General Production Information

For many years cotton has been Mississippi’s leading row crop. Even with recent acreage reductions, Mississippi is still among the top five cotton producing states in the nation.

Records of acreage and production have been kept since 1866. The record highest yield was recorded in 1997 at 901 pounds of lint per acre. The record lowest yield per acre occurred in 1864 at 68 pounds of lint per acre. The record highest acreage occurred in 1939, 4,166,000 acres. The record lowest acreage occurred in 1982, 680,000 acres. The record highest production occurred in 1973 at 2,692,000 bales. The record low production occurred in 1966 at 250,000 bales.

Typically Mississippi ranked second in acres behind Texas, third in yield per acre behind California and Arizona, and third in total bales produced behind Texas and California. Recently, due to increased acreage after boll weevil eradication, Georgia has exceeded Mississippi acreage and production. In 1996, cotton production ranked Number 1 in the United States and led all crops in Mississippi with cash receipts of $381 million.

In 1999, cotton in Mississippi was valued at $461.1 million, the average yield was 708 pounds of cotton per acre. There were 1,180,000 acres planted in 1999 producing 764 million bales.

Cotton requires large investments of capital, labor and management. However, cotton can offer tremendous economic benefits to growers, the community and the state. There are also risks associated with the production of cotton. These risks, low prices and reductions in governmental support, resulted in growers reducing acreage. In 1997, Mississippi harvested 1,420,000 acres as compared to 970,000 acres in 1987 and some 916,000 acres in 1988.

In 2000, there were 1,300,000 acres planted which yielded 642 pounds per acre. In 2001, there were 1,800,000 acres planted which yielded 708 pounds per acre.

Production Region

Cotton is primarily grown in three areas of the state: North Delta, South Delta and Hills with spotted acres in a few southern counties.

Worker Activities

Insect Scouting: Scouting for insects and monitoring plant development is the primary activity requiring pedestrian workers to enter cotton fields during the growing season. Scouting is performed by professional crop consultants and extension scouts (usually high school or college aged individuals) employed by these consultants, as well as by producers and industry fieldhands. Full time cotton scouts normally work in excess of 40 hours per week and much of this time is spent walking through cotton fields, counting insects and collecting information on plant development. Ideally, cotton is counted twice weekly, from emergence through the boll opening period. Full time cotton scouts are in direct contact with plants for a large portion of the day each work day of the growing season.

Irrigation: Approximately 21% of the cotton in Mississippi is furrow irrigated. Irrigation pipe must be placed in fields after all tillage operations are completed for the season and removed before harvests. This requires pedestrian workers to enter fields at least twice during the growing season to place and remove pipe. Workers may also be required to enter fields during the irrigation process to make repairs and to manage the irrigation procedures. Workers performing such irrigation procedures may be in direct contact with plants, but this occurs during a limited portion of the season.

Hand Weeding: Hand weeding is uncommon, but is still performed occasionally by workers who are chopping weeds or "spot spraying" with a hand carried sprayer. Workers performing such procedures are in direct contact with plants for a large portion of the time period during which the procedure is being performed, but this occurs during a limited portion of the season.

Cultural Practices

In Mississippi’s crop production system, the cotton grower makes major decisions regarding input use and production practices. Cotton is primarily grown in three areas of the state: North Delta, South Delta and Hills with spotted acres in a few southern counties.

Integrated Pest Management

Cotton in Mississippi is attacked by more than a dozen different species of insect pests. Table 1 provides a list of the most common pests of cotton and a brief description of the damage they cause. Each of these pests is capable of causing economic yield loss, and some, such as the tobacco budworm, are capable of totally destroying a crop. Historically, the bollworm/tobacco budworm complex has ranked as one of the most damaging pests of Mississippi cotton, but boll weevils, terminal plant bugs, beat armyworms, fall armyworms, cotton aphids, and frits have also caused high levels of damage in some years (Table 2).

Cotton growers may invest more than $500 to produce an acre of cotton, and all of this investment is potentially at risk to insect damage. The cost of controlling insects is one of the largest items of the crop production budget, annually averaging from $87 to over $100 per acre (Figure 1).

Integrated pest management (IPM) is practiced on all of Mississippi’s cotton acreage. Producers utilize a variety of non-chemical management tools (Table 3) to limit the number of times that pests exceed economic thresholds and consequently require treatment with insecticides. However, timely judicious use of insecticides is an important component of cotton IPM. Recommendations for cotton insect management are published in the Cotton Insect Control Guide, which is revised annually to incorporate the latest technology and research. Table 4 enumerates the insecticides recommended for use in Mississippi cotton and the pests for which they are recommended.

Because pest populations can change quickly, cotton insect management is both information intensive and time sensitive. During the growing season, fields must be scouted every three to four days, and accurate estimates of pest populations must be determined by time consuming sampling procedures. Because of the time involved in making these counts, most Mississippi producers contact the services of a professional crop consultant, usually for a ‘per acre’ scouting fee, to monitor insect populations and make treatment recommendations.

During recent years there have been significant changes in Mississippi’s cotton IPM system, and this system continues to evolve rapidly. Those changes are occurring because of three major factors: transgenic Bt-cotton, bell weevil eradication, and now, more targeted specific insecticides.

In recent years from 70 to 80% of Mississippi’s cotton acreage has been planted to Bt transgenic cotton varieties. Because Bt cotton is highly effective against tobacco budworm, fields planted to Bt varieties do not require treatment for this pest. Bt cotton is also effective against boll weevils, but is to a lesser degree, and Bt fields occasionally require treatment for control of bollworms. However, since Bt cotton was first introduced in 1996, Bt fields have consistently required fewer treatments than non-Bt fields for caterpillar pests, while also sustaining less boll damage (Table 5).

Mississippi began bell weevil eradication efforts in 1997 in the Eastern portion of the state. In 2001, the Hill Region of Mississippi was in the 5th year of Bell Weevil Eradication Program and the South Delta and North Delta were in the forth and third year, respectively. Although Mississippi has not yet achieved the goal of establishing this pest, overall bell weevil numbers have been low in 2000, and no yield loss was attributed to bell weevils. Only 32% of the acres in

The Crop Profile/PMSP database, including this document, is supported by USDA NIFA.
the widespread adoption of transgenic Bt cotton, combined with the progress of the boll weevil eradication effort have resulted in significant reductions in the number of foliar spray applications by Mississippi cotton producers (Figure 2). Unfortunately, the reduction in the number of foliar insecticide treatments has not provided a corresponding decrease in the per-acre cost of cotton insect control (Table 1). This is because of offsetting costs associated with technology use fees for the cotton, assessment fees to fund boll weevil eradication efforts, and increased costs of newer insecticides. Still, boll weevil eradication and Bt cotton have had the very positive impacts of reducing the risks of insect induced yield losses, reducing overall use of insecticides, and reducing the physical and logistical effort that growers must devote to insect management.

One consequence of this new pest management system under which cotton is grown in Mississippi has been a shift in the overall pest spectrum. Pests such as boll weevils and tobacco budworms are of much less concern than they had been in past years, because of the direct effects of boll weevil eradication and Bt cotton. The reduction in foliar sprays has also had an indirect effect in reducing outbreaks of secondary pests, such as cotton aphids and beet armyworms. However, pests such as tarnished plant bugs and stink bugs have thrived in this reduced spray environment and the number of treatments applied specifically to control these pests has increased.

Together, the broad adoption of transgenic Bt cotton, combined with the progress of the boll weevil eradication effort have resulted in significant reductions in the number of foliar sprays applied by Mississippi cotton producers (Figure 2). Unfortunately, this reduction in the number of foliar insecticide treatments has not provided a corresponding decrease in the per-acre cost of cotton insect control (Table 1). This is because of offsetting costs associated with technology use fees for the cotton, assessment fees to fund boll weevil eradication efforts, and increased costs of newer insecticides. Still, boll weevil eradication and Bt cotton have had the very positive impacts of reducing the risks of insect induced yield losses, reducing overall use of insecticides, and reducing the physical and logistical effort that growers must devote to insect management.

One consequence of this new pest management system under which cotton is grown in Mississippi has been a shift in the overall pest spectrum. Pests such as boll weevils and tobacco budworms are of much less concern than they had been in past years, because of the direct effects of boll weevil eradication and Bt cotton. The reduction in foliar sprays has also had an indirect effect in reducing outbreaks of secondary pests, such as cotton aphids and beet armyworms. However, pests such as tarnished plant bugs and stink bugs have thrived in this reduced spray environment and the number of treatments applied specifically to control these pests has increased.

Together, the broad adoption of transgenic Bt cotton, combined with the progress of the boll weevil eradication effort have resulted in significant reductions in the number of foliar sprays applied by Mississippi cotton producers (Figure 2). Unfortunately, this reduction in the number of foliar insecticide treatments has not provided a corresponding decrease in the per-acre cost of cotton insect control (Table 1). This is because of offsetting costs associated with technology use fees for the cotton, assessment fees to fund boll weevil eradication efforts, and increased costs of newer insecticides. Still, boll weevil eradication and Bt cotton have had the very positive impacts of reducing the risks of insect induced yield losses, reducing overall use of insecticides, and reducing the physical and logistical effort that growers must devote to insect management.

One consequence of this new pest management system under which cotton is grown in Mississippi has been a shift in the overall pest spectrum. Pests such as boll weevils and tobacco budworms are of much less concern than they had been in past years, because of the direct effects of boll weevil eradication and Bt cotton. The reduction in foliar sprays has also had an indirect effect in reducing outbreaks of secondary pests, such as cotton aphids and beet armyworms. However, pests such as tarnished plant bugs and stink bugs have thrived in this reduced spray environment and the number of treatments applied specifically to control these pests has increased.
Table 5: Comparison of number of insecticide treatments and percent boll damage on Bt and non-Bt cotton in Mississippi, 6-year summary.

<table>
<thead>
<tr>
<th>Year</th>
<th>avg. no. bollworm/budworm treatments</th>
<th>avg. % caterpillar damaged bolls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bt</td>
<td>non-Bt</td>
</tr>
<tr>
<td>1996</td>
<td>0.33</td>
<td>3.05</td>
</tr>
<tr>
<td>1997</td>
<td>0.86</td>
<td>3.14</td>
</tr>
<tr>
<td>1998</td>
<td>1.22</td>
<td>5.18</td>
</tr>
<tr>
<td>1999</td>
<td>0.44</td>
<td>2.47</td>
</tr>
<tr>
<td>2000</td>
<td>0.27</td>
<td>2.44</td>
</tr>
<tr>
<td>2001</td>
<td>0.44</td>
<td>2.27</td>
</tr>
</tbody>
</table>

Figure 1. Estimated average cost per acre of controlling cotton insects in Mississippi (from annual Cotton Insect Losses Estimates). These estimates include cost of insecticides, application costs, scouting fees, eradication program fees, and licensing fees for all Bt cotton. The sharp increase in cost beginning in 1992 is due primarily to the development of high levels of insecticide resistance in tobacco budworm and other cotton pests. Since 1996, a number of new tools have been introduced that provide improved control of pests that are resistant to older insecticides. However, because these new tools are higher in cost and more target specific, their availability has had relatively little effect on the cost of insect control.

Figure 2. Average number of foliar insecticide treatments applied to Mississippi cotton fields, 1988-2000. The decline in number of sprays is due to progress of the Boll Weevil Eradication Program and widespread adoption of transgenic Bt cotton. Treatments of ULV malathion applied as part of the Boll Weevil Eradication Program are not included in these estimates.
<table>
<thead>
<tr>
<th>Pest</th>
<th>acres infested</th>
<th>acres treated</th>
<th># insect appls</th>
<th>Cost of 1 applic</th>
<th>cost/ acre</th>
<th>%red</th>
<th>Bales lost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boll weevil</td>
<td>0</td>
<td>0</td>
<td>0.000</td>
<td>N/A</td>
<td>0.000</td>
<td>0.000</td>
<td>0</td>
</tr>
<tr>
<td>Bollworm/budworm</td>
<td>1,287,000</td>
<td>515,000</td>
<td>0.863</td>
<td>$13.20</td>
<td>$1.39</td>
<td>2.232</td>
<td>39,850</td>
</tr>
<tr>
<td>Pink Bollworm</td>
<td>0</td>
<td>0</td>
<td>0.000</td>
<td>N/A</td>
<td>0.000</td>
<td>0.000</td>
<td>0</td>
</tr>
<tr>
<td>Cotton Fleahopper</td>
<td>28,800</td>
<td>0</td>
<td>1.000</td>
<td>N/A</td>
<td>0.000</td>
<td>0.000</td>
<td>0</td>
</tr>
<tr>
<td>Lygus</td>
<td>1,287,000</td>
<td>870,000</td>
<td>0.925</td>
<td>$6.97</td>
<td>$6.44</td>
<td>0.352</td>
<td>9,448</td>
</tr>
<tr>
<td>Cotton Leafperforator</td>
<td>0</td>
<td>0</td>
<td>0.000</td>
<td>N/A</td>
<td>0.000</td>
<td>0.000</td>
<td>0</td>
</tr>
<tr>
<td>Spreader Mites</td>
<td>480,000</td>
<td>74,000</td>
<td>0.075</td>
<td>$10.93</td>
<td>$8.02</td>
<td>0.062</td>
<td>1,667</td>
</tr>
<tr>
<td>Thrips, early season</td>
<td>1,287,000</td>
<td>632,000</td>
<td>0.514</td>
<td>$5.24</td>
<td>$3.94</td>
<td>0.626</td>
<td>16,790</td>
</tr>
<tr>
<td>Bt Armyworm</td>
<td>330,000</td>
<td>60,000</td>
<td>0.183</td>
<td>$11.73</td>
<td>$0.87</td>
<td>0.071</td>
<td>1,971</td>
</tr>
<tr>
<td>Fall Armyworm</td>
<td>767,000</td>
<td>157,000</td>
<td>0.202</td>
<td>$12.14</td>
<td>$1.48</td>
<td>0.445</td>
<td>11,925</td>
</tr>
<tr>
<td>European Corn Borer</td>
<td>20,000</td>
<td>0</td>
<td>0.000</td>
<td>N/A</td>
<td>0.000</td>
<td>0.000</td>
<td>0</td>
</tr>
<tr>
<td>Stink Bugs</td>
<td>770,000</td>
<td>38,100</td>
<td>0.004</td>
<td>$3.37</td>
<td>$1.61</td>
<td>0.026</td>
<td>3,011</td>
</tr>
<tr>
<td>Grasshoppers</td>
<td>31,200</td>
<td>10,000</td>
<td>0.032</td>
<td>$7.60</td>
<td>$0.60</td>
<td>0.007</td>
<td>196</td>
</tr>
<tr>
<td>Salt-marsh Caterpillars</td>
<td>209,000</td>
<td>19,000</td>
<td>0.095</td>
<td>$9.11</td>
<td>$0.13</td>
<td>0.016</td>
<td>415</td>
</tr>
<tr>
<td>Aphids</td>
<td>1,287,000</td>
<td>531,000</td>
<td>0.433</td>
<td>$6.78</td>
<td>$0.96</td>
<td>0.154</td>
<td>8,648</td>
</tr>
<tr>
<td>Bandedwinged Whitefly</td>
<td>736,000</td>
<td>106,500</td>
<td>0.143</td>
<td>$4.95</td>
<td>$0.96</td>
<td>0.154</td>
<td>4,440</td>
</tr>
<tr>
<td>Silverleaf Whitefly</td>
<td>1,000</td>
<td>1,000</td>
<td>0.000</td>
<td>$19.50</td>
<td>$0.00</td>
<td>0.004</td>
<td>104</td>
</tr>
<tr>
<td>Soybean Loopers</td>
<td>235,000</td>
<td>47,000</td>
<td>0.198</td>
<td>$11.83</td>
<td>$0.43</td>
<td>0.028</td>
<td>760</td>
</tr>
<tr>
<td>Cabbage Loopers</td>
<td>0</td>
<td>0</td>
<td>0.000</td>
<td>N/A</td>
<td>0.000</td>
<td>0.000</td>
<td>0</td>
</tr>
<tr>
<td>Western Flower Thrips</td>
<td>1,287,000</td>
<td>152,000</td>
<td>0.118</td>
<td>$6.68</td>
<td>$0.79</td>
<td>0.087</td>
<td>3,243</td>
</tr>
<tr>
<td>Cutworms</td>
<td>1,287,000</td>
<td>152,000</td>
<td>0.118</td>
<td>$6.68</td>
<td>$0.79</td>
<td>0.087</td>
<td>3,243</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pest</th>
<th>acres infested</th>
<th>acres treated</th>
<th># insect appls</th>
<th>Cost of 1 applic</th>
<th>cost/ acre</th>
<th>%red</th>
<th>Bales lost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boll weevil</td>
<td>0</td>
<td>0</td>
<td>0.000</td>
<td>N/A</td>
<td>0.000</td>
<td>0.000</td>
<td>0</td>
</tr>
<tr>
<td>Bollworm/budworm</td>
<td>812,000</td>
<td>410,000</td>
<td>0.161</td>
<td>$13.20</td>
<td>$13.20</td>
<td>1.000</td>
<td>32,142</td>
</tr>
<tr>
<td>Pink Bollworm</td>
<td>0</td>
<td>0</td>
<td>0.000</td>
<td>N/A</td>
<td>0.000</td>
<td>0.000</td>
<td>0</td>
</tr>
<tr>
<td>Cotton Fleahopper</td>
<td>28,000</td>
<td>0</td>
<td>0.000</td>
<td>N/A</td>
<td>0.000</td>
<td>0.000</td>
<td>0</td>
</tr>
<tr>
<td>Lygus</td>
<td>812,000</td>
<td>730,000</td>
<td>1.209</td>
<td>$7.20</td>
<td>$7.20</td>
<td>0.450</td>
<td>8,419</td>
</tr>
<tr>
<td>Cotton Leafperforator</td>
<td>0</td>
<td>0</td>
<td>0.000</td>
<td>N/A</td>
<td>0.000</td>
<td>0.000</td>
<td>0</td>
</tr>
<tr>
<td>Spreader Mites</td>
<td>360,000</td>
<td>55,000</td>
<td>0.100</td>
<td>$10.93</td>
<td>$10.93</td>
<td>0.100</td>
<td>1,000</td>
</tr>
<tr>
<td>Thrips, early season</td>
<td>812,000</td>
<td>510,000</td>
<td>0.122</td>
<td>$5.40</td>
<td>$5.40</td>
<td>0.122</td>
<td>11,442</td>
</tr>
<tr>
<td>Bt Armyworm</td>
<td>390,000</td>
<td>510,000</td>
<td>0.183</td>
<td>$11.70</td>
<td>$11.70</td>
<td>0.206</td>
<td>11,442</td>
</tr>
<tr>
<td>Fall Armyworm</td>
<td>380,000</td>
<td>320,000</td>
<td>0.141</td>
<td>$11.80</td>
<td>$11.80</td>
<td>0.289</td>
<td>7,250</td>
</tr>
<tr>
<td>European Corn Borer</td>
<td>20,000</td>
<td>0</td>
<td>0.000</td>
<td>N/A</td>
<td>0.000</td>
<td>0.000</td>
<td>0</td>
</tr>
<tr>
<td>Stink Bugs</td>
<td>420,000</td>
<td>8,100</td>
<td>0.066</td>
<td>$7.70</td>
<td>$7.70</td>
<td>0.066</td>
<td>3,500</td>
</tr>
<tr>
<td>Grasshoppers</td>
<td>3,200</td>
<td>0</td>
<td>0.000</td>
<td>N/A</td>
<td>0.000</td>
<td>0.000</td>
<td>0</td>
</tr>
<tr>
<td>Salt-marsh Caterpillars</td>
<td>329,000</td>
<td>37,000</td>
<td>0.102</td>
<td>$6.80</td>
<td>$6.80</td>
<td>0.102</td>
<td>269</td>
</tr>
<tr>
<td>Aphids</td>
<td>812,000</td>
<td>490,000</td>
<td>0.724</td>
<td>$6.80</td>
<td>$4.92</td>
<td>0.400</td>
<td>6,767</td>
</tr>
<tr>
<td>Bandedwinged Whitefly</td>
<td>310,000</td>
<td>85,000</td>
<td>0.136</td>
<td>$4.70</td>
<td>$1.84</td>
<td>0.031</td>
<td>531</td>
</tr>
<tr>
<td>Silverleaf Whitefly</td>
<td>310,000</td>
<td>85,000</td>
<td>0.136</td>
<td>$4.70</td>
<td>$1.84</td>
<td>0.031</td>
<td>531</td>
</tr>
<tr>
<td>Soybean Loopers</td>
<td>0</td>
<td>0</td>
<td>0.000</td>
<td>N/A</td>
<td>0.000</td>
<td>0.000</td>
<td>0</td>
</tr>
<tr>
<td>Cabbage Loopers</td>
<td>0</td>
<td>0</td>
<td>0.000</td>
<td>N/A</td>
<td>0.000</td>
<td>0.000</td>
<td>0</td>
</tr>
<tr>
<td>Western Flower Thrips</td>
<td>0</td>
<td>0</td>
<td>0.000</td>
<td>N/A</td>
<td>0.000</td>
<td>0.000</td>
<td>0</td>
</tr>
<tr>
<td>Cutworms</td>
<td>812,000</td>
<td>110,000</td>
<td>0.135</td>
<td>$6.60</td>
<td>$6.60</td>
<td>0.080</td>
<td>1,355</td>
</tr>
</tbody>
</table>

