

HISTORY AND TAXONOMY OF BERMUDAGRASS

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I. Introduction

Origins

Bermudagrass [Cynodon dactylon (L.) Pers.] probably originated in tropical Africa; however, Australia, Eurasia, the Indo-Malaysian area, and the Bengal region of India/Bangladesh have also been proposed as its home (13). Although many early writers believed that bermudagrass started in India, most improved strains of Cynodon have been developed from African stock (20). C. dactylon appears to be native in Australia, though some evidence suggests that it might have been introduced (6).

Old Uses

The Veda (the entire body of Hindu sacred writing) celebrated bermudagrass as the "Shield of India" and "Preserver of Nations," a plant sacred to the Hindus, as without it the herds would perish and famine consume the people (8). Close examination of blossoming spikes of bermudagrass reveals dark purple stigmas; the beauty of the inflorescence was noted by European researchers as long ago as the 18th century (18).

Bermudagrass is still used medicinally by Europeans in the Transvaal of South Africa. For heartburn it is taken bruised and mixed with sodium bicarbonate and other substances, and the crushed plant alone is applied to wounds to check bleeding. A decoction of the root is a "Dutch" remedy for indigestion and a blood purifier. The Xhosa tribe of Africa derived a lotion for sores and swellings from bermudagrass. The Sotho of Lesotho, a kingdom in South Africa, use the grass as a charm and to ward off sorcery. In the Philippines, bermudagrass is used as a diuretic and as a tonic for lung ailments. The plant also has medical uses in India, where the leaves are used as a source of vitamin C (30).

Recent History

Bermudagrass was probably introduced into the United States during the middle 1700s; reportedly it was first imported in 1751 into Savannah, Georgia, by Governor Henry Ellis (3). Its rapid propagation and wide distribution in the southern United States were noted in 1807 by James Mease in his Geological Account of the United States (24). Frederick Pursh, who collected from Maine to the Carolinas during the first ten years of the 19th century, also reported bermudagrass as "frequent...on road sides and in cultivated ground" (27).

It is not known when bermudagrass first entered California. In 1856, flats of bermudagrass for ornamental use were reportedly sold in San Francisco for \$5(!). In 1880, Sereno Watson reported bermudagrass near San Bernardino and San Jose and mentioned that it was a troublesome weed in cotton fields

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(29). However, he also stated, "[Bermudagrass] has never been known in the Eastern States to perfect its seed, and it can only be propagated by cuttings" (29), an assertion which has long been disproved. By 1915, bermudagrass was established sufficiently in California to rank as a top weed in Imperial, Napa (25), and Kern (21) counties.

The oldest specimens in California herbariums include the following:

- 1875. Cultivated specimen collected at Santa Cruz. California Academy of Science herbarium, Golden Gate Park, San Francisco.
- 1882. Specimens collected at Duncan's Mill, California. Rancho Santa Ana Botanic Garden herbarium, Claremont, and UC Berkeley herbarium.
- 1885. Specimen collected at Sacramento. UC Berkeley herbarium.
- 1890. Specimen collected at Los Angeles. Rancho Santa Ana Botanic Garden herbarium, Claremont.
- 1893. Specimen collected at Fresno. UC Berkeley herbarium.

II. Taxonomy

Nomenclature

In 1753 Carolus Linnaeus (1707-1778) named bermudagrass Panicum dactylon in his "Species Plantarum" (1). In 1805, Christiaan Hendrick Persoon (1761-1836) reclassified the plant as Cynodon dactylon in his "Synopsis Plantarum" (1, 2); however, Louis Claude Marie Richard (1754-1821), a French botanist who collected in South America and the West Indies, coined the name "Cynodon" and described the genus, which was then published in Persoon's "Synopsis"; thus both Richard and Persoon are credited as authorities for the genus (1). Richard is given as the dominant authority in current literature.

