

**Johnsongrass, *Sorghum halepense* (L.)  
Pers. and Shattercane,  
*Sorghum bicolor* (L.) Moench ssp.  
*drummondii* (Steud.) de Wet  
Gramineae**

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**JOHNSONGRASS:**

**I. Nomenclature:** A) *Sorghum halepense* (L.) Pers. (Fig. 1); B) johnsongrass-more than 40 different common names have appeared in the literature. Some of these include adjectives modifying guinea grass: false, new, true, Alabama, and Georgia. It also has been called Samoa grass, Cuba grass, Egyptian grass, Means grass, Meanie grass, green valley grass, St. Mary's grass, and Syrian grass. The plants also have been named millet, preceded by the adjectives

*Fig. 1. Johnsongrass (left) and shattercane (right) seed heads.*

evergreen, Arabian, Egyptian, Australian, and Morocco. In an attempt to standardize common names, johnsongrass has been variously written as Johnson grass (from 1880's until 1960), Johnsongrass (July, 1960, first report on standardization of common and botanical names of weeds by the Weed Science Society of America), and johnsongrass (October, 1966, in a WSSA subcommittee report). It also is known as alleppo millet grass and herbe de Cuba; C.) Synonyms: *Holcus halepensis* L., *Blumenbackia halepensis* (L.) Koel., *Milium halepensis* (L.) Cav., *Andropogon halepensis* (L.) Brot. var. *genuinus* (Hack.) Stapf, *A. halepensis* (L.) Brot. var. *typicus* (L.) Brot., *A. arundinaceus* Scop., *Sorghum miliaceum* (Roxb.) Snowden based on *A. miliaceus* Roxb., and *S. controversum* (Steud.) Snowden based on *A. controversus* Steud.

**SHATTERCANE:**

**I. Nomenclature:** A) *Sorghum bicolor* (L.) Moench ssp. *drummondii* (Steud.) de Wet (Fig. 1); B) shattercane, wild cane, gooseneck sorgho, sorgho vulgaire, maiz millo, mijo; C) Synonyms: *Sorghum drummondii* (Steud.) Millsp. et Chase, *S. vulgare* Pers. (cf Hafliger 1979), *Andropogon sorghum* (L.) Brot., *Holcus sorghum* L. Weedy sorghums include *S. atterimum* Stapf, *S. elliotii* Stapf, *S. hewisonii* (Piper) Longley, *S. niloticum* (Stapf ex Piper) Snowden, *S. nitens* (Busse et Pilger) Snowden, and *S. sudanense* (Piper) Stapf.

**NOTE:** The perennial species *Sorghum halepense* in North America has introgressed with cultivated sorghum to produce the weed we call johnsongrass. In South America (Argentina) derivatives of such introgression have been formally recognized as *S. alnum* Parodi (Columbus grass). *Sorghum bicolor* is divisible into two subspecies: *S. bicolor* ssp. *bicolor* which includes the extremely variable, annual, cultivated grain and forage sorghum, and *S. bicolor* ssp. *drummondii*, which is comprised of stabilized weedy derivatives arising from introgression between domesticated sorghum (*S. bicolor* ssp. *bicolor*) and closely related wild relatives. *Sorghum bicolor* ssp. *bicolor* (cultivated sorghum) introgress with the widely distributed *S. halepense* (which as johnsongrass in America already contains *S. bicolor* ssp. *bicolor* genes) to produce both annual and perennial weedy offspring. For convenience all annual weeds are classified as *S. bicolor* ssp. *drummondii* and all perennial weeds are classified as *S. halepense*, regardless of parentage (origin) and amount of genetic material from other sources, such as introgression.

**II. History:** The Gramineae (Poaceae), consisting of twelve tribes, 700 genera, and 10,000 species, is the largest and most widely distributed family of vascular plants. The genus *Sorghum* belongs to the tribe Andropogoneae.

The genus *Sorghum* contains a highly variable, diverse assemblage of taxa. Some plants are wild, some cultivated, some weedy. The variability has resulted in overclassification of the genus; it is a taxonomic and nomenclatural enigma.

