CONSERVATION TILLAGE

FACTS

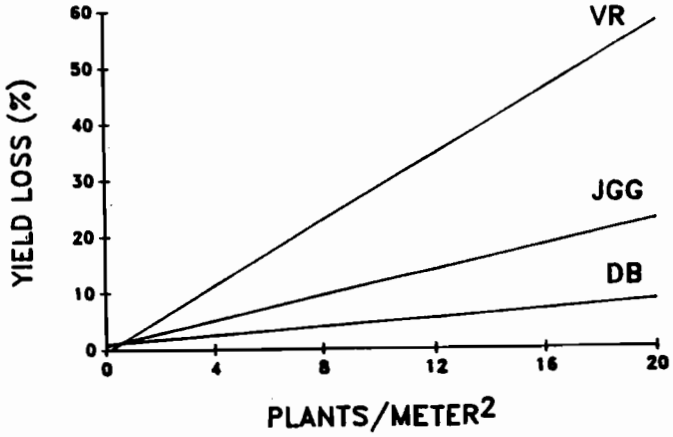
CONTROL STRATEGIES FOR JOINTED GOATGRASS, VOLUNTEER RYE, AND DOWNY BROME

Winter wheat producers in the central Great Plains face three serious weeds: jointed goatgrass, downy brome, and volunteer rye. Because these winter annual grasses have similar life cycles to winter wheat, they are well adapted to winter wheat-fallow systems.

These species cause serious grain yield loss, even at low populations. For example, each plant/m^2 of volunteer rye, jointed goatgrass, and downy brome reduces grain yield 3%, 1%, and 0.5%, respectively (Figure 1). Currently, there are no effective and/or economical herbicides that control these grasses selectively in winter wheat.

Infested fields have a reservoir of weed seeds in the soil (seed bank). To minimize future infestations, producers can employ management strategies that limit the number of weed seed in the soil before planting winter wheat again. This fact sheet suggests strategies for minimizing the seed bank population before the next wheat crop.

Figure 1. Winter wheat grain yield loss as related to population of volunteer rye (VR), jointed goatgrass (JGG), or downy brome (DB).



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STRATEGIES DURING THE WINTER WHEAT GROWING SEASON

A single plant of these grasses produces 500 to 800 seeds Thus, even low populations of these weeds in the crop dramatically increase the soil seed bank.

Producers can prevent weed seed production by spraying weed-infested patches in winter wheat with foliarly-active herbicides such as paraquat or glyphosate. Applying these herbicides in the spring eliminates wheat also, but seed addition to the seed bank is prevented, thus minimizing weed infestations in future crops.

A second option is mowing infested areas for hay, provided mowing occurs before viable seed is produced by the plant. Seed viability develops in grasses soon after flowering. Therefore, producers prevent seed production by mowing grasses before plants begin heading.

Mowing is especially effective in controlling volunteer rye because of its tall growth habit and slow development. Mowing is not as effective with jointed goatgrass and downy brome, as both species are shorter and produce secondary tillers after mowing. Secondly, downy brome flowers approximately two weeks before winter wheat, necessitating mowing two to three weeks earlier, which reduces hay production. Thus, applying herbicides in early spring may be more effective with downy brome and jointed goatgrass.

Also, producers can destroy a percentage of their crop for government program benefits, if crop removal occurs before June 10. Producers should consider destroying their crop two to three weeks earlier than June 10, if volunteer rye or jointed goatgrass are present, and five to six weeks earlier if downy brome is present, to prevent viable seed production.

STRATEGIES BEFORE THE NEXT WINTER WHEAT CROP

<u>Add summer-annual crops to the crop rotation</u>.

Weed seed survival in soil decreases over time because of germination, predation, or natural death of seeds. Longevity of seed survival in soil, however, varies among species. With volunteer rye and downy brome, less than 20% of seed is alive one year after entry into the soil and < 5% of the seed is viable after two years (Figure 2). Jointed goatgrass seed, however, persists longer, as > 20% of the seed bank remains viable after two years.

By delaying the next wheat crop for two years, producers can reduce the seed bank of volunteer rye and downy brome by 90%, while a three-year interval between wheat crops will reduce

jointed goatgrass seed population similarly.

To lengthen the time between winter wheat crops, producers can grow summer-annual crops before the next winter wheat crop. Weed seedlings that emerge in or after summer-annual crops, however, must be controlled to prevent seed production.

