



**AGRICULTURAL CHEMICALS
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Weed Control for Corn and Soybeans in Reduced Tillage Systems

The effectiveness of chemical weed control is often a key to success of crops in reduced tillage systems. Much of the tillage in conventional cropping systems is to control weeds. When tillage is reduced, reliance is primarily on chemicals. More consistent performance of recently developed herbicides makes reduced tillage systems practical.

Reduced tillage systems mean primary and/or secondary tillage have been decreased to save time, labor, energy and soil. Historically, extensive tillage loosened the soil, prepared a fine seedbed, and lessened weed competition. A more recent system includes tilling the entire field with a chisel plow or disk, leaving a rough surface covered with a crop residue. Other systems include: tillage in a narrow band where the crop is planted; reducing the number of secondary tillage operations; or complete elimination of all tillage operations. In systems where the total area is tilled to some extent, pre-plant incorporated herbicide applications can be used. However, in most systems where tillage is reduced substantially, pre-plant and some pre-emergence herbicide applications may not be effective. Herbicide treatments used in these systems will vary according to the type of tillage used and the expected weed problem.

Reduced tillage systems present several weed control problems which conventional tillage systems usually do not. The species of weeds usually change under reduced tillage. Biennial weeds (bull thistle, musk thistle, plumeless thistle, wild carrot) can become a problem because the life cycle is not broken by fall or spring tillage. Perennial weeds (milkweed, dandelion, nutsedge, Canada thistle, perennial sowthistle, quackgrass) can increase under reduced tillage. If these perennials become a serious problem, use appropriate herbicides or revert to conventional methods until the weeds are controlled. Annual grasses (panicum, crabgrass) may also increase under reduced tillage. The trashy soil surface seems to collect windborne weed seeds. These and small grass seeds germinate easily in the moist soil surface. With conventional plowing, many of the weed seeds are too deep to germinate and will decay before surfacing again. With reduced tillage, weed seedlings may not be destroyed prior to planting and will compete more vigorously with the crop. Uneven planting depth and poorly covered crop seed can be a problem with limited soil disturbance, causing crop injury as a result of greater herbicide contact with the crop seed. Many of these problems can be eliminated with proper use of herbicide combinations.

The trashy soil surface under reduced tillage systems often is not favorable for applying herbicides that act in the soil. The trash on the soil surface may intercept the spray preventing it from coming in contact with the soil where weeds are germinating, resulting in untreated spots where weeds can later become established. Larger volumes of water or herbicide granules can be used to reduce this problem. Soil may become compacted where reduced tillage systems are used. This condition limits

the rate of herbicide penetration, particularly for herbicides tightly held by soil particles and those with low water solubility. More rainfall may be required to move the herbicides into the compacted soil than into the looser surface soil of conventional seedbeds.

Under reduced tillage systems, the alternative weed control practices available are limited. Some cultural practices such as narrow rows, higher plant populations, and adequate fertility for rapid crop growth will help the crop compete with weeds. Rolling cultivators, cultivators with few shanks and wide sweeps, and cultivators equipped with discs may be used effectively to control weeds. However, cultivating tools commonly used for early shallow cultivations may not perform well. For example, rotary hoes tend to clog; harrows, spring-tined weeders, and sweep cultivators tend to act like rakes. Late season weeds which overtop low-growing crops may be controlled by treating the weeds with specially designed applicators such as recirculating sprayers, roller applicators, and rope wick applicators.

Although weed control in reduced tillage systems presents some problems, effective chemical programs have been developed. Herbicides in reduced tillage crops must provide the following:

- o Eliminate existing vegetation
- o Control germinating weeds
- o Avoid injury to the crop or succeeding crops
- o Prevent buildup of new weeds

There is no single herbicide for this. Therefore, a suitable mixture or sequence of herbicides must be planned according to the existing vegetation, kinds of weeds expected to germinate, soil characteristics, and crops. Buildup of resistant weeds can be prevented by using different herbicides in rotation and rotating crops occasionally. At some time during the crop rotation, reverting to conventional moldboard plowing may be necessary to control some weeds.

Carryover of persistent herbicides in unplowed soil may be a serious problem in low rainfall areas. Herbicides remain concentrated and are toxic to succeeding crops when left on dry, unplowed surfaces. Moldboard plowing dilutes the chemical and enhances herbicide decomposition because the herbicides are distributed throughout the plowlayer which increases moisture contact with the herbicides. The combination of moisture and soil microbes is needed to break down the herbicides. Triazine [atrazine, simazine (Princep)] and dinitroaniline [trifluralin (Treflan), profluralin (Tolban), fluchloralin (Basalin), pendimethalin (Prowl)] herbicides may cause injury in subsequent crops because of herbicide carryover. A nonpersistent chemical should be used for 1 or 2 years before growing a sensitive crop in the rotation.