The genus Capriola [from the Latin "capreolus," a tendril (17)] had been proposed in 1763 by Michel Adanson (1727-1806) in his "Familles des Plantes"; since this generic name predated Cynodon, Carl Ernst Otto Kuntze (1843-1907) in 1891 reclassified bermudagrass as Capriola dactylon, but the genus Capriola was ultimately rejected by the International Botanical Code in favor of Cynodon (1, 2, 7).

"Cyn-" is from the old Greek kynos, a dog; "odon" is from the Greek odontos, tooth (17). The name Cynodon alludes to the sharp hard scales of the plant's rhizomes and stolons; the old bladeless sheaths of the stolon and the lowest branch often form conspicuous pairs of 'dog's teeth' (12). Linnaeus derived the specific epithet from the old Greek daktylos, meaning finger, in reference to the four or five fingerlike branches of the flowering stalk (17).

Popular names include bermudagrass, dogstooth grass, devilsgrass, wiregrass [especially the weedy form in fields (12)], and scutchgrass [a name it shares with quackgrass (Agropyron repens)] (17). In Africa, it is called bahamagrass, kweekgrass [probably a variation on quackgrass], or dhub (22).

It is not definitely known how C. dactylon became associated with the Bermuda Islands [named, incidentally, after Juan de Bermudez, a Spaniard who landed there in 1515 (16)]. The association may start with the French botanist Richard, who collected in the West Indies in the late 1700s, when bermudagrass may already have become widespread in these islands.

Related Species

The genus Cynodon includes 8 tropical and warm-climate species (22) and several varieties, mostly in Africa and Australia; only C. dactylon is widely distributed throughout the world. The genus includes several pasture and lawn grasses, principally strains of the species dactylon (22). Members of the genus are perennial, usually low grasses, with creeping stolons or rhizomes, short blades, and several slender spikes digitate at the summit of the upright culms. C. dactylon is the type species of the genus (12).

Species are difficult to define and distinguish; there is great variability within species, particularly in the C. dactylon complex [including six varieties (10)], and much confusion of nomenclature in the literature (6). Based on hybridization studies in Africa, some researchers have even concluded that "no completely satisfactory classification of the genus is possible" (11).

To further complicate matters, at least domestically, C. dactylon bears a layman's resemblance to large crabgrass [Digitaria sanguinalis (L.) Scop.], goosegrass [Eleusine indica (L.) Gaertn.], and dallisgrass (Paspalum dilatatum Poir.); however, it is unique in having a ring of white hairs at the base of each leaf blade (10).

African bermudagrass or "ugandagrass," C. transvaalensis Burtt-Davy, has become locally naturalized in the United States (22). This fine-leaved species is often crossed with C. dactylon to produce turf hybrids (23). C. bradleyi is another African species (30). C. hirsutus Stent is a common weed in Argentina, and C. plectostachyum (Schum.) Pilger is a common weed in Australia and Kenya (14). C. nlemfuensis and C. incompletus have been reported as native to both Australia and Africa (6, 11).

III. Current Status of Bermudagrass

Bermudagrass Growth Habits

Bermudagrass grows throughout the tropical and subtropical areas of the world, from latitudes 45 N to 45 S; in eastern Africa it is distributed from sea level to 2,200 m (13). In the United States, bermudagrass is found in open ground, grassland, fields, and waste places, from Maryland to Oklahoma, south to Florida and Texas, and west to California; it occasionally grows north of this region - from Massachusetts to Michigan, and Oregon (12).

It thrives in warm or hot weather; it usually does not survive heavy freezes, although it has lived through temperatures of 10 F in the vicinity of the District of Columbia (15). It browns during cold weather.

Bermudagrass will grow on any moderately well-drained soil, either acid or alkaline, provided moisture and plant food nutrients are adequate (26). Bermudagrass is drought resistant and tolerant of alkali; it is recorded that "patches of Bermudagrass near Mecca, California, although submerged in the Salton Sea for over 2 years, were still alive and making new growth from the stems when that body of water finally evaporated to a lower level" (28).

