



NAPPO

ORGANISATION NORD-AMERICAINE POUR LA PROTECTION DES PLANTES
NORTH AMERICAN PLANT PROTECTION ORGANIZATION
ORGANIZACION NORTEAMERICANA DE PROTECCION A LAS PLANTAS

PEST FACT SHEET

Aegilops cylindrica Host

Native to western Asia and eastern Europe, *Aegilops cylindrica* is an introduced, winter annual grass that is recorded as being present in Mexico (Chihuahua) and in most of the continental US but is not known from Canada. It is closely related to winter wheat, *Triticum aestivum*, and is a major problem in the crop due to its similarity to wheat in appearance, seed size, growth pattern and genetics. Increasing its impact within winter wheat production areas due to its highly competitive nature in relation to the crop, *A. cylindrica* is spread only by seed. Standard sieve-type seed cleaners will not completely remove jointed goat grass seed pieces from seed wheat and there are limited options for selective chemical control of this pest so exclusion from uninfested areas remains an important strategy for management.

Preferred Scientific Name *Aegilops cylindrica* Host

Other Scientific Names *Aegilops cylindrica* Host var. *rubiginosa* Popova
Aegilops tauschii auct. non Coss
Cylindropyrum cylindricum (Host) A. Löve
Triticum cylindricum (Host) Ces., Pass. & Gib
Triticum caudatum (L.) Godr. & Gren.
Aegilops caudata L. var. *cylindrica* (Host) Fiori

Common Names English - jointed goat grass, jointed goat-grass, jointed goatgrass, goatgrass
French - ègilope cylindrique
Spanish - Zacate cara de cabra

Habitat

Aegilops cylindrica can grow in areas of less than 25 - 50 cm of annual precipitation, and at elevations of 250 to 2000 m (Lyon 1999). Most commonly, goat grass is found in winter wheat fields or other cereal grain fields, fence rows, roadsides, and waste areas. Goat grass also infests rangelands surrounding wheat-growing areas and land in the Conservation Reserve Program (CRP) throughout the western United States. If land is returned to wheat production from the CRP, jointed goat grass could become an even more serious problem. Jointed goat grass is also well adapted to reduced tillage or mulch tillage farming systems.

Distribution List

Asia Afghanistan (USDA NCRS 2002)
Armenia (USDA NCRS 2002)
Azerbaijan (USDA NCRS 2002)
Georgia (USDA NCRS 2002)
India (SAGAR 1995)
Iran (USDA NCRS 2002)
Iraq (USDA NCRS 2002)
Kazakhstan (USDA NCRS 2002)

Kyrgyzstan (USDA NCRS 2002)
Lebanon (USDA NCRS 2002)
Pakistan (USDA NCRS 2002)
Russian Federation - Ciscaucasia, Dagestan (USDA NCRS 2002)
Tajikistan (USDA NCRS 2002)
Turkey (Holm *et al.* 1979, USDA NCRS 2002)
Turkmenistan (USDA NCRS 2002)
Uzbekistan (USDA NCRS 2002)

Europe

Bulgaria (USDA NCRS 2002)
France (SAGAR 1995)
Greece (USDA NCRS 2002)
Italy (SAGAR 1995)
Hungary (USDA NCRS 2002)
Moldova (USDA NCRS 2002)
Romania (USDA NCRS 2002)
Slovakia (USDA NCRS 2002)
Slovenia (USDA NCRS 2002)
Ukraine (USDA NCRS 2002)
Yugoslavia (USDA NCRS 2002)

North America

Mexico - Chihuahua (SAGAR 1995)
USA (Holm *et al.* 1979)
All US states except AL, CT, DE, FL, GA, LA, MA, MD, ME, MN, MS, NH, NJ, RI, VT, WI
(USDA, NRCS 2002)

Distribution Notes

Described as native to western Asia and eastern Europe and naturalized in western Europe & North America (USDA NCRS 2002), *Aegilops cylindrica* is not known from Canada (Darbyshire 2003). The species was introduced into North America as a contaminant in winter wheat seed. Introduced into the United States in the late 1800's, it is speculated that it was transported into Kansas from the eastern Mediterranean. Mennonite settlers from Russia may have brought the weed in Turkey winter wheat. Jointed goat grass is now found in most of the continental United States but is condensed around the wheat-growing regions.

Biology and Ecology

Seeds of jointed goat grass usually germinate from mid-September to November. If temperatures are low enough (37° F) to vernalize (chill) the seed, it can also germinate in late spring and still mature (Donald 1984). Seeds germinate in a temperature range of 40° to 95° F, with 60° to 70° F being the optimum (Morishita 1999). In fact, winter wheat and jointed goat grass germinate together and develop at about the same rate throughout the growing season. Research indicates that jointed goat grass has a quantitative requirement for vernalization in order to flower, meaning that increasing the vernalization period progressively decreases the number of days the plant takes to attain maturity (Donald 1984).