**Table 16a. Mississippi Delta**

**Table 16a. Mississippi Hills**
**Foliar Insecticides:**

**Acephate (Orthene):** For the past several years acephate has been the most commonly used individual foliar insecticide in Mississippi cotton. In 2001 Mississippi growers applied approximately 1.4 applications of acephate per field, which constituted one-third of all foliar sprays. The most important use of acephate is for control of tarnished plant bugs. Acephate belongs to a different sub-class of chemistry than most other organophosphates used on cotton, and it is one of the few "older" insecticides to which plant bugs have not developed high levels of resistance. Acephate is used to control plant bugs throughout the growing season. Use rates in the range of 0.25 to 0.5 lbs. ai/acre are usually effective during early season, but rates of at least 0.5 lbs. ai/acre are required during mid to late season. Successful control of heavy, mid to late season plant bug infestations requires repeated applications applied approximately 5 days apart.

**Dimethoate:** Dimethoate is an organophosphate insecticide that has declined in use, primarily because of resistance in tarnished plant bugs. Use rates in the range of 0.25 to 0.5 lbs. ai/acre are usually effective during early season, but rates of at least 0.5 lbs. ai/acre are required during mid to late season. Multiple applications applied approximately 5 days apart are required to control heavy, mid to late season plant bug infestations. Dimethoate is also quite effective against stink bugs and is a good choice for control of mixed populations of plant bugs and stink bugs. Dicrotophos is one of the most frequently used cotton insecticides. In 2001, Mississippi cotton received an average of 0.53 applications per field, which represented 13.9% of all foliar insecticide treatments. The relative importance of dicrotophos has increased in recent years, because plant bugs and stink bugs are becoming more important in post-emergence/flower cotton systems.

**Dicrotophos (Bidrin):** Dicrotophos is one of the most frequently used cotton insecticides. In 2001, Mississippi cotton received an average of 0.53 applications per field, which represented 13.9% of all foliar insecticide treatments. The relative importance of dicrotophos has increased in recent years, because plant bugs and stink bugs are becoming more important in post-emergence/flower cotton systems.

**Methyl Parathion:** As the treatment of choice against boll weevils, this organophosphate insecticide was once the most commonly used insecticide in Mississippi cotton. However, in 2001, Mississippi cotton received an average of 1.4 applications per field, which constituted one-third of all foliar sprays.

**Prothion (Curacron):** At one time prothion was widely used for control of tobacco budworms and tarnished plant bugs, as well as other pests. However, its use has declined greatly in recent years due to resistance in tobacco budworms and plant bug populations, as well as to seed spread planting of Bt cotton and availability of new, more effective control materials.

---

**Insect Pests**

Insecticides recommended for use in Mississippi cotton and the primary pests for which they are recommended are listed in Table 4. Table 4A-4D summarizes the relative use of these insecticides during the past four growing seasons, 1998 through 2001. Examination of these tables shows that acephate, dicrotophos, and the pyrethroids (collectively) were the most commonly used insecticides. The use and significance of each of the insecticides recommended for use in Mississippi cotton is discussed below.
Properpigs (Consists): Properpigs, which is a specific miticide, is rarely used in Mississippi, because of cost and because spider mite outbreaks are uncommon. This organophosphate is effective against spider mites but, because it is moderately non-selective, it is not commonly stocked by distributors. However, because it is one of the more effective products for use against mites, it would become extremely important in the event of severe mite outbreaks.

**Propargite (Comite):** Propargite is a specific miticide that is rarely used in Mississippi, because of cost and because spider mite outbreaks are uncommon. This organophosphate is effective against spider mites but, because it is not commonly stocked by distributors. However, because it is one of the more effective products for use against mites, it would become extremely important in the event of severe mite outbreaks.

**Profenofos** (Thimet). Profenofos is still recommended for control of budworm/bollworm and plant bugs, but its use is limited due to the factors previously mentioned. It is also labeled and recommended for control of spider mites and fall armyworms, but it is generally less effective than other labeled products against both pests. Currently the key value of profenofos is that it is an economical choice for use against mixed populations of bollworms and plant bugs, or against mixed populations of bollworms/budworms and a building spider mite infestation. Use rates range from 0.25 lbs aic to 0.33 lbs aic (as an ovicide for control of bollworm/budworms egg to 1.0 lbs aic [labeled rate]).

**Prophetic (Comite):** Prophetic, which is a specific miticide, is rarely used in Mississippi, because of cost and because spider mite outbreaks are uncommon. This organophosphate is effective against spider mites but, because it is not commonly stocked by distributors. However, because it is one of the more effective products for use against mites, it would become extremely important in the event of severe mite outbreaks.

**Pyrifos (Telone):** Pyrifos is a very effective and economical miticide for the control of spider mites. It is currently recommended for use against mixed populations of spider mites and fall armyworms. Use rates range from 0.25 lbs aic to 0.33 lbs aic (as an ovicide for control of bollworm/budworms egg to 1.0 lbs aic [labeled rate]).

**Pyrethroids:** Pyrethroids currently recommended for use in Mississippi cotton are: bifenthrin (Capture), fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.

**XL),** fenpropathrin (Danitol), tralomethrin (Scout X-Tra), and zetamethrin (Fury). These are discussed collectively because of their broad similarities. Collectively, the pyrethroids are one of the most important, most commonly used insecticides.
Bifenthrin (Capture) is a somewhat unique pyrethroid that also has activity against spider mites and is recommended for control of mites. In past years bifenthrin was also recommended for control of cotton aphids, but development of pyrethroid resistance in aphids has nullified this use. Fenpropathrin (Danitol) is recommended primarily in a tank mix with acephate for control of silverleaf whiteflies, which currently is a very minor use in Mississippi. Fenpropathrin also has activity against spider mites.

Soil Applied Insecticides:

Soil applied insecticides are applied at planting, primarily for control of thrips. These treatments may be applied as seed treatments, or as in-furrow granules or in-furrow sprays.

Aldicarb (Temik): Aldicarb, which is a carbamate, is the most commonly used soil-applied insecticide. This is because of its excellent, long-lasting activity against thrips and because, when used at adequate rates, it provides good suppression of nematodes. In 2001, approximately 39% of Mississippi cotton fields were treated with aldicarb. Recommended soil rates range from 3.5 to 5 lbs. A.i./acre. Aldicarb also provides early season suppression of plant bugs and cotton aphids, but it does not control cutworms.

Acephate (Orthene): When applied as a seed treatment, acephate (organophosphate) will provide thrips control in seedling cotton for 7 to 10 days after emergence. However, acephate is also recommended as a liquid in-furrow spray or as the granule formulation known as Payload at a rate of 1.0 lbs. a.i./acre, and this rate will provide longer thrips control, as well as suppression of plant bugs and cutworms.

Imidacloprid (Gaucho): Imidacloprid is a chloro-nicotinyl insecticide that is offered as a seed treatment. It provides effective control of thrips on seedling cotton and was used on approximately 9% of Mississippi cotton fields in 2001.

Thiamethoxam (Adage): Thiamethoxam (chloro-nicotinyl) is sold as a seed treatment known as Adage for control of thrips on seedling cotton. This new product provides effective control of thrips for two to three weeks following emergence. It will also control aphids on seedling cotton. Use of thiamethoxam is likely to increase in future years, but will be limited somewhat by the lack of nematode control.

Table 6A: Use of individual foliar applied insecticides on cotton in Mississippi, 2001

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Trt/Field</th>
<th>% of sprays</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammo</td>
<td>0.13</td>
<td>3.0</td>
</tr>
<tr>
<td>Amistar</td>
<td>0.05</td>
<td>1.2</td>
</tr>
<tr>
<td>Bifenthrin</td>
<td>0.05</td>
<td>1.2</td>
</tr>
<tr>
<td>Baythroid</td>
<td>0.31</td>
<td>7.5</td>
</tr>
<tr>
<td>Biflora</td>
<td>0.53</td>
<td>12.9</td>
</tr>
<tr>
<td>Bircator</td>
<td>0.13</td>
<td>3.0</td>
</tr>
<tr>
<td>Capture</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Centric</td>
<td>0.34</td>
<td>8.4</td>
</tr>
<tr>
<td>Comite</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Confidor</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Curacron</td>
<td>0.06</td>
<td>1.5</td>
</tr>
<tr>
<td>Danitol</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Decis</td>
<td>0.08</td>
<td>2.0</td>
</tr>
<tr>
<td>Derbick</td>
<td>0.02</td>
<td>0.5</td>
</tr>
<tr>
<td>Dimilin</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Dimethoate</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Dursban</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Erythrol</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Fenex/Prenda</td>
<td>0.07</td>
<td>1.6</td>
</tr>
<tr>
<td>Gaucho</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Orthene</td>
<td>1.38</td>
<td>32.3</td>
</tr>
<tr>
<td>Owasso</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Proda</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Scree Extra</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Serrad</td>
<td>0.13</td>
<td>3.0</td>
</tr>
<tr>
<td>Tinsar</td>
<td>0.21</td>
<td>5.0</td>
</tr>
<tr>
<td>Vydate</td>
<td>0.14</td>
<td>3.4</td>
</tr>
<tr>
<td>Total</td>
<td>4.13</td>
<td>100</td>
</tr>
</tbody>
</table>

Compiled from a survey of 120 Mississippi Cotton Fields (69 Bt fields and 51 non-Bt fields) which received a total of 496 foliar insecticide treatments.

(Does not include foliar applications of ULV materials applied as part of the boll weevil eradication program.)

Table 6B: Use of individual foliar applied insecticides on cotton in Mississippi, 2000

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Trt/Field</th>
<th>% of sprays</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammo</td>
<td>0.15</td>
<td>3.0</td>
</tr>
<tr>
<td>Amistar</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Bifenthrin</td>
<td>0.17</td>
<td>3.4</td>
</tr>
<tr>
<td>Biflora</td>
<td>0.46</td>
<td>15.0</td>
</tr>
<tr>
<td>Bircator</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Capture</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Centric</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Confidor</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Curacron</td>
<td>0.07</td>
<td>2.0</td>
</tr>
<tr>
<td>Danitol</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Derbick</td>
<td>0.02</td>
<td>0.5</td>
</tr>
<tr>
<td>Dursban</td>
<td>0.08</td>
<td>2.0</td>
</tr>
<tr>
<td>Erythrol</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Gaucho</td>
<td>0.02</td>
<td>0.5</td>
</tr>
<tr>
<td>Orthene</td>
<td>1.38</td>
<td>32.3</td>
</tr>
<tr>
<td>Owasso</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Proda</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Scree Extra</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Serrad</td>
<td>0.13</td>
<td>3.0</td>
</tr>
<tr>
<td>Tinsar</td>
<td>0.21</td>
<td>5.0</td>
</tr>
<tr>
<td>Vydate</td>
<td>0.14</td>
<td>3.4</td>
</tr>
<tr>
<td>Total</td>
<td>4.13</td>
<td>100</td>
</tr>
</tbody>
</table>

Compiled from a survey of 120 Mississippi Cotton Fields (69 Bt fields and 51 non-Bt fields) which received a total of 496 foliar insecticide treatments.
Compiled from a survey of 59 Mississippi Cotton Fields (34 Bt fields and 25 non-Bt fields) which received a total of 183 foliar insecticide treatments.

1Does not include foliar applications of ULV malathion applied as part of the boll weevil eradication program.

Table 6C: Use of individual foliar applied insecticides on cotton in Mississippi, 1999

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Trt/Fld</th>
<th>% of Sprays</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammo</td>
<td>0.31</td>
<td>3.3</td>
</tr>
<tr>
<td>Asana</td>
<td>0.01</td>
<td>0.3</td>
</tr>
<tr>
<td>Baythroid</td>
<td>0.10</td>
<td>11.0</td>
</tr>
<tr>
<td>Bidrin</td>
<td>0.38</td>
<td>11.0</td>
</tr>
<tr>
<td>Bifenthrin</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Capture</td>
<td>0.04</td>
<td>1.3</td>
</tr>
<tr>
<td>Comite</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Confirm</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Comite</td>
<td>0.11</td>
<td>3.2</td>
</tr>
<tr>
<td>Deltamethrin</td>
<td>0.04</td>
<td>1.3</td>
</tr>
<tr>
<td>Dimethoate</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Dicofol</td>
<td>0.02</td>
<td>0.6</td>
</tr>
<tr>
<td>Furadan</td>
<td>0.32</td>
<td>9.5</td>
</tr>
<tr>
<td>Guthion</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Karate</td>
<td>0.39</td>
<td>11.4</td>
</tr>
<tr>
<td>Kethane</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Larvin</td>
<td>0.04</td>
<td>1.3</td>
</tr>
<tr>
<td>Malathion</td>
<td>0.02</td>
<td>0.6</td>
</tr>
<tr>
<td>Metan Synys</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Metho Pahtin</td>
<td>0.17</td>
<td>2.7</td>
</tr>
<tr>
<td>Monitor</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Orthane</td>
<td>0.05</td>
<td>1.6</td>
</tr>
<tr>
<td>Ovasyn</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Phase/Thidam</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Provado</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Scout Extra</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Tracer</td>
<td>0.55</td>
<td>16.1</td>
</tr>
<tr>
<td>Vidyac</td>
<td>0.14</td>
<td>4.1</td>
</tr>
<tr>
<td>Total</td>
<td>3.41</td>
<td>100</td>
</tr>
</tbody>
</table>

Compiled from a survey of 93 Mississippi Cotton Fields (55 Bt fields and 38 non-Bt fields) which received a total of 317 foliar insecticide treatments.

