United States Department of Agriculture
NATURAL RESOURCES CONSERVATION SERVICE
Plant Materials Technical Note No. MT-77
September 2012

PLANT MATERIALS TECHNICAL NOTE

Overcoming Seed Dormancy in Indian Ricegrass *Achnatherum hymenoides*

Joseph Scianna, Manager, USDA-NRCS, Bridger Plant Materials Center
Jim Jacobs, Plant Materials Specialist, USDA-NRCS, Bozeman
Robert Kilian, Rangeland Specialist, USDA-NRCS, Miles City Area Office

Figure 1. 'Rimrock' Indian ricegrass seeds.

Abstract

In germination tests at the Bridger Plant Materials Center (BPMC), a combination of modest seed coat scarification with sandpaper plus a 6- to 10-month moist chilling period (stratification) at approximately 38° to 40° F resulted in the highest germination (42 and 57 percent, respectively) of Indian ricegrass (*Achnatherum hymenoides*) seeds. Different or additional scarification may increase germination, but more testing is needed to verify this theory. Dormant field planting (shortly after October 15) with light seed coat scarification if possible, is the preferred planting method for Indian ricegrass. Even when improperly planted, Indian ricegrass seed is long-lived, and may emerge the second or later years after planting on sites to which it is adapted, although subsequent plant and weed competition may reduce its survival and establishment.

Introduction

Many plant species adapted to semi-arid, northern temperate latitudes have dormancy mechanisms preventing seeds from germinating until conditions are favorable for growth and establishment. These adaptive strategies typically prevent germination in the fall when cold temperatures are likely to kill delicate new seedlings, but may also delay or stagger germination until other conditions like soil moisture are ideal for germination and seedling establishment. Lengthy dormancy mechanisms are common in woody plants and forbs (wildflowers), but less prevalent in grass and grass-like species. Indian ricegrass is one example of a grass species requiring a dormancy-breaking treatment or period before its seeds germinate well. Unfortunately, because seed dormancy in grasses is relatively rare, improper timing of planting is common and often results in poor or failed plantings of this valuable conservation species.

Indian ricegrass is an excellent conservation plant for reclamation of disturbed sandy soils, offering early season forage value, as well as food and cover late in the season for a variety of wildlife. For more information on Indian ricegrass see Plant Materials Technical Note Number MT-74. It is thought to have both mechanical dormancy (limiting O_2 uptake by the seed) and physiological dormancy. Mechanical dormancy is overcome by mechanical and acid scarification, whereas physiological dormancy is overcome by seed aging, fall planting, artificial pre-chilling, and application of growth regulators. Older seed lots show less response to mechanical scarification than newer ones. Although scarification that removes the palea and lemma has been shown to improve germination, additional seed coat scarification improves germination as well. In one study, percentage germination of Indian ricegrass when non-scarified and non pre-chilled (Control), non-scarified pre-chilled, scarified non pre-chilled and scarified pre-chilled averaged 9.3, 25.0, 29.4, and 34.7, respectively (Jones and Nielson, 1992). Over-saturation of seeds with water reduced the germination of Indian ricegrass in one study (Blank and Young, 1992), and may explain, in part, why this species thrives on sandy and gravelly sites.

Study

A two treatment study with 10 replications was factorially arranged in a Randomized Complete Block Design and initiated in the greenhouse at the Bridger Plant Materials Center in March 2011 using seed from a 2004 lot of Foundation 'Rimrock' Indian ricegrass seed. Seed viability tested by tetrazolium staining indicated 99% viability. The treatment factors were scarification at two levels (with and without) and moist chilling at five levels (0, 14, 53, 189, and 300 days). One hundred grams of seed was scarified in a scarification box (Figure 2) with 100 grit sandpaper until the normally shiny seed coat was dull (approximately 2 minutes). An equal amount of seed was not scarified. Ten lots of 10 seeds of each scarification treatment were allowed to soak overnight in water in shallow dishes. The next day the 20 lots of seed were sown in 7-cubic-inch containers in Sunshine No. 1® mix, re-moistened, then placed in a greenhouse maintained at 75° to 80° F days and 60° to 65° F nights to germinate. The remaining seeds of each scarification treatment were

