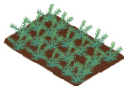
Prairie junegrass

Koeleria macrantha, K. cristata, K. gracilis, K. nitida, K. pyramidata

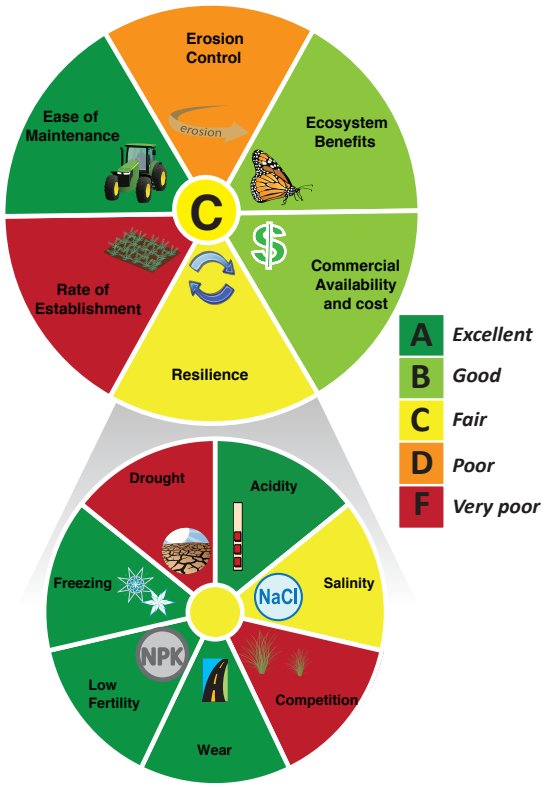
Prairie junegrass is a native grass that is widely distributed. As a short-statured species, it is an excellent species to plant in areas where less frequent mowing is desired. The species is observed in diverse grass communities and is therefore an excellent biodiversity enhancer. Despite these benefits, prairie junegrass has numerous management concerns that limit its use along roadsides, resulting in a Fair rating (grade = C):

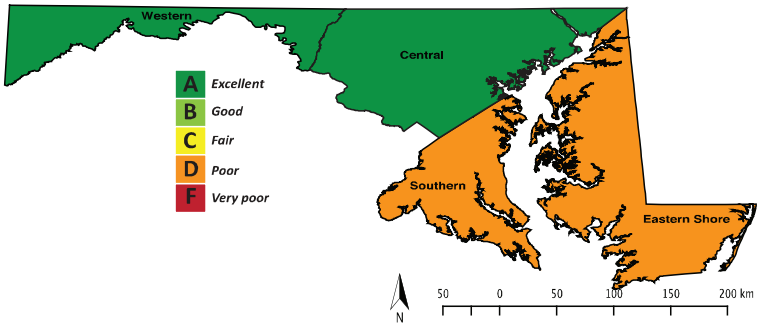


Prairie junegrass is very difficult to establish owing to its slow growth.

Root distribution of prairie junegrass is shallow and therefore not suited for erosion control.

Prairie junegrass is drought sensitive, intolerant of salinity, and a very poor competitor. Thus resilience to roadside conditions is weak.





Because of excellent winter hardiness and tolerance to infertile soils, prairie junegrass is well suited to grow in Western and Central Maryland. Owing to drought sensitivity, planting in Southern Maryland and the Eastern Shore should be avoided.

Prairie junegrass cultivars include Turtle Turf, BarKoel, and Barleria. Native germplasm should be used to increase plant fitness in local environments.

Biology: Prairie junegrass is a cool season perennial bunchgrass that is widely distributed in and native to the United States (Bakker and Wilson 2004). According to USDA, the species is present in Maryland, but it is an uncommon occurrence in the region (Rhoads and Klein 1993). In natural settings, prairie junegrass cover is ~5% (USDA fact sheet) such that in natural settings the species will typically be observed in diverse plant communities. Prairie junegrass was important in the recovery of prairie after the severe drought of the 1930s because it recolonized bare areas rapidly through seed germination and rapid tillering (Albertson and Weaver 1944). Through time, however, other grasses would recolonize and outcompete prairie junegrass. NTEP trials show that prairie junegrass can produce fairly good quality turf (Kevin Morris *pers. communication*). Prairie junegrass is found growing in poor soils and stressful environments and shows the greatest abundance in dry sites of meadows, grasslands, and rocky slopes (Johnson 2008). Owing to its slow growth and short stature (McKernan et al. 2001, Brown et al. 2010), it is considered an excellent candidate for low-input turf areas (Clark and Watkins 2010a) of roadsides, golf courses, and landscaping.