1Does not include foliar applications of ULV malathion applied as part of the boll weevil eradication program.

Table 6D: Use of individual foliar applied insecticides on cotton in Mississippi, 1998

<table>
<thead>
<tr>
<th>Insecticide</th>
<th>Trt/Fld</th>
<th>% of Sprays</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cypermethrin (Ammo)</td>
<td>0.17</td>
<td>2.6</td>
</tr>
<tr>
<td>Etofenprox (Ammo)</td>
<td>0.19</td>
<td>3.0</td>
</tr>
<tr>
<td>Cyfluthrin (Baythroid)</td>
<td>0.45</td>
<td>7.3</td>
</tr>
<tr>
<td>Dicofol (Bidrin)</td>
<td>0.44</td>
<td>7.3</td>
</tr>
<tr>
<td>Sulfathion (Bidrin)</td>
<td>0.02</td>
<td>0.2</td>
</tr>
<tr>
<td>Bifenthrin (Captan)</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Propargite (Comite)</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Etofenprox (Comite)</td>
<td>0.04</td>
<td>0.6</td>
</tr>
<tr>
<td>Prothiofos (Comite)</td>
<td>0.32</td>
<td>5.0</td>
</tr>
<tr>
<td>Delkarmethrin (Deltam)</td>
<td>0.24</td>
<td>3.6</td>
</tr>
<tr>
<td>Delkarmethrin (Deltam)</td>
<td>0.05</td>
<td>0.8</td>
</tr>
<tr>
<td>Bacillus Ferriprosz (Dipol)</td>
<td>0.01</td>
<td>0.1</td>
</tr>
<tr>
<td>Dimethoate</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Carbophos (Furadan)</td>
<td>0.17</td>
<td>2.7</td>
</tr>
<tr>
<td>Ziramethrin (Fur)</td>
<td>0.41</td>
<td>6.5</td>
</tr>
<tr>
<td>Astigamethrin (Guthion)</td>
<td>0.20</td>
<td>3.1</td>
</tr>
<tr>
<td>Cyhalothrin (Karan)</td>
<td>0.33</td>
<td>5.3</td>
</tr>
<tr>
<td>Dicofol (Kethane)</td>
<td>0.00</td>
<td>0.0</td>
</tr>
<tr>
<td>Methoxyl (Larvin)</td>
<td>0.07</td>
<td>1.1</td>
</tr>
<tr>
<td>Thiodicarb (Larvin)</td>
<td>0.05</td>
<td>0.7</td>
</tr>
<tr>
<td>Metho pahtin</td>
<td>0.56</td>
<td>8.7</td>
</tr>
</tbody>
</table>

Compiled from a survey of 93 Mississippi Cotton Fields (55 Bt fields and 38 non-Bt fields) which received a total of 317 foliar insecticide treatments.

1Does not include foliar applications of ULV malathion applied as part of the boll weevil eradication program.
Historically, the boll weevil was the most important insect pest of Mississippi cotton. Boll weevil was considered a key pest of cotton, because the early season treatments that were necessary to control boll weevil destroyed beneficial insects and thus “fixed” secondary pests, such as tobacco budworms and aphids.

As of the end of the 2001 growing season, statewide eradication efforts have reduced boll weevil numbers to extremely low levels, and it appears that complete eradication will be achieved within the next two years. Mississippi cotton growers no longer spray for boll weevils themselves, and only 32% of Mississippi’s cotton acreage was treated by the Boll Weevil Eradication Program (BWEP) in 2001. Fifty-one percent of Mississippi fields treated boll weevils for the entire season, and no yield loss was attributed to boll weevils in 2001. Therefore, the primary concern for Mississippi cotton producers with respect to the boll weevil is to complete the BWEP and to successfully maintain eradication, since it is achieved. The Hill Region of Mississippi passed a 10-year eradication maintenance referendum in 2001 and the remaining two regions of the state will vote on maintenance programs during the next two years.

A successful eradication program requires the continuation of a vigorous pheromone trapping program on all cotton in the state. This is necessary so that any re-introductions of boll weevils can be promptly detected and eliminated before they have a chance to spread. Successful eradication maintenance will also require continued education of growers and scouts, so that they will be able to recognize and promptly report the presence of boll weevils and/or boll weevil damage in their fields. Successful eradication maintenance also requires continual, ready access to insecticides that are effective against boll weevil and can be used to eliminate any re-infestations that do occur. Because of logistic, environmental, and cost considerations, Malathion ULV has been the primary insecticide used in the BWEP, but a number of other insecticides are also effective against boll weevils.

The damage done by the pest: Weevils puncture squares and bolls with their trunks and lay eggs. If a weevil puncture is tapped with a white-tipped brown bump on the boll and sealed the puncture to the egg. This glairy substance is white on newly sealed egg punctures, but browns with age. Some weevil punctures will not have this trait; particularly the insect merely feeds. Normally, the weevil’s probing squares and makes only one egg puncture per square, but it will select young bolls in many cases. Weevil damage will range from one or two locks per boll to complete boll loss since many punctured squares or young bolls will drop off after the post-drill bolls are harvested.

Life cycle: Total time from egg to adult ranges from 16 to 25 days; egg - two to three days; larva - five to eight days; pupa - three to five days; newly emerged adult ("callow" adult) - one day; feeding adult - five to eight days before egg laying. Adult females lay an average of 30 eggs each day for approximately 10 days. Each generation normally multiplies tenfold. In a typical short-season boll weevil population will increase at a rate of about two and one-half times each week - about the same rate of increase as the squares in the field.

Boll weevils spend the winter in a semi-dormant state (reproductive diapause) in hardwood ground cover, such as patches of woods. During mild winters, they also can survive in grass or other cover. Usually four generations of weevils occur within the growing season. When daytime temperatures begin to rise above 70 degrees weevils begin emerging. Emergence may continue from better cotton is big enough to support the pests until July, peaking normally in May and June. While there are not always clear-cut steps in the emergence of over-wintered weevils, the first adult in-field generation can begin emerging about a week after the first white bloom, with others following at about three-week intervals. Climate and weevil food supply can greatly influence peaks in weevil populations.

Critical timing of control measures: Treatment for suppression of overwintering boll weevils is determined using pheromone traps. If the captures the week prior-to-square exceeds four weevils per trap per week, a suppression spray may be needed, and second treatment may be required if populations are high. Three- to five-week square sprays are highly effective in eliminating a large portion of the overwintered generation of boll weevils before they have a chance to reproduce. After cotton begins, applications of insecticides to control the boll weevil will normally be applied when-square damage levels match specified treatment thresholds. Successful control requires the application of a series of three to six treatments applied on a three to four day schedule. This spray schedule is necessary because immature stages of the boll weevil are inside squares and bolls where they are protected from exposure to insecticides. The objective is to control newly emerged adult boll weevils before they have the opportunity to reproduce.

Yield losses and prevalence: In the absence of effective control efforts boll weevils have the ability to completely destroy a cotton crop. Historically, 16% of Mississippi’s cotton fields were infested by boll weevils and growers applied multiple, close interval insecticides to keep boll weevils in check. Despite this heavy insecticide use, yield losses were still significant. Before the BWEP was initiated in 1995 the estimated annual yield loss attributed to boll weevils ranged from 0.2% to 6.5%. Yield losses were historically higher in the Hill region of the state than in the Delta and middle regions and occasionally exceeded 5% in the Hills. Beginning in 2000, and continuing in 2001, the eradication effort had reduced boll weevil populations to such low levels that no yield loss was attributed to this pest.

Chemical Control Information:

**Guanacol**
- Trade names are Vydate L, and Vydate C-LV. Approximately 60 percent of the cotton acres receive an application of guanacol each year. Applications are made primarily by air. Applications rates average 0.24 pounds a.i. per acre. Approximately 3 to 4 applications are made each growing season. The preharvest interval for Vydate C-LV is 14 days. The preharvest interval for Vydate L is 21 days. The restricted-entry interval for both products is 48 hours.

**Malathion**
- Trade names are Malathion ULV. Since the initial implementation of the Boll Weevil Eradication Program in 1996 the use of malathion for boll weevil control has increased rapidly. In 1999 15-20% of the cotton acres were treated with malathion for boll weevil control. In 2000 approximately 50% of the cotton acres were treated with malathion. Applications are made by air, with some by ground equipment. The rate for aerial applications is 0.05 pounds a.i. per acre. Approximately 1 to 3 applications are made each growing season. The preharvest interval is 7 days. The restricted-entry interval is 48 hours.

**Cyatholita**
- Trade names are Karate. Approximately 30 percent of the cotton acres receive an application of cyatholita each year to
control boll weevils. Applications are made by ground and air with a larger percentage being applied by air. Application rates average 0.03 pounds a.i. per acre. Approximately 2 to 3 applications are made each growing season. The preharvest interval is 21 days. The restricted-entry interval is 24 hours.

Chemical Control Information - Ovicides

Ranged from $34 to $57 per acre during recent years. Although yields were not affected in recent years, but a 23% yield loss was reported for the Hill Region in 1995. Costs of bollworm/budworm control using thiodicarb have been high. However, if the costs of the "technology use fee" are considered, the cost of controlling these pests has been lower. The majority of bollworm/budworm control is achieved through the use of thiodicarb.

Yield Losses and Prevalence:

Historically, the bollworm/tobacco budworm complex has been one of the most damaging pests of cotton. The tobacco budworm and tobacco budworm species attack cotton in a similar fashion. In Arkansas, bollworms and tobacco budworms are pests that are especially prevalent. Over the past 10 years, the tobacco budworm has become a more significant pest to control.

Critical timing of control measures:

Before bloom, treatment is recommended if the number of larvae reaches or exceeds 8 per 100 plants. From first bloom through cutout the threshold is 4 larvae per 100 plants but increases to 8 per 100 plants during the season. Female bollworm moths can lay from 250 to 1,500 eggs. In a normal season, there are usually about two generations, but some of those are on plants other than cotton. Normally, only two or three generations inflict important damage on cotton.

Life cycle:

These worms overwinter in the soil, in the pupa stage, after going through a preparation phase. The next generation may reach about 0.18 pounds a.i. per acre. The preharvest interval is 28 days. The restricted-entry interval is 12 hours.

Biological Controls:

There are few effective parasitoids or predators of boll weevils in the Mid-South. Fire ants are known to prey on developing larvae in foliar squares, but this predator does not provide effective biological control.

Control Alternatives:

There are few effective parasitoids or predators of boll weevils in the Mid-South. Fire ants are known to prey on developing larvae in foliar squares, but this predator does not provide effective biological control.

COTTON BOLLWORM and TOBACCO BUDWORM

The bollworm and tobacco budworm species comprise what is commonly referred to as the Heliothine complex. Both species belong to the Noctuidae Family of moths and attack cotton in a similar fashion. In Arkansas, bollworms and tobacco budworms are pests that are especially prevalent. Over the past 10 years, the tobacco budworm has become a more significant pest to control.

Critical timing of control measures:

Before bloom, treatment is recommended if the number of larvae reaches or exceeds 8 per 100 plants. From first bloom through cutout the threshold is 4 larvae per 100 plants but increases to 8 per 100 plants during the season. Female bollworm moths can lay from 250 to 1,500 eggs. In a normal season, there are usually about two generations, but some of those are on plants other than cotton. Normally, only two or three generations inflict important damage on cotton.

Life cycle:

These worms overwinter in the soil, in the pupa stage, after going through a preparation phase. The next generation may reach about 0.18 pounds a.i. per acre. The preharvest interval is 28 days. The restricted-entry interval is 12 hours.

Biological Controls:

There are few effective parasitoids or predators of boll weevils in the Mid-South. Fire ants are known to prey on developing larvae in foliar squares, but this predator does not provide effective biological control.

Control Alternatives:

There are few effective parasitoids or predators of boll weevils in the Mid-South. Fire ants are known to prey on developing larvae in foliar squares, but this predator does not provide effective biological control.
Mississippi cotton fields received very few applications of thiodicarb in 2001.

Cyromazine
Trade name is Bintrol. Applications are made by ground and air with a large percentage being applied by air. Application rates average 0.05 pounds a.i. per acre. The preharvest interval is 12 days. The restricted-entry interval is 24 hours.

Mississippi cotton fields received an average of 0.09 applications of cyromazine in 2001, which represented 2% of all foliar insecticide treatments.

Cyhalothrin
Trade name is Deltamethrin. Applications are made by ground and air with a large percentage being applied by air. Application rates average 0.05 pounds a.i. per acre. The preharvest interval is 12 days. The restricted-entry interval is 24 hours.

Mississippi cotton fields received an average of 0.13 applications of cyhalothrin in 2001, which represented 3% of all foliar insecticide treatments.

Cyfluthrin
Trade name is Baythroid 2. Applications are made by ground and air with a large percentage being applied by air. Application rates average 0.02 pounds a.i. per acre. The preharvest interval is 2 days. The restricted-entry interval is 12 hours.

Mississippi cotton fields received an average of 0.21 applications of cyfluthrin in 2001, which represented 5% of all foliar insecticide treatments.

Emetacontain
Trade name is Larvin 3.2. Applications are made by ground and air with the majority applied aerially. Application rates average 0.08 pounds a.i. per acre. The preharvest interval is 30 days. The restricted-entry interval is 12 hours.

Mississippi cotton fields received an average of 0.05 applications of esfenvalerate in 2001, which represented 1.2% of all foliar insecticide treatments.

Fenamiphos
Trade name is Curacron 8E. The majority of applications are made by air. Application rates average 0.05 pounds a.i. per acre. The preharvest interval is 14 days. The restricted-entry interval is 24 hours.

Mississippi cotton fields received an average of 0.18 applications of fenamiphos in 2001, which represented 4.2% of all foliar insecticide treatments.

Furadan
Trade name is Decis. Applications are made by ground and air with the majority applied by air. Application rates average 0.06 pounds a.i. per acre. The preharvest interval is 12 days. The restricted-entry interval is 12 hours.

Mississippi cotton fields received an average of 0.03 applications of deltamethrin in 2001, which represented 0.8% of all foliar insecticide treatments.

Indosarcar
Trade name is Lonate. This insecticide is primarily used to control caterpillar pests in non-Bt cotton. It is effective against bollworms, tobacco budworms, armyworms, and loopers. Applications are made with ground equipment and by air, with a recommended rate range of 0.04 to 0.11 lbs ai/acre. The preharvest interval is 12 days. The restricted-entry interval is 12 hours.

Mississippi cotton fields received an average of 0.31 applications of indosarcar in 2001, which represented 7.5% of all foliar insecticide treatments.

Control Alternatives: Enmeracane benzamid (Domin), which is currently under developed and has been used under Section 18 Emergency Status, is effective against bollworms and tobacco budworms, as well as more caterpillar pests. Transgenic Bt cotton whose been planted approximately 50% of Mississippi’s cotton acreage in 2001.

Cultural Control Practices: Transgenic Bt cotton varieties currently provide 100% control of tobacco budworms and approximately 60 to 70% control of bollworms. Early maturing varieties of non-Bt cotton may escape damage from the last, and heaviest, generations of bollworms and budworms. Varieties exhibiting the “high-gland” trait possess some resistance to budworms and budworms. Smooth-stalk varieties are less attractive to emerging pests than are varieties with more hairy leaves. Fields planted using no-till methods benefit from enhanced biological control of bollworm budworm due to increased conservation of the soil, which are important predators of bollworm budworm.
Thrips

Thrips are a common (i.e., yearly) problem for most cotton producers in the Mid-South. Thrips infest cotton in the young seedling stage and severe thrips damage can stunt growth and reduce yield potential. As a result, most cotton is treated with an in-furrow insecticide to prevent the development of damaging populations and consequently thrips are rarely a devastating problem, cotton.

The damage done by the pests: Thrips have punch and suck or piercing sucking mouthparts, which allow them to punch a hole in a leaf cell, insert their mandibulate stylets, and siphon the cellular fluids. When it occurs on leaves and other plant parts that have already expanded, this type of injury causes little or no significant harm to the plant. However, when such injury occurs within the terminal bud, on tiny developing leaves and fruiting structures, the effect can be quite different.

When thrips feed on the young undamaged leaves within the terminal bud, the resulting damage is magnified on those leaves later developed and expanded. This is because the damaged tissues fail to develop properly, while undamaged tissue continues to grow. After prolonged feeding or feeding by high numbers of thrips, seedlings have a ragged appearance, with visible Injury that results on cutleaf and terminal bud tissue. Over time these silver areas will become brown in color. Heavily infested leaves usually have a chipped, tattered appearance and often curl upward at the margins. Seedlings exhibiting this type of injury are often described as “brown curled cotyledon.” Heavily thrip-populated cottons can stunt growth, cause death of the terminal bud (resulting in “crazy cotyledon”), delay flowering and reduce yields. Thrips damage often is magnified by cool weather or drought, which can slow plant growth and lengthen the developmental time and increase the probability of yield reducing injury. Seedlings that emerge under warm, favorable growing conditions are much less likely to succumb to thrips injury than those that emerge under conditions conducive to slow seedling development.

