WEED MANAGEMENT

Weeds reduce wheat yield and profit by competing with the crop for moisture, light and nutrients. Weeds also can interfere with harvest and result in dockage and lower quality grain. Yield loss and harvest problems caused by weeds in wheat will vary depending on the weed species, weed population, time of weed emergence, growing conditions and status of the wheat crop. A healthy stand of wheat that has a head start on weeds is competitive and will suppress weed growth. A thin stand of wheat that is stressed by disease, insects, nutrient deficiency or drought is not very competitive with weeds.

The timing of weed emergence relative to crop emergence has a great influence on competition and yield reduction caused by weeds. Weeds that emerge with the wheat crop or early in the fall are more competitive than weeds that emerge in the winter or spring (Table 3). Thus, winter annual weeds generally cause more yield loss in winter wheat than summer annual weeds. Summer annual weeds can interfere with harvesting and cause problems in the summer annual crop (usually soybean) planted after wheat harvest.

Table 3. Percent crop yield loss associated with common winter annual weeds found in Missouri.

Weed species	Density per 100 sq. feet	Yield loss potential (%)
Field pennycress	50	37
Wild buckwheat	50	15
Prickly lettuce	80	15

Winter annual weeds usually germinate and emerge in the fall about the time wheat is planted, and they complete their life cycles and produce seed in the spring. Winter annual weeds may also germinate and emerge during the winter or spring but are usually not as competitive with wheat as the fall-germinating weeds are. Germination depends on soil temperatures and precipitation.

Figure 11. Horseweed is a common weed in Missouri.

In Missouri, the most common weeds that emerge in the fall or winter include cheat, downy brome, annual ryegrass, wild garlic, wild onion, field pennycress, chickweed, henbit, horseweed (marestail), prickly lettuce, shepherd's-purse and wild buckwheat. Summer annual weeds present in wheat could include common lambsquarters, common ragweed, giant ragweed, redroot/smooth pigweed, smartweed and velvetleaf (see page 15 for Weed Identification).

CULTURAL WEED CONTROL PRACTICES

Establishing and maintaining a competitive wheat stand is one of the best techniques for minimizing yield loss due to weed interference. A seeding rate that results in 30 to 35 wheat seedlings per square foot is ideal for achieving optimum yields and limiting weed infestations. Applying nitrogen at recommended rates and timings (see fertility management) can promote tillering of wheat and limit the presence of weeds that affect harvest efficiency.

Crop rotation can be used to reduce weed populations. Infestation levels of wild garlic, chickweed and henbit tend to be lower following corn than following soybean, because the atrazine used in corn provides late-season, soil-residual activity on these weeds. Thus, a rotation of corn/wheat/double-crop soybean would be more favorable for managing these weeds than a soybean/wheat/soybean rotation.

Managing weeds in the fall before planting wheat, either with tillage or with burndown herbicides, is beneficial for controlling winter annual weeds. The benefits of these practices are greater

if weather conditions before planting wheat are favorable for germination of the weed seed. Fall tillage practices that use both plowing and disking are effective for controlling perennial weeds such as wild garlic. Control of perennial weeds is enhanced with aggressive tillage to break up the underground reproductive structures.

Managing winter weeds in other crops in the rotation also can be beneficial by reducing the amount of weed seed in the seed bank. Using fall-applied herbicides to control winter weeds before corn and soybean planting should be considered in areas where winter weed growth is prevalent.

CHEMICAL WEED CONTROL PRACTICES

Herbicides are a safe and effective option for control of certain weeds in wheat. However, herbicides will not solve all weed problems and should be used only as a component of an integrated weed management program. Important factors to consider when choosing which herbicide to use are (1) identification of the weed species present, (2) the stage of crop and weed development, (3) herbicide persistence in the soil and rotational crop restrictions, and (4) the risk of off-site movement.

Much of the information related to items two, three and four can be found in MU publication MP 575, *Weed Control Guide for Missouri Field Crops*. This publication is updated annually with new information on herbicides, their efficacy on various weed species, appropriate application timings based on crop and weed-growth stages and rotational crop sensitivity to these herbicides.

