Cynodon dactylon (L.) Pers. (Poaceace)
Bermuda Grass

Description. Strongly rhizomatous or stoloniferous perennials, often mat-like, stems 2-8 dm long, leafy, prostrate or decumbent and rooting at the nodes. Leaves alternate; ligules less than 0.5 mm long, membranous, densely ciliate; auricles absent; sheaths glabrous, ciliate near the summit; blades linear, flat to folded, 1.5-5 mm wide, glabrous to soft-puberulent, margins minutely scabrous. Inflorescence umbel-like, typically composed of 3-7 spreading spikes, each 2-8 cm long. Spikelets 2-3 mm long, sessile, appressed, alternating in 2 rows, compressed, composed of 1 floret, the glumes lanceolate, 1-nerved, the lower one 1-1.5 mm long, slightly curved, the upper one 1-2 mm long, straight; lemmas 2-2.5 mm long, ovate, 3-nerved, the back keeled, glabrous to slightly puberulent, the apex blunt to obtuse. In California, flowering from March to August. (Arnow 1987, Clapham et al. 1962, de Wet and Harlan 1970, Fernald 1950, Gleason and Cronquist 1991, Hitchcock 1944, Holmgren and Holmgren 1977, Munz 1959, Smith 1993).

Note: Naturalized populations of Bermuda grass can have considerable genetic variation for growth traits, including erect versus prostrate stems, root penetration, and tolerance of soil temperatures (Rochecouste 1962a, 1962b, Speranza 1995). Some ecological distribution patterns are correlated with ploidy levels (De Silva and Snaydon 1995, Harlan et al. 1969). Numerous selections have been released as lawn grasses and for pastures (Hanson 1965). The common cultivar 'Tifway', which often escapes from cultivation vegetatively, is a sterile hybrid between *Cynodon transvaalensis* Burtt-Davy and *C. dactylon* (L.) Pers. (Johnson 1994a). In Australia, Bermuda grass is a preferred food plant of suburban populations of black-gloved wallabies and western grey kangaroos (Wann and Bell 1997).

Geographic distribution. A native of southern Africa, Bermuda grass has been introduced throughout much of the warm-temperate and subtropical world, primarily for use as a lawn and as a forage grass, especially in saline habitats (Clapham et al. 1962, de Wet and Harlan 1970, Gibbs Russell et al. 1955, Gleason and Cronquist 1991, Holm et al. 1977, Horowitz 1996, Montenegro et al. 1991, Omacini et al. 1990, Santos and Boechat 1994, Stromberg 1995, Thomasson and Theodore 1997, Toth et al. 1997).

Bermuda grass was first reported as naturalized (San Bernardino, San Jose) by Watson (1880). By the turn of the 20th century, it was widespread throughout much of central and southern California (Robbins 1940). Bermuda grass is reported from all northern California Channel Islands (Junak et al. 1997) and from nearly all counties west of the Sierra Nevada (Anonymous 1998, Smith 1993).

Reproductive biology. Like most grasses, *Cynodon dactylon* is wind-pollinated (Proctor et al. 1996). Strains of Bermuda grass show considerable variation with respect to seed set; in general, seed production is relatively low, but seed longevity and viability is high (Holm et al. 1977). Once established, it reproduces primarily by vegetative means through extensive rhizomes and stolon development (Dong and De Kroon 1994).

Ecological distribution. Bermuda grass is generally distributed on sandy or saline soils of open

sites, including road sides, agricultural fields, irrigation canals, orchards, and waste places (Arnow 1987, Clapham et al. 1962, Fernald 1950, Gleason and Cronquist 1991, Holmgren and Holmgren 1977, Munz 1959).

Weed status. Bermuda grass is considered a noxious weed in agricultural or horticultural practice at a global level (Holm et al. 1977), but is not considered a noxious weed by the State Dept. of Food and Agriculture (Anonymous 1996). Holm et al (1977) suggest that it may be the most serious weed in the grass family from an agricultural perspective. It is listed for the United States in Lorenzi and Jeffery (1987) and is considered the most difficult grass weed in the southern U.S. (Webster and Coble 1997).

Microbial pathogens. Bermuda grass has been reported as host of viral stripe diseases (which affect corn and rice) and several fungal diseases, including *Bipolaris*, *Gaeumannomyces*, *Leptosphaeria*, *Marasmius*, *Phyllachora*, *Puccinia*, *Sporisorium*, and *Ustilago* (Stevens 1925, Almarez and Durrieu 1997, Baird et al. 1992, Chandrasrikul 1962, Datnoff et al. 1997, Elliott and
Landschoot 1991, Jorda et al. 1995, Lockart et al 1985a, 1985b, Marley 1995, Sharma and Sachan 1994, Tisserat et al. 1991, Wadhwani and Mehrotra 1982, Wu and Wang 1994, Yamada et al. 1956).