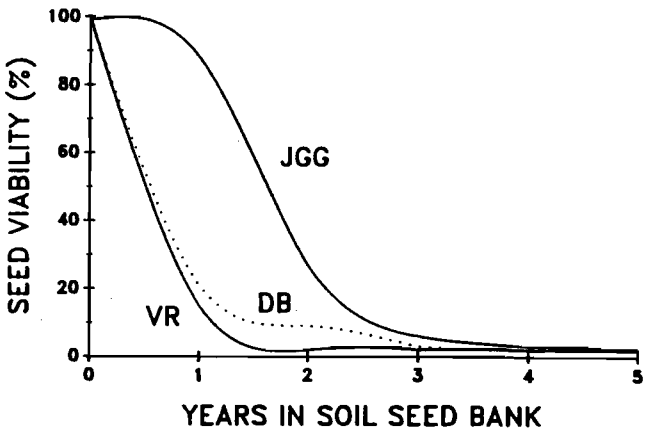


Figure 2. Length of survival of volunteer rye (VR), jointed goatgrass (JGG), and downy brome (DB) seed in soil.

Choice of summer-annual crop within rotations.

Choice of summer-annual crop, however, can affect the rate of seed bank decline by its impact on germination and emergence. Canopy structure varies among summer-annual crops, especially during the fall. This difference in canopy structure alters the soil microclimate, which subsequently affects grass seedling germination and emergence. Comparing several crops for effect on winter annual grass weed emergence in the fall shows that for every seedling emerging in proso millet, 1.5, 4, and 4 seedlings emerge in sorghum, corn, and barley stubble (crop was harvested in July), respectively. Growing corn or barley after winter wheat favors seed bank depletion more than proso millet because of greater fall germination and seedling emergence.

Tillage effect on seedling emergence.

Crop residue requirements for reducing erosion and complying with government support programs encourage the use of reduced- and no-till production systems. Tillage, however, incorporates weed seed and stimulates germination. Tilling the soil with a sweep plow once after winter wheat harvest increases weed seedling emergence by two-fold compared to a no-till system where herbicides replace tillage. Producers can accelerate weed seed bank depletion yet maintain ASCS program compliance with a reduced-till system of one sweep plot tillage followed by herbicides to control weeds thereafter.

STRATEGIES AT WINTER WHEAT PLANTING

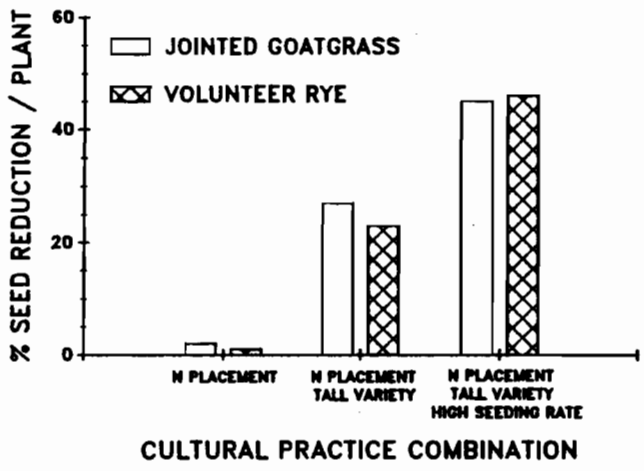
Cultural practices to limit weed seed production.

Producers can enhance winter wheat competition with weeds by using cultural practices such as: N fertilizer placement, tall varieties, and increased seeding rates. These practices exert minimal impact on weeds when used alone, but combining several practices together greatly enhances wheat competitiveness.

For example, applying N fertilizer in April of the fallow season rather than just before planting slightly favors wheat over jointed goatgrass and volunteer rye (Figure 3). When N placement is combined with a tall variety (Lamar), seed production is reduced by approximately 25%. By also increasing the seeding rate of Lamar, seed production by weeds is reduced by more than 40%. Downy brome production is reduced even more by these cultural practices because of its shallow rooting pattern and short height.

One drawback of using tall varieties is their lower yielding ability. However, using these cultural practices at winter wheat planting minimizes weed seed addition to the seed bank, consequently lessening future infestations and yield loss.

Figure 3. Effect of cultural systems on seed production of volunteer rye and jointed goatgrass growing in wheat.



Delaying planting.

Delaying wheat planting is useful if rain occurs near planting time. These grasses germinate and emerge 10 days after a rain, therefore tilling with a rodweeder eliminates these seedlings. However, effectiveness of this strategy is erratic, especially with jointed goatgrass and downy brome. After a rain, seedling emergence of these species is spread out over several weeks, while volunteer rye emerges within a two-week window. Therefore, delaying planting would be most effective with volunteer rye.