Herbicides should only be applied at the crop-growth stages recommended on the label to achieve the desired results. Wheat must be at the proper stage of growth to avoid crop injury. Application too early or late may result in stunting and yield reduction. Wheat is generally most tolerant of postemergence broadleaf herbicides after it is fully tillered but before jointing. Application of 2,4-D before tillering can result in stunted wheat and incomplete head formation and grain fill.

No herbicides are labeled for application when the wheat is in the early-boot to soft-dough stage. Application during this time would result in sterility, poor grain fill and reduced yield.

Postemergence herbicides are usually most effective when applied to weeds that are actively growing. Winter annual broadleaf weeds are most susceptible when in the rosette stage of growth in the fall or early spring. Winter annual weeds that have bolted and produced the flowering stalk are more herbicide tolerant than younger weeds. Only a handful of herbicides are registered for the control of broadleaf weeds in winter wheat grown in Missouri.

Phenoxy herbicides, such as 2,4-D and MCPA, control a number of annual broadleaf weeds and are the least expensive of these herbicides to use. However, proper application timing of the growth-regulating herbicides 2,4-D, MCPA and Banvel is critical to avoid crop injury and possible yield losses. These herbicides can cause substantial crop injury and yield loss in small grains if applied before tillering begins or after development of the grain heads has begun.

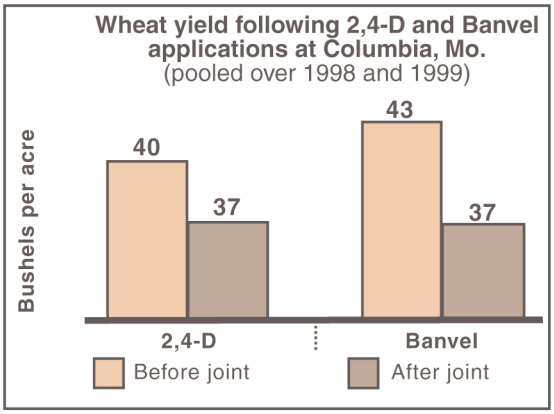


Figure 12. Wheat yield comparing herbicide application timing.

The exact time at which grain heads begin developing is not easy to determine, but this event always precedes stem elongation. The occurrence of stem elongation easily can be detected by the appearance of the first node or "joint" above the soil surface, which is commonly referred to as the "jointing stage." Pinch a wheat plant stem at the base between the thumb and forefinger and slide your fingers up the stem. The presence of a node or joint will be felt as a hard bump about an inch above the soil surface. Slicing the stem lengthwise with a sharp knife will reveal a cross section of the hollow stem and solid node.

If jointing has occurred, applications of 2,4-D, MCPA and Banvel should be avoided because crop injury and yield loss are likely (Figure 12). Research from the University of Missouri Weed Science program has shown a yield loss of 3 to 6 bu/acre from 2,4-D and Banvel applications to wheat after the jointing stage. MCPA alone at labeled rates should be applied before jointing. However, the amount of MCPA applied in Bronate, a combination of bromoxynil and MCPA, is low enough to permit later applications.

Many wheat fields in Missouri contain wild garlic and wild onion. Although not considered to be strong competitors with a wheat crop, wild garlic *(Allium vineale)* and wild onion *(Allium canadense)* are both responsible for imparting a strong odor to beef and dairy products. Wheat producers and grain elevator operators are familiar with dockages that occur with the presence of wild garlic or onion bulbs in their harvested grain. Found throughout Missouri, wild garlic is a native of Europe, while wild onion is native. Despite the fact that these perennials occur in similar habitats, wild garlic occupies the majority of small grain settings, including wheat.

Control measures for wild onion and wild garlic differ. Producers, consultants and industry personnel will want to make certain that they are able to distinguish between these two weed species. The vegetative leaves of wild garlic are linear, smooth, round and hollow (flowering stems are solid). A major difference with wild onion is that its leaves are flat in cross section and not hollow. Another varying feature is the underground bulbs. Wild garlic bulbs have a thin membranous outer coating while wild onion bulbs have a fibrous, net-veined coating.