Life cycle: Egg — four days; larva — six days; sucking two to four days; egg — adult — 14 to 18 days. These periods are shorter in the poppy stage in plant growth. Thrips begin reproducing in early spring on non-cotton host plants, such as grasses, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, late-sown cotton, as grains, early blooming weeds, and legumes. Once the early host plants toughen, thrips move quickly into cotton fields. In many areas of the Cotton Belt, thrips migrate into cotton about the time wheat is cut. When the pests migrate, lat
Tarnished Plant Bug (TPB) is an important pest of cotton throughout Mississippi. However, it is relatively more important in the Delta Region of the state than in the Hills. TPB is considered a “key” pest of cotton because it often reaches economically damaging levels during the early portion of the season and insecticides applied to control these early plant bug infestations often result in populations of secondary pests, such as aphids or tobacco budworms. Before July, no control efficacy of the important TPB is a key part of cotton pest management. Due to the success of the TPB control efforts, the wide spread adoption of Bt-cotton, the importance of TPB has increased in recent years. Not only has the TPB infestations and bollworms declined in importance, but the reduction in gypsy moth control has reduced these infestations as well. As a result, the number of gypsy insects required specifically to control TPB has increased in recent years, especially in the Delta.

The damage done by the pest: All plant bugs have piercing mouthparts used to suck plant juices. Porthole squares are primary targets. Soon after damage, the small square turns brown and dead. Pre-squaring cotton is not safe from damage, since the infestations attack growing portions of the plants and interfere with the proper development of the squares. Plant bugs, in this case, distort the leaves and the young, tender terminals of the cotton plant. This injury can be serious enough to cause the plants to drift into exaggerated growth, with cotton branches becoming long and whip-like. In many cases, the cotton never really recovers. Damage symptoms sometimes cause “stunt cotton” whose plants are severely stunted and stay in a pattern of fruitless growth for several weeks.

Severe infestations often develop quickly because these pests may build up into a massive population on another host, such as spring blooming weeds along roadsides. When the first host plant is cut or becomes tough, plant bugs migrate quickly into cotton and growers are faced with a full-blown plant bug problem just a day or two after the shelling plant faltering. Flowers are also attacked by some plant bug species, causing warty growths on flower petals and brown spots on stamens and pods. Plant bugs lay eggs inside cotton stems near the top of the plant. The pests usually lay very small eggs in groups that normally are impossible to detect.

Life cycle: The rapid plant bug and tarnished plant bug: eggs - 10 to 15 days; nymphs - 15 to 20 days; number of life stages - five. Clouded plant bug: eggs - 12 to 14 days; nymphs - 10 to 18 days; number of life stages - five. All plant bugs are multiple-host insects and spend most of the season on other hosts, which they prefer over cotton.

The damage done by the pest: TPB infestations can result in substantial yield reductions. In research plots, yield reductions of 15% to 55% have been documented for plants infested with one to four bugs per plant. During the past ten years, estimated annual yield losses attributed to plant bugs in Mississippi cotton have ranged from 0.2% to 3.6%, with losses as high as 4.7% being reported for the Mississippi Delta.

Critical timing of control measures: Treatment thresholds for tarnished plant bugs depend on the stage of crop development and method of sampling. During the post-bloom stage, thresholds may be adjusted downward if square retention drops below 80%.

Stage of Crop Treatment Threshold:

- Pre-squaring: 1 bug per 10 feet of row
- 1.2 weeks of squaring: 6 bugs/100 sweeps
- 3 weeks of squaring to bloom: 10 bugs/100 sweeps
- After first bloom: 15 bugs/100 sweeps or 3 bugs per 6 row foot

Yield losses and Prevalence: Tarnished plant bugs may be found in all Mississippi cotton fields. Prolonged heavy TPB infestations can result in substantial yield reductions. In recent plots, yield reductions of 15% to 55% have been documented for plants infested with one to four bugs per plant. During the past ten years, estimated annual yield losses attributed to plant bugs in Mississippi cotton have ranged from 0.2% to 3.6%, with losses as high as 4.7% being reported for the Mississippi Delta.

Chemical Control Information:

Oxamyl
Trade names are Vydate C-LV and Vydate L. Applications are made by ground and air with the majority applied with ground equipment. Application rates average 0.25 pounds a.i. per acre. The preharvest interval is 14 days for Vydate and 28 days for Vydate C-LV. The restricted-entry interval for both formulations is 48 hours.

Thiamethoxam
Mississippi cotton fields received an average of 0.56 applications in 2001, which represented 12.9% of all foliar insecticide treatments.

Dicrotophos
Trade name is Vydate C-LV and Vydate L. Applications are made by ground and air with the majority applied with ground equipment. Application rates average 0.24 pounds a.i. per acre. The preharvest interval is 48 hours for Vydate C-LV. The restricted-entry interval for both formulations is 48 hours.

Control Alternatives:

- Oxamyl: Vydate C-LV and Vydate L
- Thiamethoxam: Vydate C-LV and Vydate L
- Dicrotophos: Vydate C-LV and Vydate L

The damage done by the pest: TPB infestations result in less coincidental control of TPB. As a result, the number of sprays required specifically to control TPB has increased in recent years, especially in the Delta.
Both indica and G. barbadensis cotton (Dorin), which are primarily cultivated in the southern and southeastern United States, are susceptible to a wide range of pests and diseases. Among these, aphids are a significant pest, causing damage to cotton plants by feeding on their sap and excreting honeydew, which attracts sooty molds. This can lead to reduced yields and quality losses.

### Aphids

**Life cycle:**
Female aphids are capable of giving birth to live young throughout the year, continuously reproducing without the need for a male. Under favorable environmental conditions, aphids can multiply rapidly under high temperatures and may develop the equivalent of a new generation every five days.

**Frequency of occurrence:**
Aphids tend to be a frequent pest in cotton when early applications of insecticides have been made to control other pests such as boll weevils or tarnished plant bugs. The reproductive rates of aphids can be influenced by environmental conditions such as temperature and humidity.

**Critical timing of control measures:**
Aphids build up relative to the blooming period of the cotton plant. Therefore, treatments should be applied when populations are building and aphids are present on approximately 50% of the cotton plant.

### Control Alternatives:

#### Biological Controls:
- **Nezara viridula**: Stink bugs are a frequent pest of a portion of Arkansas cotton each year. In recent years estimated yield losses attributed to aphids have ranged from 0.2% to 0.9%. However, yield losses as high as 220 lbs of lint per acre have been documented for extremely heavy, prolonged aphid infestations. The yield impact of aphid infestations can vary considerably, depending on environmental conditions. In some research trials no yield loss resulted from heavy infestations exceeding 100 aphids per square foot. However, yield losses as high as 220 lbs of lint per acre have been documented for extremely heavy, prolonged aphid infestations. In recent years estimated yield losses attributed to aphids have ranged from 0.2% to 0.9%.

#### Chemical Control Information:
- **Thiamethoxam (Prevail)**: The trade name is Centric; first labeled for use on cotton in 2001. Application rate is 0.047 lbs a.i. per acre. The preharvest interval is 14 days. The restricted-entry interval is 12 hours.
- **Imidacloprid (Calypso)**: The trade name is Centric; first labeled for use on cotton in 2001. Application rate is 0.047 lbs a.i. per acre. The preharvest interval is 14 days. The restricted-entry interval is 12 hours.
- **Thiacloprid (Assail)**: The trade name is Centric; first labeled for use on cotton in 2001. Application rate is 0.047 lbs a.i. per acre. The preharvest interval is 14 days. The restricted-entry interval is 12 hours.
- **Acetamiprid (Assail)**: The trade name is Centric; first labeled for use on cotton in 2001. Application rate is 0.047 lbs a.i. per acre. The preharvest interval is 14 days. The restricted-entry interval is 12 hours.
- **Carbofuran (Furadan)**: Highly effective against cotton aphids and has been used successfully in a number of Section 18 Emergency Exemptions. Application rates range from 0.025 to 0.047 lbs a.i. per acre. The preharvest interval is 21 days. The restricted-entry interval is 12 hours.
- **Imidacloprid (Calypso)**: The trade name is Centric; first labeled for use on cotton in 2001. Application rate is 0.047 lbs a.i. per acre. The preharvest interval is 14 days. The restricted-entry interval is 12 hours.
- **Thiacloprid (Assail)**: The trade name is Centric; first labeled for use on cotton in 2001. Application rate is 0.047 lbs a.i. per acre. The preharvest interval is 14 days. The restricted-entry interval is 12 hours.
- **Thiamethoxam (Prevail)**: The trade name is Centric; first labeled for use on cotton in 2001. Application rate is 0.047 lbs a.i. per acre. The preharvest interval is 14 days. The restricted-entry interval is 12 hours.
- **Imidacloprid (Calypso)**: The trade name is Centric; first labeled for use on cotton in 2001. Application rate is 0.047 lbs a.i. per acre. The preharvest interval is 14 days. The restricted-entry interval is 12 hours.

### References:

- **Aphids**: A. P. Leary
- **Stink Bugs**: C. L. Brown

More information can be found in the cited sources for detailed biological and chemical control strategies for aphids and stink bugs in cotton fields.
Several species of stink bugs may occur in cotton. These include the southern green stink bug, *Nezara viridula*, the green stink bug, *Acrosternum hilare*, and several species of brown stink bugs belonging to the genus *Euschistus*. Of these brown stink bugs, *Euschistus servus* is the most common species found in cotton. Several other species of stink bugs may be found occasionally in cotton fields, but these rarely occur in large numbers.

**Biology**: Stink bugs are found on a large number of agricultural crops, including soybeans, corn, and grain sorghum. Crops or weeds bearing immature seeds are especially favored, as are all species everywhere in early spring and bug threat decreasing as seed bearing crops such as wheat, clover, and various weeds. Small nymphs often feed on vegetation portions of the plants, but larger nymphs and adults prefer to feed on developing seeds. The brown-stained eggs are laid in clusters which hatch in seven to twelve days. Of about 5 nymphal instars. Newly emerged nymphs usually remain clustered together, but disperse as they grow older. Development rate is temperature dependent, but at normal summer temperatures the time to complete one generation is approximately 45 to 50 days. There are approximately three generations per season.

**Control**: Effective control of stink bugs depends on the application of foliar insecticide sprays that are applied properly. Stink bugs have ranged as high as 3.8%. And, it is anticipated that the importance of stink bugs will increase considerably in the plant. Historically, the percent yield loss attributed to stink bugs in the Mid-South has been near zero. However, in years when stink bug populations are high, yield reductions of 10% to 20% have been reported. Yield reductions in cotton fields located near fields of corn, grain sorghum, or early-spring hosts, such as wheat, are more likely to experience infestations. Yield effects of stink bug injury are dependent on the percent injury and the age of the plant. Early-summer hosts, such as soybeans, are especially susceptible to invasion by stink bugs. If such cotton fields are receiving a lot of foliar insecticide treatments, the potential for stink bugs to cause damage by lower leaves to even greater.

**Damage**: Although stink bugs feed on vegetation parts of the plant and will occasionally feed on fruits, feeding injury to bolls is the most common type of stink bug damage to cotton. Both adults and large nymphs are capable of damaging bolls. Stink bugs have piercing-sucking mouthparts, which they use to pierce the boll wall and feed preferentially on the developing seed. Immature stink bug feeding in the bolls has been shown to reduce the number of seeds per boll and the lint quality of the cotton. In addition, stink bug feeding in the bolls may cause a delay in boll opening. Depending on the severity of the feeding and the age of the boll, bolls that have been fed upon by stink bugs may be completely destroyed or they may open normally and produce a normal amount of lint.

**Yield Losses and Prevalence**: Low numbers of stink bugs can be found in most Mid-South cotton fields, especially during the latter portion of the growing season. The potential for stink bug infestations is greater following heavy rainfalls, which favor survival of the southern green stink bug. Cotton fields located near fields of soybeans, corn, or early-spring hosts are most likely to experience infestation. Yield effects of stink bug injury are dependent on the percent injury and the age of the plant. If the damage appears in the cotton field during the latter part of the growing season, damage is often more pronounced in the upper portions of the plant. Stink bug feeding in the bolls has been shown to reduce the number of seeds per boll and the lint quality of the cotton. In addition, stink bug feeding in the bolls may cause a delay in boll opening. Depending on the severity of the feeding and the age of the boll, bolls that have been fed upon by stink bugs may be completely destroyed or they may open normally and produce a normal amount of lint.

**Chemical Control Information**:

**Acephate**: Trade name is Orthene from 90 and Orthene from 75. The type of application is evenly divided between ground and air equipment. The recommended rate for stink bug control is 0.75 to 1.0 lbs ai/acre. The preharvest interval is 21 days. The restricted-entry interval is 24 hours.

**Deltamethrin**: Trade name is Decis. Applications are made by ground and air with a larger percentage being applied by air. Application rates average 0.013 to 0.019 pounds a.i. per acre. The preharvest interval is 21 days. The restricted-entry interval is 12 hours. The trade name is Bifenthrin 2L. Applications are made by ground and air with a larger percentage being applied by air. Application rates average 0.06 pounds a.i. per acre. There is no preharvest interval. The restricted-entry interval is 12 hours.

**Cyhalothrin**: Trade name is Trelona from 2E. Applications are made by ground and air with a larger percentage being applied by air. Application rates average 0.6 pounds a.i. per acre. There is no preharvest interval. The restricted-entry interval is 12 hours.

**Dicrotophos**: The trade name is Dicro. Applications are made by ground and air with a larger percentage being applied by air. Application rates range from 0.01 to 0.03 pounds a.i. per acre. The preharvest interval is 21 days. The restricted-entry interval is 12 hours.

**Cypermethrin**: Trade name is Fenamiphos. Applications are made by ground and air with the majority applied with ground equipment. Rates of 0.0 to 0.05 pounds a.i. are required to control stink bugs. The preharvest interval is 48 hours. The restricted-entry interval is 24 hours.

**Methyl Parathion**: Trade name is Methyl Parathion Oil and Parathion M. The type of application is evenly divided between air and ground equipment. The use rate is 0.5 lbs ai/acre. The preharvest interval is 7 days. The restricted-entry interval is 48 hours.

**Tr Branam**: Trade name is Sevenc X-Tra, and Sevenc X-Tra Gel. The application method is evenly divided between air and ground. Application rates average 0.02 pounds a.i. per acre. The preharvest interval is 28 days. The restricted-entry interval is 14 days.
The most common materials used in the Midsouth:

1. The materials most commonly used in the Midsouth are Apron, Thiram, Vivatax-PCNB, RTU-Baytan/Thiram, Baytan 30, with seedling disease, the use of more than one seed-applied fungicide is suggested.

Rhizoctonia. Because several disease-causing organisms may be involved in combinations of two fungicides under a single trade name. In combinations, one fungicide is active against one host plants. Spreader-sticky granules occur along leaflets and buds where the spreader-sticky granules on seeds and other host plants. Spreader-granules are a greater problem during growing seasons when average less than the expected rainfall. Concomitantly, seed-sticky granules by coating the young plant in the soil line and roots on field by field basis. Rarely, large numbers of seeds affected by seedling. Seed and seedling granules occur primarily in the more southern areas of the region during late summer. Populations of hot spot areas and seedling granules commonly build up to large populations until late summer. Likewise, sprays, primarily the seedling granules, are occasional, late-season pests that are more common in the more southern areas of the region.

Despite their status as minor or occasional pests, each of these species has the potential to cause severe crop injury when they occur in seedling numbers. Hot spot areas in an excellent example of this. In 1993 hot spot areas was the most damaging phase of Mississippi cotton, causing an estimated 8-9% yield loss, despite control expenditures of approximately $37,000. A NPS’s yield reduction was attributed to a serious outbreak of hot spot areas that occurred in the Lower Rio Grande Valley of Texas in 1993. Therefore, it is critical to maintain knowledge of PPM tools that can help prevent these minor and occasional pests from reaching outbreak levels and to maintain an arsenal of insecticides that will be effective against these minor or occasional pests when outbreaks do occur.

Other Insect Pests Of Cotton:

Other spores or occasional pests such as spider mites, whiteflies, caterpillars, beet armyworms, full armyworms, and looper occur sporadically throughout the Mid-South, but do not occur in economically damaging numbers every year. Spider mite outbreaks occur along field borders and roadsides where the spider mite ovipositors or winter work and other host plants. Spider mite stasis a greater problem during growing seasons when average less than the expected rainfall. Concomitantly, seed-sticky granules by coating the young plant in the soil line and roots on field by field basis. Rarely, large numbers of seeds affected by seedling. Seed and seedling granules occur primarily in the more southern areas of the region during late summer. Populations of hot spot areas and seedling granules commonly build up to large populations until late summer. Likewise, sprays, primarily the seedling granules, are occasional, late-season pests that are more common in the more southern areas of the region.

Despite their status as minor or occasional pests, each of these species has the potential to cause severe crop injury when they occur in seedling numbers. Hot spot areas in an excellent example of this. In 1993 hot spot areas was the most damaging phase of Mississippi cotton, causing an estimated 8-9% yield loss, despite control expenditures of approximately $37,000. A NPS’s yield reduction was attributed to a serious outbreak of hot spot areas that occurred in the Lower Rio Grande Valley of Texas in 1993. Therefore, it is critical to maintain knowledge of PPM tools that can help prevent these minor and occasional pests from reaching outbreak levels and to maintain an arsenal of insecticides that will be effective against these minor or occasional pests when outbreaks do occur.

Diseases

Seedling disease identifies a complex situation involving the interaction of several organisms and the environment. Certain fungi that cause these seedling diseases are carried either on or in the seed. Other fungi live from season to season in the soil and can attack the seed or seedling. The organisms that cause seedling disease are found in all cotton-growing areas of the United States, but populations differ from area to area. Soil-borne pathogens most commonly involved in the seedling disease complex in the Southeast are Rhizoctonia, Fusarium, and Pythium.

Identification Of Seedling Diseases:

Seedling diseases may cause many different effects on cotton plants. These may be grouped into three general phases.