*Sorghum halepense* is said to be native only to the Mediterranean littoral. Yet some authors claim it is indigenous to the Madeira Islands, Asia Minor, and southeastern Europe. Closely related species are distributed

from India to the Malay Peninsula and the Philippines (Piper 1928). It was introduced into the United States some time in the early 19th century. Authors conjectured that *Sorghum halepense* was introduced first into the U.S. by Dr. J. Davis, who sent material to Governor Means of South Carolina while working for the Sultan of Turkey (Ottoman Empire) in 1830 (Ball 1902) or later. Around 1840 Col. Wm. Johnson of Marion Junction (Selma), Alabama, visited South Carolina and returned home with seeds. He was certainly the first American to cultivate it in great quantity. In a letter dated 1874, from John Haralson of Selma to Dr. George Vasey of the Smithsonian Institution, it was dubbed Johnson grass. Some authorities date the importation of *S. halepense* prior to 1830 (McWhorter 1971a). Regardless of the date of origin, by the 1890's it was distributed over much of the southern United States, already reaching economically detrimental proportions.

Isaac Martindale (1876) records *Andropogon halepensis* Sibth ("a few specimens") as a ballast plant in the vicinity of Philadelphia, one of the first reports of johnsongrass in Pennsylvania. Darlington (1826) lists several species of *Sorghum* cultivated in Chester County, PA: *S. saccharatum* ("broom corn, made into brooms"), *S. cernuum* (guinea corn, Indian millet, "rarely cultivated here - chiefly as feed for poultry"), and *S. bicolor* (chocolate corn "sometimes cultivated, as a matter of curiosity, and has been used as a sort of substitute for chocolate - which, like rye-coffee, may answer for those who cannot obtain better; but it is not likely to come into general use").

In America *Sorghum halepense* has introgressed with grain sorghum to produce the widely distributed johnsongrass (Celarier 1958), currently a major weed problem. The first appearance of *S. bicolor* ssp. *drummondii*, shattercane, as a weed problem of crops has not been well documented.

### III. Technical Evaluation:

#### JOHNSONGRASS

Ecotypes. abundant; variability is due partially to interfertility with other species of sorghum and subsequent back crossing. Variable characters include plant height, leaf blade length and width, panicle size and shape, spikelet size and number, seed production, shattering characteristics (seed falling from panicle), attitude of rachillae, rhizome production, clump characteristics, seed germination behavior, and response to herbicides (McWhorter 1971b,c).

Generally, *Sorghum halepense* is a tall, stout, *perennial* grass; *culms*: erect (0.5-3.5 m tall, up to 2.0 cm wide at base) to rarely geniculate, mostly simple, occasionally rooting at lower nodes, in large tufts or clumps from creeping, *scaly rhizomes* (Fig. 2) 50-150 (250) cm, nodes rarely hairy; linear *elongate blades*: 1.0-3.0(4.0) cm wide x 20-60 (90) cm long; juncture of sheath and blade often densely hairy; *ligule*: 2.0-5.0 mm, membranous (or absent), truncate or fringed; *terminal panicle*: large, open branching 10 (15)-40 (60)cm long x 5.0-25cm wide, panicle branches slender, jointed, often the lower pendulous; racemes fragile, 1-5 (+) noded up to 2.5 cm long, pedicels densely ciliate; *florets*: vary from 90 to 350 ( + ) sessile spikelets; *spikelets*: in pairs (binate or less frequently ternate), dissimilar, dorsally compressed; *sessile spikelet*: perfect, 4.0-6.5 mm long, elliptic-lanceolate to ovoid, ± glabrous to densely hairy (sericeous) awned or awnless; *glumes*: coriaceous, 2 x as long as wide; first glume 5-9 (12) nerved; second glume 3-7 nerved; *lemmas*: thin, hyaline ciliate;

