editor's note

"Grass softens the rude outline of the world. Its tenacious fibers hold the earth in its place. It invades the solitude of deserts, climbs the inaccessible slopes and forbidding pinnacles of mountains, modifies climates, and determines the history, character and destiny of nations."

-John James Ingalls, 1953

I came across this quote in a 1950s textbook. I'm sure Mr. Ingalls meant it in a good way, but geez! Do not attempt this in your homeland! Some of us might actually *like* the 'rude outlines' of the world. The focus of this issue of *Wildland Weeds* is grasses. They are troublesome to identify (examining hairs on a ligule *is not* for everyone) and they are troublesome to kill. Ornamental grasses (native and exotic) are becoming increasingly popular in landscapes. The Internet's flooded with gardening sites that offer everything from *Arundo* to *Zizaniopsis*. Many of the selections are sterile cultivars. Others don't produce viable seed where they are introduced. But sterility isn't always forever. Land managers should be vigilant in looking for new populations of these grasses in natural areas. Plants — like everything in life — are unpredictable.

Torpedograss - Forage Gone Wild

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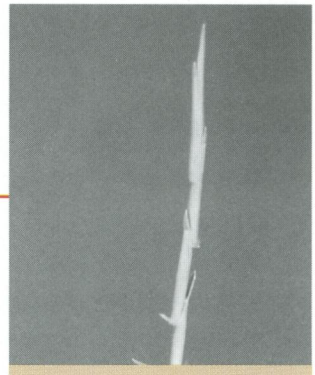

Figure 1. Sharp-pointed torpedo-like growing tips of torpedograss.

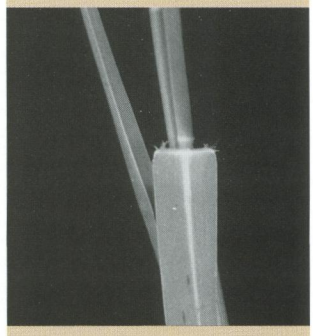

Figure 2. Torpedograss ligule is a short ciliate membrane.

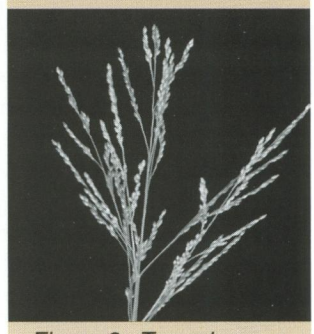

Figure 3. Torpedograss inflorescence is a loose, open, terminal panicle.

Introduction

"Rhizomes are dug or green stems mowed to obtain planting material. Five hundred pounds per acre of stems will produce a stand if they are evenly scattered and packed into moist ground" (Hodges and Jones, 1950). This is how easily torpedograss (*Panicum repens*) was established in pastures throughout central and southern Florida in the early 1900s. In 1950 (Hodges and Jones), the University of Florida agricultural experiment station warned: *"Torpedograss is a serious weed when established in farm and grove land and indiscriminate planting without regard to future crops or adjoining land is dangerous."* Although other forage grasses were found to be equal or superior to torpedograss by then, it had already been planted in almost every county in southern Florida and in a few central and north central counties (Hodges and Jones, 1950).

Torpedograss, which not only flourishes in wet pastures but also in wetlands and lake, pond, and river margins, was here to stay. It now occurs in 70% of Florida's public waters (Schardt, 1994) and is naturalized in 75% of Florida's 67 counties (Wunderlin, 1996). Torpedograss has been called the number one pest grass in southern Florida (Tarver, 1979), and is in parks and preserves throughout the state (EPPC, 1996). An estimated two million dollars per year are spent for management of torpedograss in flood control systems (Schardt and Schmitz, 1991). In waters two to four feet deep, torpedograss displaces native shoreline species (Tarver, 1979). In Lake Okeechobee, it has displaced 14,000 acres of native marsh (Schardt, 1994). It is a serious or principal weed in 19 crops including, fruits, field crops, and pastures, in 27 countries as well as in watercourses, and other noncrop areas (Holm et al., 1977).

Identification

Sharp-pointed torpedo-like growing tips (Figure 1) on rhizomes give torpedograss its name. Rhizomes and stolons are extensive, up to 20 feet long, have overlapping, brownish to white scales and swollen bulbil-like nodes. Aerial stems grow to 3 feet tall with the lower portions often wrapped in bladeless

sheaths. Leaf sheaths are glabrous or hairy, usually at least with hairs on the upper margins. The ligule is a short ciliate membrane (Figure 2). Leaf blades are stiff, linear, flat or folded, to 10 inches long and 0.3 inches wide, glabrous or sparsely hairy below, usually long-hairy above (particularly noticeable on younger leaves), especially near the base behind the ligule; blade surfaces often have a whitish waxy coating, or "bloom." Inflorescence is a loose open terminal panicle, 3 to 9 inches long, with branches erect or ascending (Figure 3). Ovate shaped spikelets are 0.08 to 0.12 inches long and about 0.04 inches wide, glabrous, the first glume (outermost spikelet bract) short, truncate, loose, and nearly encircling the base of the other spikelet bracts.