Bermuda grass is apparently resistant to bacterial biocides (e.g., *Xanthomonas*) that have been successfully used to control *Poa annua* and *Lolium perenne* in warm-temperate lawns and pastures (Johnson 1994b, Johnson et al. 1996).

Insect pathogens. Some cultivated strains are susceptible to infestation by rice borers (Browning and Hussey 1987). Other insects reported to infest cultivated Bermuda grass include crickets, fall army worms, and several hemiptera (Buntin 1988, Cobb and Mack 1989, Pashley et al. 1987). Although Bermuda grass serves as a host of billbugs (Curculionidae: *Sphenophorus*), it is the least preferred in grass mixtures (Johnson-Cicalese and Funk 1990). Mohamed et al. (1992) reported the presence of natural compounds that stimulated feeding on Bermuda grass by fall army worms (Lepidoptera: Spodoptera).

Herbicide control. Numerous herbicides have been used to control Bermuda grass, including dinitroanilines (endimethalin, prodiamine, trifluralin), glyphosate, 2,4-d, and sulfonylureas (imazapyr, sulfometuron, and thiazopyr) (Bedmar 1997, Bhowmilk and Bingham 1990, Edward 1998, Grichar 1995, Grichar and Bosewell 1989, Johnson 1992, Johnson 1994a, Johnson and Carrow 1989, Lagoke et al. 1992, Meyer and Bovey 1991, Montgomery et al. 1992a, 1992b).

Numerous studies have also been conducted on controlling other weeds in Bermuda grass lawns with herbicides and herbicide combinations, including imazaquin, dicamaba, glyphosate, 2,4-d, and sulfonylyurea herbicides (Chism and Bingham 1991, Davis et al. 1997, Ferguson et al. 1992, Goatley et al. 1993, Griffin et al. 1994, Hanna et al. 1989, Johnson and Murphy 1992, Karlik et al. 1993, Smith and Martin 1992). Tolerance of Bermuda grass to various pre-emergents in lawns was evaluated by Johnson (1998) and several herbicides in general (Johnson 1995).

Combinations of iron sulfate with herbicides has been shown to increase the tolerance of *Cynodon* to several herbicides (Carrow and Johnson 1992). Neither tralkoxydim alone or in

combination with isoproturon were found to be effective in controlling it in Indian wheat fields (Kumar and Singh 1997). Sulfometuron and metribuzin were found to be more effective than thiazopyr and imazapyr in sugar cane fields (Edward 1998). Taylor and Coast (1996) evaluated efficacy of sulfometuron in relation to seasonal variation application rates.

Literature Cited

Almaraz, T. and G. Durrieu. 1997. Ustilaginales from the Spanish Pyrenees and Andorra. Mycotaxon. 65:223-236.

Anonymous. 1996. Exotic pest plants of greatest ecological concern in California as of August 1996. California Exotic Pest Plant Council. 8 pp.

Anonymous. 1998. California county flora database version 2, Santa Barbara Botanic Garden and USDA National Plants Data Center, Santa Barbara and New Orleans. URL = plants.usda.gov

Arnow, L. 1987. Gramineae. pp.684-788. In Welsh et al. A Utah flora. Great Basin Naturalist Memoirs 9:1-894.

Baird, R., J. Wilson, and D. Sumner. 1992. Identity and pathogenicity of two *Marasmius* species from the sterile white basidiomycete complex. Plant Disease. 76: 244-247.

Bedmar, F. 1997. Bermudagrass (*Cynodon dactylon*) control in sunflower (*Helianthus annuus*), soybean (*Glycine max*), and potato (*Solanum tuberosum*) with postemergence graminicides. Weed Technology. 11: 683-688.

Bhowmik, P. and S. Bingham.1990. Preemergence activity of dinitroaniline herbicides used for weed control in cool-season turfgrasses. Weed Technology. 4: 387-393.

Browning, H. and M. Hussey. 1987. Susceptibility of 'Tifion 68' and 'Coastal' bermudagrass to the Mexican rice borer. Crop Science. 27: 358-360.

Buntin, G. 1988. *Thigonotylus doddi* (Distant) as a pest of bermudagrass: damage potential, population dynamics, and management by cutting. Journal of Agricultural Entomology. 1988.5: 217-224.