SEED ROT:

A number of organisms in the soil and on or in the seed can cause seed rot. Seed decay can result from poor handling of seed during harvest or from poor storage conditions. Such seed tend to be low in ability to live and easy prey for seed-rotting organisms.

SEEDLING ROT:

Premature seedling rot describes the loss of a cotton seedling to disease before the time the seed germinates and emerges from the soil. The infection is usually seen as a soft rot or lesions on the expanding root and stem.

DAMPING OFF:

Premature damping off is a phase of the disease occurring at any time during the first part of the growing season. "Sensitized" is another name for this stage of the disease. At first, plants are more radial and lighter green than normal. As the disease progresses, the plants begin to show midday wilting, and lesions appear near the soil line. These lesions are light brown at first but turn progressively darker until the whole area takes on a black "wet-soil" appearance. Plants eventually die, leaving an uneven stand.

Control:

Seed Treatments:

All cotton seed used for planting should be treated with a fungicide. Seed-treatment fungicides are sold individually or in combinations of two fungicides under a single trade name. In combinations, one fungicide is active against Fusarium, while the other is active against Pythium. Because several disease-causing organisms may be involved in seedling disease, the use of more than one seed-applied fungicide is suggested.

The materials most commonly used in the Mid-South are Apron, Thiram, Vivatax-PCNB, RTU-Baytan/Thiram, BAYTAN 30, and other biological fungicides such as System 3, Kodiak HB Biological, Delta Coat AD, and Accruent AD.

Soil Treatments:

1. Planter Box - Planter box is the best effective of the soil treatments, but it is better than no additional treatment. If equipment is not available for the in-furrow fungicide applications, use a planter box treatment. Following are the most common materials used in the Mid-South:

<table>
<thead>
<tr>
<th>Planter Box Fungicides</th>
<th>Rate/50 lb seed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Delta Coat AD</td>
<td>5.75 - 11.75 oz</td>
</tr>
<tr>
<td>Peroral</td>
<td>4 - 16 oz</td>
</tr>
<tr>
<td>Kodiak HB Biological</td>
<td>4 - 16 oz</td>
</tr>
<tr>
<td>System 3</td>
<td>25 oz</td>
</tr>
</tbody>
</table>

Methods of Application: Soil fungicides cannot be applied well by the hopper-box method with acid-delinted seed unless the seeds and fungicides are properly layered in planter box. When mixed well with seed, some fungicides will fall out with each seed to treat the soil around it. Fungicides may reduce the seedling rate by 10-20 percent, so you must calibrate the planter with the seed and fungicide mixture to get the desired seeding rate.

The hopper-box method is less expensive than in-furrow spray and in-furrow granules, but the method is also less effective. When used properly, the method gives better results than do seed treatments alone.

2. In-the-Furrow Granules - In-furrow granules have given about the same degree of seedling disease control as in-furrow
Chemical Control Information:

**Fungicides**

<table>
<thead>
<tr>
<th>Fungicide</th>
<th>Drill rate/acre</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ridomil Gold PC</td>
<td>1¼ - 2½ lb</td>
</tr>
<tr>
<td>Ridomil Gold</td>
<td>1½ - 2½ lb</td>
</tr>
<tr>
<td>Ridomil 5G</td>
<td>1¼ - 2½ lb</td>
</tr>
<tr>
<td><em>For broader spectrum disease control, apply as</em></td>
<td></td>
</tr>
</tbody>
</table>

3. In-the-Furrow Sprays - The process mixes more fungicide with the soil to give a greater zone of protection around the germinating seed and young seedling.

For best results, the fungicide is applied through two cone-type nozzle tips. The front cone-type nozzle is mounted just behind the seed-drop outlet to treat the soil around the seed. Direct the rear nozzle to spray soil as it is tumbled into the seed furrow, with a small amount of spray striking the top of the covered row.

- Chemical Control - A number of cultural practices lower the risk of seedling disease. Early culturing and churning of stubble soil in the control of seedling disease by cutting down on the amount of inoculum that carries over from year to year. Also, it is important to prepare a good seedbed for seedling disease control. Raised beds give some control to seedling disease, especially in early-planted cotton.

- Soil pH - Maintain soil pH 6.0 to 6.5. Extremely low pH favors the development of some cotton seedling diseases. A pH of 6.5 or 6.5 not only encourages vigorous plant growth but also suppresses certain diseases.

- Soil Temperature - Avoid planting when soil temperatures are below 68 °F. At this temperature, germination is slow and the seeds and seedlings are more vulnerable to infection.

- Seed Quality - Poor-quality seeds with low germination rates are much more susceptible to seedling diseases than are high-quality seeds. Seeds with high germination usually produce more vigorous, healthy seedlings even under adverse conditions.

- Soil Treatment - All cotton seeds used for planting should be treated with fungicide. Seed-applied fungicide helps to prevent diseases caused by organisms carried on the seed surface and is the most important and economical method for controlling seedling disease. Seed treatment is not a substitute for high-quality seed but is a supplement.

- Soil Treatment - Seed fungicide is good insurance for getting a good stand of cotton. All producers should use at least a planter-box fungicide in addition to a seed treatment.

If getting a stand (from seedling disease) is a problem one out of three years, an in-the-furrow granular or spray treatment would be economical.

**Chemical Control Information:**

**Metalaxyl** - Trade name is Allegiance (seed treatment). Approximately 3% of the cotton acreage in MS is planted using metalaxyl treated seed. Metalaxyl is effective in controlling Pythium seedling disease. Application rates average 0.75 to 1 fluid ounce per 100 pounds of seed. The REI for Allegiance is 24 hours unless the seed is treated and the treated seed is soil incorporated or soil injected. The pre-harvest interval is not applicable.

**PCNB** - Trade names are Terramol 2E, Terramol Super X (When combined with etridiazole), Terramol Super X + Disyston EC, Terramol 1HG, Terramol 75 WP, and Ridomil Gold PC (mefenoxam + PCNB). At least 20 percent of the cotton acreage receives a single in-furrow PCNB application at planting to control seedling diseases. Application rates average from 0.5 to 1.0 pounds a.i. per acre. PCNB is effective in controlling Rhizoctonia. The REI for PCNB is 24 hours unless it is soil incorporated. The pre-harvest interval is not applicable.

**Methylban** - Trade name is Ridomil Gold PC (mefenoxam + PCNB). At least 3 percent of the cotton acreage receives a single in-furrow methylban application at planting to control seedling diseases. Application rates range from 7 - 10 pounds per 5,000 linear feet of row. The REI for the product is 48 hours unless it is soil incorporated or soil injected. The pre-harvest interval is not applicable.

**Nematodes**

Three species of nematodes occur in Mississippi that can cause economic yield losses in cotton. These are the root-knot nematode (Meloidogyne incognita), the reniform nematode (Rotylenchulus reniformis), and the lance nematode (Hoplolaimus(andersoni)). In Mississippi, approximately 75 percent of the cotton soil samples submitted during 2000 tested positive for either root knot or reniform nematodes. Over a twenty year period, root knot nematode presence has remained relatively low. Reniform nematode populations began to increase during the late 1980’s and have increased each year since.

The average yield loss caused by these three nematode species, beyond any control measures, on Mississippi cotton is 5.3% (1995-2000). The Mississippi Delta suffers from medium to high populations of root-knot and reniform nematodes with yield losses proving to be substantial. Research also shows a definite reduction between reniform nematodes and cotton seedling disease. Total field loss is possible in severe situations.

The symptoms associated with nematodes are often mistaken for other problems such as nutritional imbalance, soil compaction, and water stress. Necrotic root galls are associated with root-knot nematode infection, while reniform nematodes do not cause galls.

Crop rotation is generally the most cost-effective method of nematode control over time, but rotational crops may be of relatively low economic value. Production of rice, corn, grain sorghum, or peanut, or resistant sorghum cultivars for one or two years in rotation with cotton may improve crop performance by lowering nematode populations.

Careful selection of rotation crops, based on the nematode species to be controlled is essential.

**Chemical Control Information:**

- Conventional cotton varieties with root-knot Fusarium root rot tolerance are Sonora LS 487, Delphina 50, Delphina 51, Bangor 139 and Binneckville 152. These varieties will perform satisfactorily if the root knot nematode population is not too high. No-current cotton varieties are resistant to reniform nematodes. Thaysonic cotton varieties are currently being evaluated for nematode resistance.
Weeds

Good weed control is not an accident—it’s planned. Successful weed control depends on preparing a smooth, firm seedbed, a vigorous-growing stand of cotton, proper rates and placement of fertilizer, disease control, and a well-till manured. All of these cotton-production practices contribute to a good-quality stand of cotton and ease in weed control.

A planned weed control program is based on knowledge of the weed problem. Most fields are infested with grass and broadleaf weeds. Herbicides generally do not control both equally well, so preplant, preemergence, and postemergence herbicides along with cultivation are needed.

Preplant Incorporated Herbicides:

The herbicides Protral and Tofuran are similar in the weeds they control. Both provide excellent grass control, good control of many small-seeded broadleaf weeds, and post-emergence control of sedges, large-seeded broadleaf, and most perennials.

Both of these herbicides are fairly volatile. On a warm, windy, cloudy day, losses from not incorporating for 24 hours average 15 percent for Protral and 10 percent for Tofuran. Poor incorporation is the greatest source of weed control failure. For best control, apply herbicide to a fairly dry, well-pulverized soil, and mix thoroughly. Application to soils that have not been tilled or tilled needs in high herbicide levels and poor incorporation. Two passes with the equipment to incorporate 1 to 2 inches deep are generally preferred. Since these herbicides can prevent normal development of small cotton roots, incorporation on a scrunched row reduces injury.

Cold, wet weather, excessive rates, low organic matter soils, swolling disease, banded fertilizers, and other herbicide applications may intensify cotton injury.

Preemergence Weed Control:

Preemergence herbicides are applied at planting, before weeds emerge, to provide control during cotton emergence and early growth.

Preemergence herbicides control most small-seeded, annual broadleaf weeds and grasses such as crabgrass, pigweed, sunflower, and lambsquarter. Preemergence herbicides alone will not effectively control many of the larger-seeded annual broadleaf and perennial weeds such as cocklebur, morningglory, intercrop, and monolóż. Since preemergence herbicides normally are applied on the soil surface after planting, little or no weed control occurs until they are moved into soil by rainfall. If rainfall is delayed, a light rotary hoeing sometimes improves performance but must be done without damaging the cotton.

All preemergence herbicides can damage young cotton or reduce or destroy stands if high concentrations of the herbicides come in contact with the germinating seed or young seedling. Cotton appears to be more tolerant to Zorial than to Prowl and Treflan on cotton in the first planting. The herbicides Prowl and Treflan are similar in the weeds they control. Both provide excellent grass control, good control of many small-seeded broadleaf weeds, and post-emergence control of sedges, large-seeded broadleaf, and most perennials.

Tests of some commercial incorporators indicate that ground-driven band equipment gives incorporation approximately half the incorporation depth. With power-driven, rotary-tiller-type incorporation, the chemical is applied to the depth the machine operates. Rotary hoes, rolling cultivators, or gang disks can seal on a broadcast basis. You will get better results by making two passes over the field with rotary hoes or rolling cultivators. If you use gang disks, they should not be deeper than 3 inches. The spray booms is usually mounted on the tractor and the chemical applied at the first disking. The second or cross disking is sometimes postponed until later planting time.

Maintain a speed of 3 mph or more with ground-driven incorporating equipment. Some of the equipment described may not be limited on company labels, so read labels carefully before incorporating herbicides.