Figure 2. Seed scarification box with sandpaper roller.

placed in ventilated Ziploc® bags in a refrigerator maintained at 38° to 40° F, the recommended temperature for stratification. Ten samples of 10 seeds each were taken out of both scarification lots at 14-, 53-, 189-, and 300-day intervals and placed in containers in the greenhouse as previously described. Percentage germination of each scarification X chilling treatment was recorded after 30 days in the greenhouse. Differences in percentage germination among scarification and stratification treatments were tested using a two factor Analysis of Variance

model. The analysis resulted in significant scarification by chilling interaction and means were compared to the no-treatment control using the two-sided Dunnett's multiple comparison.

Results and Discussion

The mean percentage germination values of the ten replications for each treatment combination are listed in Table 1. The non-scarified plus no-chill treatment combination represents the control and suggests Indian ricegrass has a 10% germination rate when seeded in the spring with no pre-treatment. Fourteen days of chilling with no scarification significantly increased germination (32%) compared to the control; however, this may be an anomaly. It was not significantly different than germination (15%) of seed scarified and chilled for 14 days, nor were germination rates of the 53-day (16%) and 189-day (23%) chilled seed with no scarification greater than the germination rate of the control. Disregarding the 14-day chill result, germination of non-scarified seed was not significantly greater than the control until after 300 days of moist chilling, or greater than 9 months. This suggests that a fall dormant seeding with no scarification will result in less than a third of the seed germinating. In a sense, Indian ricegrass is not putting all its eggs in one basket, but banking seed for the future in case a cool, moist winter is followed by an early and seedling desiccating hot, dry summer.

Scarifying seed significantly increased germination compared to the control only after 189 days of moist chilling. This suggests scarifying seed for a fall dormant seeding will improve germination, compared to a spring seeding with or without scarification, from about 10% to 42% to 57%. Even with scarification, Indian ricegrass banks about half of its seed to hedge against the harsh summer conditions typical of the semi-arid west.

Table 1. Percentage germination of Indian ricegrass seeds over time as a function of scarification treatment and duration of cold:moist chilling.

	No Chill %	**14-day Chill %**	**53-day Chill %**	**189-day Chill %**	**300-day Chill %**
Non-Scarified	10	32	16	23	37
Scarified	10	15	21	42	57

Conclusions

A previous study (Jones and Nielson, 1992) also showed scarification and moist chilling increased germination rates of Indian ricegrass. The results of this study suggest moist chilling has a stronger effect than scarification, and the length of moist chilling is an important factor, with no significant increase in germination rate until after nine months of moist chilling. Combining scarification with moist chilling can reduce the effective length of moist chilling to six months, and can be used to improve first year establishment of Indian ricegrass if planting in the fall is delayed past October planting. Similarly, if an early fall dormant seeding is missed and it must be seeded in the spring, proper artificial scarification plus moist chilling will improve germination. However, expect only about 50% germination of Indian ricegrass after a fall dormant seeding or seeding in the spring with artificial seed scarification plus moist chilling for six to nine months.

References and Additional Information

Baskin, C.C., and J.M. Baskin. 2001. Seeds – Ecology, biogeography, and evolution of dormancy and germination. Academic Press.

Blank, R.R., and Young, J.A. 1992. Influence of matric potential and substrate characteristics on germination of Nezpar Indian ricegrass. J. Range Management. 45:205-209.

Jones, T.A., and D.C. Nielson. 1992. Germination of pre-chilled mechanically scarified and un-scarified Indian ricegrass seed. J. Range Management. 45:175-179.

Majerus, M.E. 1997. Recommendation for the release of Rimrock Indian ricegrass. USDA Ecological Sciences Division, Washington D.C. 33 pages.

Plant Fact Sheet for Indian ricegrass *Achnatherum hymenoides*, electronic availability at http://plants.usda.gov.

Plant Guide for Indian ricegrass *Achnatherum hymenoides,* electronic availability at http://plants.usda.gov.

USDA-NRCS, Plant Materials Technical Note Number MT-74**.** Indian Ricegrass (*Achnatherum hymenoides*) Electronic availability at (http://www.mt.nrcs.usda.gov/technical/ecs/plants/technotes/pmtechnoteMT74.html).