USDA NRCS
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Natural Resources Conservation Service

# Plant Guide

# INDIAN RICEGRASS

## *Achnatherum hymenoides* (Roem. & Schult.) Barkworth

Plant Symbol = ACHY

*Contributed by*: USDA NRCS Idaho Plant Materials Program and USDA Agricultural Research Service, Forage and Range Research Laboratory, Logan, Utah

**'Nezpar' Indian ricegrass. Photo by Dan Ogle, USDA-NRCS (retired).**

**Alternate Names**

*Common Alternate Names:* Indian mountain-ricegrass, Indian millet, wye, silky mountain rice, sandgrass

*Scientific Alternate Names: Oryzopsis hymenoides, Stipa hymenoides*

**Uses**

*Grazing:* Indian ricegrass is one of the most important native forage grasses on western desert and semi-desert rangelands (Forest Service, 1937). Indian ricegrass is used by domestic cattle, sheep and horses and is highly palatable during most of the year with the exception of late spring when seed heads are forming. It provides valuable forage for cattle in winter especially in salt desert communities and it supplies a source of green feed for domestic livestock early in the spring before most other native grasses have started to produce new growth (Tirmenstein, 1999). It is not typically used as hay.

*Erosion control/reclamation:* Indian ricegrass is drought tolerant and has a fibrous root system, which makes it desirable for erosion control and reclamation in areas receiving 8 to 14 inches annual precipitation in many arid and semiarid areas in the western United States. However, it is not highly effective in controlling sand movement on dunes (Tirmenstein, 1999). It is one of the first species to establish on cut-and-fill slopes. It does not compete well with aggressive introduced grasses during the establishment period but is very compatible with less aggressive native species.

*Wildlife:* Indian ricegrass is highly palatable to wildlife. It is preferred forage for elk in all seasons and for deer and antelope in spring, late fall, and winter (Tirmenstein, 1999). Indian ricegrass provides poor cover for big game but fair to good cover for birds and small mammals. The seed of Indian ricegrass is readily eaten by many species of birds and rabbits. Desert rodents (mice, ground squirrels, prairie dogs and rats) also utilize Indian ricegrass for food and cover (Tirmenstein, 1999).

*Other uses/values:* Indian ricegrass can be used in low rainfall locations for horticultural value and in dry floral arrangements because of the large-seeded panicle (Tirmenstein, 1999). A company in Montana markets an all-purpose baking flour and flour blend of Indian ricegrass as a gluten-free food product (Amazing Grains, 2013).

**Status**

Indian ricegrass is listed as endangered in the state of Minnesota. Please consult the PLANTS Web site and your State Department of Natural Resources for this plant's current status (e.g., threatened or endangered species, state noxious status, and wetland indicator values).

**Description**

*General*: Grass Family (Poaceae). Indian ricegrass is a cool season, native bunchgrass which grows 30-50 cm tall. The sheath is open and auricles are absent. The ligule is membranous, acute and 6 mm long. The leaves are 1-2 mm wide and 15-25 cm long and usually tightly rolled, giving the plant a slightly wiry appearance. The inflorescence is a wide spreading panicle with a single flower at the end of each hair-like branch. The glumes are 3 to 5 nerved, 6-8 mm long and papery. The lemmas are about 3 mm long, densely pilose and the awn is nearly straight and 3-6 mm long (Majerus, 2009; Skinner, 2010).

Seeds are round to elongated, black or brown, and covered with a fringe of short, dense, white callus hairs.

Johnson and Rogler (1943) reported the chromosome count for Indian ricegrass as 2n=48. Indian ricegrass is recognized as highly polymorphic (Robertson, 1976) and that most forms are ecotypes since variation from site to site is more marked than variation among plants within a site. Jones and Nielson (1989) found that under mesic conditions, the anthers may be exerted permitting cross pollination. But under hot, stressful conditions, pollination occurs before the flower opens, a condition known as ecological cleistogamy. They concluded that Indian ricegrass is self-pollinated and the mode of reproduction can be induced by extreme environments. Indian ricegrass can form natural hybrids with other members of the Stipeae, usually referred to as *Achnatherum x bloomeri* (Barkworth, et al., 2007).

A seed zone map has been developed for Indian ricegrass in the Southwestern United States which distinguished genetic variation between cooler and warmer regions and separating more northern, higher elevation areas from more southern, lower elevation areas into 12 seed zones (Johnson, et al., 2012). The seed zone map was developed to guide and broaden germplasm collection and utilization of Indian ricegrass for restoration.