Carrow, R. 1996. Drought resistance aspects of turfgrasses in the Southeast: root-shoot responses. Crop Science. 36: 687-694.

Carrow, R. and B. Johnson. 1992. Frequency of iron application influences bermudagrass tolerance to herbicides. Journal of Environmental Horticulture. 10: 228-231.

Chandrasrikul, A. 1962. A preliminary host list of plant diseases in Thailand. Technical Bulletin 6, Department of Agriculture, Bangkok, Thailand. 23 pp.

Chism, W. and S. Bingham. 1991. Postemergence control of large crabgrass (*Digitaria sanguinalis*) with herbicides. Weed Science. 39: 62-66.

Cobb, P. and T. Mack. 1989. A rating system for evaluating tawny mole cricket, *Scapteriscus vicinus* Scudder, damage (Orthoptera: Gryllotalpidae). Journal of Entomological Science. 1989.24:142-144.

Datnoff, L., M. Elliott, and J. Krausz. 1997. Cross pathogenicity of *Gaeumannomyces graminis* var. *graminis* from bermudagrass, St. Augustinegrass, and rice in Florida and Texas. Plant Disease. 81: 1127-1131.

Davis, S., R. Duncan, and B. Johnson. 1997. Suppression of seashore paspalum in bermudagrass with herbicides. Journal of Environmental Horticulture. 15:187-190.

De Silva, P. and R. Snaydon. 1995. Chromosome number in *Cynodon dactylon* in relation to ecological conditions. Annals of Botany. 76: 535-537.

de Wet, J. and J. Harlan. 1970. Biosystematics of *Cynodon* L. C. Rich (Gramineae). Taxon 19: 565-569.

Dong, M. and H. De Kroon. 1994. Plasticity in morphology and biomass allocation in *Cynodon dactylon*, a grass species forming stolons and rhizomes. Oikos. 70: 99-106.

Edward, P.1998. Control of perennated bermudagrass (*Cynodon dactylon*) and johnsongrass (*Sorghum ha/epense*) in sugarcane (*Saccharum* spp. hybrids). Weed Technology. 12:128-133.

Elliott, M. and P. Landschoot. 1991. Fungi similar to *Gaeumannomyces* associated with root rot of turfgrasses in Florida. Plant Disease. 75: 238-241.

Ferguson, G., G. Coats, G. Wilson, and D. Shaw. 1992. Postemergence control of wild garlic (*Allium vineale*) in turfgrass. Weed Technology: 6:144-148.

Fernandez, C. 1976. Studies on penetration and tyranslocation of glyphosate (N-phosphomonomethyl glycine) on *Cynodon dactylon*. Ph.D. dissertation, University of California, Davis.

Gibbs Russell, G., L. Watson, M. Koekemore, L. Smook, N. Barker, H. Anderson, and M. Dallwitz. 1955. Grasses of southern Africa. Memoirs of the Botanical Survey of South Africa No.58. 437 pp.

Goatley, J., V. Maddox, and R. Watkins. 1993. Growth regulation of common bermudagrass (*Cynodon dactylon*) with imazaquin and AC 263,222. Weed Technology. 7: 746-750.

Grichar, W. 1995. Comparison of postemergence herbicides for common bermudagrass (*Cynodon dactylon*) control in peanut (*Arachis hypogaea*). Weed Technology. 9: 825-828.

Grichar, W. and T. Bosewell. 1989. Bermudagrass (*Cynodon dactylon*) control with postemergence herbicides in peanut (*Arachis hypogaea*). Weed Technology. 3: 267-271.

Griffin, K., R. Dickens, and M. West. 1994. Imazapyr for common bermudagrass contol in sod fields. Crop Science. 34: 202-207.

Gould, F. and R. Shaw. 1983. Grass systematics. Texas A&M Press, College Station. 397 pp.

Hanna, W., C. Swann, J. Schoreder, and P. Utley. 1989. Sulfometuron for eliminating Bahiagrass (*Paspalum notatum*) from centipedegrass (*Eremochloa ophiuroides*) and bermudagrass (*Cynodon dactylon*). Weed Technology. 3: 509-512.

Hanson, A. Grass varieties in the United States. USDA, Agriculture Handbook No.170.102 pp.

Harlan, J., J. de Wet, and W. Richardson. 1969. Hybridization studies with species of *Cynodon* from east Africa and Malagasy. American Journal of Botany 56: 944-950.

Hitchcock, A. 1944. Poaceae. pp.103-255. In Abrams, L. Illustrated flora of the Pacific States. 1. Ophioglossaceae to Aristolochiaceae, Stanford University Press, Stanford, California. 538 pp.

