REED CANARY GRASS (RCG) *Phalaris arundinacea*

Reed canary grass is a very important invasive plant in Wisconsin and nearby states, and its eradication is especially difficult. It ranked #1 in importance in IPAW's survey of invasive plants.

Reproduction and Basic Ecology

Reed canarygrass (*Phalaris arundinacea* - RCG) is a perennial, cool-season, rhizomatous plant in the grass family (Poaceae / Gramineae) that grows successfully in northern latitudes. Its creeping rhizomes often form a thick sod layer which can exclude all other plants. Its upright stems grow to 2 meters tall from the rhizomes, and its flat leaf blades measure up to 0.5 m long by 2 cm. RCG has open sheaths, hollow stems, small clasping auricles and membranous ligules. Reed canary grass can grow on dry soils in upland habitats and in the partial shade of oak woodlands, but does best on fertile, moist organic soils in full sun. It is a major problem in natural wetlands, including marshes, wet prairies, sedge meadows, fens, stream banks, and seasonally wet areas. It also grows in disturbed areas such as bergs and spoil piles. These stands exclude and displace desirable native plants. Areas invaded by reed canarygrass may be of little use to wildlife (Hoffman & Kearns, 1997). Human disturbance and alteration of water levels encourage reed canarygrass invasion.

RCG can reproduce vegetatively by its rhizomes and rhizome fragments, as well as sexually by its abundantly produced seed. Although each inflorescence can produce approximately 600 seeds, it probably has a low successful establishment rate from seeds, especially within dense infestations. Most plants and recurring populations of RCG develop from rhizomes. RCG seeds can be dispersed in animal fur, on human clothing or on automobiles. The most common vector for RCG seeds and rhizome fragments however, is probably dispersal by water. RCG seeds have a relatively low rate of germination, and do not germinate in dense shade. Seedlings are susceptible to prolonged flooding, prolonged drought, and do not appear to be highly competitive with perennial native species. Established populations can survive prolonged drought and can survive over one year of flooding, especially if parts of the plant are not submerged.

Prevention

Prevention of new invasions is the most efficient and cost effective method of invasive species management and control, and the prevention of new RCG infestations are no exception to this rule. Recent research completed in Wisconsin and Minnesota have shown that when levels of available soil nutrients (such as nitrogen) are reduced via carbon enrichment, a native sedge, *Carex hystericina,* is able to competitively suppress the growth of RCG. Sustaining a mosaic of microtopographies (by preventing sediment accumulation) facilitates native species richness, and maintaining complex herbaceous canopies also work to prevent RCG infestation, since RCG seed germination is dependent on amounts of light penetration.

Manual & Mechanical Control Methods:

Digging

Isolated plants or small patches of RCG can successfully be removed by digging out and removing the entire root mass. Removal is easiest when the soil is moist. Be sure to

remove all rhizomes and roots, as small rhizome fragments can resprout. Properly dispose of plant material, since rhizomes and stems can develop new roots if inundated, or if kept in contact with moist ground. Be sure to follow-up to catch any resprouted stems.

Mowing/Cutting

Mowing or cutting (using a mower, brush cutter, weed eater, tractor-drawn mower, machete, etc.) by itself will not kill RCG. In fact, if RCG is mowed only once or twice per year, it actually stimulates additional stem production. Continued mowing (5x or more per year) for 5 to 10 years is reported as successful in controlling RCG, but this has not been demonstrated on a large scale.

Mowing can be used in combination with another control method, such as a subsequent herbicide application, for good control. Additionally, mowing prior to or at the onset of flowering can eliminate seed set for that year. So, you can choose to mow RCG for several years to eliminate the seed bank, and then a final mow followed by herbicide application to eliminate mature RCG. Mowing can also facilitate the installation of shade cloth, or be used as a pre-treatment for tillage, since it will remove or break up the thick layer of dead litter.

