HERBICIDE OPTIONS IN SMALL GRAINS

Steve Wright, Steve Orloff, Mick Canevari, Kassim Al- Khatib[1]

INTRODUCTION

Small grains, which include wheat, triticale, barley, oats, and rye, are grown throughout most of California. In addition to their economic value, small grains are an important agronomic crop because they are an integral part of many crop-rotation programs, helping to reduce weed and disease problems in subsequent crops. Most of the small grain acreage is under irrigation in California; however, dryland production represents approximately 20 percent of the acreage and is common in many coastal and foothill regions. Small grains are grown for grain, for forage (silage, green-chop or hay) and as cover crops.

Within a small grain type, some varieties are more susceptible to certain herbicides; therefore, labels should be checked before making an application. It is important to control weeds in small grains because weeds can: (1) compete, reducing the grain or forage yield, (2) impede harvest operations late in the season when they mature later than the grain, and (3) contaminate the grain with their seeds, making extra cleaning necessary and causing loss of return to the grower due to dockage. Some weeds are poisonous, affecting silage or hay quality. Effective weed control in small grains also helps reduce weed infestations in subsequent crops. Many weeds, such as broadleaf weeds, are easier to control in small grains than other crops.

Broadleaf Weeds

The most common broadleaf weeds that infest cereals include mustards (black mustard, wild radish, London rocket), fiddleneck, malva, burning nettle, common chickweed, field bindweed, smartweed, lambsquarters, and yellow starthistle. Broadleaf weeds vary in their competitive ability. One wild radish plant/square foot, when established at the same time the crop emerges, can reduce wheat yield by as much as 66%. It does this by completely overtopping the wheat canopy and competing for light. Common chickweed is low growing and is generally less competitive; it reduces yield by removing soil nutrients and moisture, however under high fertility conditions can grow over the top of small grains.

[1] S. Wright (sdwright@ucdavis.edu) UCCE Farm Advisor, Tulare County, 4437B S. Laspina Street, Tulare, California, 93274; [2]S. Orloff UCCE Farm Advisor, Siskiyou County, 1655 South Main Street Yreka, CA 96097; [3] Mick Canevari (wmcanevari@ucdavis.edu), University of California Cooperative Extension Emeritus. 2101 E Earhart ave, Ste 200, Stockton Calif. 95216; Email: [4] **In**: Proceedings, 2014 California Alfalfa and Grains Symposium, Long Beach, CA, 10-12 December, 2014. UC Cooperative Extension, Plant Sciences Department, University of California, Davis, CA 95616.(See http://alfalfa.ucdavis.edu for this and other alfalfa conference proceedings.)

Grasses

Many grasses germinate at the same time as small grains, and their seed matures slightly before or at the same time as their crop competitor (thus assuring an ample supply of seed for next year's weed crop). These weeds compete primarily for light, but also remove moisture and nutrients needed for crop growth. Wild oat and canarygrass have been shown to reduce grain yield by as much as 75%. Problematic grassy weeds in California's small grain fields are winter annuals including: wild oat, Italian ryegrass, ripgut brome, annual wild barley (hare barley), rabbitfoot grass, both hood and littleseed canarygrass, and annual bluegrass. Proper identification of seedling grasses is essential because grass herbicides do not control all grassy weeds.

Wild Oat has been the major grassy weed problem throughout California; however, other grassy weeds are replacing it in importance in many areas because wild oat is now controlled with most of the grass herbicides used in small grains. Wild oat emerges throughout the cool season from autumn through spring. It causes lodging, slows harvest, clogs harvester screens, and lowers yields. As few as seven wild oat plants/square foot can reduce wheat yields by 3,000 pounds/acre compared to a 6,000 pounds/acre yield where no wild oat exist (fig. 2).

Barley competes better with wild oat than does wheat. In one study, 14 wild oat plants/square foot reduced barley yield by 27.2% and wheat yield by 39%. Delayed planting, mulch planting, crop rotation, and selective herbicides are all effective strategies to reduce wild oat.

Italian ryegrass is primarily a problem in the irrigated regions of California's central and northern valleys. Delayed planting along with herbicides can provide control. Crop rotation is also effective.

Hood and **littleseed canarygrass** can reduce grain yield in extreme conditions by more than 50%. Hood canarygrass is a problem in the central valley and coast dryland areas. Littleseed canarygrass is the most prevalent grass in low desert grain fields. Canarygrass is a prolific seeder, and as a result, populations of canarygrass from fields continuously cropped to cereals often exceed 100 plants per square foot. Crop rotation, delayed planting, and mulch planting can aid in control.

