Weed Control in Corn

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WEED CONTROL IN CORN

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Use of a trade name does not imply endorsement of that brand.
South Dakota farmers annually plant approximately 4 million acres of corn that produce a gross annual income of around $100 million. Weeds often reduce the crop yield by 25% and even more under adverse conditions.

In one test, a wet spring prevented early cultivation and a dry summer allowed the weeds to exert abnormal competition. Weedfree corn yielded 51 bushels per acre and weedy corn produced only 12 bushels. The weedy corn was cultivated three times, but weeds were not killed by the first cultivation because the soil was too wet. The weeds got too big to be controlled by later cultivations. Annual weeds reduced the yield 77%.

**CULTIVATION**

For many years the conventional method of planting corn was to check it. Excellent weed control could be obtained by cultivating lengthwise the first and third cultivations and crosswise the second time through. In recent years most corn is drilled, power checked, or hill-dropped, making it impossible to cultivate crosswise. Good weed control is more difficult to obtain by cultivation. However, several systems have proved to be effective.

A good cultivation system for a crop planted in furrows is to use disks for the inside shovels and “throw out” as soon as the operation can be performed without covering the crop, and “throw in” during the second cultivation as soon as new weeds emerge. Many small weeds in the row are covered by the second operation.

The annual weed control problem is greatly reduced in wheel track planted crops, by planting within 24 hours after plowing. Delayed planting frequently allows weeds in the tracks to emerge earlier than the crop. Cultivation may cover the crop while attempting to kill the weeds.

**Rotary Hoe**

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

A much larger acreage can be rotary hoed than can be row-crop cultivated in the same length of time. However, several hoeings are generally required to replace one row-crop cultivation. The rotary hoe is generally not effective if weed seedlings are big enough to develop a green color.

**Flextine Harrow**

The flextine harrow can be used in much the same way as the rotary hoe except that it can be operated at slower speeds. The rotating action of the flexible tines makes it an effective implement for killing weed seedlings. As with the rotary hoe, a much larger acreage can be covered than with the row-crop cultivator; several harrowings are generally required to replace one row-crop cultivation and it is not effective if weed seedlings are taller than one-fourth inch.

**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**

Many broad-leaved annual weeds and some perennials can be killed with 2,4-D in corn. Some hybrids are more susceptible to 2,4-D than others. However, corn is usually tolerant to ¼ pound of 2,4-D acid in an ester form or ½ pound in an amine form at any growth stage except the week before silking.

Use drop nozzles for 2,4-D application after the corn is knee high. The spray does not touch the upper leaves of the corn, but must hit the tops of the weeds. The risk of injury to the crop is reduced and better coverage of weeds is often obtained. Use a high clearance sprayer with drop nozzles for application made after tasseling.

Stalks often become brittle after treatment with 2,4-D and a strong wind or careless cultivation may break many of them (the larger the corn at time of treatment, the greater the chance of breakage). Sometimes brace roots are damaged and severe injury will allow the corn to lodge.
Environmental conditions influence the degree of injury more than stage of growth at the time of treatment (except for the week before silking). Corn is more susceptible when growing rapidly. The temperature during the period before treatment is more important than the temperature at time of treatment. Corn is more susceptible after several days at 85°F than it is after several days at 65°F.

**Noxious Weeds**

Use ¾ to 1 pound of 2,4-D per acre to control broad-leaved noxious weeds. Although there is some chance of injuring the corn, numerous applications at these rates have been made near the time of the second cultivation without causing damage. Apply a second treatment after tasseling 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.