Table 1. Herbicides for corn grown in reduced tillage systems¹

Treatment	Chemical
Before planting	Paraquat* Glyphosate (Roundup) fall or spring
Preemergence	Alachlor (Lasso) Atrazine Cyanazine (Bladex) Metolachlor (Dual) Propachlor (Bexton, Ramrod) Alachlor + atrazine Alachlor + cyanazine Metolachlor + atrazine Propachlor + atrazine Glyphosate + metolachlor + atrazine Glyphosate + alachlor + atrazine Glyphosate + alachlor + simazine Paraquat* + atrazine Paraquat* + cyanazine Paraquat* + atrazine + simazine Paraquat* + alachlor + atrazine Paraquat* + metolachlor + atrazine Paraquat* + pendimethalin (Prowl) + atrazine Paraquat* + pendimethalin + cyanazine
Postemergence	Atrazine + oil Bentazon (Basagran) Cyanazine (Bladex) 80W only 2,4-D 2,4-D + dicamba Dicamba (Banvel)
Postemergence-directed	Ametryne (Evik) Linuron (Lorox)

*plus nonionic surfactant

¹Refer to labels for specific information on use of these herbicides. *Cultural and Chemical Weed Control in Field Crops*, Extension Bulletin 400, also gives additional information on use of these chemicals.**Table 2. Herbicides for soybeans grown in reduced tillage systems¹**

Treatment	Chemical
Before planting	Paraquat* Glyphosate (Roundup)
Preemergence	Alachlor (Lasso) Chloramben (Amiben) Linuron (Lorox) Metolachlor (Dual) Alachlor + chloramben Alachlor + linuron Alachlor + metribuzin (Sencor, Lexone) Metolachlor + linuron Metolachlor + metribuzin Glyphosate + metolachlor + linuron Glyphosate + alachlor + linuron Glyphosate + alachlor + metribuzin Glyphosate + metolachlor + metribuzin Paraquat* + linuron Paraquat* + metribuzin Paraquat* + metolachlor + linuron Paraquat* + alachlor + linuron Paraquat* + alachlor + metribuzin Paraquat* + metolachlor + metribuzin
Preemergence + postemergence	Alachlor + bentazon (Basagran) Metolachlor + bentazon
Postemergence	Bentazon Glyphosate (recirculating sprayer or spot treatment)

*plus nonionic surfactant

¹Refer to labels for specific information on use of these herbicides. *Cultural and Chemical Weed Control in Field Crops*, Extension Bulletin 400, also gives additional information on use of these chemicals.

Tables 1 and 2 list some of the chemicals that may be used in reduced tillage systems.

Paraquat is an effective contact herbicide for quickly killing annual weeds and the topgrowth of perennial weeds. Paraquat does not control regrowth of perennial weeds nor does it have residual soil activity to control later germinating annual weeds. Paraquat works most effectively on young, rapidly growing vegetation. A nonionic surfactant such as Ortho X-77 must be used with paraquat to give complete coverage and improved control. Paraquat is a *restricted* use chemical; it is extremely important to follow use precautions on the label.

Glyphosate (Roundup) is a rapidly translocated herbicide that kills all existing vegetation, including the underground vegetative parts of perennial weeds. It does not have residual soil activity to control later germinating weeds. Glyphosate may be applied in either fall or spring to kill actively growing perennial weeds or crops. Planting or tillage should be delayed 3 to 7 days following a glyphosate treatment.

Several preemergence herbicides used for weed control in corn and soybeans may be used to control annual weeds in reduced tillage systems. Refer to tables 1 and 2 for chemicals registered for tank mixing with paraquat or glyphosate. Preemergence herbicides with some postemergence activity [atrazine, cyanazine (Bladex), or linuron (Lorox)] can be used without the assistance of a contact herbicide on very small annual weeds. Preemergence treatments can be a followup treatment after paraquat or glyphosate applications, or a tank mixture with paraquat or glyphosate and applied before the crop emerges. Several of these mixtures may be used with appropriate fertilizer solutions. Read label instructions regarding mixtures. Some herbicides are not compatible with fertilizer solutions.

The selection of mixtures or sequential applications depends on the extent of the weed problem. Where the crop will be established in sod or if perennial weeds exist, sequential treatments could be beneficial. Where tillage was done before planting or weed problems are less serious, tank mixtures can be more economical. Select a mixture which will specifically control problem weeds.

Any of the postemergence herbicides for corn and soybeans may be used as needed in reduced tillage systems. These herbicides should be selected according to the kinds of weeds, size of weeds, and stage of crop development. Early postemergence treatments are more effective for increasing crop yields than later treatments.

For further information on chemicals refer to *Cultural and Chemical Weed Control in Field Crops*, Extension Bulletin 400, which can be requested from local county extension offices.

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