Crop Reports

Stokes Aster

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Stokes aster [*Stokesia laevis* (J. Hill) Greene] is an underused herbaceous perennial that has great potential use as a landscape ornamental and as an industrial oilseed crop. It has large, showy flowers and is available in several attractive cultivars. Grown primarily for its flowers (Bailey, 1949), it has been described as a species of minor ornamental importance in the southeastern United States (Gunn and White, 1974). Huxley (1992) recommended its use both as a cut flower and as an ornamental landscape plant.

Stokes aster also has potential use as an oilseed crop because its seeds contain large amounts of vernolic (12,13-epoxy-cis-9-octadecenoic) acid, a fatty acid that is converted to epoxy oil products for use in the manufacture of plastics and adhesives (Campbell, 1981; Kleiman, 1990). Oil content in seeds can be as high as 40%, with about 70% of this oil being vernolic acid (Gunn and White, 1974). In the 1980s, the annual global market for seed-derived epoxy oils was between 45 and 90 billion tons (40.8 and 81.6×10^9 t) per year (Campbell, 1981; Princen, 1983). The United States alone currently uses between 50 and 75 billion tons (45.4 and 68.0×10^9 t) of epoxy oil on an annual basis (Cunningham, 1997). Most of this is derived from traditional petrochemicals and the processing of linseed and soybean oils. Cultivation of stokes aster as an oilseed crop could reduce the amount of petrochemicals used in this process while providing an alternative, sustainable source for raw material (Gunn and White, 1974; White, 1977).

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Classification, origin, and environmental requirements

Stokes aster initially was described and classified as *Carthamus laevis* by J. Hill in 1769. The genus *Stokesia* was described by L'Héritier de Brutelle (1788), who proposed that the type specimen used by J. Hill to describe *C. laevis* should be selected as the type specimen for the new genus *Stokesia*. L'Héritier de Brutelle (1788) also referred to *S. cyanea* but failed to describe the species; therefore, the name *S. cyanea* is illegitimate. The final authority regarding the nomenclature of stokes aster is Greene (1893), who stated that the proper binomial for the specimen called *C. laevis* by J. Hill and *S. cyanea* by L'Héritier de Brutelle should be *Stokesia laevis*. The genus is named for the English botanist Jonathan Stokes (1755-1831).

Stokesia is one of about 950 genera in the aster family (Asteraceae Dumont) and is monotypic, with *S. laevis* the only species (Bailey, 1949; Els, 1994; Greene, 1893; Gunn and White, 1974). *Stokesia* belongs to the subfamily Tubiliflorae within the tribe Vernonieae Cass. Vernonieae has two other genera—*Elephantopus* L. and *Vernonia* Schreb. *Stokesia* is the only member of the Vernonieae tribe that is restricted to the United States. *Stokesia* can be separated from the other genera in the tribe based on the large 3- to 4-inch (7.6- to 10-cm)

Fig. 1. Plant of stokes aster 'Purple Parasols' in flower.

diameter inflorescence and enlarged marginal flowers; in addition, the pappus of *Elephantopus* and *Vernonia* is permanent, while the pappus of *Stokesia* is early deciduous (Gunn and White, 1974).

Stokes aster is indigenous to southeastern North America (Bailey, 1949; Gunn and White, 1974). Native populations are concentrated in South Carolina, southern Mississippi, Louisiana, southern Alabama, and Florida (Bailey, 1949; Gunn and White, 1974; Huxley, 1992). Isolated colonies in southern South Carolina, central Georgia, and the Florida Panhandle are found in areas that are damp to wet for at least part of the year (Gunn and White, 1974). L'Héritier de Brutelle (1788) stated that the specimen he called *S. cyanea* is native to South Carolina. Stokes aster is classified as hardy in USDA hardiness zones 5–8 (Brickell, 1992) and American Horticultural Society heat zones 4–8 (Cathey, 1998). DeFreitas (1987) stated that stokes aster can thrive into southern Florida (USDA hardiness zones 10B–11). Brickell (1992) stated that stokes aster is fully hardy, meaning the species can withstand subfreezing temperatures during the winter without significant damage, but Coughlin (1991) recommended that protective measures, such as the application of several inches of mulch, be taken in regions that experience freezing and thawing.