Tillage/Cultivation

The use of large tillage machinery can successfully eliminate RCG if combined with a proper flooding regime. This method, however, requires the use of large, expensive equipment, and requires the ability to manipulate water levels. Additionally, use of tillage to manage RCG assumes that you have no species or communities of concern that you are trying to preserve at the site. If you are working in a sensitive area or in a relatively intact native system, this may not be a viable option. The purchase of the large tillage equipment (48-inch tillage plates and tractor) can be prohibitively expensive, but it may be available locally for rental or borrowing.

To eliminate large, dense RCG infestations using tillage + flooding, you should till through the RCG sod layer as soon as it is possible in the field season (usually, as soon as it is dry enough). The initial tillage may require several passes of the equipment, since the RCG sod layer may be thick and tough. Let the exposed stems and rhizomes dry-out. You will need to till several times during the fieldseason to break-up and dry all rhizome fragments (until you have nothing left but broken-up clods of soil). Finally, when the winter flooding begins, close floodgates and keep the entire area inundated at least 18 inches deep through late spring (late May-June) the following year. This combination of methods will eliminate large infestations of RCG, but follow-up (i.e. spot herbicide treatment with a backpack sprayer) will still be required for several years, since some RCG plants will survive or will reinvade the site. Active restoration will be necessary if a remnant seed bank does not exist.

Flooding without tillage

Controlling the hydrology of the site to lengthen the time an area spends totally submerged may be a viable control strategy if you have control over the hydroperiod of your site.

Prescribed Fire

Burning generally does not kill mature RCG, and similar to occasional mowing, actually appears to stimulate additional stem production unless the fire burns through the entire

RCG sod layer down to the mineral soil (which in turn, may create other problems). In most cases, RCG remains green long into the season, and so does not burn very hot. Herbicide treatment prior to burning can facilitate a prescribed fire, especially outside of typical "fire seasons." Prescribed fire can however, be used as a pretreatment to tillage, shade cloth, or prior to herbicide application for good results, since the fire will remove the aboveground dead litter and standing vegetation. Burning for several years in a row is generally not possible because of lack of fine fuels after the first-year burn.

Solarization, Shade Cloth, & Mulching

Solarization (essentially baking under clear or black plastic) or the use of a thick woven geotextile shade cloth can be used to eliminate RCG. In dense areas of patchy RCG growth, this method can provide specific, targeted control . In areas where RCG is mixed-in with desirable species, the kill of those desirable species may or may not be an option. Also, the use of certain materials for this method depends on your overall management goals. Excellent control of RCG can also be accomplished by using a thick woven plastic fabric (Mirafi(r) or Amoco(r) brands), held in place by 7-inch gutter spikes and washers and duck-bill tree anchors. The fabric is kept in place for over one year (over an entire growing season), even under inundation. This method will kill all plants under the cloth. Revegetation or reseeding is generally necessary with this method.
Shade cloth is initially expensive (approximately $400 per 12 ft x 350 ft roll), but can be reused several times, and this method does not require follow-up visits during treatment. Mowing prior to the installation of shade cloths greatly facilitates installation. Small patches can likely be treated using black plastic bags, if they are kept in place for the entire duration, the edges are tacked-down firmly, and the bags do not shred.

Grazing
Grazing may be effective means for controlling reed canarygrass but the palatability of RCG is questionable--the genus *Phalaris* is notoriously unpalatable and an illness associated with the affects of consumption is called 'Phalaris staggers' (Marten et al., 1976). Cattle prefer RCG when stems and leaves are young and succulent, but do not prefer it once stems become old and tough. Goats and sheep will graze on RCG. Grazing can be combined with another treatment method (followed by tillage, herbicide, shade cloth), for good control. Grazing can also be inappropriate in wetland settings (Hutchison, 1992).

Biological Control
There are no known biological control agents for RCG.