Wild annual barley and **rabbitfoot grass** populations are increasing in California grain fields. Both are common in throughout the state. **Ripgut brome** is an increasing problem, particularly in dryland culture. In addition to reducing yield, its seed can reduce the marketability of grain. Delayed planting, mulch planting, rotation, or alternate year production (where ripgut brome is controlled in the fallow year) all help to control it. Often these weeds appear when grain prices are high and former pastures or fallow fields are brought under production.

CULTURAL PRACTICES

An integrated weed-management system involves the combination of several practices including fertilization, irrigation, tillage, herbicide applications, and establishing optimum plant populations. Field sanitation is a prerequisite for weed control. When problem fields must be planted, weed control plans should be made in advance. It is important to use clean planting and tillage implements. Field perimeters should be kept free of difficult-to-control weeds because they serve as a weed-seed reservoir to infest the field.

Seedbed Preparation and Planting

Seedbed preparation can directly influence yield and weed pressure. It is very important to use high-quality, as clean as possible planting seed. Certified seed assures the grower the best chances of seed freer of weed-free seed. Using noncertified seed increases the risk of introducing new weed infestations. Planting date and seeding rate can also influence weed competition. Late plantings result in small grain plants that are shorter with fewer tillers and are thus less competitive with weeds. University studies have shown that higher plant populations are very effective in reducing competition of most weeds. Mulch planting is a technique that has been used effectively in cereals for many years. This technique is accomplished by irrigating the soil in the fall or early winter prior to planting. This “preirrigation” is followed by a timely, shallow cultivation. The crop seed is then planted into moist soil below the mulch of dry soil that resulted from the cultivation. Because the crop seed is placed in moist soil, it germinates early, whereas the weeds fail to germinate until the dry mulch is wetted from rainfall or irrigation. This technique gives the crop a head start over the weeds.

Fallowing

Under dryland conditions, it is often advisable to fallow fields every other year to prevent weed seed buildup and to conserve moisture for maximum small grain growth. No weeds should be permitted to escape and produce seed during the fallow period. If possible, it is advantageous to let fall rains germinate the first flush of weeds before tillage operations for planting are started. The tillage kills weeds prior to planting, thus reducing the number of weeds that emerge with the crop. Weeds may also be treated with an herbicide during the fallow period—a practice referred to as “chemical fallow.”

Crop Rotation

Fields should be rotated to cultivated crops to reduce infestations of Johnsongrass, wild oat, ryegrass, and many other weed species. Crop rotation allows weeds that are not easily controlled in small grains to be reduced chemically, mechanically, and physically in the rotation crop. It also permits the use of crops grown at different times of the year, breaking the reproduction cycle of some problem weeds. Small grains are often planted in fields as a means of reducing

weeds in subsequent higher value crops. Rotation for managing problem weeds accounts for at least some of the small grain acreage in California.

CHEMICAL CONTROL

Postemergence Broadleaf Weed Control

Typically, only postemergence herbicides applied after the crop has emerged are used for weed control in small grains. Fall-planted small grains are usually treated between December and mid-March, depending on the planting date and growing conditions. Spring-seeded cereals in the intermountain area are treated in April to June. Several postemergence herbicides are registered for use.

Hormonal herbicides are commonly used in cereals, alone or in combinations. These herbicides include 2,4-D, MCPA and dicamba (Clarity), and are most effective when applied to small and succulent weeds. These herbicides are especially effective against weeds in the mustard family. Ester and amine formations of 2,4-D and MCPA control most broadleaf weed species encountered in small grains. The preferred time for applying 2,4-D is after the cereals are well established and tillered, but before they reach the boot stage. Yield reductions can occur if application is made before tillering or before jointing stage. Best control is obtained when weeds are small, and before the crop has reached the jointing stage. Late applications are sometimes ineffective because the crop canopy shields the weeds, preventing the herbicide from making contact. Dense weed populations require a more thorough application with a greater spray volume to ensure that weeds are contacted by the herbicide. The use of aircraft often facilitates timely herbicide application, but care must be taken to make applications at the appropriate time to avoid injury to adjacent crops from drift or volatilization.

MCPA does not control large weeds as well as 2,4-D, but it offers greater crop safety, especially when it is applied to cereals in early-growth stages. It is also safer to oats than 2,4-D.