Harmony Extra (thifensulfuron + tribenuron) is the herbicide most commonly used for control of garlic in wheat. It also controls a relatively wide spectrum of other broadleaf weeds and possesses a fairly wide application window. Harmony GT (thifensulfuron) has activity on wild garlic but is considered slightly weaker than Harmony Extra. Peak also is labeled and effective on wild garlic in wheat but it is fairly persistent in soil. The Peak label does not allow one to plant double-crop soybean following wheat harvest in Missouri. Wild onion is controlled with 2,4-D. Keep in mind that both of these weeds are perennials, and the full-labeled rate is needed for adequate control.

Harvest aid or rescue herbicide treatments

Occasionally, late-season, harvest-aid treatments are needed to burn back weed vegetation to improve harvest efficiency. These treatments should be applied no earlier than the hard-dough stage of wheat so they do not interfere with wheat grain fill.

There are three products labeled for this use: 2,4-D, Banvel/Clarity and glyphosate (Roundup/others). Keep in mind that if these treatments are needed, it is likely that the weeds are 2 feet or more in height and that the upper limit of the labeled rate will be required for effective control. Also, each product will have unique feed, forage, grazing and rotational crop restrictions. These restrictions include the following:

- If you are planning to double-crop soybean or sunflower after the wheat, do not use Banvel/Clarity, because herbicide residues remaining in the soil will not allow effective establishment of the crop.
- If you have underseeded legumes, all products will cause various degrees of injury to the underseeded legumes, with Banvel/Clarity causing the most severe injury.
- Double-crop soybean can be planted after use of 2,4-D, but the label requires a waiting period of 14-30 days before planting.

Other restrictions relate to feed, forage and grazing. Consult the manufacturer's label or MU publication MP 575 for more information.

Reference to specific trade names in this publication does not imply endorsement by the University of Missouri; discrimination is not intended against similar products.

Before using any herbicide, read and follow directions on the label accompanying that product.

Figure 13. Mouseear chickweed.

Herbicide-resistant weeds in wheat

At this time, there are no documented cases of herbicide-resistant weeds in Missouri wheat, although horseweed is suspected of resistance. Herbicide-resistant populations of the following weeds occur in adjacent states in wheat-production areas (Table 4).

Table 4. Weeds with known herbicide-resistant populations in wheat-producing adjacent states.

Weed	State	Herbicide
Perennial ryegrass	Arkansas	Diclofop (Hoelon)
Kochia	Illinois, Nebraska, Kansas	Thifensulfuron (Harmony, Harmony Extra)
Kochia	Nebraska	Dicamba (Banvel/Clarity)
Kochia	Kansas	Metribuzin (Sencor)

Figure 16. Wild garlic.

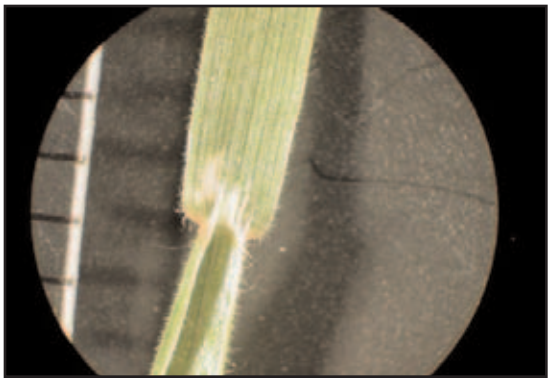


Figure 14. Cheat.

Figure 15. Henbit.

The weeds most commonly treated in Missouri wheat are henbit, chickweed, wild garlic and cheat/downy brome (Figures 13-16). Care should be taken to avoid repeated use of herbicides with the same mode of action for these weeds. In addition, weed management in other crops using different modes of action or cultural practices will slow or minimize the development of herbicide resistance in these weeds.