*Fig. 2. Johnsongrass (two plants on left) and shattercane (two plants on right). Note the presence of rhizomes and excessive tillering on johnsongrass.*

first lemma 2-nerved, 3.0-5.0 mm long, second lemma, 1 nerved, 3.0-4.0 mm long (or reduced), awn 10.0-20.0 oblong-ovate, 2.0-3.0 mm long; *stamens* 3; *grains* (caryopsis): oblong-ovate, 2.0-3.0 mm long; 200-400 (+) grains per panicle; *pedicelled spikelet*: male or neuter, glabrous; *lemmas*: hyaline, awned or awnless; *glumes* up to 4x as long as wide; all awns often deciduous (caducous), may be geniculate or twisted below; *chromosome number*: 2n = 40 (tetraploid); *distribution*: a cosmopolitan weed of waste places, perennial and rotation crops, and grasslands. Commonly distributed along railroads (Fig. 3) and highways. Native to Eurasia east to

*Fig. 3. Railroads are a major means of northward migration of johnsongrass from southern states*

India. It is a major weed problem, with regular control measures necessary in the US, Central America, Colombia, Venezuela, Argentina, Italy, Central and Southeastern Europe, and Southeastern Asia; *seedlings*: sheath clasping, blade 20 x as long as wide, glabrous; outer leaf sheaths purple; ligule 2 ± mm long, membranous, deltoid or truncate at apex, lacinate (fringed) or ciliate; seedlings becoming flattened at base (soil line). The seedlings of johnsongrass (Fig. 4) resemble shattercane (Fig 5); however, the latter possesses a ligule devoid of cilia at the apex, but may be deeply torn.

Fig. 4. Johnsongrass seedling.

Fig. 5. Shattercane seedlings.

#### SHATTERCANE

A diverse group of annual weeds. It is probably the result of wild genes expressed in cultivated sorghum (*Sorghum bicolor* ssp. *bicolor*) through genetic recombination, or from introgression of cultivated sorghum with weed sorghum, e.g., American johnsongrass (*Sorghum halepense*) yielding annual, weed plants.

Several field types of shattercane, *Sorghum bicolor* ssp. *drummondii*, have been collected in Pennsylvania, ranging from fragile, geniculate specimens 1.0 m tall having small, loose terminal panicles (6.0 to) 12 cm long x (2.0 to) 3.0 cm wide (Fig. 6), to robust, thick-stemmed material 4 m tall having dense, compact, terminal panicles, 30 (+) cm long x 12.0 cm wide (Fig. 7a,b). Intermediate forms also exist. Some shattercane has the appearance of an annual johnsongrass, having loose, large terminal panicles 60 cm long x 30 cm wide. There is no typical material; however, the following description is derived from material commonly found in southeastern Pennsylvania.

*Plants:* annual, tufted, to 4 (6) m tall, culms 0.5-4 (6) m; *leaf blade:* linear lanceolate, 30-60(100) cm long x 5-8 (12) cm wide, often hairy at blade-sheath junction; *ligule:* to 5 mm, membranous, fringed; *panicles:* contracted (or loose) and very similar to grain sorghum, esp. Trudan, or Sorghum-Sudangrass Hybrids, 8-40 cm long; *branches:* whorled, erect ascending, contorted, or pendulous; *racemes:* crowded, 3-5 noded, tardily disarticulating at maturity through callus formation, leaving a small swollen "cup" on twisted rachillae (Fig. 8); *spikelets:* very variable, many persistent at maturity, binate (rarely ternate), dissimilar, sessile and pedicelled, pedicel hairy (Fig. 9); *sessile spikelets:* perfect, lanceolate-elliptical to ovoid, 4.0-6.0 mm long; *lemmas:* hyaline, ciliate; *first lemma:* 2-nerved, thin, 6.0 mm long, often awned (geniculate, base twisted); *second lemma:* 1-nerved, thin, 3.0 (5.0) mm long x 2.5 (3.0) mm wide, 5.0 mm long; awns 5-13 mm long; *grains:* variable, about equal with the glumes and laterally exposed about 1/2 the length of the floret; *pedicelled spikelet:* linear lanceolate, 4.0-5.0 mm long x 1.5 (2.0) mm wide, glabrous to ciliate, male or neuter.

Fig. 6. Slender ecotype of shattercane collected in field-corn, Dauphin Co.

Fig. 7. Robust ecotype of shattercane collected in field-corn, Lebanon Co. A) grains light brown, B) grains ebony to purple black.

