A summary of methods for Johnsongrass control in soybeans in Mississippi

C. G. McWhorter
Summary of Methods for
Johnsongrass Control in Soybeans in Mississippi

C. G. McWHORTER

MISSISSIPPI STATE UNIVERSITY
AGRICULTURAL AND FORESTRY EXPERIMENT STATION
JAMES H. ANDERSON, Director

MISSISSIPPI
A SUMMARY OF METHODS FOR JOHNSONGRASS CONTROL IN SOYBEANS IN MISSISSIPPI

C. G. McWHORTER1

Johnsongrass (Sorghum halepense (L.) Pers.) is one of the most troublesome weeds in soybean production in Mississippi. This grass is difficult to control because it produces large quantities of seed and rhizomes. Johnsongrass produces several million seed annually in newly infested soybean fields. In our own research plots at Stoneville up to 2 tons of rhizomes/acre were produced.

Johnsongrass has been shown to reduce soybean yields nearly 50 percent. The purpose of this report is to summarize the most effective practices for controlling johnsongrass in soybeans in Mississippi.

An understanding of the johnsongrass habit is necessary to obtain the best control with many of the practices available.

Growth Habit

Johnsongrass produces hard seed which remain in the soil for many years before germinating. A field in which johnsongrass has reached maturity for several years will have a tremendous supply of seed. Seed begins to germinate in March or April and continue to emerge throughout the growing season. Seedling plants usually begin to develop rhizomes within 3 to 4 weeks after emergence. Reinfestation in seed is especially troublesome in fallow areas where each overflow may become new seeds. Seedlings continually sprout serious problems in these areas and if established johnsongrass is effectively controlled.

In addition to its spread by seed, johnsongrass reproduces vegetatively by means of rhizomes. Production of these aboveground stems is most rapid after heading development. After heading, a single johnsongrass plant may produce 200 to 300 linear feet of rhizomes in one month. Though rhizome production begins 3 or 4 weeks after emergence, they develop slowly until plants reach the heading stage.

Many of the rhizomes produced early in the growing season (May or June) will die during the winter, but those produced later in the season usually survive to produce plants the following spring. Small rhizome fragments with a single bud may sprout to produce a new plant. Johnsongrass is also propagated by older above-ground stems. The buds that occur on nodes of stems at least 4 to 6 weeks old will sprout when plowed into the moist soil.

Johnsongrass thrives best on fertile, well-drained soil. If moisture and nutrients are not limiting, rhizomes will penetrate deeper in porous soils than in compact clays. At Stoneville, approximately 80 percent of the johnsongrass rhizomes produced in clay were in the top 3 inches of soil whereas in sandy loam they were in the upper 5 inches. Our research has also shown that soil incorporation of recommended1, 3 rates of the herbicides a,a,a-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine (trifluralin) and 4-(methylsulfonyl)-2, 6-dinitro-N,N-dipropylaniline (nitralin) retard growth from johnsongrass rhizomes in addition to controlling seedlings (Figure 1). Thus, it is...

1Plant Physiologist, Southern Weed Science Laboratory, Plant Science Research Division, Agricultural Research Service, U.S. Department of Agriculture in cooperation with the Delta Branch, Mississippi Agricultural and Forestry Experiment Station, Stoneville, Mississippi 38776.

2All references to recommendations are those described in Weed Control Recommendations for Mississippi, 1972. A Report by the Mississippi Weed Science Committee, Mississippi State University, Agricultural and Forestry Experiment Station, State College, Mississippi

3All agricultural chemicals recommended for use in this report have been registered by the Environmental Protection Agency. They should be applied in accordance with the directions on the manufacturer's label as registered under the Federal Insecticide, Fungicide, and Rodenticide Act.
important that these herbicides be incorporated uniformly to a depth of 3 to 4 inches to be in contact with most of the rhizomes in the soil profile.

Plants from rhizomes emerge more uniformly and from deeper depths in sandy soil than in clay. More plants are obtained from rhizomes cut into small sections than from long rhizomes. Cultural practices that break rhizomes are important in assuring more uniform emergence of johnsongrass for subsequent control either with herbicides or with cultural practices. Increased germination of buds on short rhizomes can be important in a control program because toliar-applied herbicides do not translocate in quantities toxic to dormant (ungerminated) rhizome buds.

**Figure 1.** Inhibition of johnsongrass roots from rhizomes by trifluralin (on the left) and nitratin (on the right) as compared to an untreated plant in the center. Both herbicides were applied in nutrient solution to pots of sand in which rhizomes were planted. The rate applied, 2 ppm, was approximately equal to 1 lb-A applied in a field of sandy loam soil. Nitratin was more toxic than trifluralin in this experiment but both often provide equal johnsongrass control of the field.

**Cultural Control**

Mechanical cultivation during the growing season often provides the best control for large infested areas of johnsongrass. Cultivation is most successful in months with least precipitation—July to October. Moldboard plows, disk plows, field cultivators with flat sweeps are used for fallow plowing although disks are used most frequently. Fields should be cultivated every 7 to 14 days to remove growth and to expose rhizomes to drying. Alternate usage of field cultivators and disk cultivators is slightly more effective than the repeated use of either implement alone. Disking cuts rhizomes into smaller pieces which increases dehydration; field cultivators with sweeps tend to bring me
rhizomes to the soil surface which also ceases dehydration.