**Ethnobotany**

Indian ricegrass was a widely known food plant of Indian tribes in the Southwest and Great Basin (Forest Service, 1937). There is documented use of Indian ricegrass by many western tribes including the Apache, Gosiute, Havasupai, Hopi, Kawaiisu, Navajo, Paiute, and Zuni Indian tribes of western North America (University of Michigan, 2013). The major uses were as ground seed used to make bread, mush, pones and dumplings and hay for horses. The starch and sugar content of Indian ricegrass seed is not as high as commonly cultivated grains but does yield approximately 120 calories per ounce (Benfer, 2013).

A study to evaluate the baking qualities of 'Nezpar' Indian ricegrass seed was reported by Stearns and Booth (1980). Nezpar seed showed a good test weight, high milling yield, and high flour protein content. The flour was a cream color and displayed a "sharp feel" more like that of hard wheat flour than of soft wheat flour. Nezpar flour showed a poor baking response as the bread dough became weaker and the loaf volume decreased as the percentage of Nezpar flour was added to standard hard red wheat bread flour. The cookie spread of Nezpar flour was less than cookie spread for soft wheat flour and the study concluded that the poor baking qualities of Nezpar eliminated its consideration for use in domestic bakery goods.

**Adaptation**

Indian ricegrass is very winter hardy and has a broad climatic adaptation. It can be found at elevations from 3,300 to 9,500 feet above sea level. It grows best in areas that receive 8-14 inches annual precipitation but has been observed to establish and reproduce from seeding in areas with as low as 6 inches annual precipitation. It prefers sandy, coarse textured soils and can also be found on sands, fine sandy loams, silt loams, clay loams, gravelly, rocky and shale soil textures (Ogle, et al., 2011a).

It does not tolerate poorly drained soils, extended periods of inundation, winter flooding, or shading. It is tolerant of weakly saline and sodic soil conditions but prefers neutral soil conditions. Response to fire is variable with reports of slight to moderate damage to generally killed by fire. Indian ricegrass regenerates by seed after fire (Tirmenstein, 1999).

*Distribution*: Indian ricegrass is widely distributed throughout the western United States. It occurs east of the Cascade Range from British Columbia south to southern California and northeastern Mexico and east to Alberta, the Dakotas and Texas. For current distribution, please consult the Plant Profile page for this species on the PLANTS Web site.

*Habitat*: Indian ricegrass is found in salt desert shrub communities, sagebrush steppe, short and mixed grass prairie and in pinyon-juniper and ponderosa pine forest communities. It is commonly associated with needleandthread (*Hesperostipa comata*), Thurber's needlegrass (*Achnatherum thurberianum*), sideoats grama (*Bouteloua curtipendula*), blue grama (*Bouteloua gracilis*), wheatgrasses (Triticeae), Sandberg bluegrass (*Poa secunda*), bottlebrush squirreltail (*Elymus elymoides*), big sagebrush (*Artemisia tridentata*), black sagebrush (*Artemisia nova*), winterfat (*Krascheninnikovia lanata*) and shadscale (*Atriplex confertifolia*) (Tirmenstein, 1999).

**Establishment**

The major factor limiting use of Indian ricegrass is the high percentage of dormant seed. Two types of dormancy have been identified: 1) morphological seed dormancy associated with the hard seed coat, and 2) embryo dormancy (Booth, et al., 1980). Research has shown that mechanical scarification of the seed improves germination of dormant seed (Jones and Nielson, 1992). Scianna, et al., (2012) found a combination of modest seed coat stratification with sandpaper plus a 6-10 month moist chilling period at approximately 38-40° F resulted in the highest germination of Indian ricegrass seeds. Dormant field planting in fall (after soil temperatures reach 40° F or less) with light seed coat scarification is the preferred method for establishment of Indian ricegrass. However, commercial seed is rarely scarified. A practical method to overcome seed coat dormancy is by dormant planting

seed that has been properly stored for 4-6 years (Booth et al., 1980).

Embryo dormancy can be overcome by use of Gibberlic acid, kinetin, thiorea, and hydrogen peroxide but are only slightly effective and not very practical (Robertson, 1976). As with seed coat dormancy, fall planting seed that has been properly stored for 4-6 years is the most practical method to overcome embryo dormancy in Indian ricegrass (Booth et al., 1980) but older seed may not emerge from seeding depths as well as younger seed.

The recommended seeding rate for Indian ricegrass is 8 pounds Pure Live Seed (PLS) per acre or approximately 30 PLS seeds per square foot (Ogle, et al., 2011a). There are approximately 161,920 seeds per pound (PLANTS database, 2013). For erosion control or reclamation plantings, the seeding rate should be doubled. If used as a component of a mix, adjust to percent of mix desired. It should be seeded with a drill at a depth of ½-1 inch on medium to fine-textured soils and 1-3 inches on coarse-textured soils into a clean, firm, and weed-free seedbed. A deeper planting depth places the seed in contact with soil with increased moisture content which aids in seed stratification and makes the seed less likely to be dug up by digging rodents. When planting seed mixes that include species that require shallower planting depths (0-¼ inch), two separate seeding operations may be necessary. Plant Indian ricegrass first at the deeper planting depth and then plant the other components of the seed mix at the shallower depth.