Fig. 8. Swollen "cup" on twisted rachillae of shattercane.

Fig. 9. Sessile and pedicelled spikelets of shattercane.

#### IV. Diagnostic Characteristics

##### JOHNSONGRASS

*Sorghum halepense* usually is a tall grass with spikelets having one functional flower and two glumes (Fig. 10). Disarticulation (seed shedding) occurs below the glumes, leaving a bare rachis with small "suction-cup" ends. Spikelets in cross-section are nearly round. Spikelets are of two kinds; one sessile and fertile, the other pedicelled and staminate (or neuter). The panicle is usually diffuse and delicate. The plants are perennials with scaly underground rhizomes.

Fig. 10. Heavy inflorescence of johnsongrass from Virginia showing more robust southern plants.

##### SHATTERCANE

*Sorghum bicolor* ssp. *drummondii* is similar to johnsongrass described above. Several differences include the annual life cycle, a dense, stout, compact inflorescence in some biotypes of shattercane, and the absence of rhizomes (Fig. 2).

**V. Confused Taxa:** The following key will help identify johnsongrass, shattercane, and cultivated sorghum. It must be emphasized that intrageneric (interspecific) hybridization occurs freely, and back crossing with parental types yields a continuum of characteristics, sometimes making delimitation difficult.

1. Plants perennial, rhizomes creeping; leaf blades 20 times as long as wide, to 60 (90) cm long x 3 (4) cm wide; panicle 15 to 40 (+) cm long; awns (on lemma) 7.0-32 mm long or absent ... *S. halepense* johnsongrass (Fig. 11)
1. Plants annual; no rhizomes; leaf blades often wider than 4 cm in robust specimens.
  2. Leaf blades 7 times as long as wide, to 60 (+) cm long x 8 (+) cm wide; plants to 4 (6) m tall; panicle contracted, 40 cm long x 15 cm wide; branches erect and stiff, or occasionally pendulous and soft; racemes 3 to 5 noded, tardy disarticulation at maturity; awns (on lemma) 5.0-15 mm long or absent. . . . *S. bicolor* spp. *drummondii* (shattercane)

This complex in PA appears to represent introgression between cultivated sorghum and weedy johnsongrass or spontaneous wild progenitor genes appearing in cultivated sorghum (or both.)

2. Leaf blades 90 cm long x 12 cm wide; plants often to 5 m; inflorescence an open or contracted panicle, 60 cm long x 30 cm wide; branches obliquely ascending or spreading, slender, pendulous or more frequently stiff, the lowermost often as long as the panicle; raceme 1 to 5 noded, cultivated crop ..... *S. bicolor* ssp. *bicolor* (Cultivated Sorghum) Table 1 provides diagnostic characteristics for 5 races. See also key provided below.



Fig. 11. Johnsongrass. A) sessile and pedicelled spikelets, B) ligule, C) inflorescence, D) scaly rhizome and stem.

*Key to Several Common Cultivated  
S. bicolor ssp. Bicolor*

1. Panicle erect, stout; measured from lower node, 30 cm long x 8 cm wide; lemmas awned or awnless; grains ovoid.
  2. Grains at maturity white, stramineous, or light yellow;  $\pm$  uniformly colored (purple pigment spots may be present).
    3. Grains light yellow, glumes light buff; grains 5.0 mm long x 4.0 mm wide, upper portion of grains translucent; lemmas awned; stout plants 1-1.5 m tall. (A) DeKalb 42 Y Hybrid grain sorghum (Kansas)
    3. Grains white to stramineous, glumes ebony or purple-brown; grains 4.5 mm long x 3.5 mm wide, sharply cuneate at base, dull and opaque; lemmas awnless; late maturing, plants 2 (+) m tall. (B) Northrup King 326 (Texas)
  2. Grains at maturity orange, rust, or light brown; not always uniformly colored.
    4. Glumes of mature grains ebony, mature grains russet (at least on top); grains 6 mm long x 4 mm wide; plants graceful, 2-3 m tall. (C) Agway 44 (Kansas), Sorgho x Sudangrass Hybrid
    4. Glumes of mature grains brown mottled, especially at apex (use lens); grains light orange to brown, 4.5 mm long x 4.0 mm wide; stout plants 1-1.5 m tall. (D) DeKalb, Variety FSIA (Kansas), Hybrid forage sorghum

