Plant Guide

PURPLE NUTSEDGE

Cyperus rotundus L.

Plant Symbol = CYRO

Contributed By: USDA, NRCS, National Plant Data Center & Louisiana State University-Plant Biology; partial funding from the US Geological Survey and the US National Biological Information Infrastructure

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Caution: This plant is considered a noxious weed in several states and considered highly invasive by various sources. Consult the Noxious and Invasive portion of PLANTS for additional information.

Alternate Names

nutgrass, nutsedge, coco sedge, cocograss, red nut sedge, coquito, souchet rond.

Uses

Ethnobotanic: Purple nutsedge has been used in traditional medicine and in landscaping in China. There are reports of its use in India as a soil binder. It is undesirable as fodder, because it quickly becomes fibrous with age, but in the absence of more desirable plants, it can serve that purpose (Holm et al. 1977). Extracts and compounds isolated from purple nutsedge have medicinal properties such as the reduction of fever, inflammation, and pain. The literature contains numerous references to the use of this plant's roots for essential oils and its seeds for food products. Tuber extracts may reduce nausea and act as a muscle relaxant (Wills 1987).

Noxiousness: Purple nutsedge, has been called the "world's worst" weed. A befitting designation for a species known from more countries (at least 92) than any other weed that infests at least 52 different crops worldwide (Holm et al. 1977). It grows in all types of soils and can survive the highest temperatures known in agriculture. In the United States, purple nutsedge infests cultivated fields, waste areas, roadsides, pastures, and natural areas. It is considered a headache for the southern gardener because of its insidious, rapid growth in flowerbeds and vegetable gardens. Purple nutsedge produces an extensive system of underground tubers from which they can regenerate. Nutsedge is very difficult to control once it is established.

Purple nutsedge greatly impacts agriculture and has an unfavorable effect on natural ecosystems by displacing native plants or by changing the availability of food or shelter for native animals. Although relatively small in stature, purple nutsedge provides formidable resource competition for much larger crop plants and ornamentals. This rapid growing plant can quickly form dense colonies due to its ability to produce an extensive system of rhizomes and tubers. Many studies document reduced yields in sugar cane, corn, cotton, rice, vegetables, and numerous other crops. The abundantly produced tubers present an efficient means of dispersal and reproduction. These features together with the ineffectiveness of herbicides make this weed nearly indestructible.

Impact/Vectors: Reduction in crop yields is one of the greatest impacts of this species. In extreme cases purple nutsedge can reduce sugarcane yields by 75% and sugar yields by 65%. In Australia, in experimental plots with cultivation, sugarcane yield was reduced by 38%. In Colombian cornfields, when purple nutsedge was allowed to grow for 10 days, yield was reduced by 10%. If allowed to remain for 30 days, yield dropped to 30%. Similar dramatic effects of this weed on cotton, corn, tomatoes, tobacco, mulberries, lemons, and many other crops have been demonstrated (Holm et al. 1977).

Rochecouste (1956) noted that even in humid regions the production of purple nutsedge shoots and tubers could severely restrict water availability to sugarcane. Approximate quantities of fertilizer that may be mobilized and stored in purple nutsedge equal 815 kilograms of ammonium sulfate, 320 kilograms of potash, and 200 kilograms of phosphate per hectare (Holm et al. 1977).

Besides resource competition, evidence suggests that organic substances released from the decay of dead subterranean tissues may be allelopathic and reduce crop yields where purple nutsedge infestations are severe. Purple nutsedge may produce up to 40,000 kilograms of subterranean plant material per hectare. Under experimental conditions, barley yield was reduced by 15 to 25% by *Cyperus rotundus* residues in the soil (Horowitz & Friedman 1971).

Tuber and rhizome production are important factors in this species' success as a weed. Rhizomes provide the major means by which the plants may colonize an area. Tubers offer a mechanism for asexual reproduction, and they are the major dispersal unit that can survive extreme conditions. Tubers make the plant difficult to control, because only translocated herbicides are potentially effective on this species.

Rhizomes and tubers form extensive networks in the soil. While most tubers are found growing in the upper 15 to 20 cm of soil, a few penetrate to a depth of 40 cm. The root system in heavy clay may extend more than a meter deep (Andrews 1940; Smith and Fick 1937). Under favorable conditions, a single tuber could produce 99 tubers in 90 days (Rao 1968). Experimental plantings of tubers set on 0.9 meter centers resulted in their nearly five-fold increase by the end of the growing season (Hauser 1962).

Tubers resist all but high temperature extremes, but seem more sensitive to lower temperatures. Germination failed in tubers held for 12 hours at 50^0 C. However, greater than 80% germination occurred after exposure to 40^0 C. Tubers exposed to temperatures of -5 ^{0}C or lower did not survive more than two hours (Ueki 1969).

Tubers and basal bulbs serve as vegetative propagules. They are carried on farm tillage implements and may be spread by erosion and running water. Severe storms may bring tubers to the surface and transport them to new areas. Such propagules may also be transported long distances with nursery stock. Even though purple nutsedge flowers abundantly, it rarely produces viable seeds. Seeds, although of little reproductive significance in the southern United States, are disseminated by wind or water, transported in mud, or carried onto fields by flooding streams or with irrigation water (Wills 1987; Holm et al. 1977).