Temperatures at the soil surface in midsummer often reach 120 to 140°F. In our search, rhizomes exposed at 140°F for 24 hours were killed. Rhizomes exposed at 100°F were killed in three days. Rhizomes 2-4 inches long were killed more quickly than were rhizomes 8 to 10 inches long. Thus, cultural practices that break rhizomes into smaller pieces and bring them to the soil surface are most effective a fallow program.

Regardless of the method of fallow, elders should usually be cultivated at 2- to 3-week intervals, but the grass should not be allowed to reach a height of more than 12 to 16 inches or to produce seedheads. A disadvantage of summer fallow is the loss of a cropping season. This can be partially offset by production of a small grain crop during the winter preceding fallow Plowing. Small grain production before allowing with cultivation is highly effective and more economical than fallow without grain production.

Intensive fallow in early season permits soybean production after a brief fallow period. Six to 10 diskings in a 4- to 6-week period in the spring will control rhizome johnsongrass effectively. Approximately 10 disk cultivations per week in a 4- to 6-week period in April and May often provide good to excellent control of rhizomes. This method would be impractical if heavy rainfall occurred during his period. Intensive fallow is also impractical on many farms because the heaviest demand for tractors and equipment for other farming operations occurs in April and May.

Johnsongrass rhizomes may also be controlled with flooding. Best results are obtained when fields are covered with 3 to 4 inches of water before johnsongrass rhizomes germinate in early spring. It is necessary to keep water over the infested area for 3 to 6 weeks during the period that johnsongrass normally germinates. Two to 3 weeks of flooding in mid-summer is even more effective although this is usually impractical.

Pasturing has long been recognized as a method of controlling johnsongrass but effective control from pasturing usually requires two or more seasons. Close grazing for two or more years makes johnsongrass plants weak or stunted and causes rhizomes to be formed near the soil surface.

Johnsongrass rhizomes are killed after exposure to freezing temperatures for a few hours. Cultural practices that bring rhizomes to the soil surface for increased exposure provide johnsongrass control in the fall and winter. Continuous cultivation throughout the winter is particularly effective in controlling johnsongrass although most fields are usually too wet to support ground equipment in the winter.

Control with Herbicides

Preplanting treatment with chemicals. Only two chemicals, 1,1'-dimethyl-4,4'-bipyridinium ion (paraquat) and 2,2'-dichloropropionic acid (dalapon), are recommended for use in soybean production in Mississippi after johnsongrass has emerged but before soybeans are planted (Table 1). Paraquat at 0.5 to 1.0 lb-A is applied as a broadcast spray to wet all johnsongrass foliage. Paraquat is effective in destroying top growth, but johnsongrass will quickly initiate new growth under optimum growing conditions. As a result, johnsongrass control with paraquat is temporary and control may last no more than 2 or 3 weeks unless repeated applications are made.

Foliar treatment with dalapon at 3.7 to 5.5 lb A is the most effective treatment available for controlling regrowth from rhizomes. Dalapon is applied in water as a broadcast spray to wet johnsongrass foliage. The area treated with dalapon should be thoroughly disked or plowed after 3 days to remove all top growth. Soybeans should not be planted for 5 additional days. If the soil is unusually dry after cultivation, a longer waiting period is needed before planting soybeans. Many
farmers have obtained poor control from dalapon primarily because it was applied under environmental conditions that were not satisfactory for rapid johnsongrass growth. To be effective, dalapon must translocate from the leaves to the rhizomes. Maximum dalapon translocation does not occur unless johnsongrass is actively growing at the time of treatment. Droughty or excessively wet soil, prolonged cloudy periods, or air temperatures below 60°F are not satisfactory for obtaining good results from the use of dalapon.

The arsenical herbicides, disodium methanearsonate (DSMA) and monosodium methanearsonate (MSMA), should not be used in a soybean production program. The use of these chemicals is not registered for application in soybeans. In addition, their usage probably will result in increased arsenic content in soybean seed. Preemergence treatment with chemicals. Regardless of the preplanting method used to control johnsongrass, a herbicide for preemergence application should always be used to control seedling johnsongrass. Little value will be obtained even from complete eradication of johnsongrass rhizomes if seedling johnsongrass is not controlled. Seedlings produce new rhizomes within a few weeks.

Of the seven herbicides recommended for preemergence use in soybeans Mississippi, trifluralin, nitrалin, and chloro-2', 6'-diethyl -N-(methoxymethyl

### Table 1. Common, trade, and chemical names of herbicides recommended for johnsongrass control in soybeans by the Mississippi Weed Science Committee.

