is beginning to fill. Drying time takes about two weeks but can vary with different soil types.

SECOND YEAR AND OLDER FIELD MANAGEMENT

Tillage

Fields should be rototilled after fall harvest to incorporate straw and help control cattails. This provides for earlier spring flooding. Working the fields in the spring is usually not possible due to the wetness of the soil. Fields may have to be taken out of production for a year and fallowed if cattails become a problem.

Fertilization

Fertilization of older fields should be the same as for first year fields.

Thinning

Fields, both shattering and partially shatter-resistant types, reseed themselves. Approximately 90 to 180 grams of seed per hectare (500 to 1000 pounds of seed per acre) fall to the ground before harvest, resulting in dense stands in following years. For maximum yields, the population must be thinned with equipment pulled through the water to uproot seedlings in the floating leaf stage. The majority of the equipment used reduces plant populations to five or six plants per square foot with the remaining plants in rows or in a checkerboard design. Experiments have shown that 15-centimeter (6-inch) plant rows with 60 centimeters (24 inches) between rows give good yields and less lodging than with a narrower spacing between rows.

Water Management

This is the same as described for first year fields.

Harvesting Procedures

Shattering types are harvested several times with a picker-harvester machine that knocks mature kernels from the plant with a reel. The seed is caught in a series of long, narrow troughs.

The partially shatter-resistant types are harvested with modified rice combines when the average grain moisture is about 45 percent. Combine modifications include lengthened reel arms and extensions bolted onto the tracks. Wild rice requires slower reel speeds than does rice. Special wagons can be brought directly to the combine in wet fields, loaded, and hauled to trucks to be transported to processors.

Control of Weeds

Rototilling after harvest helps to control cattails. Other weeds can be reduced by water depths of at least 15 centimeters (6 inches). Herbicides have been used but wild rice is less tolerant than rice.

Weed growths on the dikes can be controlled by mowing or by an approved chemical such as 2,4-D amine at 183 grams per hectare (1 pound per acre). Avoid chemical drift onto wild rice.

Diseases

Leaf blight caused by several species of Helminthosporium and stem rot caused by Helminthosporium sigmoideum can be severe after the first crop. Thinning helps but does not prevent severe losses. Removal of plant debris or fallowing every other year may be necessary where climatic conditions favor these diseases. Leaf and head smut caused by Entyloma sp. has been observed but resulting yield reduction is not known. At the present time, disease resistant varieties are not available.

Ergot, a common disease of cereals, also occurs on wild rice; however, wild rice is affected by a different species Claviceps zizaniae. The fungus infects florets and large ergot bodies (sclerotia) replaces the kernels. Ergot bodies contain a toxin poisonous to man; however, the disease is not severely prevalent. Also, the ergot bodies are usually separated from grain during harvesting and processing because they are much larger than the kernels. Where and when pieces are detected, they can be floated out with water.

Insects

The wild rice worm (Apamea sp.) is the major insect pest. The larvae feed on developing kernels. The wild rice midge (Cricotopus sp.) can also cause damage before plants emerge from the water. Leaves that have been chewed are an indication of the presence of this insect. Other insects known to attack wild rice are of no economic importance. These include the leaf miner (Hydrellia sp.), stem maggot (Eribolus sp.), and the stem borer (Chilo sp.).

Only approved chemicals should be used for insect control.

Other Pests

Blackbirds can cause severe losses but can be controlled by the intelligent use of frightening techniques or by altering the roosts of the birds. Deer and muskrats will sometimes eat the plants and various species of waterfowl can cause problems.

MDNR & SCS DO NOT MAKE PESTICIDE RECOMMENDATIONS DIFFERENT FROM MICHIGAN STATE UNIVERSITY OR OTHER OFFICIAL PUBLICATIONS. (Pesticides include insecticides, herbicides, fungicides, rodenticides, defoliants, repellents, etc.) WHEN PESTICIDES ARE NEEDED, ALL RECOMMENDATIONS MUST BE IN STRICT ADHERENCE TO, AND CONSISTENT WITH THE REGISTERED USE, LABEL DIRECTIONS, AND PRECAUTIONS - NO EXCEPTIONS! ANY USE OF A PESTICIDE THAT VARIES IN ANY WAY FROM THAT GIVEN ON THE LABEL IS A MIS-USE AND IS IN VIOLATION OF STATE LAW.

Literature Cited

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3. A New Crop For the North Country. Vincent J. Price, Soil Conservation Magazine, April 1973, Vol. 38, No. 9.

4. Wild Rice - An Industry That's Coming of Age. Hal Anderson, Brainard, Minnesota, The Farmer, October 1970.

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Prepared by: Charles M. Smith
Wildlife Biologist

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