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Weed Control in Sorghum
Weed Control in Sorghum

by LYLE A. DERSCHEID, extension agronomist, and
ROBERT PARKER, extension agronomist—weeds

In the last few years about 600,000 acres of sorghum have been planted annually in South Dakota and it appears the acreage will increase. Approximately 60% of it has been harvested for grain.

Sorghum grows slowly after emerging. Weed control is essential if the new seedlings are to develop into high producing plants. Weeds often reduce yields by 25% and even more under adverse conditions.

CULTIVATION

For many years sorghum was planted and cultivated with corn planting and cultivating equipment. Good weed control was difficult to obtain because the crop could not be cross-cultivated. Better annual weed control has been obtained with a rotary hoe, flextine harrow, and herbicides. Using corn planting equipment made it essential to plant sorghum in 40- to 42-inch rows; these newer implements and herbicides can be used on sorghum planted in narrower rows. Even though newer weed control methods are very helpful, it is frequently necessary to use at least one row-crop cultivation to get good weed control.

Rotary Hoe

The rotary hoe controls annual weeds early in the season. Its efficiency depends on pulling it at a speed of 8 to 10 miles per hour when the weeds are just emerging. Use a shield over the hoe or behind the tractor driver’s head as protection from flying clods and stones. It is most effective if the soil is crusted as a result of drying after a rain; but it also is effective on moist soil. It may cover small plants growing in furrows, wheel tracks, or loose soil. If crop plants are large, hoe during the heat of the day to prevent breaking plants.

A much larger acreage can be hoed than can he row-crop cultivated in the same time. Although several hoeings are generally needed to replace one row-crop cultivation, two hoeings can be done for approximately the same cost as the first cultivation. The rotary hoe is generally not effective if weed seedlings are big enough to develop a green color.

Flextine Harrow

The flextine harrow is used much the same way as the rotary hoe except that it is operated more slowly. It is most effective at 2 miles per hour or less. The rotating action of the flexible tines makes it effective for killing weed seedlings. As with the rotary hoe, a much larger acreage can be covered than with the row-crop cultivator. Several harrowings generally are needed to replace one row-crop cultivation, but three harrowings can be made for about the same cost as the first cultivation. The harrow is most effective on weed seedlings ½ inch high or less.

Costs of Cultivation

If labor is not considered, the cost of rotary hoeing is about 45 cents per acre, while the flextine harrow costs 21 to 24 cents per acre, and row-crop cultivation costs about 66 cents. If labor is worth $1.25 per hour, the costs increase to 67 cents, 35 cents, and 91 cents per acre, respectively. The first row-crop cultivation takes longer than others and the cost would be some higher than the 66 or 91 cents quoted here. Consequently, two rotary hoeings or three harrowings can be done for approximately the same cost as the first row-crop cultivation.

SPRAYING WITH 2,4-D

Spray with 2,4-D when the sorghum is 4-12 inches tall, to base of upper-most leaf, to control broad-leaved annual weeds.

Forage sorghums generally are more tolerant to 2,4-D than grain sorghums unless the forage sorghums are grown for seed. Forage yields seldom are reduced by 2,4-D application, but treatment at the wrong time may decrease grain yields greatly.

Do not spray sorghums before they are 4 inches tall. Both forage and grain sorghums can be injured severely and sometimes killed if treated at this stage. The best time to spray is when plants are 4-12 inches tall. These heights are determined by measuring from the ground up to where a new leaf is emerging. An application of ½ pound of 2,4-D acid in ester form or ½ pound in amine form during this period seldom causes a serious yield reduction. However, brace roots are sometimes injured. Severe injury may result in lodging.

Grain sorghum is in the most susceptible stage of development when approximately 12 inches tall. The head begins to develop within the plant only a few inches above the ground. Use a sharp knife or razor blade to slit the stalk. If the head can be seen, do not spray with 2,4-D.

Little damage occurs from spraying after the grain has started to form. When the sorghum has reached this stage, annual weeds already have done their damage, but high clearance sprayers with drop nozzles should be used to spray perennial noxious weeds.
Annual Weeds

Apply the amount of 2,4-D required to kill the weed. The quantity of herbicide required for control varies with the weed species. The same rate of herbicide is usually less effective as the weed matures. The amount of 2,4-D required to control numerous weeds at different stages of growth is listed below:

