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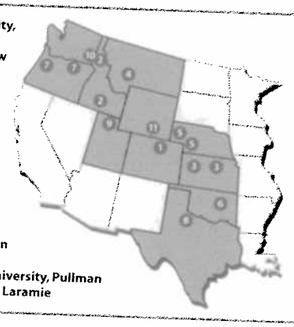

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Jointed Goatgrass Ecology

Jointed goatgrass management in winter wheat has been difficult because the genetics and growth patterns of these two species are similar. Knowledge of jointed goatgrass growth characteristics can help producers select effective management strategies, as some attributes of jointed goatgrass respond to control practices. In this bulletin, we describe the ecology of jointed goatgrass at various stages of its life cycle, and then relate these characteristics to the effectiveness of cultural practices used for managing jointed goatgrass.

Plant Identification

Identifying jointed goatgrass in the field challenges producers because seedlings of jointed goatgrass resemble winter wheat seedlings in appearance. Two prominent traits aid growers in distinguishing between seedlings of the two species:

- First, jointed goatgrass seedlings have evenly spaced hairs lining the leaf blade margin (Figure 1)—these hairs usually are not present in winter wheat. If hairs appear on winter wheat leaves, they are longer and randomly spaced.

- Second, the flower structure of mature jointed goatgrass—referred to as a spikelet or a joint—is distinct. The outer spikelet glumes fuse together and enclose one to three seeds, giving the spikelet an appearance of a cylindrical joint (Figure 2); hence, the name jointed goatgrass. After germination, jointed goatgrass seedlings usually remain attached to the spikelet (Figure 3). Removing soil from around the seedling to expose the spikelet confirms whether the seedling is jointed goatgrass.

Spikelets resemble pieces of wheat straw. They are easy to overlook in winter wheat seeds (Figure 4). However, producers can quickly determine if jointed goatgrass is present by placing a seed sample in water; jointed goatgrass spikelets usually float, whereas wheat kernels rarely do.

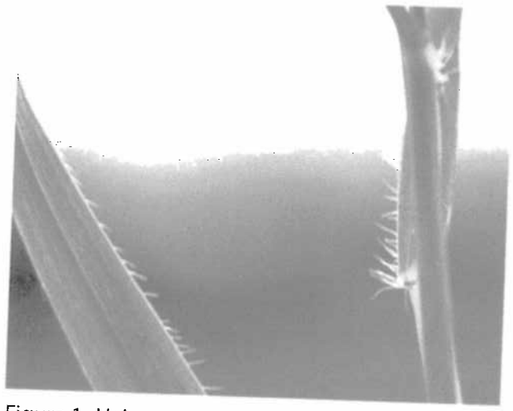

Figure 1. Hairs present on the edge of a jointed goatgrass leaf.

Figure 2. Jointed goatgrass spikelets beside seeds of winter wheat.

When jointed goatgrass was removed by March 1, yield loss was 5%, whereas removing jointed goatgrass on April 1 increased yield loss to 15% (Figure 7). These yield loss trends suggest the optimum time to control jointed goatgrass is late fall or early spring. This guideline will help producers using postemergent herbicides such as Beyond™ (imazamox), which controls jointed goatgrass in imazamox-tolerant wheat cultivars.

Another principle for designing management strategies suggests any crop or weed plant that captures resources first gains a competitive advantage. In that vein, producers can take steps to improve the competitiveness of winter wheat with jointed goatgrass. For example, banding N fertilizer with winter wheat seed at planting reduces jointed goatgrass interference 10% to 15% compared with N applied broadcast. Banding allows winter wheat to reach N fertilizer first.

Also, winter wheat cultivars differ in their competitiveness with jointed goatgrass. Cultivar characteristics favoring wheat over jointed goatgrass include early fall and spring growth, higher tillering capacity, and taller plants. In Washington, tall cultivars having early spring growth reduced jointed goatgrass biomass in some years 20% to 40% compared with other cultivars. Increasing seeding rates and reducing row spacing likewise give winter wheat a competitive advantage over jointed goatgrass.

Seed Production

Jointed goatgrass growing in winter wheat may produce anywhere from a few to more than 200 spikelets per plant (each spikelet contains one to three seeds). If growing without competition (e.g., in areas of winter-killed wheat), jointed goatgrass can produce 3,000 seeds or more per plant.