<table>
<thead>
<tr>
<th>Crop, weed, or situation and active chemical per treated land acres</th>
<th>Formulation needed to treat 1 acre broadcast</th>
<th>Time of application</th>
<th>Weeds controlled</th>
<th>Special instructions and remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preharvest/Postharvest/Prenocrop/Foliar</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Preharvest/Postharvest/Prenocrop/Foliar herbicide applications are designed to provide residual control of winter annuals and hard-to-control grasses. Applications can be made during or after fall tillage, up to various time intervals prior to planting, depending on which herbicides are used. Full application of residual herbicides can reduce the need for sprout flax or spring broadcast herbicides. However, surrounding residues can persist in any row so it is possible to control certain broadleaf weeds. Also, full application of most herbicides eliminates the possibility of getting control costs in the following season.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fenoxaprop at 0.5 to 1.25 lb/A</td>
<td>Zerital Rapid 80 — 1.0 to 1.5 lb/A</td>
<td>Surface applied in fall after final disking or bud formation</td>
<td>Annual bluegrass, chickweed, burdocks. Poor control of kochia and Carolina geranium.</td>
<td>Do not exceed broadcast rates of 0.125 lb/A for light soils, 0.25 lb/A on medium soils, or 0.5 lb/A on heavy soils in any one year.</td>
</tr>
<tr>
<td>fluazifop at 1.0 to 1.25 lb/A</td>
<td>1 X 51.5 g/L formulation — 2 to 2.5 g/pt</td>
<td>Apply and incorporated any time between Oct. 15 and Dec. 31. May be fall flax or banded.</td>
<td>Annual bluegrass, chickweed, and other winter annuals.</td>
<td>Do not apply to test soils or soils subject to prolonged flooding.</td>
</tr>
<tr>
<td>pendimethalin at 0.75 to 1.0 to 1.5 lb/A</td>
<td>PRO Trials Express 53 EC — 1 to 2.4 to 3.6 lb/A</td>
<td>After Dec. 15 up to 140 days prior to planting</td>
<td>Most winter annuals and other small-seeded annuals.</td>
<td>Incorporation within 7 days of application if tillage does not occur. Do not apply to test soils or soils subject to prolonged flooding.</td>
</tr>
<tr>
<td>cyhalofop at 1.5 to 2.5 lb/A or 0.5 lb/A</td>
<td>1 X 51.5 g/L formulation — 2 to 2.5 g/pt or 0.5 g/pt</td>
<td>20 to 60 days prior to planting; or 7 days prior to planting if 0.5 lb/A is used.</td>
<td>Residual control of most winter annuals including annual bluegrass, kochia, chickweed, small-seeded annuals.</td>
<td>Use 1.5 g/A on leaning walls with less than 2% organic matter or in other soils with less than 2% organic matter. Use 2.5 g/A on medium to heavy soils with more than 1% organic matter up to 2 days before planting. Adding ammonium, superphosphate or MSMA will improve herbicide of emerged weeds when the 0.5 lb/A rate is used.</td>
</tr>
<tr>
<td>Herbicide</td>
<td>Rate</td>
<td>Formulation</td>
<td>Application Timing</td>
<td>Use Notes</td>
</tr>
<tr>
<td>-----------</td>
<td>------</td>
<td>-------------</td>
<td>--------------------</td>
<td>-----------</td>
</tr>
<tr>
<td>pendimethalin at 0.5 to 0.75 to 1.5 lb/A</td>
<td>Prowl/Pendimax 3.3EC</td>
<td>1.2 to 1.8 to 3.6 pt in 5 gal water by air or 10 gal water by ground.</td>
<td>Residual control of most winter annuals, especially henbit. Postemergence control of hardwoods, common groundsel, and shepherdspurse up to 4-leaf stage with the addition of suitable surfactant. Fair control of clover.</td>
<td>Consult label to determine rates for weeds and growth stages. Include nonionic surfactant at 0.25% v/v. If applied in the spring following a full application the total amount applied cannot exceed 2.0 lb ai/A. Use higher rate for more vigorous weeds. Residual control must be applied at least 21 days before planting. Consult label for added restrictions following a full application.</td>
</tr>
<tr>
<td>norflurazon at 1 to 1.5 to 2 lb/A</td>
<td>Zorial 80 DF</td>
<td>1.25 to 1.9 to 3.5 lb in 10 to 20 gal water.</td>
<td>Most annual grasses and small-seeded broadleaf weeds. Good to excellent control of prickly sida and good control of johnsongrass.</td>
<td>Use lower rate for shorter term (cool winter, early spring) applications. Use higher rate for longer residual (full, early winter) applications. Use higher rate for larger weeds. Neutralize irrigation should occur within 3 to 4 weeks after application and soil should be left undisturbed during the period of desired weed control.</td>
</tr>
<tr>
<td>paraquat at 0.625 to 0.94 lb/A</td>
<td>Gramoxone Extra (2.5 lb/gal)</td>
<td>2 to 3 pt in 20 gal water by ground equipment or 5 gal by air. Add 1 qt nonionic surfactant per 100 gal of spray mix unless formulation contains surfactant.</td>
<td>Most annual grasses and small-seeded broadleaf weeds such as crazygrass, chickweed, henbit, and buttercup. Apply to young actively growing weeds. Allow 1 to 3 weeks after application for full control. May be mixed with other preplant herbicides to broaden weed spectrum.</td>
<td>Avoid drift to nearby crops or areas not intended to be treated. Do not use with galvanized (zinc coated) spray equipment. Apply a preplant or preemergence herbicide to control johnsongrass from small.</td>
</tr>
<tr>
<td>MSMA at 2.0 lb/A</td>
<td>MSMA</td>
<td>2.5 to 3.3 fl oz per gal formulation in 10 to 20 gal water. Add 1 qt nonionic surfactant to each 1 gal of spray mix unless formulation contains surfactant.</td>
<td>Most annual grasses and cloverklee. Weak on most other broadleaf weeds. Top kill of johnsongrass.</td>
<td>Avoid where planting was delayed and weeds have emerged. Control decreases in cool weather. Cotton may be planted immediately after spraying.</td>
</tr>
<tr>
<td>glyphosate/sulfosate at 0.5 to 1.0 lb/A</td>
<td>Roundup Ultra 4AS or 0.75 to 2.33 pt Touchdown 5AS</td>
<td>After weed emergence up to 3 to 7 days before planting. Touchdown must be applied at least 35 days before planting.</td>
<td>Touchdown may be mixed with other preplant herbicides to broaden weed spectrum.</td>
<td>Include 0.25% v/v nonionic surfactant with Touchdown. Use higher rate for larger weeds or heavy infestations. Use of flood irrigation may increase rate of glyphosate. Treat irrigation at least 3 days after Touchdown application. Use higher rate for larger weeds. For applications to cotton, use higher rate for larger weeds. Residual control of most winter annuals, especially henbit. Postemergence control of prickly sida and good control of johnsongrass.</td>
</tr>
<tr>
<td>thifensulfuron + tribenuron at 0.225 to 0.45 lb/A</td>
<td>Harmony Extra</td>
<td>0.3 to 0.6 oz/A with nonionic surfactant at 1 qt per 100 gal spray mix.</td>
<td>Most annual grasses and small-seeded broadleaf weeds. Good to excellent control of henbit, common groundsel, and shepherdspurse up to 4-leaf stage with the addition of suitable surfactant. Fair control of clover.</td>
<td>Consult label for complete list of weeds controlled.</td>
</tr>
<tr>
<td>prometryn at 0.75 to 1.0 lb/A</td>
<td>4 lb/gal formulation</td>
<td>1.5 to 2 pt/A with crop oil concentrate at 1 pt/A. Nov. 1 up to 30 days before planting.</td>
<td>Residual control of most winter annuals and postemergence control of small (less than 2 inches) existing vegetation. Use high rate for early applications, low rate for late applications. Use higher rate for larger weeds. Neutralize irrigation should occur within 3 to 4 weeks after application and soil should be left undisturbed during the period of desired weed control.</td>
<td>Avoid drift to nearby crops or areas not intended to be treated. Do not use with galvanized (zinc coated) spray equipment. Apply a preplant or preemergence herbicide to control johnsongrass from small.</td>
</tr>
<tr>
<td>thifensulfuron at 0.25 to 0.5 lb/A</td>
<td>Harmony Extra</td>
<td>0.3 to 0.6 oz/A with nonionic surfactant at 1 qt per 100 gal spray mix.</td>
<td>Most annual grasses and small-seeded broadleaf weeds. Good to excellent control of prickly sida and good control of johnsongrass.</td>
<td>Avoid where planting was delayed and weeds have emerged. Control decreases in cool weather. Cotton may be planted immediately after spraying.</td>
</tr>
<tr>
<td>oxyfluorfen at 0.25 to 0.5 lb/A</td>
<td>Goal 2XL</td>
<td>1.0 to 2 pt/A in a minimum of 20 gal water by ground.</td>
<td>Most annual grasses and small-seeded broadleaf weeds such as curlydock, chickweed, henbit, and buttercup. Apply to young actively growing weeds. Allow 1 to 3 weeks after application for full control. May be mixed with other preplant herbicides to broaden weed spectrum.</td>
<td>Avoid drift to nearby crops or areas not intended to be treated. Do not use with galvanized (zinc coated) spray equipment. Apply a preplant or preemergence herbicide to control johnsongrass from small.</td>
</tr>
<tr>
<td>dicamba at 0.188 to 0.25 lb/A</td>
<td>Clarity 4AS</td>
<td>6-8 fl oz Preplant for vegetation knockdown. Cutleaf eveningprimrose, buttercup species, clovers, Pennsylvania smartweed, &amp; other winter annual weeds. Consult label to determine rates for weeds and growth stages. Include nonionic surfactant at 0.25% v/v. If applied in the spring following a full application the total amount applied cannot exceed 2.0 lb ai/A. Use higher rate for more vigorous weeds. Residual control must be applied at least 21 days before planting. Consult label for added restrictions following a full application.</td>
<td>Increase rate by 0.6 pt/A on coarse and medium textured soils where heavy weed populations are anticipated. Use 3.0 pt/A on heavy clay soils. Incorporate 1 to 2 inches deep immediately after application for best results. A 15% loss can occur if incorporation is delayed 24 hours. When making band applications, avoid removal of treated soil from the surface during incorporation and planting.</td>
<td>Avoid drift to nearby crops or areas not intended to be treated. Do not use with galvanized (zinc coated) spray equipment. Apply a preplant or preemergence herbicide to control johnsongrass from small.</td>
</tr>
<tr>
<td>paraquat at 0.625 to 0.94 lb/A</td>
<td>Gramoxone Extra (2.5 lb/gal)</td>
<td>2 to 3 pt in 20 gal water by ground equipment or 5 gal by air. Add 1 qt nonionic surfactant per 100 gal of spray mix unless formulation contains surfactant.</td>
<td>Most annual grasses and small-seeded broadleaf weeds such as crazygrass, chickweed, henbit, and buttercup. Apply to young actively growing weeds. Allow 1 to 3 weeks after application for full control. May be mixed with other preplant herbicides to broaden weed spectrum.</td>
<td>Avoid drift to nearby crops or areas not intended to be treated. Do not use with galvanized (zinc coated) spray equipment. Apply a preplant or preemergence herbicide to control johnsongrass from small.</td>
</tr>
<tr>
<td>metribuzin at 0.5 to 0.75 lb/A</td>
<td>41% RR</td>
<td>1.0 to 2 pt/A with crop oil concentrate at 1 pt/A. Nov. 1 up to 30 days before planting.</td>
<td>Residual control of most winter annuals and postemergence control of small (less than 2 inches) existing vegetation. Use high rate for early applications, low rate for late applications. Use higher rate for larger weeds. Neutralize irrigation should occur within 3 to 4 weeks after application and soil should be left undisturbed during the period of desired weed control.</td>
<td>Avoid drift to nearby crops or areas not intended to be treated. Do not use with galvanized (zinc coated) spray equipment. Apply a preplant or preemergence herbicide to control johnsongrass from small.</td>
</tr>
<tr>
<td>ametryn at 0.88 to 1.25 lb/A</td>
<td>Harmony Extra</td>
<td>0.3 to 0.6 oz/A with nonionic surfactant at 1 qt per 100 gal spray mix.</td>
<td>Most annual grasses and small-seeded broadleaf weeds. Good to excellent control of prickly sida and good control of johnsongrass.</td>
<td>Avoid where planting was delayed and weeds have emerged. Control decreases in cool weather. Cotton may be planted immediately after spraying.</td>
</tr>
<tr>
<td>metolachlor at 0.5 to 0.75 to 1.125 lb/A</td>
<td>Provis P Pendulum 3.3EC</td>
<td>1.2 to 1.8 to 3.6 pt in 5 gal water by air or 10 gal water by ground equipment.</td>
<td>Most annual grasses and small-seeded broadleaf weeds such as pigweed and purslane. Increase rate by 0.8 pt/A on course and medium textured soils where heavy weed populations are anticipated. Use 3.0 pt/A on heavy clay soils. Incorporate 1 to 2 inches deep immediately after application for best results. A 15% loss can occur if incorporation is delayed 24 hours. When making band applications, avoid removal of treated soil from the surface during incorporation and planting.</td>
<td>Avoid drift to nearby crops or areas not intended to be treated. Do not use with galvanized (zinc coated) spray equipment. Apply a preplant or preemergence herbicide to control johnsongrass from small.</td>
</tr>
</tbody>
</table>

**Note:** The above information is based on the document provided and may not reflect the most current or complete list of herbicides, rates, and application methods.
<table>
<thead>
<tr>
<th>Crop, weed, or situation and active chemical per treated land acre</th>
<th>Formulation needed to treat 1 acre broadcast</th>
<th>Time of application</th>
<th>Weeds controlled</th>
<th>Special instructions and remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Estimated Levels of Preplant Foliar Weed Control Normally Expected</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3 to 1.5 to 2 pt Bladex 90DF -- 0.56 to 1.0 to 1.33 lb in 10 to 20 gal water.</td>
<td>At planting.</td>
<td>Good control: Bladex, Cy-Pro, Caparol/Cotton Pro, Goal, Harmony Extra</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bladex, Cy-Pro, Caparol/Cotton Pro, Goal, Harmony Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Preplant - FPP</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual Rhagasia</td>
<td>Excellent control: Bladex, Cy-Pro, God, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Gramoxone Extra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bittercress</td>
<td>Excellent control: Bladex, Cy-Pro, Caparol/Cotton Pro, Clarity, Goal, Gramoxone Extra, Harmony Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Burndrop</td>
<td>Excellent control: Bladex, Cy-Pro, Caparol/Cotton Pro, Clarity, Goal, God, Gramoxone Extra, Harmony Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carolina Goosefoot</td>
<td>Excellent control: Bladex, Cy-Pro, Caparol/Cotton Pro, Clarity, Goal, God, Gramoxone Extra, Harmony Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chickweed</td>
<td>Excellent control: Bladex, Cy-Pro, Caparol/Cotton Pro, Clarity, God, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chilt</td>
<td>Excellent control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clover</td>
<td>Excellent control: Bladex, Cy-Pro, God, Gramoxone Extra</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evening Primrose</td>
<td>Good control: Bladex, Cy-Pro, Caparol/Cotton Pro, Clarity, Goal, God, Gramoxone Extra, Harmony Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Creosote</td>
<td>Excellent control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Bladex, Cy-Pro, God</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fleabane</td>
<td>Excellent control: Bladex, Cy-Pro, Clarity, Goal, Gramoxone Extra, Harmony Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Caparol/Cotton Pro, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freeway</td>
<td>Excellent control: Bladex, Cy-Pro, Caparol/Cotton Pro, Clarity, God, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Caparol/Cotton Pro</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Purslane</td>
<td>Excellent control: Bladex, Cy-Pro, Clarity, Goal, God, Gramoxone Extra, Harmony Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Caparol/Cotton Pro</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Purslane 5.3% 12 to 1.6 to 2.4 pt</td>
<td>Good control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Purslane 5.3% 12 to 1.6 to 2.4 pt</td>
<td>Good control: Goal, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Purslane 5.3% 12 to 1.6 to 2.4 pt</td>
<td>Good control: Cy-Pro, God, Gramoxone Extra</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Purslane 5.3% 12 to 1.6 to 2.4 pt</td>
<td>Excellent control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Purslane 5.3% 12 to 1.6 to 2.4 pt</td>
<td>Good control: Bladex, Cy-Pro, God, Gramoxone Extra</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Longleaf</td>
<td>Excellent control: Bladex, Cy-Pro, Caparol/Cotton Pro, Clarity, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Roundup</td>
<td>Excellent control: Bladex, Cy-Pro, Caparol/Cotton Pro, Clarity, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Caparol/Cotton Pro</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sawtooth</td>
<td>Excellent control: Bladex, Cy-Pro, Clarity, Goal, God, Gramoxone Extra, Harmony Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Caparol/Cotton Pro</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Virginia Pepperweed</td>
<td>Excellent control: Bladex, Cy-Pro, Caparol/Cotton Pro, Clarity, God, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Gramoxone Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vetch</td>
<td>Excellent control: Clarity, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fair control: Bladex, Cy-Pro, Caparol/Cotton Pro, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Little Barley-Can. Fernald</td>
<td>Excellent control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Bladex, Cy-Pro</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Caparol/Cotton Pro</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Silerweed</td>
<td>Excellent control: God</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Bladex, Cy-Pro, Caparol/Cotton Pro, Clarity, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fair control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Purslane 5.3% 12 to 1.6 to 2.4 pt</td>
<td>Excellent control: God, Gramoxone Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Purslane 5.3% 12 to 1.6 to 2.4 pt</td>
<td>Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Purslane 5.3% 12 to 1.6 to 2.4 pt</td>
<td>Excellent control: Bladex, Cy-Pro, Caparol/Cotton Pro, Clarity, God, Harmony Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Caparol/Cotton Pro, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Purslane 5.3% 12 to 1.6 to 2.4 pt</td>
<td>Excellent control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Purslane 5.3% 12 to 1.6 to 2.4 pt</td>
<td>Excellent control: Clarity, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Field Purslane 5.3% 12 to 1.6 to 2.4 pt</td>
<td>Excellent control: Clarity, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fair control: Bladex, Cy-Pro, Caparol/Cotton Pro, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fair control: Bladex, Cy-Pro, God</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sheoak</td>
<td>Excellent control: Clarity, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fair control: Bladex, Cy-Pro, Caparol/Cotton Pro, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seedling Johnsongrass</td>
<td>Excellent control: Clarity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Bladex, Cy-Pro, Caparol/Cotton Pro, God, Harmony Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity, Harmony Extra</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good control: Godran Extra, Roundup Ultra/Touchdown</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Excellent control: Clarity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Estimated Levels of Weed Control Normally Expected**

**Preplant**

**Barnyardgrass**  
Excellent control: Prowl/Pendimax, Trifluralin, Zoral (PPI or Split)

**Broadleaf signalgrass**  
Excellent control: Prowl/Pendimax, Trifluralin, Zoral (PPI or Split)

**Cranegrass**  
Excellent control: Prowl/Pendimax, Trifluralin, Zoral (PPI or Split)

**Klamathweed**  
Excellent control: Prowl/Pendimax, Trifluralin, Zoral (PPI or Split)

**Wild panicum**  
Excellent control: Prowl/Pendimax, Trifluralin, Zoral (PPI or Split)

**Johnsongrass-seeding**  
Excellent control: Prowl/Pendimax, Trifluralin, Zoral (PPI or Split)

**Johnsongrass-choke**  
Excellent control: Prowl/Pendimax, Trifluralin, Zoral (PPI or Split)

**Nodding - purple**  
Excellent control: Zoral (PPI or Split)

**Nodding - yellow**  
Excellent control: Zoral (PPI or Split)

**Annual sedge**  
Excellent control: Zoral (PPI or Split)

**Eclipta**  
Excellent control: Zoral (PPI or Split)

**Annual morningglory**  
Excellent control: Zoral (PPI or Split)

**Jack pine**  
Excellent control: Command, Concor, + Dual

**Barnyardgrass**  
Excellent control: Command, Concor, + Dual

**Broadleaf signalgrass**  
Excellent control: Command, Concor, + Dual

**Cranegrass**  
Excellent control: Command, Concor, + Dual

**Klamathweed**  
Excellent control: Command, Concor, + Dual

**Wild panicum**  
Excellent control: Command, Concor, + Dual

**Johnsongrass-seeding**  
Excellent control: Command, Concor, + Dual

**Johnsongrass-choke**  
Excellent control: Zoral (PPI or Split)

**Nodding - yellow**  
Excellent control: Zoral (PPI or Split)

**Annual sedge**  
Excellent control: Florazan, Concor, + Diuron

**Eclipta**  
Excellent control: Zoral (PPI or Split)

**Annual morningglory**  
Excellent control: Zonal + Cyanoamine

**Fewley - FYE**  
Excellent control: Prowl/Pendimax, Trifluralin, Zoral (PPI or Split)

**Herbicide (PPI + PRE) Treatment will control a broader spectrum of weeds but effectiveness on any given species will be so better than the highest rating for the best herbicide in the specific combination selected.**

**Preemergence**

**Barnyardgrass**  
Excellent control: Caparol/Cotton Pro, Clarity, + Caparol/Cotton Pro, Clarity

**Broadleaf signalgrass**  
Excellent control: Caparol/Cotton Pro, Clarity, + Caparol/Cotton Pro, Clarity

**Cranegrass**  
Excellent control: Caparol/Cotton Pro, Clarity, + Caparol/Cotton Pro, Clarity

**Klamathweed**  
Excellent control: Caparol/Cotton Pro, Clarity, + Caparol/Cotton Pro, Clarity

**Wild panicum**  
Excellent control: Caparol/Cotton Pro, Clarity, + Caparol/Cotton Pro, Clarity

**Johnsongrass-seeding**  
Excellent control: Caparol/Cotton Pro, Clarity, + Caparol/Cotton Pro, Clarity

**Johnsongrass-choke**  
Excellent control: Caparol/Cotton Pro, Clarity, + Caparol/Cotton Pro, Clarity

**Nodding - yellow**  
Excellent control: Caparol/Cotton Pro, Clarity, + Caparol/Cotton Pro, Clarity

**Annual sedge**  
Excellent control: Florazan, Concor, + Diuron

**Eclipta**  
Excellent control: Zonal + Cyanoamine

**Annual morningglory**  
Excellent control: Zonal + Cyanoamine

**Preplant**

**Barnyardgrass**  
Excellent control: Prowl/Pendimax, Trifluralin, Zoral (PPI or Split)

**Broadleaf signalgrass**  
Excellent control: Prowl/Pendimax, Trifluralin, Zoral (PPI or Split)

**Cranegrass**  
Excellent control: Prowl/Pendimax, Trifluralin, Zoral (PPI or Split)

**Klamathweed**  
Excellent control: Prowl/Pendimax, Trifluralin, Zoral (PPI or Split)

**Wild panicum**  
Excellent control: Prowl/Pendimax, Trifluralin, Zoral (PPI or Split)

**Johnsongrass-seeding**  
Excellent control: Prowl/Pendimax, Trifluralin, Zoral (PPI or Split)

**Johnsongrass-choke**  
Excellent control: Prowl/Pendimax, Trifluralin, Zoral (PPI or Split)

**Nodding - purple**  
Excellent control: Zoral (PPI or Split)

**Nodding - yellow**  
Excellent control: Zoral (PPI or Split)

**Annual sedge**  
Excellent control: Zoral (PPI or Split)

**Eclipta**  
Excellent control: Zoral (PPI or Split)

**Annual morningglory**  
Excellent control: Zoral (PPI or Split)

**Fewley - FYE**  
Excellent control: Prowl/Pendimax, Trifluralin, Zoral (PPI or Split)

**Herbicide (PPI + PRE) Treatment will control a broader spectrum of weeds but effectiveness on any given species will be so better than the highest rating for the best herbicide in the specific combination selected.**

**Preemergence**

**Barnyardgrass**  
Excellent control: Caparol/Cotton Pro, Clarity, + Caparol/Cotton Pro, Clarity

**Broadleaf signalgrass**  
Excellent control: Caparol/Cotton Pro, Clarity, + Caparol/Cotton Pro, Clarity

**Cranegrass**  
Excellent control: Caparol/Cotton Pro, Clarity, + Caparol/Cotton Pro, Clarity

**Klamathweed**  
Excellent control: Caparol/Cotton Pro, Clarity, + Caparol/Cotton Pro, Clarity

**Wild panicum**  
Excellent control: Caparol/Cotton Pro, Clarity, + Caparol/Cotton Pro, Clarity

**Johnsongrass-seeding**  
Excellent control: Caparol/Cotton Pro, Clarity, + Caparol/Cotton Pro, Clarity

**Johnsongrass-choke**  
Excellent control: Caparol/Cotton Pro, Clarity, + Caparol/Cotton Pro, Clarity

**Nodding - yellow**  
Excellent control: Caparol/Cotton Pro, Clarity, + Caparol/Cotton Pro, Clarity

**Annual sedge**  
Excellent control: Florazan, Concor, + Diuron

**Eclipta**  
Excellent control: Zoral (PPI or Split)

**Annual morningglory**  
Excellent control: Zoral (PPI or Split)
Potentially assume the herbicides are applied in the manner suggested in the guidelines and according to the label under optimum growing conditions.