Horowitz, M. 1996. Bermudagrass (*Cynodon dactylon*): A history of the weed and its control in Israel. Phytoparasitica. 24: 305-320.

Johnson, B. 1992. Common bermudagrass (*Cynodon dacty/on*) suppression in *Zoysia* spp. with herbicides. Weed Technology. 6: 813-819.

Johnson, B. 1994a. Response of Tifway bermudagrass and tall fescue turfgrasses to preemergence herbicides. Journal of Environmental Horticulture. 12:19-23.

Johnson, B. 1994b. Biological control of annual bluegrass with *Xanthomonas campestris* pv. *poannua* in bermudagrass. HortScience. 29: 659-662.

Johnson, B. 1995. Tolerance of four seeded common bermudagrass (*Cynodon dactylon*) types to herbicides. Weed Technology. 9: 794-800.

Johnson, J. 1998. Influence of spring-applied herbicides on bermudagrass (*Cynodon dactylon*) greens overseeded with roughstalk bluegrass (*Poa trivialis*). Weed Technology. 12:1-6.

Johnson, B. and R. Carrow. 1989. Bermudagrass encroachment into creeping bentgrass as affected by herbicides and plant growth regulators. Crop Science. 29:1220-1227.

Johnson, B. and T. Murphy. 1992. Purple nutsedge control with imazaquin in bermudagrass turf. Research Bulletin, University of Georgia, Agricultural Experiment Station. 408:1-12

Johnson, D., D. Wyse, and K. Jones 1996. Controlling weeds with phytopathogenic bacteria. Weed Technology. 10: 621-624.

Johnson-Cicalese, J. and C. Funk. 1990. Additional host plants of four species of billbug found on New Jersey turfgrasses. Journal of the American Society for Horticultural Science. 115: 608-611.

Jorda, C., A. Ortega, and M. Juarez. 1995. New Hosts of Tomato Spotted Wilt Virus. Plant Disease. 79: 538.

Junak, S., S. Chaney, R. Philbrick, and R. Clark. 1997. A checklist of vascular plants of Channel Islands National Park. Southwest Parks and Monuments Association, Tucson, AZ. 43 pp.

Karlik, J., W. Affleck, and L. Murphy. 1993. Evaluation of two herbicides for control of purple nutsedge in common bermudagrass. Proceedings, 45th California Weed Conference. pp. 9-11.

Kumar, S. and G. Singh. 1997. Efficacy and selectivity of tralkoxydim alone or in combination with isoproturon in wheat (*Triticum aestivum*) streak virus, a previously underscribed plant rhabdovirus infecting Bermuda grass and maize in the Mediterranean area. Phytopathology. 75:1094-1098.

Lockhart, B., N. Khaless, A. Lennon, and M. El Maatauoi 1985b. Properties of Bermuda grass etched-line virus, a new leafhopper- transmitted virus related to maize rayado fino and oat blue dwarf viruses. Phytopathology. 75:1258-1262.

Marley, P.1995. *Cynodon dacty/on*: An alternative host for *Sporisorium sorghi*, the causal organism of sorghum covered smut. Crop Protection.14: 491-493.

Meyer, R. and R. Bovey. 1991. Response of Yankeeweed (*Eupatorium compositifolium*) and associated pasture plants to herbicides. Weed Technology. 5: 214-217.

Mohamed, M. , S. Quisenberry, and D. Moellenbeck. 1992. 6,10,14-Trimethylpentadecan-2-one: a Bermuda grass phagostimulant to fall armyworm (Lepidoptera: Noctuidae). Journal of Chemical Ecology. 18: 673-682.

Montenegro, C., S. Teillier, P. Arce, and V. Poblete. 1991. Introduction of plants into the mediterranean-type climate area of Chile. pp. 103-114. In Groves, R. and F. Di Castri. Biogeography of Mediterranean invasions. Cambridge University Press, Cambridge. 485 pp.

Montgomery, D., L. Cargill, D. Martin, and J. Barber. 1 992a. Bermudagrass (*Cynodon dactylon* L. Pers.) enroachment control along Oklahoma rights-of-way. Miscellaneous Publication, Agricultural Experiment Station, Oklahoma State University. 135: 45-54.

Montgomery, D., L. Cargill, and D. Martin. 1992b. Suppression of common bermudagrass (*Cynodon dacty/on*) growth and development. Miscellaneous Publication, Agricultural Experiment Station, Oklahoma State University. 135: 55-70.

Munz, P.1959. A flora of California. University of California Press, Berkeley. 1681 pp.