Biology

Torpedograss reproduces principally by rhizome extension and fragmentation (Holm et al., 1977). Rhizomes are tolerant to desiccation with air-drying up to 60% of initial fresh weight having no effect on subsequent regrowth (Wilcut et al., 1988). High levels of carbohydrate reserves (Manipura and Somaratne, 1974) in rhizomes allows for rapid regeneration of the shoot and new rhizomes from small fragments (Chandrasena, 1990). It produces axillary buds along the entire length of the rhizome and growth of these axillary buds leads to the subsequent production of numerous aerial stems (Wilcut et al., 1988). Spread by seed has been reported in Portugal (Moreira, 1978) but viable seed was not produced in Taiwan (Peng, 1984) and seeds were never found in Java (Siregar and Soemarwoto, 1976). Wilcut et al. (1988) were unable to induce germination of seeds from torpedograss in the United States using standard germination-inducing treatments. However, evidence for limited production of viable seed has been observed in Florida (Brian Smith, unpublished data). Flowering is day-neutral, i.e. flowering is continuous throughout the growing season (Smith, 1993). Chromosome numbers of x'18, 20, and 30, and 2x'36, 40, and 54 have been reported (Mehra, 1982; Moore, 1973).

Habitat and Distribution

Torpedograss thrives on moist to wet sandy or organic soils but also can do well on high land where conditions are droughty (Hodges and Jones, 1950). It is considered semi-haline and has an adaptive mechanism to allow it to tolerate a moderate range of salinity levels (Ramiti et al., 1979). It occurs on moist sandy beaches and shores of lagoons, spreading on to dunes, interdune swales, marshy shores of lakes and ponds, canals and ditches, tidal flats and spreading out into the water (Godfrey and Wooten, 1979). While it is most frequently associated with wet habitats in Florida, it has been observed in upland scrub habitats of Palm Beach County (Daniel F. Austin, 1997 pers. comm.).

Torpedograss is widely introduced and its place of origin is uncertain (Webster 1987). Hitchcock and Chase (1910) initially considered torpedograss native to tropical and subtropical coasts of both hemispheres. Later, Hitchcock and Chase (1950) reported it as probably introduced to the United States. Godfrey and Wooten (1979) reported it possibly introduced in Americas. According to Holm et al. (1977) it is native to the Old World and has spread throughout the tropics and subtropics of both hemispheres and occurs from about latitude 35° S to 43° N.

The earliest herbarium record of torpedograss in the United States was collected near Mobile, Alabama in 1876 (Hodges and Jones, 1950). In Florida, the earliest herbarium specimen was collected in 1932 near Tampa but it had been observed in the lower valley of the Kissimmee River in the early 1920s (Hodges and Jones, 1950). According to Tabor (1952) it was introduced in ballast of sailing vessels. It now occurs in the United States from Florida to Texas (Godfrey and Wooten, 1979). It has been observed on the Atlantic coast as far north as Bald Head Island, North Carolina (K. A. Langeland, 1984 pers. obs.).

Control

Control of torpedograss requires destruction of rhizomes and rhizome buds (Chandrasena, 1990). This makes its control extremely difficult and expensive. Control by digging out rhizomes has been attempted in the past but this method is labor intensive and ineffective (Chandrasena, 1990; Manipura and Somaratne, 1974). Tillage, which is effective for controlling certain grass weeds in agriculture, is not effective for torpedograss (Holm et al., 1977). Rhizomes, pro-

tected underground, are resistant to fire (Hoffstetter, 1974; Van Arman and Goodrick, 1979). The weakly pathogenic fungi, *Phoma* and *Fusarium*, have been implicated in providing a degree of natural suppression to torpedograss growing under stress in water 3 to 6 feet deep. However, other biological controls are not available and are not anticipated in the future (Thayer and Haller, 1990).

Herbicide products containing the active ingredients fluazifop (FUSILADE II), glyphosate (RODEO, ROUNDUP Pro, ROUNDUP Super Concentrate), and imazapyr (ARSENAL) can be used for management of torpedograss. Although all of these herbicides are translocated and highly effective on most grasses, repeat applications are usually necessary to control torpedograss because of the many dormant axillary rhizome buds, which are not affected by the herbicide. The number and frequency of reapplication depends on season and varies among populations.

FUSILADE II is specific against grasses. Therefore, it is useful for torpedograss management in mixed populations with non-target broad leaf plants. It is not registered for direct application to water or to areas where surface water is present. ROUNDUP Pro and ROUNDUP Super Concentrate are similar products that can be used for torpedograss control in terrestrial habitats. Pro is packaged for the commercial market, whereas Super Concentrate is available on the homeowner market in packaging as small as one pint containers. ARSENAL should be used very carefully because it is readily absorbed by roots of non-target woody plants and can damage them. It can be used in certain wetland situations (Table 1). ARSENAL is being tested in aquatic habitats under an experimental use permit. After being applied by helicopter two consecutive years in Lake Okeechobee, ARSENAL has resulted in up to 90% control (unpublished data). However, control was inconsistent with no control being observed in one treatment area of the lake.

Table 1. Herbicides used for control of torpedograss.

PRODUCT	FORMULATION	COMMENTS
FUSILADE	Fluazifop 24.5% EC	Post emergence, grass specific. Cannot be applied directly to water.
RODEO	Glyphosate 53.8% L	Can be applied directly to water.
ROUNDUP Pro	Glyphosate 41.0% L	May be applied to ditch banks, dry ditches, dry canals. May not be applied directly to water.
ROUNDUP Super Concentrate	Glyphosate 41.0% L	Homeowner packaging readily available in retail stores. May not be applied directly to water.
ARSENAL	Imazapyr 28.7% L	May be applied to non-irrigation ditches and low lying areas when water has drained but may be isolated in pockets due to uneven or unlevel conditions. Otherwise, may not be applied directly to water. Nontarget plants can be damaged by root absorption.

Published with the approval of the Florida Agricultural Experiment Station as J. Series No. T-00435. Mention of trade names is not intended to recommend the use of one product over another.

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