<table>
<thead>
<tr>
<th>Weed</th>
<th>Size</th>
<th>Rate</th>
<th>Weed</th>
<th>Size</th>
<th>Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kochia, 2-4 in.</td>
<td></td>
<td>⅛ lb./A.</td>
<td>Marsh elder, 2-4</td>
<td>over 4 in.</td>
<td>⅛ lb./A.</td>
</tr>
<tr>
<td>Marsh elder, 4 in.</td>
<td></td>
<td>⅛ lb./A.</td>
<td>Ragweed, 2-4 in.</td>
<td>over 4 in.</td>
<td>⅛ lb./A.</td>
</tr>
<tr>
<td>Ragweed, 4-6 in.</td>
<td></td>
<td>⅛ lb./A.</td>
<td>Pennycress, over 6 in.</td>
<td></td>
<td>⅛ lb./A.</td>
</tr>
<tr>
<td>Pigweed, 2-4 in.</td>
<td></td>
<td>⅛ lb./A.</td>
<td>Pigweed, over 4 in.</td>
<td></td>
<td>⅛ lb./A.</td>
</tr>
<tr>
<td>Mustard, 3-6 in.</td>
<td></td>
<td>⅛ lb./A.</td>
<td>Mustard, over 6 in.</td>
<td></td>
<td>⅛ lb./A.</td>
</tr>
<tr>
<td>Lamb's quarters, 4-6 in.</td>
<td></td>
<td>⅛ lb./A.</td>
<td>Cocklebur, 2-6 in.</td>
<td>over 6 in.</td>
<td>⅛ lb./A.</td>
</tr>
<tr>
<td>Sowthistle, annual, 2-6 in.</td>
<td></td>
<td>⅛ lb./A.</td>
<td>Sowthistle, annual, over 6 in.</td>
<td></td>
<td>⅛ lb./A.</td>
</tr>
<tr>
<td>Sunflower, 2-6 in.</td>
<td></td>
<td>⅛ lb./A.</td>
<td>Sunflower, over 6 in.</td>
<td></td>
<td>⅛ lb./A.</td>
</tr>
<tr>
<td>Ladysthumb, 2-6 in.</td>
<td></td>
<td>⅛ lb./A.</td>
<td>Ladysthumb, over 6 in.</td>
<td></td>
<td>⅛ lb./A.</td>
</tr>
<tr>
<td>Velvet leaf, 4-6 in.</td>
<td></td>
<td>⅛ lb./A.</td>
<td>Velvet leaf, over 6 in.</td>
<td></td>
<td>⅛ lb./A.</td>
</tr>
<tr>
<td>Wild lettuce, 4-6 in.</td>
<td></td>
<td>⅛ lb./A.</td>
<td>Wild lettuce, over 6 in.</td>
<td></td>
<td>⅛ lb./A.</td>
</tr>
<tr>
<td>Russian thistle, 2-4 in.</td>
<td></td>
<td>⅛ lb./A.</td>
<td>Russian thistle, 2-4 in.</td>
<td></td>
<td>⅛ lb./A.</td>
</tr>
<tr>
<td>Wild buckwheat, 2 leaves</td>
<td></td>
<td>⅛ lb./A.</td>
<td>Wild buckwheat, 2 leaves</td>
<td></td>
<td>⅛ lb./A.</td>
</tr>
<tr>
<td>Morning glory, annual</td>
<td></td>
<td>⅛ lb./A.</td>
<td>Morning glory, annual</td>
<td></td>
<td>⅛ lb./A.</td>
</tr>
<tr>
<td>Peppergrass, annual</td>
<td></td>
<td>⅛ lb./A.</td>
<td>Peppergrass, annual</td>
<td></td>
<td>⅛ lb./A.</td>
</tr>
</tbody>
</table>

Noxious Weeds

Use ⅔ to 1 pound of 2,4-D per acre to control broad-leaved noxious weeds. Although there is some chance of injuring the crop, numerous applications at these rates have been made near the time of the second cultivation without causing damage. Apply a second treatment after heading, with high clearance sprayer equipped with drop nozzles.

For more details on noxious weed control see the Fact Sheet that discusses the weed you have in question.

The cost of 2,4-D is about 90 cents a pound and the cost of application is about 75 cents per acre.

PRE-EMERGENCE SPRAYING

Atrazine, propazine, CDAA, and propachlor are useful for controlling annual weeds when applied before the weeds emerge. They are absorbed by the roots of the weeds; consequently, they must be moved into the root zone in the soil. Rain will leach them into the soil and mechanical incorporation with the rotary hoe or harrow will help if too little rain is received to do the leaching.

Atrazine

Use 2 to 3 pounds of active ingredient per acre to control foxtails, barnyard grass, pigweeds, mustard, lamb’s quarters, Russian thistle, kochia, and other annuals. Use the lower rate on light soils and the higher rate on heavy soils. Treat 8- to 14-inch bands over the rows. Rotary hoe or harrow 2 weeks later if less than ½ inch of rain falls during the 2-week period. Cultivate twice with a row-crop cultivator.