Bladex. The selection of a layby herbicide program should be based on weeds present, crop rotation restrictions, cotton

Of the layby treatments suggested, diuron and Bladex are the most economical. Diuron is much more persistent than

is preferred when the late cultivation is used to suppress perennials.

Two methods of layby herbicide application are recommended. Use a split application where perennials, such as

be used. Read the label for the maximum amount of a herbicide that can be used. Do not exceed this amount in any one year.

Recall the number and rates of postemergence herbicides that were used before making layby applications. Where rotation

spray volumes are used. Thorough spray coverage is essential for acceptable weed control. Spray volume does not

fields with dense populations of large weeds, a volume of 1 gallon per inch of treated band may be needed for good

Cobra herbicide. Several cases of cotton injury have been observed when a COC was substituted for surfactant and used

Crop oil concentrates (COC) are not routinely suggested for use with directed sprays in cotton. COC use is required with

Most herbicides require 1 quart of surfactant (85% ± 10% active ingredient) per 100 gallons of spray solution. However,

herbicide formulations already contain surfactant. Consult the label before adding surfactant to the spray solution.

Surfactants:

Directed sprays should be applied with minimal cotton foliage contact to avoid injury.

Crop, weed, or situation and

active chemical per treated

hand area

Pigweed

Excellent control:

Excellent control:

Good control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Good control:

Good control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Good control:

Good control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Good control:

Good control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:

Excellent control:
<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Rate (lb/a)</th>
<th>Formulation</th>
<th>Application Method</th>
<th>Recommended Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clethodim</td>
<td>0.0625-0.125</td>
<td>2EC, 6-8 oz/a</td>
<td>Ground or Postemergence</td>
<td>Most small broadleaf weeds, including cocklebur, prickly sida, morningglory, and pigweed. Additional of DSMA or MSMA improves grass control.</td>
</tr>
<tr>
<td>Fluazifop</td>
<td>0.094-0.188</td>
<td>Fusilade DX, 0.375-0.75 pt</td>
<td>Air or ground</td>
<td>Excellent postemergence control of most broadleaf weeds especially cocklebur and morningglory. Does not control grasses or weeds.</td>
</tr>
<tr>
<td>Lactofen</td>
<td>0.2</td>
<td>Bladex 90DF, 0.67-1.11 lb</td>
<td>80% formulation (80% formulation) - 0.25 to 0.62 lb or 4L formulation (4L formulation) - 1.2 to 3.2 lb in 10 to 20 gal water. Add 1 qt surfactant to each 100 gal of spray mix.</td>
<td>Excellent control of susceptible cocklebur and small annual grasses. Poor control of hemp sesbania and prickly sida. Use as a salvage treatment only. Possible burning and reddish color of foliage may appear. May delay cotton maturity. Do not tank mix with other herbicides. Apply only to healthy cotton under favorable growing conditions. Can be applied to vigorously growing cotton and bigger weeds.</td>
</tr>
<tr>
<td>Glyphosate</td>
<td>0.5-1.0</td>
<td>Roundup Ultra, 1 to 2 pt/A</td>
<td>POSTDIRECT IF COTTON IS BEYOND 4-LEAF STAGE.</td>
<td>Postemergence control of most annual broadleaf and grass weeds, including control of johnsongrass. A well-designed postemergence program is recommended for optimum control.</td>
</tr>
<tr>
<td>Propanil</td>
<td>2.5</td>
<td>BCP, 8 oz/a</td>
<td>48% formulation - 1 pt</td>
<td>Excellent control of susceptible weeds. Poor control of hemp sesbania and prickly sida. Use as a salvage treatment only. Possible burning and reddish color of foliage may appear. May delay cotton maturity. Do not tank mix with other herbicides. Apply only to healthy cotton under favorable growing conditions. Can be applied to vigorously growing cotton and bigger weeds.</td>
</tr>
<tr>
<td>Dicamba</td>
<td>0.5</td>
<td>Staleout 2EC, 1.2 to 2.0 pt in 10 to 20 gal water. Add 1 pt surfactant to each 100 gal of spray mix.</td>
<td>POSTDIRECT IF COTTON IS BEYOND 4-LEAF STAGE.</td>
<td>Excellent control of susceptible weeds. Poor control of hemp sesbania and prickly sida. Use as a salvage treatment only. Possible burning and reddish color of foliage may appear. May delay cotton maturity. Do not tank mix with other herbicides. Apply only to healthy cotton under favorable growing conditions. Can be applied to vigorously growing cotton and bigger weeds.</td>
</tr>
<tr>
<td>Postemergence</td>
<td>Over-the-top</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bromoxynil</td>
<td>0.5</td>
<td>Benlate 4 FL, 1 pt/acre</td>
<td>Before or after wheat emergence up to 75 days prior to harvest.</td>
<td>Excellent postemergence control of most broadleaf weeds especially cocklebur and morningglory. Does not control grasses or weeds.</td>
</tr>
<tr>
<td>Triclopyr</td>
<td>0.4</td>
<td>80% formulation (80% formulation) - 0.25 to 0.5 lb or 4L formulation (4L formulation) - 0.5 to 1.0 lb in 10 to 20 gal water. Add 1 qt surfactant to each 100 gal of spray mix.</td>
<td>Excellent control of susceptible weeds. Poor control of hemp sesbania and prickly sida. Use as a salvage treatment only. Possible burning and reddish color of foliage may appear. May delay cotton maturity. Do not tank mix with other herbicides. Apply only to healthy cotton under favorable growing conditions. Can be applied to vigorously growing cotton and bigger weeds.</td>
<td></td>
</tr>
<tr>
<td>2,4-D</td>
<td>0.5</td>
<td>Paragon 80WEP, 0.67 to 1.1 lb</td>
<td>48% formulation (48% formulation) - 1.2 to 2.0 lb in 10 to 20 gal water. Add 1 qt surfactant to each 100 gal of spray mix.</td>
<td>Excellent control of susceptible weeds. Poor control of hemp sesbania and prickly sida. Use as a salvage treatment only. Possible burning and reddish color of foliage may appear. May delay cotton maturity. Do not tank mix with other herbicides. Apply only to healthy cotton under favorable growing conditions. Can be applied to vigorously growing cotton and bigger weeds.</td>
</tr>
<tr>
<td>Diuron</td>
<td>1.8</td>
<td>80% formulation (80% formulation) - 0.25 to 0.5 lb or 4L formulation (4L formulation) - 0.5 to 1.0 lb in 10 to 20 gal water. Add 1 qt surfactant to each 100 gal of spray mix.</td>
<td>Excellent control of susceptible weeds. Poor control of hemp sesbania and prickly sida. Use as a salvage treatment only. Possible burning and reddish color of foliage may appear. May delay cotton maturity. Do not tank mix with other herbicides. Apply only to healthy cotton under favorable growing conditions. Can be applied to vigorously growing cotton and bigger weeds.</td>
<td></td>
</tr>
<tr>
<td>Cyanazine</td>
<td>0.6</td>
<td>Bladex 90DF, 0.67-1.11 lb (or plus DSMA or MSMA)</td>
<td>Excellent control of susceptible weeds. Poor control of hemp sesbania and prickly sida. Use as a salvage treatment only. Possible burning and reddish color of foliage may appear. May delay cotton maturity. Do not tank mix with other herbicides. Apply only to healthy cotton under favorable growing conditions. Can be applied to vigorously growing cotton and bigger weeds.</td>
<td></td>
</tr>
</tbody>
</table>

**Important Notes:**
- Do not mix with the following substances: Staple, Axxara, Quackmaster, Lyric, and Kontakt. Multiple applications without allowing sufficient growth between treatments and/or use of improper application causes abnormal fruiting patterns and yield loss.
- Do not use on crops that contain the bromotol gene or BHT. Use only on cotton that contains the bromotol gene. Do not apply over-the-top beyond 4-leaf stage. For information regarding the use of BHT, refer to the manufacturer’s label.
- Do not tank mix with insecticides containing malathion. Staple antagonizes cyprosulfuron. Do not tank mix with other herbicides. Apply only to healthy cotton under favorable growing conditions. Can be applied to vigorously growing cotton and bigger weeds.
**Alternative weed management techniques**

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spray application</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| **Cotton spray** | **Roundup Ultra** — 1% solution in water for most weeds including johnsongrass. | Treatment most effective on large actively growing weeds. Cotton sprayed with herbicide solution will be severely injured or killed. Avoid windy conditions and high pressure to minimize cotton injury. Repeat treatments may be necessary to control weeds re-plants from surrounding plants or seed. See label for details. }
| | **Flumioxazin** | Most annual grasses and small-seeded broadleaf weeds such as pigweed and purslane. | |
| | **Sulfentrazone** | | Avoid spray contact to nonwoody portion of cotton stems and foliage or serious crop injury may occur. |

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Preemergence cultivation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Deep cultivation</strong></td>
<td></td>
<td>Do not apply more than 12 times during season.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Post-emergence cultivation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cultivation</strong></td>
<td></td>
<td>Avoid spray contact to nonwoody portion of cotton stems and foliage or serious crop injury may occur.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Transplanting</strong></td>
<td></td>
<td>Do not apply within 40 days of harvest.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Spot treatment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Roundup Ultra</strong> — 1 gal + 2 gal water.</td>
<td>Quantity to use per acre will vary depending on density of weeds. Do not apply more than 48 oz/season.</td>
<td>Do not apply after half set or within 90 days of harvest.</td>
</tr>
<tr>
<td><strong>Flumioxazin</strong></td>
<td>Most annual grasses, seedling and rhizome johnsongrass, and bermudagrass.</td>
<td>Spray to wet foliage but not to point of runoff.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cyanazine</strong></td>
<td>Most annual grasses and small-seeded broadleaf weeds such as pigweed and purslane.</td>
<td>Do not apply more than 48 oz/season. Do not apply after half set or within 90 days of harvest.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Layby</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cyanazine</strong> at 0.8 to 1.2 lb/a</td>
<td>Blades 80DF — 0.49 to 0.79 lb a.i.</td>
<td>Add 1.6 to 2.4 pt in 20 gal water.</td>
</tr>
<tr>
<td><strong>Flumioxazin</strong></td>
<td>80% formulation — 0.35 to 0.6 lb/a</td>
<td>Each 25 lb fee will be treated with 25 gal water. Use this herbicide where a shorter residual effect is desired.</td>
</tr>
<tr>
<td><strong>Pendimethalin</strong></td>
<td>0.5 to 1.5 lb/a</td>
<td>Preem-Post 3.36EC — 1.2 to 3.6 pt per acre depending on soil texture.</td>
</tr>
</tbody>
</table>
Flame Cultivation -- The newer types of burners available for flame cultivation allow use of lower pressures, making it easier to maintain sufficient temperatures for excellent control of weeds coming into contact with the flame. In some cases, one flame treatment is sufficient. However, at least two flameings, 1 to 5 days apart, are generally required for best results, especially for weeds larger than 2 inches. Flame cultivation provides no residual control. Flame cultivation does not control weeds in row middles.

3-gallon with specialized burner equipment

Estimated Levels of Weed Control Normally Expected

<table>
<thead>
<tr>
<th>Herbicides</th>
<th>Preemergence-directed</th>
<th>Postemergence-over-the-top</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fusion</td>
<td>Assure II</td>
</tr>
<tr>
<td></td>
<td>Buctril/BXN</td>
<td>Herbicide/Fenitrostan</td>
</tr>
<tr>
<td></td>
<td>Assure SL</td>
<td>Poast Plus</td>
</tr>
<tr>
<td></td>
<td>Staple</td>
<td>Roundup</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Layby-preemergence</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Fusilade</td>
<td></td>
</tr>
</tbody>
</table>

Recommended rates: 3 to 5 gal at operating pressure of 15 to 30 psi and 3 to 5 mph. Use in cotton with stems at least 3/16 inch in diameter (6-inch tall cotton) with water shield delivery at least 5 gallons per acre. In 10- to 12-inch tall cotton, water shield is not necessary.

Annual grasses and broadleaf weeds, especially morningglory. Be careful to avoid burning equipment, field borders, and perimeter areas. Operate cultivator with staggered burners positioned 10 inches above the soil surface at a 30 to 45-degree angle and 5 to 10 inches from the cotton stalks so flame strikes the soil surface 2 inches from the cotton main stem. Get Extension Publication 5000 or 1500 for more details.

Rating scale: E = excellent; G = good; F = fair.

Two applications.

Flame Cultivation In Cotton

Recently, several issues have forced some producers to reconsider the merits of flame cultivation. Increasing herbicide prices, government regulations regarding worker protection, restricted-use pesticide records, public fear of herbicide damage to the environment, lack of acceptable chemical control of certain problem weed species, and herbicide-resistant weeds are among current factors. These issues, combined with LP gas prices, make this old technology attractive.

Flame Cultivation without a water shield can safely be used in cotton after plants develop a main stem 3/16 inch in diameter (8-inch tall cotton) with water shield. The water-shielded burner in the early 1970's improved cotton tolerance, thereby allowing use of flame cultivation in cotton 5 to 6 inches tall. The water-shielded burner was a single-flame nozzle positioned above the burner to deliver 7 to 10 gallons of water per acre, so a burner to prevent heat movement into the cotton canopy.

To control weeds effectively in the cotton row, have the burner perpendicular to the row. Position the burner 8 to 10 inches above the soil surface; angled 30 degrees to 45 degrees to the ground, and spaced approximately 8 to 10 inches from the row. This position the flame to strike the soil surface. In this manner, the flames strike the soil and move horizontally along the surface across the cotton row, killing small weeds in the row. A burner on each side of the row controls weeds on either side. Bumers must be offset (or side-burners) to avoid a plane of heat rising into the cotton canopy.

Liquid pressure-type burners should be operated in the 15- to 30 psi range to develop the optimal flame pattern and to prevent flame-out. Liquid pressures are best suited for small cotton or sparse weed populations, while high pressures are best used in large cotton and dense weed infestations. Keep the tractor speed in the 3 to 5 mph range. Like pressure, use slower speeds in dense weed populations or large cotton, used in large cotton and dense weed infestations.

Avoid crop contact with spray solution. Allow 7 days between application and harvest. Avoid contact with spray solution. Tank mixing with triazines or certain herbicides may magnify growth control.

Avoid crop contact with spray solution. Avoid use of spray tips that produce fine spray droplets. (See Label).

Sicklepod

Annual and perennial grasses and broadleaf weeds; especially morningglory.
Disadvantages of this method of weed control include:

- No residual control;
- Cotton fruits higher on stalk;
- There are hazards of handling pressurized gas;
- A fire potential;
- Must apply at least twice; and
- The tractor-mounted liquid pressure tank requires frequent refills.

**Chemical Control Information**

**Preplant Incorporated Treatments for Grasses**

**Tribulfid**

Trade names include Triben HPP, Triben TR-10 (granule), Triben H. Approximately 45 percent of the cotton acreage receives a single preplant incorporated tribulfid application each year. Most applications are made by ground equipment. Application rates average 0.5 pounds a.i. per acre. Tribulfid effectively controls all of the listed annual grasses except goosegrass. The typical REI for tribulfid on cotton is 12 hours. Pre-harvest intervals are not applicable.

**Norflurazon**

Trade name is Zoral Ropid 80. Approximately 30 percent of the cotton acreage receives a single preplant incorporated norflurazon application each year. Most applications are made by ground equipment. Application rates average 0.56 pounds a.i. per acre. Norflurazon effectively controls all of the listed annual grasses. The REI for norflurazon on cotton is 12 hours unless it is soil incorporated (i.e., preplant incorporated). If soil incorporated the REI is not applicable in most cases. Pre-harvest intervals are not applicable.