In addition, field research shows that in dry years, jointed goat grass emerges in the wheat row, probably due to better soil moisture and soil-seed contact. In wet years or when the soil seed bank is large, jointed goat grass will germinate both within the row and between rows. Furthermore, seed grown in high moisture conditions have higher germination rates than seed grown under drier conditions. In fact, seed viability and dormancy studies indicate that soil moisture has the greatest influence on dormancy and longevity (Morishita 1999). Evidence suggests that burial depth has little influence on jointed goat grass seed viability and dormancy.

Shallow depths of 0 - 5 cm have reportedly been the most favorable for jointed goat grass emergence. Studies show that emergence is restricted to just 2.5 cm in sand, 5 cm in some silt loam soils, 7.5 cm in loamy sand, and 10 cm in certain Montana soils. Growers and researchers have observed better emergence in compacted soils such as the wheel tracks of combines and tractors. This suggests that compaction makes for better contact between the soil and seed thereby boosting ensuing germination and emergence.

Generally jointed goat grass seeds have an intermediate level of persistence, remaining viable in the soil for 3 to 5 years. The seeds are polymorphic, meaning that part of the seeds germinate early while the rest of the seeds may persist for several more years (Morishita 1999). Recently harvested seeds are still dormant, requiring a postharvest ripening before dormancy is broken. Seed dormancy is directly related to how long the seed will survive in the soil. Field studies show that in drier areas of less than 35 cm of annual rainfall, jointed goat grass seeds will survive for a minimum of 5 years. Contrastingly, in regions with more annual rainfall seeds do not survive in the soil for longer than 3 or 4 years (Ogg 1999).

Economic Impact

Aegilops cylindrica is classed as a noxious or designated weed in Arizona, California, Colorado, Idaho, New Mexico, Oregon and Washington (USDA, NRCS 2002). It is a major problem in winter wheat due to its similarity to wheat in appearance, seed size, growth pattern, and genetics. Found in many agricultural areas around the Pacific Northwest, jointed goat grass is a winter annual grass. It is genetically related to wheat, *Triticum aestivum*, and therefore is very similar to wheat in appearance (Morishita 1999). Presently, this serious weed infests 5 million acres of winter wheat in the United States plus 2.5 million acres of fallow land and is spreading at the rate of 50,000 acres or more per year (Thompson 1999).

Seeds of this species are attached to their rachis segment and shed in June and July, during and prior to the wheat harvest. The seeds are very similar in size and shape to wheat seed and therefore are difficult to screen out. Jointed goat grass is becoming an increasing problem in the wheat land areas of eastern Colorado.

A two-year study was conducted in Broadview, Montana that looked at the competitiveness of jointed goat grass in winter wheat. Researchers observed that jointed goat grass densities of 10 plants per meter reduced winter wheat yields 7 to 13% depending on winter wheat seeding and year. As the density of jointed goat grass tillers increased in 1995 and 1996, the maximum yield loss was estimated at 38.87% and 61.89%, respectively (Maxwell 1998).

Jointed goat grass is highly competitive with winter wheat but variations in wheat variety, seeding rate, and row spacing have increased the competitiveness of the crop against the weed. As an example, a tall variety should be more competitive with jointed goat grass than a short wheat variety (Yenish *et al.* 1998). Also, seeding rates that are 25 to 50% higher than normal can increase crop competitiveness against weeds. However, in low moisture areas, high seeding rates could reduce grain yields and test weights due to the majority of soil water being used to produce plant foliage. Narrow row spacing can also slightly increase the competitiveness of crops against weeds, depending on environmental conditions.

Morphology

Aegilops cylindrica is a member of the Grass family, Barley tribe. It is a winter annual, reproducing by seed and grows 40 - 80 cm tall on erect stems which branch at the base to give the plant a tufted appearance. The leaf blades are 3 - 8 mm wide (usually smooth) with small auricles at the base. The root system is shallow and fibrous. The most distinguishing characteristic is the 5 - 10 cm jointed, cylindrical, seed head.

Goat grass plants at maturity reach 40 - 80 cm inches tall. The seedhead of jointed goat grass is a spike 5 to 10 cm long. Internodes along the rachis (the main axis of the spike) are visible along the spike every 6 to 8 mm (Donald 1991). Each plant can produce more than 100 spikes. Generally two flowers are present on each spikelet; however, researchers have reported up to five florets per spikelet. At two to five spikelets per spike and one to three seeds per spikelet, one plant, without competition, can generate 3,000 seeds. On average though,

in a wheat crop, jointed goat grass will produce about 130 seeds per plant (Daines 1996).