1. Panicle diffuse, to 40 cm long x 20 cm wide; lemmas awned or awnless; grains, when mature, lanceolate to lanceolate-elliptic.
  5. Glumes ebony, ovate, grains maturing in late season in our latitude from plants sown in greenhouse 6/10 (transplanted to field 6/24).
  6. Plants 3 (+) m tall, not flowering 130 days after being sown (end of August). (E) DeKalb 5T6 (Texas), Sorghum Sudangrass Hybrid
  6. Plants 3 m tall, flowering mid-August. (F) Trudan 8 (California), Hybrid Sudangrass
5. Glumes stramineous, mottled purple, lanceolate.
  7. Grains not fully mature in our latitude by the end of August. (G) Piper Sudangrass (California)
 

**Note:** Immature (E), above, may key here except that the awns are geniculate, divergent at the apex of glume, whereas in (G), the bend is several mm above the glume tip.
  7. Grains of plants sown in early June mature by frost, glumes surrounding maturest grains dark, lustrous, brown-purple. (C) Agway 44 (Kansas), Sorgho x Sudangrass Hybrids

**Note:** For (E) and (F), plants (and immature inflorescences) resemble johnsongrass whereas their mature panicles most closely resemble shattercane. (G) resembles johnsongrass in all growth stages. It is difficult to distinguish (E) and (F) from some shattercane in central Pennsylvania.

**VI. Natural History:** It has been hypothesized (Doggett 1979) that *Sorghum halepense* is the result of the natural crossing between *S. arundinaceum* (tropical Africa) and *S. propinquum* (southeast Asia) with concomitant doubling of chromosomes yielding this tetraploid plant. In America, and perhaps elsewhere, *S. halepense* is known to have crossed with cultivated sorghum (*S. bicolor* ssp. *bicolor*), yielding the weed commonly known as johnsongrass. Few genetic barriers exist between johnsongrass and domesticated sorghum. Crop sorghum, derived from wild types of grass that freely cross-pollinate, diverge by the process known as disruptive selection.

Through cultivation man has selected for nonshattering heads, large seeds and inflorescences, disarticulation (thrashability), and suitable maturity. Natural selection favors wild-type characters. The tension between the two selective forces resulted in divergence into polymorphic populations.

In nature the genus displays a wide range of character traits, with local populations more uniform than an individual species. Several different johnsongrass ecotypes (biotypes) have appeared, either through mutation or, more likely, through hybridization and back crossing. Casady and Anderson (1952) and Hadley (1953) have shown that johnsongrass hybridizes with other species of *Sorghum*.

Seeds of johnsongrass are distributed by various means. In central and southern Pennsylvania new colonies arise along railroad tracks and highways leading from southern states. The seed "coat" is hard and indurate, withstanding adverse temperatures. Johnsongrass seeds have been found in hay. Mature seeds eaten in hay can pass unharmed through the digestive tract of cattle and other livestock (Ball 1902). These are then spread in manure and farm fertilizer. Johnsongrass is known to have been distributed during flooding since it frequently grows in rich valleys. McWhorter (1972) has suggested that troop movement during the Civil War aided in johnsongrass dissemination.

*Sorghum halepense* also reproduces by rhizomes (often 2-3 feet deep). More rhizomes are produced in sandy loam than in clay soils. Ten tons of rhizomes/acre have been estimated in noncrop land (McWhorter 1972). Rhizomes produced early in the season die in winter; those produced later survive. Ninety percent of annual rhizome production occurs after flowering. Exposure of rhizomes to temperatures 120<sup>0</sup>-150<sup>0</sup>F (soil surface) and air temperatures of 90-105<sup>0</sup>F kills buds in 1-3 days.

Some data indicate that temperatures of 20-27<sup>0</sup>F for several hours kill rhizome buds, but ecotype differences make this generalization suspect. Merrill Ross, johnsongrass specialist at Purdue University, has shown that an individual rhizome rarely survives more than one winter. However, new rhizomes formed each summer perpetuate the perennial nature of this agricultural bane. Severe infestations may yield up to 10 bushels of johnsongrass seed/acre.