Seeds per pound or gram: Seeds are small. 1,800,000 – 2,300,000 seeds per pound per USDA fact sheet and plant guide
Cost per pound: $65.55 from Ernst Conservation Seed
Cost per acre: $131.10 per acre
Suggested sowing rate: 2 pounds per acre (Chesapeake Valley Seed)
Sowing depth: 0.16 inches
Germination time: 7-10 days
Seeding timing: above 57°F, not recommended for fall or dormant seeding (USDA plant guide)
Length of growing season: Greens up early in the spring when using northern accessions (Clark and Watkins 2010a). The main growth period is from February to May (Dixon 2000).
Leaf height: 1.5 to 5 inches (Simonin 2000)
Height at seed head stage: 4-16 inches (Campbell et al. 1992)
Shade tolerance: Average according to Barenbrug
Suggested mowing height: down to 0.2 inches but mowing needs to be infrequent
Tolerance of wet conditions: requires well drained soil (Simonin 2000)
Humidity tolerance: Does best at 12 to 20 inches annual precipitation (USDA plant guide)
Disease resistance: Susceptible to smut and rust disease, as well as powdery mildew and yellow-leaf spot (Dixon 2000).

Services:

Commercial availability and cost: While available commercially, the cost of prairie junegrass seed is relatively high owing to low seed yields (Johnson 2008). Prairie junegrass has a low sowing rate per acre which makes planting over a large area affordable.

Rate of establishment: Prairie junegrass is difficult to establish (Johnson 2008) owing to its slow vertical growth rate (Dixon 2000, Doak et al. 2002). Direct seeding and seedling transplants result in poor establishment but, seed stratification increases germination rate (Simonin 2000). Prairie junegrass was seeded on calcareous reclaimed mine soil but plants did not establish (Thorne and Cardina 2011). Likewise, two prairie junegrass cultivars were seeded in a roadside experiment in Minnesota (Friell et al. 2012) that included 14 turfgrass species and 75 entries. Neither of the two prairie junegrass cultivars established at either of the two study sites. Similarly, prairie junegrass plots did not establish in a field experiment that tested the effects of seed coating on germination success (Leinauer et al. 2010) and declined throughout a 3-year study that tested the response of clovers and grasses to management (Lulow 2008). Prairie junegrass also established slowly in a Canadian study (McKernan et al. 2001) and plots received poor weed ratings. Fifty percent of prairie junegrass seeds germinated in control treatments of a salinity experiment in the laboratory (Dudley et al. 2014), which was the third lowest germination rate of 14 species tested. In a study in Canada, prairie junegrass consistently covered >70% of field plots across 3 years after the establishment year (Mintenko et al. 2002). Likewise, prairie junegrass established and persisted for two years at 7 locations that were distributed across 7 midwestern states (Watkins et al. 2011) although turf quality was low at most locations and declined in the second year of the study.

Ease of maintenance: Prairie junegrass is a short-stature plant (Brown et al. 2010; 20 cm long leaves and up to 70 cm with seed head) that grows slowly (Johnson 2008) and therefore has high potential to be a low-maintenance lawn and turf grass (McKernan et al. 2001).

Erosion control: Rooting is dense but shallow (Albertson and Weaver 1944). When Brown et al. (2010) compared 19 grass species in a Rhode Island study, prairie junegrass developed the shallowest roots (11.4 cm mean depth) and produced the least root mass, which does not recommend it for anchoring hillside slopes where slope failure can occur below the shallow root mat (Brown et al. 2010). Root-to-shoot ratios in seedlings of prairie junegrass were lower compared to red fescue and Kentucky bluegrass but similar to tall fescue, perennial ryegrass and tufted hairgrass (Dziamski et al. 2012).

Ecosystem benefits: Prairie junegrass is native to the United States (Bakker and Wilson 2004) but is considered to be non-native to Maryland (Maryland Biodiversity Project). It typically does not cover more than 5-10% in natural or restored communities (Bakker and Wilson 2004, USDA Plant Fact Sheet) unless sowed or planted in high density (Bakker et al. 2003). The species provides forage to livestock and wildlife; however, it provides little coverage for birds and mammals due to its low stature and scattered distribution (Simonin 2000).

<u>Resilience</u>:

Drought: Prairie junegrass exhibits plasticity in its roots (Mueller-Dombois and Sims 1966) and can therefore acclimate to water availability. Still, because roots are generally distributed shallow (<15 cm; Brown et al. 2010), drought tolerance is only moderate, similar to fescues (McKernan et al. 2001, Johnson 2008) but higher than perennial ryegrass and alkaligrass (McKernan et al. 2001). Prairie junegrass abundance was greatly reduced by the 1930's drought, but was able to recover fast from seed in the spring of 1935 with high mortalities after another drought (Albertson and Weaver 1944). Motivated by the 1930s drought, Mueller and Weaver (1942) experimented with drought tolerance of 15 prairie grasses. They found drought tolerance of prairie junegrass seedlings

to be poor with high mortality after imposed drought. In a native plant demonstration trial in Blacksburg, Virginia, prairie junegrass appeared to persist across the 6-year study but a drought caused high mortality (Doak et al. 2004). In contrast, after four weeks of drought in New England, prairie junegrass was one of only four species (out of 19 species) that retained >50% cover (Brown et al. 2010). Prairie junegrass recovered to 75% by fall, whereas all other species declined, and remained the highest of all species after the winter (Brown et al. 2010), highlighting the species' potential to withstand and, especially, to recover from drought. Junegrass recovered well after experimental drought conditions (Milnes et al. 1998) suggesting in this study that the species would be well suited to areas where summer rainfall totals are low.