Similarities to other species/conditions

Jointed goat grass looks similar to winter wheat during the vegetative stages, however it may be distinguished by the occasional hairs extending from the margin of the leaf blade, particularly near the collar or stem. Jointed goat grass and wheat occasionally cross to produce a hybrid that is intermediate in form. Hybrid seeds are almost always sterile; however, there are a few rare documented cases where fertile seeds were produced.

Hitchcock describes the culms of jointed goat grass as erect (40 to 60 cm tall) and branching at the base. Leaves are alternate and 2 to 3 mm wide (1998). The first leaf on goat grass is usually reddish to brownish-green, whereas the first leaf on winter wheat plants is whitish-green. Fine evenly-spaced hairs can be seen on the leaf margins of goat grass but wheat has few or no hairs.

Control

Prevention

Jointed goat grass is spread by seed dispersal only. Therefore, any method that reduces seed spread will reduce the spread of the plant. Planting certified seed is the most recommended means of minimizing jointed goat grass spread (Donald 1991, Lyon *et al.* 2003). Other ways to minimize spread include planting jointed goat grass-free winter wheat seed, covering trucks when transporting contaminated grain along roads, cleaning jointed goat grass seed from combines before entering new fields, processing contaminated grain before feeding to livestock, and not baling or transporting contaminated straw to non-infested areas.

Jointed goat grass spikelets (joints) and winter wheat seed are quite similar in size, shape, and density. These similarities make it difficult to separate the two species during harvesting or seed cleaning operations. In fact, standard sieve-type seed cleaners will not completely remove jointed goat grass seed pieces from seed wheat. For complete separation, special length-graders and gravity-tables should be used (Stahman 1998).

Cultural Control

Field research indicates that crop rotation is the most effective cultural practice to control jointed goat grass. Changing the crop rotation so winter small-grain crops are not grown for at least three years, has been most effective for managing jointed goat grass. Researchers suggest that this be done in the winter wheat-fallow region by switching from winter wheat to spring wheat. In areas that receive intermediate to high rainfall the crop rotation can be lengthened by using spring grains, spring legumes, canola and fallow. It has been suggested that goat grass can be completely controlled if bluegrass is grown for 6 to 8 years (Ogg 1998).

Researchers at the University of Nebraska - Lincoln say that rotating with late spring-planted warm season crops such as corn, grain sorghum, proso millet, and sunflower is more effective than rotating with cool-season crops such as spring barley and spring wheat. Early planting of spring small grains allows time enough for jointed goat grass to still germinate and produce seed. But by planting warm-season crops, tillage and/or herbicides can control jointed goat grass before planting. Furthermore, by planting corn or grain sorghum, atrazine can be used after winter wheat harvest to effectively reduce jointed goat grass populations.

Other cultural practices that have been successful in partly controlling jointed goat grass include: summer fallowing one or more seasons, deep moldboard plowing, burning stubble after wheat harvest, delayed seeding in fall so that seedbed preparation destroys emerged jointed goat grass seedlings, seeding competitive cultivars, and adjusting seeding rate and row spacing.

Livestock can contribute to the dispersal of jointed goat grass seed significantly. Viable seed can be spread by unconfined livestock fed nonprocessed grain or straw contaminated with jointed goat grass. Nonprocessed jointed goat grass seed was collected from the rumen or manure of cattle. The viability of the seed was 75% (Lyon *et al.*

1992). Therefore, in order to limit dispersal it is recommended that contaminated feed be processed and/or the livestock remain confined until seed are excreted.

Chemical Control

Owing to the similarity of *A. cylindrica* to the crop, *Triticum aestivum*, no effective selective control has been for the control of goat grass in cereal crops. Generally, because of the closer the taxonomic relationship and the greater the similarity in physiology and morphology of the weed and the crop, the more difficult it is to find a chemical that will effectively control the weed without injuring the crop (Muzik 1970). Jointed goat grass and wheat are genetically related and the weed closely mimics the life cycle of winter wheat.

Several nonselective herbicides will control jointed goat grass in fallow. Where winter wheat is the only option, summer fallow should be considered as a rotation, using tillage and herbicides during the fallow season. Fallow is one of the best times to control the weed with herbicides because selectivity is not a factor. Field studies show that some herbicides applied preemergence, usually in combination with atrazine, provide effective residual control although the high cost of these treatments may limit their usefulness. Further, the persistence of some fallow herbicides effective on jointed goat grass may limit rotational crop options (Donald 1981).

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