**Management**

Stands may require weed control measures during establishment. Broadleaf herbicides should not be applied until plants have reached the 4-6 leaf stage. Mowing when weeds are beginning to bloom will help reduce weed seed development. Grasshoppers or other insects may damage new stands and used of pesticides may be required. All herbicides and insecticides should be applied according to the label.

Indian ricegrass establishes slowly and new seedings should not be grazed before the late summer or fall of the second growing season. New stands should be producing some seed before light grazing should be allowed (Ogle, et al., 2011b). Once established, Indian ricegrass benefits from moderate grazing during winter and early spring. Livestock should be removed while there still is enough growing season moisture to allow recovery, growth, and production of seed. Stands will deteriorate under heavy spring grazing.

The third and fourth year after establishment is critical to stand survival because reproduction is dependent on seed production. Seed must be available in the seed bank to replenish the stand as older plants begin to die. Grazing management with rest or deferment scheduled every 2 to 3 years is recommended to maintain Indian ricegrass. By the eighth or ninth year following establishment, the seed bank should be adequate, with a wide variation of low dormancy to hard seed to ensure long–term stand persistence with proper grazing management.

**Pests and Potential Problems**

Grasshoppers, jack rabbits, and rodents may damage stands. There are no known serious disease problems in Indian ricegrass.

**Environmental Concerns**

Indian ricegrass is a native bunchgrass that reproduces only by seed and is not considered to be weedy or invasive. Although it is not considered weedy or invasive, Indian ricegrass can spread into adjoining vegetation under ideal climatic conditions. Most seedings do not spread from the original planting. Although Indian ricegrass is mostly self-pollinating, it occasionally cross-pollinates with other native needlegrass species. These natural crosses generally produce sterile hybrids.

**Seed and Plant Production**

Using seed that is at least 4-6 years old that has been stored under cool and dry conditions is recommended for producing seedlings for transplanting. Moist-stratify seed at 38-40° F for 30 days prior to planting in the greenhouse. Plant stratified seed into planting containers and grow seedlings for approximately 60 to 90 days with typical greenhouse conditions and irrigation before transplanting to field. If seed is younger than 4-6 years of age, modest seed scarification with sandpaper plus a 6-10 month moist stratification may be required prior to planting seed (Scianna, et al., 2012).

Field seed production of Indian ricegrass has been very successful under cultivated conditions. Row spacing varies from 24 to 36 inches when irrigated and 36 inches under dryland conditions (14 to 16+ inches annual precipitation) are recommended. The recommended seeding rate for seed production in 36 inch row spacing is 3.5 pounds PLS/ac (Cornforth et al., 2001). Cultivation will be needed for weed control and to maintain row culture. Herbicides are used primarily for broadleaf weed control.

Seed production of Indian ricegrass is most productive and persistent on coarse-textured soils. Planting should be accomplished in late fall as a dormant seeding to overcome seed dormancy. Field should be clean, weed-free and firm and seed should be planted to a depth of 1-3 inches on coarse-textured soils and ½-1 inch deep on fine-textured soils.

Seed fields are productive for about five years. Field moisture during the fall, soil fertility, and plant regrowth in the fall determine the yield the following growing season.

Seed harvest can be accomplished by either direct combining or by windrowing followed by combining when seed is in the hard-dough stage. Seed is generally harvested in mid to late July. Wind can shatter ripe seed readily so close inspection is necessary to determine optimum harvest date. Windrowing followed by combining helps to ensure more complete threshing but windrows are also prone to seed loss from wind storms. Seed yields range from about 100 pounds per ac for dryland production to about 200 pounds per ac from irrigated fields (Cornforth, et al., 2001). Seed needs to be dried immediately after harvest to 12 percent moisture content if stored in bins, or to 15 percent if stored in sacks.

The Aberdeen Plant Materials Center uses a two-screen scalper to begin the seed cleaning process. The scalper removes larger inert matter. Once the seed has been scalped it is run through a debearder which removes the copious amounts of fuzz (fringe of short, dense, white callus hairs on the seed). The seed is then processed through a three-screen clipper and a disc or indent cleaner to complete the seed cleaning process.