In a recent survey (1982) by the PA Department of Agriculture, Bureau of Plant Industry, johnsongrass was reported from the following counties in the Commonwealth: Allegheny, Berks, Centre, Chester, Crawford, Cumberland, Dauphin, Fulton, Lackawanna, Lancaster, Lawrence, Lebanon, Lycoming, Montgomery, Northampton, Perry, Somerset, Susquehanna, and Wyoming. The data do not imply that johnsongrass is absent in other counties, only not reported.

Shattercane research has been sorely neglected. In Pennsylvania this weed may arise spontaneously in a cultivated sorghum field where (unstable) genes randomly combine to produce plants that have wild or weedy traits. Also possible is the cross between domesticated sorghum and johnsongrass, forming annual, diploid weedy plants (shattercane). In the survey mentioned above, shattercane was reported from the following counties: Berks, Cumberland, Dauphin, Lackawanna, Lancaster, Lawrence, Lebanon, Lycoming, Northampton, Northumberland, Perry, Union, and Wyoming. Most respondents identified transmission of johnsongrass and shattercane seeds by

harvesting equipment (combines), importation of seed in sorghum seed, flooding, and movement of harvested grain. Birds have been implicated; however, it is generally recognized that frugivorous birds (fruit feeders) pass seeds, whereas granivorous and some omnivorous birds have a gizzard which crushes seeds. This sheds some doubt on birds as a dispersal agent.

The crop most commonly infested was corn, followed by soybeans. Shattercane seems to have first appeared as a weed problem in southeastern Pennsylvania in the mid-1960's; johnsongrass was recognized as a farm problem a little later.

**VII. Economic Importance.** A) Beneficial. *Sorghum bicolor* ssp. *bicolor* (domesticated sorghum) and bulrush millet (*Pennisetum typhoides*) are the major cereal crops of rain-fed agriculture in the semi-arid tropics (Doggett 1979). In the Old World they occupy a substantially greater area of cultivation than corn, forming a food staple of 400 million people (India and Africa predominantly). They are raised for grain, forage crop, straw, fuel for cooking (dry plants), syrup, brooms, stems used as writing pens, decorative seed heads, and bird feed.

Johnsongrass was introduced as a forage crop that produced valuable and nutritious hay. Shattercane is an unintentionally established weed. Owing to its resemblance to johnsongrass, it has remained misidentified by many unwary people.

B) Detrimental. Under drought stress sorghum produces hydrocyanic acid in the foliage, which is poisonous to livestock. Johnsongrass is listed as one of the world's 10 worst weeds (Holm 1969). Severe infestations may reduce soybean production by 45% or more and produce enormous quantities of seeds. Johnsongrass is the most important perennial weed grass in central and southern maize-growing regions of the U.S. (Behrens 1979). It is highly competitive and chokes out crops. In addition to decreasing crop yields, it increases farming costs, limits cropping alternatives, reduces land values, decreases the market value of farm produces, and harbors diseases of corn. Overwintering rhizomes are virus reservoirs responsible for two devastating corn diseases, maize dwarf mosaic (MDM) and maize chlorotic dwarf (MCDV). These viruses are transmitted to corn by insects. Shattercane, when studied, probably will be found to equal the destructive capacity of johnsongrass.

**VIII. Control:** The rhizome production of johnsongrass is substantially reduced when plants are not allowed to exceed a height of 12-15 inches. Therefore, mowing, grazing, and cultivation are often used for control (McWhorter 1972). To prevent seed formation, plants should be mowed at 3-4 week intervals from June-September (4 or 5 mowings) prior to seed head emergence. Mowing is most effective when used in combination with a competitive forage crop or turfgrass. Thorough crop cultivation in early season, which exposes rhizomes to heat and drying, also can be effective. Fallow (clean cultivation) was the major method of controlling severe infestations in the past (Cates and Spillman 1907). Established stands sometimes can be controlled in one season; June plowing followed by heavy-duty disc or sweep-type cultivator at frequent intervals (2 weeks) to maintain all growth under 6 inches. Cultivation is then continued until heavy autumn frosts. The use of a foliage-applied, translocated herbicide prior to the first tillage increases control.