Dicamba is effective for broadleaves such as mustards, and partial control of malva and filaree. Small grains are generally more sensitive to dicamba than to 2,4-D or MCPA. Dicamba causes a flattening effect or a more prostrate growth habit. Dicamba is safer when applied at an early cereal growth stage (two-to-three-leaf stage). Dicamba cannot be applied to fall-seeded barley. Dicamba is often combined with carfentrazone (Shark), Pyraflufen-ethyl (ET) or MCPA. When applied early, these combinations are very effective and increase the weed spectrum controlled over either one of these herbicides used alone.

Bromoxynil (Buctril), a contact herbicide, is effective for controlling young seedling weeds with no more than two to four leaves, but is less effective than the hormonal herbicides on older weeds. Bromoxynil is not translocated from the site of absorption throughout the plant; therefore, thorough coverage is more important with this herbicide than with translocated hormonal herbicides. An advantage of bromoxynil is that it controls the toxic weed fiddleneck

when applied at the early-growth stages. Bromoxynil is also recommended in areas with hormonal-sensitive crops (grapes, cotton, tree crops) because it is less likely to damage nearby crops.

Carfentrazone controls plants by disrupting cell membranes. It is effective rates for controlling fiddleneck, malva spp., burning nettle, and other weeds that have been difficult to control with previous herbicides. Pyraflufen-ethyl is in the same herbicide family as carfentrazone and is very effective on common chickweed and burning nettle but does not control fiddleneck. Both herbicides usually cause some necrosis injury to wheat. Combining these herbicides with 2,4-D, MCPA or dicamba broadens the weed spectrum, lowers the herbicide-application rate of each herbicide, and can reduce the risk of weeds evolving herbicide resistance.

Tribenuron (Express) controls most broadleaves found in small grain fields but is less effective at controlling mustards. It does not crop injury; but control is slow. When mustards are present, it is often tank mixed with MCPA to broaden the spectrum of control. It can also be tank mixed with pinoxaden (Axial) when spraying for grasses. Express herbicide is currently the most widely used herbicide for small grains.

Chlorsulfuron (Glean) is registered for use in a wheat/fallow rotation. It is a sulfonyl urea herbicide that controls most broadleaves. It is not widely used in California because it has a long soil life that prevents its use in areas where cereals are rotated with many different crops.

Grass Weed Control with Preemergence Herbicides

Preemergence herbicides are not commonly used in small grains in California, but can be effective in certain situations. Trifluralin (Treflan) is a preemergence herbicide used for wild oat or canary grass control. It is applied before seeding and must be incorporated to a soil depth of less than two inches. The cereal seed is then placed below two inches. Results can be erratic if the zone of treatment does not have adequate moisture or seed is placed into the treated zone. Pendemethalin (Prowl) may be applied after wheat emerges in the 2 leaf stage but before weed emergence. Moisture is required to incorporate the herbicide.

Grass Weed Control with Postemergence Herbicides

Imazethabenz-methyl (Osprey) is available for the control of wild oat, Italian ryegrass, annual bluegrass and certain broadleaved weeds such as chickweed, burning nettle, and malva in wheat and barley. Crop injury is common. Certain rotation crops are restricted because this herbicide has soil residual.

Fenoxaprop ethyl (Puma) is applied as a postemergence spray; it controls canary grass, wild oat and several *Setaria* spp. It is most effective when application is made between the one-leaf-to-one-tiller grass growth stages. A tank mixture with bromoxynil will allow for a wide range of

weed control at an early timing. It cannot be tank-mixed with a phenoxy herbicide, since reduced grass control often results. All wheat varieties are tolerant.

Pinoxaden (Axial) controls wild oat and Italian ryegrass in wheat and barley, without variety restrictions. It can be tank-mixed with bromoxynil, MCPA and clopyralid for broadleaf control. Tank-mixing with tribenuron and MCPA controls broadleaves at the same time. Crop tolerance exists from two-leaf stage to boot stage.

Pyroxulam (Simplicity) controls wild oat, Italian ryegrass and suppresses ripgut and controls several broadleaves in wheat. Do not apply to durum wheat, barley, or oats. Apply before jointing stage.

Controlling Weeds Prior to Harvest

The presence of green immature weeds late in the season may cause both harvest and post-harvest problems. Green weeds can slow the progress of combines, raise the moisture content of the harvested crop, and discolor or even cause off-flavors in the harvested grain. Weeds that often cause problems at harvest include field bindweed, Russian thistle, fivehook bassia, kochia, lambsquarters, knotweed, smartweed, and Johnsongrass. Problems with green weeds at harvest can be resolved with a preharvest herbicide application (2,4-D or glyphosate where permitted) or by swathing the crop prior to combining. In both cases, the green weeds are allowed to dry before the crop is harvested with a combine.

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