**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>Herbicide</th>
<th>Stage of Growth</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kochia, 2-4 in.</td>
<td>¼ lb./A.</td>
</tr>
<tr>
<td>Marsh elder, 2-4 in.</td>
<td>⅓ lb./A.</td>
</tr>
<tr>
<td>Ragweed, 2-4 in.</td>
<td>⅓ lb./A.</td>
</tr>
<tr>
<td>Pennycress, 4-6 in.</td>
<td>⅓ lb./A.</td>
</tr>
<tr>
<td>Pigweed, 2-4 in.</td>
<td>½ lb./A.</td>
</tr>
<tr>
<td>Mustard, 3-6 in.</td>
<td>½ lb./A.</td>
</tr>
<tr>
<td>Lamb’s quarters, 4-6 in.</td>
<td>½ lb./A.</td>
</tr>
<tr>
<td>Cocklebur, 2-6 in.</td>
<td>¼ lb./A.</td>
</tr>
<tr>
<td>Sowthistle, annual, 2-6 in.</td>
<td>½ lb./A.</td>
</tr>
<tr>
<td>Sunflower, 2-6 in.</td>
<td>½ lb./A.</td>
</tr>
<tr>
<td>Lady’s thumb, 2-6 in.</td>
<td>½ lb./A.</td>
</tr>
<tr>
<td>Velvet leaf, 4-6 in.</td>
<td>½ lb./A.</td>
</tr>
<tr>
<td>Wild lettuce, 4-6 in.</td>
<td>½ lb./A.</td>
</tr>
<tr>
<td>Russian thistle, 2-4 in.</td>
<td>½ lb./A.</td>
</tr>
<tr>
<td>Wild buckwheat, 2 leaves</td>
<td>½ lb./A.</td>
</tr>
<tr>
<td>Morning glory, annual</td>
<td>½ lb./A.</td>
</tr>
<tr>
<td>Peppergrass, annual</td>
<td>½ lb./A.</td>
</tr>
</tbody>
</table>

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, CDAA, and CDAA-T are useful for controlling weeds in corn 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 rotary hoe or harrowing will help if too little rain is received to do the leaching.

**Atrazine**

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.

Residues from over 1 pound per acre of this herbicide applied pre-emergence in corn 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

![Figure 1. Carry-over effect from band application of atrazine killed bands of small grain seeded 1 year after treatment.](image-url)
mixing treated soil with untreated soil. In one test, plowing reduced residual effect more than disking did.

Rainfall records during the 10-year period, 1952-61, indicate that rainfall at corn planting time would have been adequate to activate atrazine and give good weed control in eastern South Dakota 8 of the 10 years. There was almost enough rainfall on the ninth year and mechanical incorporation with a harrow or rotary hoe would have improved results that year to give good weed control 9 of 10 years.

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 1/2 inch of rain falls during the 2-week period. Cultivate twice with a row-crop cultivator.

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 good agitation in the sprayer tank to keep atrazine in suspension. 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.

**CDAA and CDAA-T**

Both chemicals control most annual grasses and CDAA-T controls several broad-leaved annuals. Sprays of either herbicide give good control if applied to warm soil (60° to 65° F.) and if a minimum of 1/2 to ¾ inch of rain falls during the first week after application. CDAA and CDAA-T generally give better weed control on heavy soils high in organic matter than on light soils low in organic matter. Both herbicides are relatively volatile and relatively emulsifiable in water. Therefore, they must be leached into the soil before they volatilize, 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 records during 1952-1961, indicate that the rainfall at corn planting time would have been adequate to activate CDAA and CDAA-T sprays and give good weed control in eastern South Dakota 5 out of the 10 years. Granules would have been effective 7 or 8 years.

CDAA and CDAA-T give weed control for a shorter time than atrazine and do not give good weed control as often as atrazine, but they do not leave a chemical residue that will damage next year's crop.

CDAA spray has a repulsive odor and is very irritating to the skin. The fumes irritate the eyes. Granules are much less irritable to handle. If you use a spray, wear goggles and protective clothing when spraying. You may want to use rubber gloves and a respirator when putting the chemical into the sprayer.

Use 4 pounds of active ingredient per acre of CDAA to control annual grassy weeds or 3 pounds of CDAA-T to control most grassy annuals and some broad-leaved annual weeds. Apply in 8- to 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 are generally 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.
**Cost of Herbicides**

The cost of application is very small if applied with a corn planter attachment; however, it is about 75 cents per acre if a field sprayer is used after planting.

A wettable powder of atrazine (trade name Atrazine 80W) containing 80% active ingredient costs about $2.85 a pound of product or $3.56 per pound of active ingredient (atrazine). A spray application of 3 pounds of powder (2.4 pounds active ingredient) costs about $8.50 for the herbicide on each acre of area treated. If ¼ of the field is treated in 12- to 14-inch bands over the rows, the cost of herbicide is $2.85 for each acre in the field. With 8-inch bands the cost is reduced to $1.70 per acre of field.

Liquid CDAA (trade name Randox) costs $7.80 for a gallon containing 4 pounds active ingredient and liquid CDAA-T (trade name Randox T) costs $8.90 for a gallon containing 3.1 pounds of CDAA. A spray application of 1 gallon per acre costs $7.80 for CDAA or $8.90 for CDAA-T for each acre treated. If the herbicides are applied to ¼ of the field in 12- to 14-inch bands over the rows, the cost of herbicide for each acre in the field is $2.60 for CDAA and $2.97 for CDAA-T sprays. With 8-inch bands the costs are reduced to $1.56 per acre of field for CDAA and $1.78 for CDAA-T.