Before planting, plow the field to bring the rhizomes to the soil surface. The moldboard plow followed by a disc to level the soil, and then two additional discings to incorporate preplant herbicides for seedling control, constitutes the least amount of preplant tillage that should be used in infested fields; chisel plowing can be effective too. Discing is done 4-6 inches deep and in two directions at 4-6 miles/hour. In areas of low erosion this may be repeated in the autumn to allow winter freeze. If not possible, the spring plowing and discing schedule should be followed (Ross, personal communication; Ritter 1982).

In corn, johnsongrass can be controlled with Eradicane<sup>1</sup> extra (EPTC, 6 lb/A) or Sutan (butylate, 6 lb/A), plus AAtrex (atrazine, 1 lb/A). The Eradicane or Sutan plus AAtrex must be thoroughly incorporated into the soil before corn planting, yet immediately after application. Incorporation (3-4 inches) works the chemical into the top several inches of soil where it is needed. They should be applied to a soil with a dry surface since the presence of moisture prevents adherence to the soil particles. Because of crop injury from Eradicane, a mixture of a half rate of Eradicane plus Sutan with atrazine is slightly safer to corn and still gives "good" control of johnsongrass from rhizomes and seeds.

New herbicides, like Poast, may prove highly effective against johnsongrass in soybeans. An application when johnsongrass plants are 15 inches high is recommended. In soybean culture, Vernam (vernolate, 3 lbs/A active), Treflan (trifluralin, 3/4A to 1 lb/A), Planavin (nitralin, 1-1 ¼ lb/A), Lasso (alachlor), or Amiben (chloramben) can be used for control of johnsongrass seedlings. The first three herbicides should be thoroughly incorporated into the soil before planting soybeans, immediately after application. Lasso can be shallow-incorporated before planting or applied to the surface. Amiben is surface-applied immediately after planting (McWhorter 1972). Treflan is labeled for use at a 2X rate in soybeans for johnsongrass rhizome and seedling control. Double discing in two different directions is preferred. This restricts the field to soybean culture in the subsequent year. If corn is anticipated the following year, use a IX rate of Treflan tank-mixed with a IX rate of Vernam. It should be noted that Roundup

(glyphosate, 2-3 lb/A) is the most effective herbicide applied to foliage when johnsongrass is 3-4 ft. tall. (Pre-emergence herbicides are not currently suggested for control of johnsongrass rhizomes.)

A rope wick or recirculating sprayer with Roundup can be used to eliminate johnsongrass plants in the rows that escape the above methods. Spot treating infested areas adjoining the fields with Roundup or other suitable herbicides will eliminate reseeding into the cropping area.

Generally, any herbicide treatment that will control johnsongrass seedlings will also control shattercane seedlings. Bladex (cyanozine), 1-2 qt. 4L plus Eradicane extra (EPTC + extender), 7.33 Pt. in 10 gal. or more water will control both shattercane and johnsongrass in corn. Preplant-incorporate after 25 May when soil surface is air dry.

*Disclaimer: When trade names are used no discrimination is intended and no endorsement by either the author or the Pennsylvania Department of Agriculture is implied.*

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**TABLE I**  
**Five Basic Cultivated Races of *Sorghum bicolor* ssp. *bicolor***

<i>Bicolor</i>	Open panicle, decurrent to erect branches; elongate grains; glumes clasping; grains covered or exposed up to ¼ of apex; spikelets persistent.
<i>Guinea</i>	Panicle as above, grains flattened dorsoventrally, twisted at maturity 90° between gapping, involute glumes, more or less as long or longer than the grains.
<i>Caudatum</i>	Variable inflorescence; grain side next to lowest glume flattened to concave; opposite side rounded to bulging; glumes half the length of grains or less.
<i>Kafir</i>	Grains ± spherical; glumes clasping; head compact.
<i>Durra</i>	Heads compact; grains rounded ovate; wedge shaped at base; broadest slightly above middle; glumes very wide; the tip different textured from the base (strongly nerved herbaceous tip).