Herbicide-resistant wheat

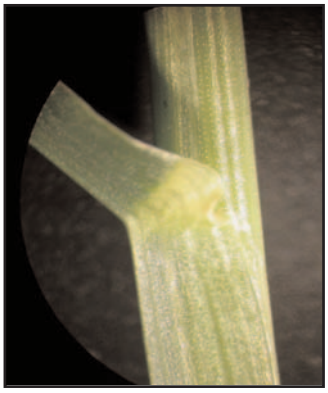
Corn and soybean varieties with tolerance for nonselective herbicides became commercially available in the mid-1990s. In 2002, wheat varieties with tolerance for a specific imidazolinone herbicide (imazamox) became commercially available. The imidazolinone-resistant varieties are currently being developed and marketed by BASF under the trade name of ClearField. The trade name of the herbicide labeled for use in ClearField wheat is Beyond. Beyond can be applied in the fall or spring from the third-leaf stage of wheat until jointing. Beyond will control ryegrass, bromegrass and many winter annual weeds. Although seed supply is somewhat limited, more varieties will become available each year. Consult your seed dealer to find a variety suited to your growing conditions.

WEED IDENTIFICATION

Left: Downy brome. Similar to cheat, especially in seedling stage, but less pubescent as it matures. Sheath of both is closed to near the top of the collar. Annual.

Middle: Ryegrass. Short auricles appear to clasp stem. Blades smooth with prominent veins. Annual.

Right: Wild garlic. Bulbous perennial. Emerges in early spring and dies back in late spring. Leaves are hollow, lack hair and have a strong odor. Perennial.



Left: Wild onion. Flowers similar to wild garlic except that the leaves are flattened and not hollow. Perennial.

Middle: Star-of- Bethlehem. Similar in appearance to wild onion and wild garlic, though no odor. Leaves are grooved and dark green with a prominent white midrib. Perennial.

Right: Dandelion. Leaf margins are irregular, toothed or wavy with deep lobes. Contains a milky sap. Flower is large and yellow. Perennial.

Left: Field pennycress. Leaves along stem lack hair and petioles. Lobes at base. Small white flowers (4 petals). Fruit is flat and round. Annual.

Middle: Common chickweed. Some petioles hairy; others smooth. Upper stem has no petioles. Leaves smooth, light green. White flowers (5 petals) similar to mouseear. Perennial.

Right: Mouseear chickweed. Small leaves lack petioles and are hairy. Flowers white (5 petals). Perennial.

Left: Horseweed. Erect, columnar appearance. Stems and leaves covered with dense hairs. Leaves lack petioles and are long and narrow. Annual.

Middle: Prickly lettuce. Basal rosette of bluish green leaves, fine prickles. Prominent midrib, row of spines, milky sap. Annual/biennial.

Right: Shepherd's-purse. Leaves deep and irregular cut in rosette stage. Later, take an arrow shape. Small, white flowers (4 petals). Annual.

Left: Wild buckwheat. Leaves alternate (pointed tips and basal lobes directed backward). Flower greenish white or purple spotted. Annual.

Middle: Wild mustard. Leaves rough and variable. Lower leaves irregular lobed margins and petioles. Flowers yellow clusters (4 petals). Annual.

Right: Common lambsquarters. Young plant has small linear cotyledons. First true leaves opposite; later leaves alternate. Annual.

Left: Common ragweed. Cotyledons are small spatulas. First true leaves appear lobed and opposite. Later, true leaves appear highly dissected. Annual.

Middle: Giant ragweed. Spatula-shaped cotyledons, larger than common ragweed. First true leaves opposite but larger and 3-lobed. Annual.

Right: Redroot pigweed. Emerging plant has linear-shaped cotyledons. Later, leaves oval shaped, rough. Stems reddish and hairy. Annual.

Left: Pennsylvania smartweed. Cotyledons about 3 times as long as wide, with dark red emerging hypocotyl. First true leaves alternate. Annual.

Middle: Velvetleaf. One heart-shaped and round cotyledon. Both softly hairy. First true leaves alternate, hairy. Leaves heart shaped. Annual.

Right: Henbit. Pinkish purple. Square stem; upper leaves appear to encircle stem. Rarely over 12 inches. Annual.