Seed production and flowering by jointed goatgrass are affected by cold temperature exposure—a process known as vernalization. Plants are easily vernalized when established in the fall. Those germinating and emerging in the spring also can be vernalized in some situations. Jointed goatgrass can emerge and produce viable seeds in early planted crops such as spring wheat or barley, reducing the effectiveness of using spring crops as a cultural practice to manage jointed goatgrass.

> ***A winter wheat management system incorporating N fertilizer banded by the wheat seed, a tall cultivar, and higher seeding rate reduced seed production of jointed goatgrass 45%***

Producers can reduce jointed goatgrass seed production in winter wheat by using several cultural practices together. A management system comprising 1) placing N fertilizer with wheat seeds at planting, 2) planting a competitive cultivar, and 3) using a higher seeding rate (140% of conventional rates), reduced seed production of jointed goatgrass 45% (Figure 8). This competitive advantage was even greater when jointed goatgrass emerged 3 weeks after winter wheat, reducing jointed goatgrass seed production nearly 60%. Employing a single cultural practice has a lesser effect, e.g., banding N fertilizer reduced seed production only 10% (Figure 8).

A key component of long-term population growth of jointed goatgrass may be dispersal of its seeds during harvest. In Australia, downy brome population growth and spread increased 16-fold when a combine dispersed seed at harvest. Since dense jointed goatgrass patches are often localized in fields, harvesting these areas separately from weed-free sections of a field will minimize seed dispersal. Cleaning combines thoroughly after harvesting infested fields also will reduce spread.

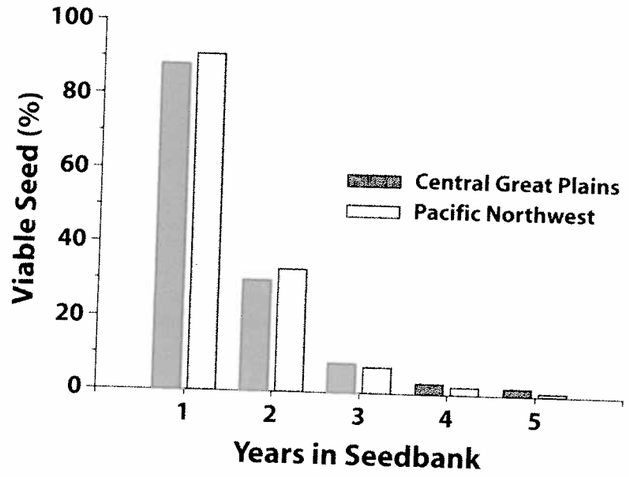

Figure 5. Longevity of live seeds of jointed goatgrass in soil. Research conducted at sites in the Central Great Plains and Pacific Northwest, where rainfall ranged from 15 to 18 inches per year.

short-term benefit of tillage for managing jointed goatgrass against the detrimental effect of tillage on crop yield.

Producers can burn postharvest crop residues to kill jointed goatgrass seeds. Although burning may help on small areas of dense infestation, two aspects of this strategy limit its general effectiveness. First, large quantities of crop residue (7,000 lbs of crop residue per acre or more) must be burned to reach lethal temperatures. Second, only jointed goatgrass seeds lying on the soil surface are killed; seeds buried in soil are protected from the lethal heat.

Seedling Emergence

Jointed goatgrass generally emerges during cool weather. Peak emergence occurs from September through early November, with a secondary flush of seedlings emerging in late winter and early spring. Seedlings can emerge in any of the cooler months. In one study, almost all seedlings emerged within a 3-week period in September of the first year; the following year, seedlings emerged every month from August through April. Germination relates closely to precipitation; dry periods delay germination until more favorable conditions develop.

To encourage seedling emergence, producers may till fields 2 to 3 weeks before planting winter wheat. If soil moisture is adequate, seedlings emerge and can easily be controlled prior to planting wheat. However, this practice is not consistently effective because precipitation is erratic in semiarid regions and tillage can rapidly dry out the soil. Also, tillage buries seeds at various depths in soil, prolonging the seedling emergence period. Since seedlings of deeply buried seeds may not emerge until after wheat has been planted, these plants will not be controlled by tillage.

Producers may delay planting winter wheat to allow the emergence of more jointed goatgrass seedlings. This approach is typically ineffective—not only because of the erratic nature of jointed goatgrass emergence, but also because delayed planting usually reduces winter wheat yields. This trend was demonstrated with downy brome, where delayed planting reduced downy brome density in winter wheat only one year out of six; yet winter wheat yield was reduced every