Established colonies of stokes aster appear to tolerate a wide range of moisture levels. Coughlin (1991) recommended its use as a drought-tolerant perennial, while Brickell (1992) merely called for well-drained soil. However, Gunn and White (1974) and Bell and Taylor (1982) observed that stokes aster naturally inhabits moist or poorly drained regions at the southernmost end of the plant's range. The dichotomy in moisture tolerance is most likely a function of climate, as increased hydration can sometimes compensate for accelerated evapotranspiration that typically accompanies high air temperatures found in extreme southern regions.

Stokes aster is thought to be a shade-tolerant sun species; full sun is preferable, but some shade is tolerated. Seedlings of stokes aster typically produce only vegetative growth the first year (Callan and Kennedy, 1995; Campbell, 1981). Stokes aster flowers from late spring through summer (Bell and Taylor, 1982; DeFreitas, 1987; Radford et al., 1964), and is thought to be a facultative intermediate-day plant (Clough et al., 1999). Facultative intermediate-day plants achieve most consistent and rapid flowering when exposed to a photoperiod of 12 to 13 h. Conflicting information is published in the literature and popular press regarding the conditions necessary to induce floral initiation. Campbell (1984) suggested that vernalization may be necessary for floral development and that plants placed in the landscape in spring may not produce flowers until summer of the following year. Clough et al. (1999) stated that seed-derived plants of stokes aster will not produce flowers during the initial year of growth due to a period of juvenility. They also reported that a cold treatment is not necessary for floral development in mature plants, and optimum flowering is dependent upon photoperiod. Highest flowering percentage of stokes aster occurred when plants were grown with a photoperiod of 12 to 13 h. Floral initiation in seed-derived breeding populations is highly variable (Werner and Gettys, unpublished data). Some genotypes were actively flowering 5 months after seeds were sown, while others required more than 1 year to flower.

Botanical description

Stokes aster is an acaulescent, herbaceous perennial with alternate leaves that form a basal rosette (Fig. 1). At maturity, plants may be up to 28 inches (70 cm) tall (Gunn and White, 1974; Liberty Hyde Bailey Hortorium, 1976), but most cultivars grow to a height of 1 to 2 ft (30-60 cm). The elliptic to lanceolate leaves are entire, thick, and range from 4 to 12 inches (10 to 30 cm) long by 0.3 to 2.0 inches (0.8 to 5.0 cm) wide. Leaves are grayish-green. Peduncles are pubescent to woolly and may become glabrate with age. Peduncle length varies among genotypes but most cultivars have peduncles that bear flower heads in or slightly above the vegetative canopy.

The composite inflorescences of stokes aster (Fig. 2) have multiple perfect flowers forming each capitulum. Flowers in native populations range in color from blue to bluish-purple or bluish-violet to white (Bailey, 1949; Gunn and White, 1974). Gunn and White (1974) reported that white-flowered taxa are seldom found in natural populations. The composite flower heads of stokes aster are typically 3 to 4 inches in width (Bailey, 1949; Liberty Hyde Bailey Hortorium, 1976). In vivo pollination of stokes aster is entomophilous, with pollen transferred primarily by bees. The cypsela (more commonly referred to as the seed) is the product of an inferior ovary.

Disagreement exists as to whether the capitulum, or composite inflorescence, is composed of disc flowers only or of both ray and disc flowers. Bailey (1949) and Steyermark (1963) stated that all plants in the Vernonieae tribe, of which stokes aster is a member, have disc flowers only. Bailey (1949) also stated that enlarged disc flowers along

Fig. 2. Mature inflorescence of stokes aster 'Klaus Jelitto'.