DO NOT USE ATRAZINE AS A PRE-EMERGENCE TREATMENT ON LIGHT SAND SOILS

This herbicide controls most annual grasses, numerous broad-leaved annuals, and quackgrass. Good control is obtained if applied to wet soil or if ½ to ¾ inch of rain falls within 2 weeks after application. Poor control can be expected if the rain is not received until the third week. If less than ½ inch of rain falls within 2 weeks after application, rotary hoeing or harrowing helps activate the herbicide and kills weed seedlings that may have started to emerge. To get effective weed control, higher rates of atrazine are needed on heavy soils or high organic matter soils than on light soils or low organic matter soils.

Rainfall at planting time has been adequate to activate atrazine and give good weed control in eastern

Figure 1. Carry-over effect from band application of atrazine killed bands of small grain seeded 1 year after treatment.
South Dakota 8 of 10 years. Mechanical incorporation with a harrow or rotary hoe has improved results to give good weed control 9 of 10 years. Residues from over 1 pound per acre of this herbicide applied in sorghum one year generally damage the crop planted the next year (figure 1). Damage from residues is reduced if the herbicide is applied in bands over the rows. Less area is covered and tillage the following spring dilutes the residue by mixing treated soil with untreated soil. Plowing reduces residual effect more than disking.

Although an over-all application will replace one and sometimes two cultivations, the cost of the herbicide and the carry-over effect from chemical residues generally make it impractical to use such a treatment. Since two cultivations will generally be needed anyway, they will kill weeds between the rows.

Sprays may be applied with an applicator similar to the one shown in figure 2 or with a regular field sprayer that has nozzles spaced the same width as the rows. Be sure that you have a good agitation in the sprayer tank to keep atrazine in suspension. Agitation is best accomplished by mechanical means. However, liquid pressure agitation is the type of agitation found on most field sprayers and will do a good job if modified to some extent. The bypass line from the pressure regulator can be outfitted with a jet agitator which will create more turbulence than the normal outlet. However, for best results a separate agitator line should be installed between the pump and the pressure regulator. This new line can then be outfitted with a jet agitator. The pump should have at least the capacity of 10 gallons per minute to give good operating pressure and agitation.

Use 15 to 20 gallons of water per acre on the area treated. Use special nozzles that give uniform coverage over the entire width of the band and use nozzle screens 50 mesh or larger in size. Nozzles on regular field sprayers are designed to overlap and deliver low volumes of water. Consequently, they do not give uniform coverage over the swath of any one nozzle and are equipped with fine screens.

**Propazine**

Use 2 pounds of active ingredient per acre to control foxtails, barnyard grass, pigweeds, mustard, lamb's quarters, Russian thistle, kochia, and other annuals. Use only on medium to heavy soils. Treat 8- to 14-inch bands over the rows. Rotary hoe or harrow 2 weeks later if less than ¼ inch of rain falls during the 2-week period. Cultivate twice with a row-crop cultivator.

Propazine, although similar to atrazine, can only be used as a pre-emergence herbicide. Although generally less effective than atrazine, it has a carry-over problem similar to atrazine. It generally damages small grains planted the following year.

The same precautions in spraying this chemical should be observed as with atrazine. Use large, 50-mesh screens in the suction strainer, line strainer and nozzle strainers of the sprayer. Be sure to have sufficient agitation of the spray mixture.

**CDAA**

Use 4 pounds of active ingredient per acre of CDAA to control annual grassy weeds. Apply in 14-inch bands over the rows. Use a row-crop cultivator twice.

An over-all application seldom replaces more than the first row-crop cultivation. Since two cultivations generally are required to give good weed control, they will control weeds between rows, and there is no point in making over-all treatments. Band applicators are shown in figures 2 and 3.

CDAA controls most annual grasses and gives good control if applied to warm soil (60° to 65° F.) and if a minimum of ½ to ¾ inch of rain falls during the first week after application. CDAA generally gives better weed control on heavy soils high in organic matter than on light soils low in organic matter. It is relatively volatile and relatively emulsifiable in water. Therefore, it must be leached into the soil before it
volatilizes, but heavy rain (2½ inches) may leach sprays beyond the root zone of weed seedlings.

Granules are effective over a wider range of conditions. They are effective if applied to cool soil, they are not rendered ineffective by heavy rains, and they are effective if rain is not received for 10 days or 2 weeks.

Rainfall at planting time has been adequate to activate CDAA sprays and give good weed control in eastern South Dakota 5 out of 10 years. Granules have been effective 7 or 8 years.

CDAA gives weed control for a shorter time than atrazine. It does not give good weed control as often as atrazine, but does not leave a chemical residue that will damage next year’s crop.

*CDAA sprays have a repulsive odor and are highly irritating to the skin.* The fumes easily irritate the eyes. Because of the foregoing, granule formulations are much preferred for use over the liquid formulations. Granules are much less irritable to handle. If you do decide to use a spray, wear goggles and protective clothing.