**Cultivars, Improved, and Selected Materials (and area of origin)**

**'Nezpar'** was originally collected in 1935 from a site south of White Bird, Idaho by the Washington Plant Materials Center. It was selected from 152 accessions for its vegetative characteristics and low seed dormancy and released by the Aberdeen, Idaho Plant Materials Center and the Idaho Agricultural Experiment Station in 1978 (Booth, et al., 1980). It is adapted to the Northwest and Intermountain regions where precipitation averages 8 inches or above. It has survived in plantings with 6 inches annual rainfall. It prefers gravelly to loamy to sandy soils. It is noted for its large erect plant type, robust stems, abundant leaves, medium to small dark nearly hairless elongated seeds (< 50 percent dormant seeds), and good to excellent seedling vigor. Certified seed is available, and Aberdeen Plant Materials Center maintains Breeder and Foundation seed.

**'Paloma'** was collected in 1957 west of Pueblo, Colorado at about 5000 feet elevation on medium textured soils. It was selected by New Mexico PMC and released cooperatively by the PMC and New Mexico Agricultural Experiment Station in 1974 (Alderson and Sharp, 1994). It is adapted to the Southwestern Regions of the Western United States. It is considered very drought tolerant, has good seedling vigor, forage, seed yields, and is long lived. Paloma has good regrowth and spring recovery. It is considered the best Indian ricegrass cultivar for the Southwestern Regions of the Western United States. Certified seed is available, and Los Lunas, New Mexico Plant Materials Center maintains Breeder seed.

**'Rimrock'** was collected in 1960 from a native site averaging 10 to 14 inches of precipitation, north of Billings, Montana, at about 3600 feet elevation on sandy soils. The Montana Plant Materials Center; ARS, Logan, Utah; and the Montana and Wyoming Agricultural Experiment Stations released Rimrock in 1996, primarily because of its ability to retain mature seed better than Nezpar or Paloma. Its more acute angle of glumes helps retain seed longer and protects it from seed shatter caused by wind and/or rain. Certified seed is available, and Bridger PMC maintains breeder seed (Jones, et al., 1998).

**Ribstone** was released in 2003 as a genetically manipulated selected class germplasm. It was selected from an accession collected in 1993 near Taber, Alberta, Canada. At the time of collection, the accession was noted as featuring an acute glume pair-angle, a trait previously associated with seed retention in the cultivar Rimrock. Based on several plot planting evaluations conducted in Utah, 10 of the original plants from the parent accession were visually selected for acute glume-pair angle. Seed from the 10 plants was bulked and used to establish a Generation 1 (G1) field. Prechilled germination of Ribstone was also compared to Rimrock with nearly doubled results for Ribstone. The intended area of use of Ribstone is the southeastern portion of Alberta extending into Saskatchewan and Montana. G1 seed is maintained by the USDA ARS Forage and Range Research Laboratory and G2 and G3 generations are available to seed growers by Ducks Unlimited-Canada and the Utah Crop Improvement Association. G4 seed is eligible for Certification but sale of Ribstone seed beyond G4 is expressly prohibited to limit genetic drift (Jones, et al., 2004).

**Star Lake** was released in 2005 as selected class germplasm that was genetically manipulated. The parent collection was made in McKinley County, New Mexico near the town of Torreon. The cleaned seed collection yielded three seed morphologies differing in size and shape: small elongate (later named Star Lake), large globose, and jumbo globose. The lemma and palea thickness of Star Lake seed was thinnest of the 3 seed morphs (increased lemma and palea thickness has been correlated with increased seed dormancy). Seed of Star Lake and 29 other accessions from southern Utah, northern New Mexico and northern Arizona were then evaluated and harvested from plots and germinated with cold-moist prechill but without scarification. Star Lake was highest in germination. The intended area of use of Star Lake is eastern Utah, western Colorado, northern Arizona and northern New Mexico. Seed of G2 is maintained by the USDA ARS Forage and Range Research Laboratory and is made available to seed growers for production of G3-5 seed by the Utah Crop Improvement Association (Jones and Nielson, 2005).

**White River** was released in 2006 as a selected class germplasm that was genetically manipulated. The

original collection was made near Rangley, Colorado. It also has small seed morphology like Star Lake germplasm (less seed dormancy). It was established in plots in Utah with other collections and had the highest seed yield of 25 accessions and second highest germination of 59 accessions tested. Following field testing in Wyoming, a nursery was established and the best performing accessions in terms of seed yield and germination (32 accessions) were bulked to form White River germplasm. It is intended for use in central and eastern Nevada, central, southern, and eastern Utah, western Colorado, southern Wyoming, southern Idaho, eastern Oregon and southeastern Washington. G2 seed is maintained by the USDA ARS Forage and Range Laboratory and G3 seed is produced by the Uncompahgre Plateau Project in Utah and made available to commercial seed growers through the Utah Crop Improvement Association for production of G4 and G5 seed (Jones et al., 2010).

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