C. dactylon creeps extensively by means of scaly rhizomes or by strong flat stolons (12). It can reproduce vegetatively, from both rhizomes and stolons, and by producing seeds. The extensive network of rhizomes and stolons makes bermudagrass particularly difficult to eradicate (5). It is introduced into new areas in many ways: the seeds are a common impurity in commercial seeds; plants bearing seeds are carried in hay, in packing, in bedding for livestock, in feed stuffs; the seeds are carried by wind and irrigation water (28). Locally, the plants spread in any of the above ways, and in addition are dragged from place to place by cultivating machinery (28).

Bermudagrass as a Weed

Worldwide, bermudagrass is perhaps the most serious weed of the grass family: it is reported as a problem in 40 crops in over 80 countries (13). It is a problem in essentially every cropping area except northern Europe, and appears in rotation crops, perennial crops, grassland, and waste places (9).

Bermudagrass is one of the world's principal weeds of corn, cotton, sugarcane, vineyards, and plantation crops. It is ranked among the three most serious weeds in sugarcane in Argentina, Colombia, India, Indonesia, Pakistan, and Taiwan; in cotton in Greece and Uganda; in corn in Angola, Sri Lanka, and Greece; in plantation crops in Kenya, Indonesia, and the Philippines; and in vineyards in Australia, Greece, and Spain. Bermudagrass is a principal weed in sugarcane in the United States, and at one time nearly destroyed the sugarcane industry in some parts of Hawaii (13).

Throughout the United States, bermudagrass is common not only in crops, but along thoroughfares, and along sidewalks or in vacant lots in cities (5). It has become well established in the warmer parts of California, and is widespread in the Sacramento, San Joaquin, and Imperial valleys; it has become one of the most troublesome weeds there (28). However, bermudagrass is absent on summer-dry soils of California valleys and foothills (5).

Bermudagrass as a Host for Parasites, Nematodes, Insects, and Diseases

Bermudagrass is a host for witchweed (Striga hermonthica and possibly other species), a parasitic plant which damages sorghum, corn, peanuts, sugarcane, cucurbits, beans, and other crops in the southern United States and in warm third-world countries (19). Bermudagrass is also a host for the sting nematode (Belonolaimus gracilis), which infests many vegetables in the southern United States, and meadow nematode (Pratylenchus spp.), which damages tobacco plants (19).

Bermudagrass is an alternate host of rust (Puccinia cynodontis Lacroix), smut (Ustilago spp.), root rot (Rhizoctonia solani Kuehn), and tar spot (Phyllachora spp.); of the nematodes Pratylenchus pratensis and Meloidogyne

spp.; and the viruses which produce stripe disease of rice, barley yellow dwarf, and lucerne dwarf.

Bermudagrass as a Turf and Pasture Grass

The useful attributes of bermudagrass have been recognized for longer than its weedy characters; this aided in its early spread, in the same way that johnsongrass was initially introduced as a pasture grass. Some strains of bermudagrass are useful as pasture, other strains make excellent lawns and playing fields, and some varieties are used to prevent soil erosion (13).

Bermudagrass is the most important pasture grass of the southern states (12). It is palatable even after frost in the fall (15). Its tenacity makes it useful where other grasses would fail; for example, there are large areas of bermudagrass around the Roosevelt Dam, Arizona, where it survives submergence and furnishes grazing at low water (12).

Some of the bermudagrass grown in Imperial County is used for hay. It is a high yielding crop--10 tons per acre--but it is low in nutrition (Carl Bell, personal communication, 5 January 1989).

Many farmers, however, hesitate to use bermudagrass as pasture or hay because of its obvious potential as a weed problem (15).

Bermudagrass has been incriminated, but not proven the culprit, in cases of apparent poisoning in cattle and sheep. Three syndromes have been described: photosensitization, posterior paralysis, and a neuro-muscular syndrome (20). Bermudagrass sometimes causes a syndrome known as "bermudagrass tremors," a convulsive ergotism with symptoms ranging from twitching of muscles in the neck and flank to paralysis of the hind limbs (20). This condition appears to be due to the presence of the parasitic fungus Balansia epichloe in the grass (20). Balansia does not occur in California, but it has been found in Florida, North Dakota, and Oklahoma. It is prevalent in India.