**Propachlor**

Propachlor (tradename Ramrod) is a new pre-emergence herbicide that is closely related to CDAA.

Use 4 pounds of active ingredient per acre at planting time to control grassy weeds. Apply in 14-inch bands over the rows. Use a row-crop cultivator twice.

An over-all application usually replaces the first row-crop cultivation and occasionally the second cultivation with optimum conditions. However, like CDAA, Ramrod does not control broad-leaved weeds as effectively as other pre-emergence herbicides used in sorghum.

On light sandy loam ½ inch of rainfall and on heavy clay and/or high organic soils ½ to ¾ inch of rainfall is required depending upon original soil moisture. Best results are obtained when moisture occurs within 10 days after application.

**Norea**

Norea (tradename Herban) is a pre-emergence herbicide that has shown promise in South Dakota and other states, and some farmers may wish to use it on an experimental basis.

Use 2.4 pounds active ingredient (3.0 pounds of product) per acre of norea to control some annual grassy and broad-leaved weeds. Apply it to the soil surface, either broadcast or as a band treatment at the time of planting, or before weeds or sorghum emerges. Less norea may be needed on light soils.

Norea-atrazine combination (tradename Herban 21A) may be used pre-emergence for broader spectrum weed control on sorghum. If this combination is used, it should be applied to the soil surface at

*Figures 4, 5, 6.* In figures 4 and 5 are seen grain sorghum plots where atrazine and propazine were applied as pre-emergence treatments. Both of these treatments gave excellent late-season weed control and increased the yield over the cultivated check (figure 6) approximately 1,300 pounds per acre.
the time of planting or before weeds and sorghum emerge. Use 2 pounds active ingredient of noerea and 1 pound active ingredient of atrazine per acre.

**Atrazine Post-emergence**

Atrazine may be applied post-emergence in two different ways.

Use 2 to 3 pounds active ingredient in 10 to 20 gallons of water per acre. Apply before weeds are over 1 inch tall. Use a dormant spray oil with a viscosity of 80-100 seconds at 100° F., specific gravity of 32-34 API, flash point of 320° F., and unsulfonated residue content of 95% or above. It should contain about 1% emulsifier—enough to emulsify 1 gallon of the oil in 10 to 20 gallons of water. Cultivate twice with a row-crop cultivator.

Use 1 pound active ingredient in 1 gallon of dormant spray oil and 10 to 20 gallons of water per acre. Apply before weeds are over 1 inch tall. Use a dormant spray oil with an active ingredient of atrazine and “breaks it down” to a non-toxic compound somewhat like corn but more slowly than corn. The use of oil increases absorption through leaves, wet soil increases absorption through roots, and cool weather reduces rate of “break down.” Therefore, an application made when the weather is wet and cool, may result in damage because the sorghum may take up the atrazine faster than it can break the chemical down. If applied later when weedy grasses are over one inch tall, a higher rate of atrazine will be needed and a larger volume of oil also may be needed. This will increase the risk of not having adequate moisture to activate the chemical and give satisfactory weed control. It will also increase cost and increase possibilities of having carry-over in next year’s crop.

**CAUTION**

Atrazine with crop oil can cause leaf burning and early height reduction which can result in delayed crop maturity. Stand reduction may also occur on very wet soils with cool weather following application.

| Herbicide* | Cost per lb. product | Cost per lb. active | Average Cost of Herbicide Per Acre
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall</td>
<td>14&quot; band</td>
<td>8&quot; band</td>
</tr>
<tr>
<td>Atrazine</td>
<td>$7.35</td>
<td>$2.45</td>
<td>$1.45</td>
</tr>
<tr>
<td>CDAA (granules)</td>
<td>8.80</td>
<td>2.93</td>
<td>1.76</td>
</tr>
<tr>
<td>CDAA (liquid)</td>
<td>7.80†</td>
<td>2.60</td>
<td>1.56</td>
</tr>
<tr>
<td>Propazine</td>
<td>7.35</td>
<td>2.45</td>
<td>1.45</td>
</tr>
<tr>
<td>Propachlor (powder)</td>
<td>9.60</td>
<td>3.20</td>
<td>1.92</td>
</tr>
<tr>
<td>Propachlor (granules)</td>
<td>10.20</td>
<td>3.40</td>
<td>2.04</td>
</tr>
<tr>
<td>Norea</td>
<td>9.00</td>
<td>3.00</td>
<td>1.80</td>
</tr>
<tr>
<td>2,4-D</td>
<td>0.25-0.50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Cost per gallon of product.

Use of a trade name does not indicate endorsement of one product over another.
Weed Control in Sorghum