Omacini, M., E. Chaneton, R. Leon, and W. Batista. 1995. Old-field successional dynamics on the Inland Pampa, Argentina. Journal of Vegetation Science. 6: 309-316.

Pashley, D., S. Quisenberry, and T. Jamjanya. 1987. Impact of fall armyworm

(Lepidoptera: Noctuidae) host strains on the evaluation of Bermuda grass resistance. Journal of Economic Entomology. 1987.80:1127-1130.
Proctor, M. P. Yeo, and A. Lack. 1996. The natural history of pollination. Timber Press, Portland, Oregon. 479 pp.
Robbins, W. 1940. Alien plants growing without cultivation in California. Agricultural Experiment Station. Bulletin 637. University of California, Berkeley. 128 pp.
Robbins, W., M. Bellue, and W. Ball. 1970. Weeds of California. Documents and Publications, Sacramento, California. 547 pp.
Rochecouste, E. 1962 a. Studies on the biotypes of *Cynodon dactylon* (L.) Pers. 1. Botanical investigations. Weed Research 2:1-23.
Rochecouste, E. 1 962b. Studies on the biotypes of *Cynodon dactylon* (L.) Pers. 1. Botanical investigations. Weed Research 2:136-145.
Santos, A. and S. Boechat. 1994. Cynodon (Poaceae, Chloridoideae) in Rio Grande do Sul, Brazil. Iheringia Serie Botanica. 44: 85-102.
Sharma, R. and S. Sachan. 1994. New hosts of rust fungi from Himachal Pradesh. Advances in Plant Sciences. 7:154-158.
Smith, A. and L. Martin. 1992. Crabgrass control in coastal bermudagrass. Journal of the American Society of Agronomy. 84: 786-788.
Smith, J. 1993. *Cynodon*. p.1248. In Hickman, J. (ed.). The Jepson manual: Vascular plants of California. University of California Press, Berkeley. 1400 pp.
Speranza, M. 1995. Morphology and phenology of *Cynodon dactylon* (L.) Pers. (Gramineae) in Italy. Webbia. 49: 225-237.
Stevens, F. 1925. Hawaiian fungi. Bulletin 19, Bernice P. Bishop Museum, Honolulu, Hawaii. 189 pp.
Stromberg, J. 1995. Exotic herbaceous species in Arizona's riparian ecosystems. pp.45-57. In Brock, et al. (eds.). Plant invasions: Studies from North America and Europe. Backhuys Publishers, Leiden, The Netherlands. 223 pp.
Taylor, J. and G. Coats. 1996. Comparison of fall versus spring applications of sulfometuron for common bermudagrass (*Cynodon dactylon*) release. Weed Technology. 10: 947-950.
Thomasson, M. and G. Theodore. 1997. The vegetation of the recent soils in southwestern Madagascar (example of Tulear): IV. The psammophilous series. Acta Botanica Gallica. 144:195-208.
Tisserat, N., S. Hulbert, and A. Nus. 1991. Identification of *Leptosphaeria korrae* by cloned DNA probes. Phytopathology. 81: 917-921.
Toth, T., M. Kertesz, L. Catasus Guerra, J. Labrada Labrada, B. Perez Machado, P. Castillo Fonseca, and M. Nieto Martinez. 1997. Plant composition of a pasture as a predictor of soil salinity. Revista de Biologia Tropical, 45: 1385-1393.
Wadhwani, K. and N. Mehrotra. 1982. Fungi associated with roots of smut infected plants of *Cynodon dactylon*. Indian Phytopathology. 35: 722-724.
Wann, J. and D. Bell, D. 1997. Dietary preferences of the black-gloved wallaby (*Macropus irma*) and the western grey kangaroo (*M. fuliginosus*) in Whiteman Park, Perth, Western Australia. Journal of the Royal Society of Western Australia. 80: 55-62.
Watson, S. 1880. Geological Survey of California. Botany. Volume 2. John Wilson, University Press, Cambridge, Massachusetts. 559 pp.

Webster, T. and H. Coble. 1997. Changes in the weed species composition of the southern United States: 1974 to 1995. Weed Technology. 11:308-317.

Wu, W-S and V-P. Wang. 1994. First report of the occurrence of *Bipolaris maydis* on bermudagrass. Plant Disease. 78: 926.

Yamada, W., T. Shiomi, and H. Yamamoto. 1956. Studies on the stripe disease of rice plant. 3. Host plants, incubation period in the rice plant, and retention of over-wintering of the virus in the insect, *Delphacodes striatella* Fallen. Special Bulletin, Okayama Prefectural Agriculture Experiment Station. 55: 35-36.