Status
Please consult the PLANTS Web site and your State Department of Natural Resources for this plant's current status, such as, state noxious status, and wetland indicator values.

Description
General: Purple nutsedge is a colonial, herbaceous, perennial with fibrous roots that typically grows from 7-40 cm tall and reproduces extensively by rhizomes and tubers. The rhizomes are initially white and fleshy with scaly leaves and then become fibrous, wiry, and very dark brown with age. Rhizomes may grow in any direction in the soil. Those growing upward and reaching the soil surface become enlarged forming a structure 2-25 mm in diameter variously called a "basal bulb, a tuberous bulb, or a corm" that produces shoots, roots, and other rhizomes. Rhizomes that grow downward or horizontally form individual tubers or chains of tubers. Individual tubers are dark reddish-brown when mature, about 12 mm thick, and vary from 10-35 mm long.

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Leaf bases.

The dark green, shiny, three-ranked leaf blades arise from or near the base of the plant. They are narrow and grass-like ranging in size from 5-12 mm wide to 50 cm long and have a prominent channel in cross section. The leaf sheaths are tubular and membranous and attach to compact nodes at or near the base of the plant.

The upright culms or stems are 10-50 cm tall, smooth, triangular in cross section, and support a much-branched inflorescence. Two to four leaf-like bracts subtend the inflorescence which is umbel-like consisting of 3-9 unequal length branches (sometimes referred to as rays) bearing spikes of 3-10 spikelets. Spikelets are flattened and linear ranging in length from 10-30 mm long, and generally dark reddish purple or reddish brown in color. Each of the 20 or so flowers (florets) in a spikelet are each subtended by a keeled scale (glumes) 2-5 mm long that have a green midvein and a membranous margin. The flowers are bisexual each with three stamens and a pistil bearing three stigmas. Fruit, although rarely produced, consists of a three-angled achene (nutlet).

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Tubers, roots, & leaves.

Purple nutsedge possesses the C_4 photosynthetic apparatus, which is an adaptation to assimilating CO_2 at higher temperatures and higher light intensities compared to C_3 pathway plants. C_4 plants typically exhibit their best growth rates at temperatures characteristic of tropical and subtropical regions. The leaf anatomy for purple nutsedge is of the Krantz-type. Sheaths of cells that form around the vascular bundles serve to compartmentalize the photosynthetic events. Greater anatomical and physiological details for purple nut sedge are given by Wills (1987).

Cyperus esculentus, yellow nut sedge, is another problematic weedy species that reproduces by tubers. It is more widespread and also grows in more temperate parts of the United States. Purple nutsedge is readily distinguished from yellow nut sedge and other sedges by its purplish brown spikelets and scaly or wiry rhizomes that often bear chains of tubers.

Distribution: Purple nutsedge is reportedly native to India, but it has been introduced around the World (Holm et al. 1977). The plant is a serious pest in the Southeast ranging from Virginia to central Texas. It also has become established in parts of Arizona and California and has the potential to invade other Pacific states. (Southern Weed Science Society 1995; FICMNEW 1997). This species occasionally occurs in more temperate regions. For example, its presence in Stearns County, Minnesota was documented by a specimen in the University Herbarium collected by J. E. Campbell, July, 1896 (MIN: accession number *81217*), but purple nutsedge has not persisted there and other cold locales. The northern limit of nutsedge in Japan is in a region where the average minimum atmospheric temperature is -5^{0}C, the temperature below which tubers will not germinate (Ueki, 1969). Temperature appears to limit the species to more tropical and warm temperate regions. For current distribution, please consult the Plant Profile page for this species on the PLANTS Web site.

Control

For control measures that are pertinent to your area, please contact your local agricultural extension specialist or your city/county weed control specialist.

Mechanical: Moisture loss is detrimental to tubers. Tuber death ensued after moisture content dropped to 15% or less. Tubers left at the surface of dry soil exposed to full sun desicated beyond recovery after 4 days. Under simulated field conditions, tubers at 5 and 10 cm depths in dry soil that were protected from rain but exposed to sunlight were killed after 8 and 12 days at those respective depths (Holm et al., 1977).

Purple nutsedge tubers can be destroyed with repeated summer tillage because of their susceptibility to drying. Infested fields plowed or disked at three-week intervals for the entire growing season reduced tuber number by 80%. At four-week tillage intervals, tuber numbers actually increased. Summer dry fallowing is most effective in light, sandy soils but less so in wetter, heavier soils. Springtooth harrows are an excellent implement for this method. Such tillage methods are often impractical, because the land cannot be used for one or more growing seasons. An exception would be where October to June cropping is feasible (Holm et al. 1977).

Where tillage is possible, it can give crops a competitive advantage. The use of precision equipment to cultivate as closely as possible, and hand or mechanical thinning can help to reduce nutsedge competition. Nutsedge is susceptible to shading, which reduces vegetative growth and tuber production.