Cynodon dactylon, C. bradleyi of Africa (30), and C. nlemfuensis and C. incompletus of Australia (6) may yield hydrocyanic acid (HCN) in amounts potentially poisonous to livestock, especially in rapidly growing shoots (6).

Bermudagrass is widely utilized in the southern states as a lawngrass (12). Some object to the grass as a lawn because it browns during the winter; nevertheless, in many areas bermudagrass is valued since it will tolerate soils where other grasses would not thrive (5). It is also useful in checking erosion: the stolons can grow over rocks 6 feet across, or down steep embankments, and are effective in holding shifting sands (8). Bermudagrass spreads rapidly when cultivated, but if not renovated, it becomes sod-bound and loses vigor in a few years (26).

Insects and disease can injure bermudagrass. In Florida, mole crickets have been known to kill out large areas; a scale insect is widely distributed, but has not caused serious damage (15). In bermudagrass production in the Imperial Valley, whiteflies, planthoppers (fulgorids), and aphids are troublesome (Ron Ruben, personal communication, 5 January 1989). Diseases that attack bermudagrass are root rot (Rhizoctonia), leaf spot (Helminthosporium),

and southern blight (Sclerotium) (15).

Improved commercial varieties of bermudagrass, most of which are hybrids of C. dactylon and C. transvaalensis (23), are more vigorous in growth and more disease resistant than common bermudagrass; however, they seed sparsely and must be planted vegetatively. These include such varieties as 'Bradley,' 'Sunturf,' 'Tiffine,' 'Tiflawn,' and several others.

Bermudagrass may be propagated by seed or by vegetative cuttings. The seeds are small and light and require a well-prepared seedbed. Spring seedings, 5 to 7 pounds per acre, are generally best. The seed should be covered with a cultipacker or a light harrow (15).

The most common method of planting stolons is to plow furrows 4 to 6 feet apart, drop stolons 2 or 3 feet apart in the furrow, and cover them by plowing or by hand. Stolons should either be watered when set, or planted deep so they do not dry out (15).

Bermudagrass Production

In 1987, 23,476 acres of bermudagrass were grown for seed in Imperial County, yielding an average of 838 lb/A of unhulled seed, or 350 to 500 lb/A of hulled seed. The crop in Imperial County is valued at \$15 million annually. Imperial seed production fields produce for 7 to 8 years; in southern states bermudagrass pastures are reseeded annually (Carl Bell, personal communication, 5 January 1989). Many Imperial County growers use bermudagrass as a "groundbreaker" in new fields; after 7 to 8 years of bermudagrass seed production, the ground is suitable for supporting less tolerant crops (Archie Dessert, personal communication, 6 January 1989). Much of the seed is shipped to the southern states for pasture and lawn use; but Imperial County bermudagrass seed is also shipped worldwide - to Australia, New Zealand, Japan, the Philippines, South America, Africa, and the Middle East (Archie Dessert, personal communication, 6 January 1989).

During the post World War II years, bermudagrass seed was harvested commercially in Arizona and southern California, from volunteer stands in abandoned fields and alfalfa plantings (15). One or two seed crops were harvested annually with a field mower and threshed soon after harvest (15). Within the last 20 years bermudagrass has become a major crop in Imperial County; now seed is produced on fields planted for this purpose.

In 1987, 59,600 lbs of certified bermudagrass seed were produced on 434 acres in California; in 1988, 413 acres of certified seed were harvested in California (4). About 75% of bermudagrass seed produced for certification is accepted; the largest cause for rejection is the presence of weed seed, especially sprangletop (Leptochloa spp.), barnyardgrass (Echinochloa crus-galli), junglerice (Echinochloa colonum), and prickly lettuce (Lactuca serriola) (Robert Stuart, personal communication, 4 January 1989). There is a Special Local Needs label for use of water run Chem-Hoe (propham) for barnyardgrass control. Antor (diethatyl) is used in bermudagrass to control sprangletop (Carl Bell, personal communication, 5 January 1989).

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