Chemical Control Methods
RCG can be successfully controlled by the proper use of herbicide. Small stands or clumps of RCG can be effectively killed with one application, but large infestations will likely require applications over several years to be effective. Since RCG frequently grows in wet areas, only herbicides approved for aquatic habitats are allowed in many situations. As with all herbicide use, be sure to read and follow all label instructions and

to abide by all state regulations. Glyphosate (Rodeo®, Aquamaster®, or Glypro® among others) applied in a 2% solution (1.08% active ingredient (a.i.)) with a nonionic surfactant works well to kill RCG. Glyphosate (Rodeo) is a non-selective herbicide that kills or injures nearly all plant species. Glyphosate is also available in many other formulations (e.g. RoundUp®). These work well to kill RCG, but are not labeled for aquatic use, so be aware of the areas where you plan on applying herbicide. Sethoxydim (Vantage®) is a grass-specific herbicide that has been used to kill RCG with some success, but it is also not labeled for aquatic use. Depending on the size and distribution of your infestation, the herbicide can be foliar-applied using a dripless wick applicator, backpack sprayer, or boom sprayer. Herbicide should be applied to foliage during the growing season. Application can occur in mid-summer (just prior to summertime dormancy) or preferably in late fall (just prior to frost and wintertime dieback). It is recommended to apply herbicide at these times, since it is speculated that these are the times of year when RCG is most actively translocating carbohydrates (along with the herbicide) down into the root system. You may also combine an herbicide treatment with another control treatment for good results. First, eliminate the aboveground dead litter by mowing or burning, then allow the RCG stems and leaves to regrow to boot height. This helps obtain better herbicide coverage and reduce total herbicide use, since you are spraying only living green RCG that is 12" tall vs. 6' tall stems mixed with old dead leaves. Follow-up monitoring and treatment is necessary for several years to ensure complete kill.

Restoration/Competition

Planting fast-growing shrubs or trees may eventually eliminate RCG since it is intolerant of year-round shade, but depending on your management goals and objectives, this may not be a viable option.

Best Management Practice Recommendation

The best management approach to use will depend on your overall management goals and objectives, the size, distribution and location of your RCG infestation(s), your capability and willingness to use herbicides (or not), and your available resources (staff and volunteer time, money, equipment, etc). The following recommendations are not necessarily the best management methods for every situation, nor are they presented in an order of preference. The methods listed below have however, been used with some success. Also, every method will require follow-up monitoring and treatment (including replanting native species if necessary) to ensure the long-term success of your treatments.

Scattered individual plants or small patches in healthy native vegetation

1. Dig out using a shovel
2. Spot-spray or wick with herbicide
3. Spot flame with a propane torch (only works for seedlings or young individuals)

Distinct patches of RCG within a matrix of native vegetation

1. Dig out using a shovel (depends on size)
2. Cover with shade cloth (may be preceded by mowing)
3. Mow (to eliminate seeds), then spot-spray or wick with herbicide
4. Spot-spray or wick with herbicide

Large patches (up to several acres) of RCG with scattered native vegetation

(Which method you choose will depend on how much you want to keep your native vegetation)

1. Mow then cover with shade cloth
2. Mow then herbicide (wick, spot-spray or boom)
3. Herbicide using appropriate application technique
4. Spot-burn then spot-spray regrowth
5. Cover with shade cloth (may be preceded by a mow treatment)

Large (hundreds of acres) monocultures of RCG

1. Mow using large mower, herbicide spray using boom sprayer
2. Prescribed burn, then herbicide spray using boom sprayer
3. Tillage and flooding

Summarized below are references to papers providing more detail.

Mandy Tu, Ph.D., works with the Invasive Species Intiative of The Nature Conservancy, Oregon Chapter.

Her PowerPoint presentation chronicles the comparison of various control efforts in Oregon. (5.4 MB) Download now.

For a quick look at the results of the study, here's a single PowerPoint slide (53 KB): Download now.

The following is the now published paper discussing the study: Controlling Phalaris in the PNW
Authored By: Mandy Tu, The Nature Conservancy's Wildland Invasive Species Team

The report by Galatowisch and Reinhart (UMn) on best management practices for reed canary grass can now be downloaded/printed from the U.S. Shorebird Conservation Plan website at: http://shorebirdplan.fws.gov/USShorebird/ManagementReports.htm