<table>
<thead>
<tr>
<th>Common name</th>
<th>Trade namea</th>
<th>Chemical name</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Herbicides for application to soil:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alachlor</td>
<td>Lasso</td>
<td>2'-chloro-2,6-diethyl-N-methoxymethylacetonilide</td>
</tr>
<tr>
<td>Trifluralin</td>
<td>Treflan</td>
<td>α,α,α-trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine</td>
</tr>
<tr>
<td>Nitrалin</td>
<td>Planavи</td>
<td>4-(methylsulfonyl)-2,6-dinitro-N,N-dipropylaniline</td>
</tr>
<tr>
<td><strong>Herbicides for application to foliage:</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dalapon</td>
<td>Basfapon or Dowpon</td>
<td>2,2-dichloropropionic acid</td>
</tr>
<tr>
<td>Herbicidal naphtha</td>
<td>Several trade names</td>
<td>Petroleum naphtha</td>
</tr>
<tr>
<td>Paraquat</td>
<td>Paraquat</td>
<td>1,1'-dimethyl-4,4'-bipyridinium ion</td>
</tr>
<tr>
<td>TCA ester</td>
<td>Glytac</td>
<td>ethylene glycol bis (trichloroacetate)</td>
</tr>
</tbody>
</table>

*aMention of a trademark or proprietary product does not constitute a guarantee or warranty of the product by the U. S. Department of Agriculture or the Mississippi Agricultural and Forestry Experiment Station, and it does not imply approval to the exclusion of other products that may also be suitable.*
etanilide (alachlor) are most effective for seedling johnsongrass control (Table 2). Trifluralin or nitratin at 0.5 to 1.0 lb/A may be applied from several weeks before planting to immediately before planting to control of seedling weeds. Both herbicides should be incorporated into the soil after application. Trifluralin is also recommended at a higher rate, 1.0 to 2.0 lb/A, for the control of johnsongrass from rhizomes. These treatments control johnsongrass by inhibiting reproduction of rhizomes so usage over a two-year period is important in obtaining adequate control (Figure 2).

Alachlor at 1.5 to 3.0 lb/A is applied to the soil surface at planting or immediately after planting. Optimum control with alachlor is usually obtained when rainfall occurs within 10 days after application. Johnsongrass from rhizomes will be top-killed by naphtha if treated in early stages of emergence but regrowth usually occurs.

Postemergence treatment with chemicals. Of the eight chemicals recommended for postemergence use in Mississippi, only herbicidal naphtha is effective for control of seedling johnsongrass. The first application of herbicidal naphtha (8 gal on a 16-inch band centered on the row) should be made no sooner than 12 days after soybeans emerge. A second application may be applied after 5 days. Johnsongrass from rhizomes will be top-killed by naphtha if treated in early stages of emergence but regrowth usually occurs.

Seedling johnsongrass is effectively controlled by rotary hoeing when weeds are breaking through a slightly crusted soil. Little control is obtained from rotary hoeing on a damp or wet soil.

![Figure 2. Excellent johnsongrass control in soybeans after 3 annual applications of fluralin at 1.5 lb-a on a Dundee silty clay loam. The herbicide was applied 2 to 3 weeks before planting and double disking was used for incorporation. The area on the left is an untreated control.](image-url)
Johnsongrass that escapes previous treatment may be controlled with spot treatment of herbicidal naphtha or ethylene glycol bis (trichloroacetate) (TCA ester). These are applied with a tractor or hand sprayer. Treatment with either material is most effective on young johnsongrass. Spot sprays of both herbicidal naphtha and TCA ester are toxic to soybeans and sprays should not be applied to crop plants. TCA ester should not be applied in soybean fields after soybean seed pods have formed. Spot treatment is seldom economical when the level of johnsongrass infestation exceeds 5 percent.

**Johnsongrass control in noncropland.** Several soil sterilants are recommended by the Mississippi Weed Science Committee that are effective for johnsongrass control in noncropland. These will normally provide johnsongrass control for one to five years depending on soil texture and rainfall after treatment. Application in the fall and early spring provides best control. Use of soil sterilants is beneficial in a total farm program to control johnsongrass because seed produced in adjacent noncropland infests soybean fields.

**Discussion**

A uniform and continuous stand of soybean plants is needed for maximum johnsongrass control regardless of the practices used for control. Research Stoneville has shown that 12 soybean plants/ft of drill are more competitive weeds than reduced soybean stands. The selection of the soybean variety is important. In research trials, Bragg and Semmes varieties consistently yield higher than other varieties where weeds presented moderate to severe competition. The Mississippi Weed Science Committee recommends their use in fields where will not be possible to provide adequate johnsongrass control. There would be yield advantage from the use of these compared to other well-adapted varieties in situations where it is known if johnsongrass will be controlled. Ear maturing varieties such as Hill should be planted in fields with a moderate severe johnsongrass infestation.

A large number of practices available for johnsongrass control soybeans but this weed can rarely exterminated within 1 to 2 years regardless of the methods used. Excellent control is possible, however within a 2 to 4 year period if rhizoid production is eliminated for 1 to 2 years and if seedlings are not permitted to become established. The expense required to exterminate johnsongrass is more than offset by increased yields and by savings from reductions in the labor requirements normally expended struggle with johnsongrass each year.