Granules of CDAA contain 20% active ingredient and cost 44 cents for a pound of granules or $2.20 for a pound of active ingredient (CDAA). Granules of CDAA-T contain 11.7% CDAA and cost 39 cents for a pound of granules or $3.30 per pound of CDAA. A granular application of 20 pounds of CDAA granules (4 pounds active ingredient) costs $8.80 for herbicide on each acre treated while 27 pounds of CDAA-T granules (3 pounds active ingredient) costs about $10.50 for each acre treated. If they are applied to ¼ of the field in 12- to 14-inch bands over the rows, the cost for each acre in the field is $2.93 for CDAA or $3.50 for CDAA-T granules. In 8-inch bands the costs are $1.76 for CDAA and $2.10 for CDAA-T.

**Herbicide-Insecticide-Fertilizer Mixtures**

You generally need separate applicators for each chemical. When applied with corn planter attachments, fertilizer is applied 2 inches to one side and 2 inches below the seed so that it will not damage the corn. The fertilizer applicator is mounted near the planter shoe. Herbicides applied pre-emergence are applied in 8- to 14-inch bands behind the packer wheel. Insecticides composed of chlorinated hydrocarbons, such as aldrin and heptachlor, may be applied as a liquid in a stream directly on the seed to control corn rootworm with an attachment that is mounted behind the planter shoe. Insecticides composed of phosphates, such as diazinon, thiamet, and parathion (stabilized), used to control western rootworm are applied as granules in 7-inch bands ahead of the packer wheel on the planter. The hydrocarbon insecticides may be applied as sprays or granules in the same manner. Figure 3 illustrates that three attachments are required to apply the three types of chemicals.

**DIRECTED-SPRAYS**

Herbicides that would ordinarily damage corn if applied to the foliage may be applied as directed-sprays. Apply them with special spraying equipment to the base of the corn plant for controlling annual weeds in the row. A directed-spray applicator is shown in figures 4 and 5.

Carefully apply directed-sprays of dalapon-2,4-D mixtures at rates of 1½ to 2 pounds of dalapon and ¼ pound of 2,4-D per acre of area treated when corn is from 8 to 16 inches tall. This mixture stunts or kills most annual weeds in the row. Do not allow excessive amounts of dalapon to contact the corn leaves, as the plants will become stunted and deformed. Twisted
leaves and undeveloped ear husks are typical injury symptoms.

Use a directed-spray applicator. Attach it directly to the tractor or mount it with a cultivator (figure 4). It must have attachments that lift the corn leaves and special nozzles that direct the spray to the base of the corn plant and the weeds in the row (figure 5). Calibrate the sprayer to apply 10 to 15 gallons of spray per acre in a 12- to 14-inch band in the row.

A directed-spray of linuron (trade name Lorox) at 2 pounds active per acre of area treated, applied when the corn is at least 15 inches tall has shown promise. It is more effective if 0.5% of surfactant is added. Linuron will kill leaf tissue it contacts and yields may be reduced if leaf kill is extensive. Apply with a directed-spray applicator.

Since directed sprays cannot be applied to small corn, use hotary hoe, harrow, pre-emergence herbicide, or row-crop cultivator to control early weed growth and prevent yield reduction from weed competition. You may replace the second cultivation with directed sprays, but you will probably use it as an emergency measure for controlling heavy stands of annual weeds in the corn row.

Application cost is about the same as a first row-crop cultivation (90 cents per acre). Most applicators cover four rows at a time and a relatively slow speed of travel must be used. The cost of herbicide is about $3.00 per acre treated for a dalapon-2,4-D mixture and $12.60 per acre for linuron. However, only ½ of the field is treated so costs are reduced to $1.00 per acre of field for dalapon-2,4-D mixture and $4.20 for linuron.

SECURE THE FOLLOWING FACT SHEETS FOR COMPLETE INFORMATION ON CORN PRODUCTION

- Planting Corn in South Dakota
- Fertilizing Corn in South Dakota
- Weed Control in Corn
- Control of Corn Rootworm
- Control of European Corn Borer
- Diseases of Corn
- Harvesting and Drying Corn

(Several of these fact sheets are not immediately available.)