Low fertility: Prairie junegrass grows well in infertile grasslands and rock outcrops (Campbell et al. 1992) suggesting that it is adapted to low fertility environments. 'Barkoel' prairie junegrass had the highest quality in low-input turf compared to 11 other native grass species (Mintenko and Smith 1999). Prairie junegrass had acceptable turf quality at some but not all locations in field studies of 10-12 turfgrass species grown under low-maintenance conditions in 8 states of the North Central Region of the United States (Watkins et al. 2011, 2014). Despite a tolerance of poor soils, prairie junegrass responded to fertilizer with lush spring growth in a Virginia roadside trial (Doak et al. 2004).


Freezing*:* Prairie junegrass is observed to grow between 5,000 – 8,000 feet elevation (1,524-2,438m; Simonin 2000). Winter hardiness is considered to be excellent (Erik Watkins on Golfdom.com). Young plants are subject to frost heaving (USDA plant guide); thus fall seeding is not recommended.

Salinity: Prairie junegrass is advertised as having excellent salt tolerance according to Barenburg. Prairie junegrass is sensitive to salt during germination (Wang et al. 2011, Dudley et al. 2014). Two cultivars of prairie junegrass were as sensitive as Kentucky bluegrass, on average, in a salinity trial that tested the effects of salt exposure (suspension of plants in nutrient-salt solution) on 74 turfgrass cultivars representing 14 species (Friell et al. 2013). However, cultivar 'Barkoel' retained a higher percentage of green tissue than the Minnesota ecotype suggesting cultivars differ in their tolerance to salinity.


Acidity: Prairie junegrass prefers pH 6-8 (Thorne and Cardina 2011, USDA Plant Fact Sheet) but seed company Barenbrug suggests that pH down to 5.5 is acceptable.


Wear tolerance: Prairie junegrass is tolerant of mowing (Johnson 2000) but will be slow to recover from any mowing damage owing to its slow growth (Johnson 2008). The species is well suited for low traffic areas. Willmott et al. (2000) found that prairie junegrass was more wear tolerant than fine fescues, and Newell and Wood (2003) showed that prairie junegrass can tolerate trampling that occurs on paths. Similarly, Mintenko et al. (2002) observed consistently high quality (>70% ground cover, green summer color, fine texture, low disease, and adaptability to mowing stress) in prairie junegrass 'Barkoel' across 3 years after the first establishment year, at three mowing heights and at two study locations in Canada. In a low-input study that compared 12 turfgrass species (Watkins et al. 2011), prairie junegrass performed well under two mowing heights in Iowa and under 10.2 cm mowing height in South Dakota.

Competition: Prairie junegrass is considered to be a subordinate species in grassland communities (Albertson and Weaver 1944) owing to its slow growth and loosely tufted growth habit (Campbell et al. 1992). In an experiment that measured shoot thrust (delay in time to open a window with known resistance), prairie junegrass was the second slowest species (26 days as opposed to 6 days for the two fastest species) in a comparison of 8 species (Campbell et al. 1992). Prairie junegrass also produced second to lowest biomass in mixtures suggesting that its non-aggressive and largely horizontal growth habit is responsible for its weak competitive ability (Campbell et al. 1992). However, the authors note that this growth habit complements the growth habit of more aggressive and taller species by allowing prairie junegrass to forage for light resources rather than competing for it physically at the top of the canopy. Because of prairie junegrass' low density and slow growth, it is vulnerable to weed invasion (McKernan et al. 2001), which may be compensated for somewhat with higher seeding rates (Wilmott et al 2000, Bakker et al. 2003). Slow growth of prairie junegrass allows more vigorous species to out-compete prairie junegrass (Dixon 2000). However, some experiments show that junegrass can establish and survive under pressure from annuals or invasive species (Simonin 2000).

Mixes: Prairie junegrass is considered useful in seed mixes. Minnesota DOT uses prairie junegrass in a prairie seed mix (MN-35-221 Dry Prairie General) with other native species for roadsides and restoration (Agassiz Seed & Supply). In a low-input and low-maintenance experiment in Minnesota, Miller et al (2013) found that a native seed mix consisting of prairie junegrass, little bluestem, side-oats grama, blue grama, poverty oatgrass, and buffalograss performed better under no-mow conditions than mixes consisting of fine fescues and Kentucky bluegrass. Though they were slow to establish, the following years showed high quality ratings and low weed percentages within the native mixes (Miller et al 2013).

Cultivars: Clark and Watkins (2010a, b, 2012) evaluated seed production and turf quality characteristics for 48 accessions from throughout the world and found high diversity as well as good potential for developing the species as a turf species. However, no individual accession excelled in both seed production and turf quality. Junegrass is marketed by California-based Quality-Turf as 'Turtle Turf'. Dutch turf grass supplier Barenbrug markets prairie junegrass as 'BarKoel' and 'Barleria' with green-up somewhat later than North American genotypes (Johnson 2008). The Elsberry Plant Materials Center in Elsberry, Iowa, released 2 native germplasms to be used in landscaping, prairie restoration, and roadside planting (USDA fact sheet).