Chemical: Purple nutsedge has proved difficult to control with herbicides. To be effective, the herbicide must be translocated throughout the rhizome and tuber network of the plant. Always follow the manufacture's recommendations for application and observe all precautions when using herbicides. Also, observe applicable local, state, and federal regulations. A few case histories of herbicide control are cited to indicate progress being made in controlling purple nutsedge.

Field experiments over a 10 year period were conducted at the USDA, Southern Weed Science Lab, Stoneville, Mississippi, to determine the effects of tillage and herbicide inputs on purple nutsedge control in cotton. Four tillage cotton production systems (conventional, two levels of reduced-tillage and no-tillage) were evaluated with two herbicide (glyphosate) input levels each. For the most part, seed cotton yields were equivalent for the conventional and reduced tillage production systems regardless of the herbicide input level. Seed cotton yields were less in no-till systems 6 of 10 years regardless of herbicide input levels. It was discovered that the timing of glyphosate application, as a preplant foliar treatment, was extremely important. Purple nutsedge control decreased (i.e., nutsedge populations increased) with glyphosate applications 2 to 4 weeks prior to cotton planting. When glyphosate applications were made at planting in the no-tillage plots, higher levels of purple nutsedge control were realized. Based on predicted costs of herbicide and tillage operations, no-tillage cotton production systems saved monetary inputs and increased net profits 8 of 10 years. Effective and efficient purple nutsedge control in cotton can be obtained in reduced-tillage production systems, but additional research is needed to develop more effective systems of purple nutsedge control in no-tillage cotton production system (Bryson 1996).

In cotton and corn, alachlor (no longer permitted in cotton in California due to its damaging effects on the crop plants) is effective against yellow nutsedge, but is less effective on purple nutsedge. DSMA and MSMA provide control of purple nutsedge when applied to cotton as directed-sprays after the cotton plants have two or more leaves. If these herbicides accidentally get on the growing point of cotton plants, they will retard the plant's growth. Because nutsedge is sensitive to competition by shade, early chemical control will allow later shading from the cotton canopy to provide additional control. Smart sprayers that detect and spray only infested areas can save on herbicide costs and introduce less pesticide into the environment (Vargas et al. 1997).

Preplant treatment with the soil fumigant, metam-sodium, may provide control if applied during summer fallow i.e., allowing the soil to remain undisturbed for approximately 90 days. (Vargas et al.1997).

In four recent studies, a combination of the pesticides Telone® C-17 and Tillam® suppresses weeds including purple nutsedge, nematodes, and certain diseases and achieved yields similar to those obtained by fumigation with methyl bromide for Florida tomatoes intended for fresh markets).

Nutsedge is very difficult to control once it is established in turf. Therefore, plant in seedbeds that are free of nutsedge where possible. Small localized infestations of nutsedge may be controlled with metham or repeated applications of glyphosate. Maintaining a closed, competitive turf and avoiding overly wet soil will help control purple nutsedge. Reportedly, Manage® Turf Herbicide does an excellent job on yellow and purple nutsedge in lawns.

Biological: Efforts at biological control have explored the usefulness of the moth genus *Bactra* and searches have been made for potentially effective fungi, viruses, and nematodes. *Bactra*, a natural insect enemy of sedges in the genera *Cyperus*, *Kyllingia*, and *Scirpus*, has been considered well-suited for biological control of sedge species (Frick & Chandler 1978). Species of *Bactra* are found in many warmer regions of the world where purple nutsedge is a problem. Their larva feed mainly on sedges. They do not cause appreciable damage to their host plants because of delayed seasonal buildup. Numbers of larvae remain low until early August whereas, large numbers are needed in late May and early June to control nutsedge (Frick & Chandler 1978).

Over a six year period, studies were made on the effectiveness of introducing large numbers of adults and larvae early in the growing season to enable insect establishment on nutsedge prior to the time of wide use of insecticides in crops (Frick & Chandler 1978). The studies were conducted on cotton at the USDA, Southern Weed Science Laboratory.

Early-season augmentation of *Bactra* populations is a feasible method for controlling purple nutsedge. Large-scale releases would have to use adults because of the difficulties and time consuming nature of releasing larvae. Releases should continue over a six week period beginning after crop planting. Because of the rapid growth rate of nutsedge, five to ten larvae per shoot are needed. The number of moths to release per unit area would be estimated on the basis of a 50:50 sex ratio and an average of 180 eggs per female (Frick and Chandler 1978).

Cyperus rotundus is susceptible to rice grassy stunt tenuivirus, rice tungro bacilliform badnavirus, and rice tungro spherical waikavirus (Brunt et al. 1996). Purple nutsedge is an alternate host for the fungi *Fusarium* and *Puccinia canaliculata*. It is also infected by the nematodes *Meloidogyne, Rotlylenchus,* and *Tylenchus*. Leaf scorch of purple nutsedge is caused by *Ascochyta cyperiphthora* (Pomella & Barreto 1997). However, none of these agents causes sufficient destruction to provide sufficient control of this weedy plant (Holm et al. 1977).

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Edited 19sep00 jsp;10feb03 ahv; 05jun06 jsp

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