**Pendimethalin**

Trade name is Preve 3.1 EC. Approximately 35 percent of the cotton acreage receives a single preplant incorporated pendimethalin application each year. Most applications are made by ground equipment. Application rates average 0.5 pounds a.i. per acre. Pendimethalin effectively controls all of the listed annual grasses except goosegrass. The typical REI for pendimethalin on cotton is 12 hours unless it is soil incorporated (i.e., preplant incorporated). If soil incorporated the REI is not applicable in most cases. Pre-harvest intervals are not applicable.

**Fluometuron**

Trade names are Costron 4L and Costron DF. Approximately 1 percent of the cotton acreage receives a single preplant incorporated fluorometuron application each year. Most applications are made by ground equipment. Application rates average 0.5 pounds a.i. per acre. Fluometuron effectively controls all of the listed annual grasses except goosegrass. The REI for fluorometuron on cotton is 12 hours unless it is soil incorporated (i.e., preplant incorporated). If soil incorporated the REI is not applicable in most cases. Pre-harvest intervals are not applicable.

**Prometryn**

Trade name is Command SME. Approximately 5 percent of the cotton acreage receives a single preplant incorporated prometryn application each year. Most applications are made by ground equipment. Application rates average 0.5 pounds a.i. per acre. Prometryn effectively controls all of the listed annual grasses. The REI for prometryn on cotton is 12 hours unless it is soil incorporated (i.e., preplant incorporated). If soil incorporated the REI is not applicable in most cases. Pre-harvest intervals are not applicable.

**Chlorimuron**

Trade name is Command. Approximately 2 percent of the cotton acreage receives a single preplant incorporated chlorimuron application each year. Most applications are made by ground equipment. Application rates average 0.5 pounds a.i. per acre. Chlorimuron effectively controls all of the listed annual grasses. The REI for chlorimuron on cotton is 12 hours unless it is soil incorporated (i.e., preplant incorporated). If soil incorporated the REI is not applicable in most cases. Pre-harvest intervals are not applicable.

**Norflurazon**

Trade name is Zoral Ropid 80. Approximately 40 percent of the cotton acreage receives a single preplant incorporated norflurazon application each year. Most applications are made by ground equipment. Application rates average 0.56 pounds a.i. per acre. Norflurazon effectively controls all of the listed annual grasses. The REI for norflurazon on cotton is 12 hours unless it is soil incorporated (i.e., preplant incorporated). If soil incorporated the REI is not applicable in most cases. Pre-harvest intervals are not applicable.

**Pendimethalin**

Trade name is Preve 3.1 EC. Approximately 30 percent of the cotton acreage receives a single preplant incorporated pendimethalin application each year. Most applications are made by ground equipment. Application rates average 0.57 pounds a.i. per acre. Pendimethalin effectively controls all of the listed annual grasses except goosegrass. The REI for pendimethalin on cotton is 12 hours unless it is soil incorporated (i.e., preplant incorporated). If soil incorporated the REI is not applicable in most cases. Pre-harvest intervals are not applicable.

**Fluometuron**

Trade name is Costron 4L and Costron DF. Approximately 2 percent of the cotton acreage receives a single preplant incorporated fluometuron application each year. Most applications are made by ground equipment. Application rates average 0.5 pounds a.i. per acre. Fluometuron effectively controls all of the listed annual grasses except goosegrass. The REI for fluorometuron on cotton is 12 hours unless it is soil incorporated (i.e., preplant incorporated). If soil incorporated the REI is not applicable in most cases. Pre-harvest intervals are not applicable.

**Prometryn**

Trade name is Command SME. Approximately 1 percent of the cotton acreage receives a single preplant incorporated prometryn application each year. Most applications are made by ground equipment. Application rates average 0.5 pounds a.i. per acre. Prometryn effectively controls all of the listed annual grasses. The REI for prometryn on cotton is 12 hours. Pre-harvest intervals are not applicable.

**Fluometuron**

Trade names are Whirl 3.3 EC and Clomazone. Approximately 1 percent of the cotton acreage receives a single preplant incorporated fluometuron application each year. Most applications are made by ground equipment. Application rates average 0.5 pounds a.i. per acre. Fluometuron effectively controls all of the listed annual grasses except goosegrass. The REI for fluorometuron on cotton is 12 hours unless it is soil incorporated (i.e., preplant incorporated). If soil incorporated the REI is not applicable in most cases. Pre-harvest intervals are not applicable.

**Metolachlor**

Trade names are Dual, Dual L, and Dual II. Approximately 4 percent of the cotton acreage receives a single preplant incorporated metolachlor application each year. Most applications are made by ground equipment. Application rates average 0.6 pounds a.i. per acre. Metolachlor effectively controls all of the listed annual grasses except goosegrass. The REI for metolachlor is 12 hours. Pre-harvest intervals are not applicable.

**Fluometuron**

Trade names are Whirl 3.3 EC and Clomazone. Approximately 1 percent of the cotton acreage receives a single preplant incorporated fluometuron application each year. Most applications are made by ground equipment. Application rates average 0.5 pounds a.i. per acre. Fluometuron effectively controls all of the listed annual grasses except goosegrass. The REI for fluorometuron on cotton is 12 hours unless it is soil incorporated (i.e., preplant incorporated). If soil incorporated the REI is not applicable in most cases. Pre-harvest intervals are not applicable.

**Prometryn**

Trade name is Command SME. Approximately 5 percent of the cotton acreage receives a single preplant incorporated prometryn application each year. Most applications are made by ground equipment. Application rates average 0.5 pounds a.i. per acre. Prometryn effectively controls all of the listed annual grasses. The REI for prometryn on cotton is 12 hours. Pre-harvest intervals are not applicable.

**Fluometuron**

Trade name is Costron 4L and Costron DF. Approximately 2 percent of the cotton acreage receives a single preplant incorporated fluometuron application each year. Most applications are made by ground equipment. Application rates average 0.5 pounds a.i. per acre. Fluometuron effectively controls all of the listed annual grasses except goosegrass. The REI for fluorometuron on cotton is 12 hours unless it is soil incorporated (i.e., preplant incorporated). If soil incorporated the REI is not applicable in most cases. Pre-harvest intervals are not applicable.

**Prometryn**

Trade name is Command SME. Approximately 5 percent of the cotton acreage receives a single preplant incorporated prometryn application each year. Most applications are made by ground equipment. Application rates average 0.5 pounds a.i. per acre. Prometryn effectively controls all of the listed annual grasses. The REI for prometryn on cotton is 12 hours. Pre-harvest intervals are not applicable.

**Fluometuron**

Trade name is Whirl 3.3 EC. Approximately 1 percent of the cotton acreage receives a single preplant incorporated fluometuron application each year. Most applications are made by ground equipment. Application rates average 0.5 pounds a.i. per acre. Fluometuron effectively controls all of the listed annual grasses except goosegrass. The REI for fluorometuron on cotton is 12 hours unless it is soil incorporated (i.e., preplant incorporated). If soil incorporated the REI is not applicable in most cases. Pre-harvest intervals are not applicable.

**Prometryn**

Trade name is Command SME. Approximately 5 percent of the cotton acreage receives a single preplant incorporated prometryn application each year. Most applications are made by ground equipment. Application rates average 0.5 pounds a.i. per acre. Prometryn effectively controls all of the listed annual grasses. The REI for prometryn on cotton is 12 hours. Pre-harvest intervals are not applicable.
Fluometuron
Trade names are Coorten 4L and Coorten BF. Approximately 65 percent of the cotton acreage receives a preemerge application of fluometuron each year. Most applications are made by ground equipment. Application rates average 0.67 pounds a.i. per acre. Fluometuron is effective in controlling all of the listed annual grasses except for spurred anoda, smartweed, and yellow nutsedge. Application rates average 0.053 pounds a.i. per acre. The REI for fluometuron is 24 hours. The pre-harvest interval is 7 days.

PREEMERGE TREATMENTS FOR BROADLEAVES

<table>
<thead>
<tr>
<th>Herbicide</th>
<th>Trade Name</th>
<th>Rate Range</th>
<th>PHI</th>
<th>REI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Norflurazon</td>
<td>Trade names include Treflan HFP, Treflan TR-10 (granular), Tri-4 HF, Treflan 45C</td>
<td>0.031 to 0.063 lb a.i. per acre</td>
<td>80 days</td>
<td>12 hours</td>
</tr>
<tr>
<td>Clethodim</td>
<td>Select 2EC</td>
<td>0.031 to 0.063 lb a.i. per acre</td>
<td>80 days</td>
<td>12 hours</td>
</tr>
<tr>
<td>Sethoxydim</td>
<td>Trade name is Assure II</td>
<td>0.2 to 0.3 lb a.i. per acre</td>
<td>40 days</td>
<td>12 hours</td>
</tr>
<tr>
<td>Fluazifop + Fenoxaprop</td>
<td>Fusion</td>
<td>0.094 to 0.25 lb a.i. per acre</td>
<td>60 days</td>
<td>24 hours</td>
</tr>
<tr>
<td>Fluoxaprop</td>
<td>Trade name is Command 111</td>
<td>0.094 to 0.25 lb a.i. per acre</td>
<td>60 days</td>
<td>24 hours</td>
</tr>
<tr>
<td>Fluometuron</td>
<td>Trade name is Prowl 3.3 EC</td>
<td>0.44 to 0.85 pounds a.i. per acre</td>
<td>60 days</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Glyphosate</td>
<td>Trade name is Roundup</td>
<td>0.65 to 0.8 pounds a.i. per acre</td>
<td>60 days</td>
<td>4 hours</td>
</tr>
</tbody>
</table>

The damage done by the pests:
Competition with the cotton crop for water, sunlight, and nutrients. Weed seeds and plant residues in the harvested cotton can result in economic loss due to grade reduction. In addition, some weeds (e.g., morningglory) can adversely affect the harvesting efficiency of the cotton picker.
Postemerge Treatments for Broadleaves

Cyanazine
Trade name is Blazer 4L and Blazer 9DF. Approximately 50 percent of the cotton acreage receives a postemergence cyanazine application each year (on 30% of the acres cyanazine is tank-mixed with MSMA). Applications are made post-directed by ground equipment and 1 to 2 applications per year is the average. Application rates average 0.375 pounds a.i. per acre. Cyanazine is effective in controlling all of the listed broadleaves except spurred anoda, velvetleaf, and smartweed. It is often tank-mixed with MSMA to provide additional grass control. The REI for cyanazine is 12 hours. The pre-harvest interval is 54 days.

Flumetsulam
Trade name is Conquest 4L, and Conquest DF. Approximately 60 percent of the cotton acreage receives a postemergence flumetsulam application each year (on 40% of the acres flumetsulam is tank-mixed with MSMA). Most applications are made by ground equipment and 1 to 2 applications per year is the average. Application rates average 0.67 pounds a.i. per acre. Flumetsulam is effective in controlling pinktop sida, cocklebur, morningglories, pigweed, purslane, hophornbeam copperleaf, ragweed, lambquarter, and flatsedge. It is often tank-mixed with MSMA to provide additional grass control. The REI for flumetsulam on cotton is 24 hours. The pre-harvest interval is 60 days.

Prometryn
Trade name is Capem 4L. Approximately 35 percent of the cotton acreage receives a postemergence prometryn application each year (on 20% of the acres prometryn is tank-mixed with MSMA). Most applications are made by ground equipment and there is an average of 1-2 applications each year. Application rates average 0.45 pounds a.i. per acre. Prometryn is effective in controlling all of the listed broadleaves except spurred anoda, velvetleaf, spotted spurge, and smartweed. It is often tank-mixed with MSMA to provide additional grass control. The REI for prometryn on cotton is 12 hours. The pre-harvest interval is not applicable.

Diclosulam
Trade name is Kerimex and Dires. Approximately 11 percent of the cotton acreage receives a postemergence diclosulam application each year (on 10% of the acres diclosulam is tank-mixed with MSMA). Applications are normally tank-mixed with other herbicides such as MSMA (to provide additional grass control) and made post-directed (postemergence) by ground equipment and 1 to 2 applications each year is the average. Application rates average 0.44 pounds a.i. per acre. Diclosulam is effective in controlling all of the listed broadleaves except spurred anoda, velvetleaf, spotted spurge, and smartweed. The REI for diclosulam is 12 hours. The pre-harvest interval is not applicable.

Lactofen
Trade name is Lactofen 4F. Approximately 10 percent of the cotton acreage receives a postemergence lactofen + MSMA tank-mix application each year. Applications are made post-directed by ground equipment and 1 to 2 applications each year is the average. Application rates average 0.38 pounds a.i. per acre. Lactofen is effective in controlling all of the listed broadleaves except spurred anoda, palmer amaranth, and smartweed. It can be tank-mixed with MSMA to provide additional grass control. The REI for lactofen is 12 hours. The pre-harvest interval is 45 days.

Glyphosate
Trade name is Roundup Ultra. Approximately 30 percent (represents the percentage of acres planted with glyphosate-resistant cotton) of the total cotton acreage receives at least one postemergence application of glyphosate. Approximately two-thirds of the glyphosate treated acres receive a second application of the herbicide. As a postemergence application for annual grasses and broadleaves glyphosate can only be applied to glyphosate-resistant cotton varieties. Glyphosate is effective in controlling all of the listed grass and broadleaf weeds except for spurred anoda, smartweed, and yellow nutsedge. Application rates average 0.75 pounds a.i. per acre. The REI for glyphosate is 4 hours. The pre-harvest interval is 7 days.

Bromoxynil
Trade name is Buctril 4EC. Approximately 55 percent (represents the percentage of acres planted with bromoxynil-resistant cotton) of the total cotton acreage receives at least one application of bromoxynil each year. A small percentage of the bromoxynil treated acres receive a second application of the herbicide. As a post-directed application for broadleaves, bromoxynil can only be applied to bromoxynil-resistant cotton varieties. Bromoxynil effectively controls cocklebur, morningglories, hophornbeam copperleaf, ragweed, lambquarter, and flatsedge. Application rates average 0.67 pounds a.i. per acre. The REI for bromoxynil is 12 hours. The pre-harvest interval is 75 days.

Norflurazon
Trade name is Zorial Rapid 80. Approximately 40 percent of the cotton acreage receives a single postemerge norflurazon application each year. Most applications are made by ground equipment. Application rates average 0.51 pounds a.i. per acre. Norflurazon is effective in controlling all of the listed broadleaves except for velvetleaf, cocklebur, morningglories, spotted spurge, and smartweed. The REI for norflurazon in cotton is 12 hours unless it is soil incorporated (i.e., preplant incorporated). If soil incorporated the REI is not applicable in most cases. Pre-harvest intervals are not applicable.

Alternatives:
Alternatives to pesticides for weed control in cotton include mechanical cultivation, hand labor, and flame cultivation. Virtually all of the cotton acres are mechanically cultivated to control weeds (broadleaves and grasses). Hand labor is used on approximately 54 percent of the cotton acreage to control weeds. Flame cultivation is used to control weeds on a small percentage of the total area (0.2%).

Spot spraying is used on a small number of acres to control weeds. In these cases only the infested areas of a field receive a pesticide application.

ENVIRONMENTAL ISSUES:

The Mississippi Office of Pollution Control of the Mississippi Department of Environmental Quality is responsible for environmental regulatory control in Mississippi. Their annual report stated that the largest percentage of fish kills is caused by low dissolved oxygen conditions with the highest percentage being to pesticide misuse. There was only one fish kill from agricultural pesticide sources and one from the misuse of a termiticide. The report stated that many fish kills were the results of natural causes, and therefore the cause was determined to be natural.

A number of state facilities have moved into Mississippi, but only in a small area (60 mile radius). To date, no fish kills below these facilities have been documented.

OTHER COTTON INFORMATION ONLINE IN MISSISSIPPI:

- Cotton Goal Setting
- Cotton Insect Management in Mississippi
- Cotton Insect Control Guide
- Insect Scouting and Management in Bt-Transgenic Cotton
- Cotton Insect Identification - Pictures of Cotton Insects
- Cotton Insect Situation Newsletter
- Annual Summaries of Mississippi’s Cotton Insect Season
- Cotton Insect Scouting Methods
- Annual Cotton Insect Losses and Control Costs
- Winter Temperatures Affecting Insect Populations
- Recent Papers on Cotton Insects in Mississippi
- Mississippi Cotton Pocket Page
- Historical Perspectives
- Cotton Facility
Cotton Weed Control - [http://www.ext.edu/anr/plantsoil/weeds/weedsdir/cotton.html](http://www.ext.edu/anr/plantsoil/weeds/weedsdir/cotton.html)

Contacts

Agronomy – Dr. Will McCarty
willm@ext.msstate.edu
662-325-2311, Box 9555, MS State, MS 39762

Diseases – Dr. David Ingram
davidl@ext.msstate.edu
601-857-2220, 3500 Seven Springs Rd, Raymond, MS 39154

Insect Pest Management – Dr. Blake Layton
blayton@entomology.msstate.edu
662-325-2085, Box 9775, MS State, MS 39762

Weather Outlook – Mark Freeland
bartf@ext.msstate.edu
562-325-2993, Box 9775, MS State, MS 39762

Weed Management – Dr. John Byrd
johnb@ext.msstate.edu
662-325-4537, Box 9555, MS State, MS 39762

Economic Outlook – Dr. O. A. Cleveland
clevelan@ext.msstate.edu
662-325-2750, Box 5187, MS State, MS 39762

Cotton Insect Losses – Dr. Michael Williams
michaelw@entomology.msstate.edu
662-325-2085, Box 9775, MS State, MS 39762

Boll Weevil Management Corporation – Dr. Jeannine Smith
jks1@ra.msstate.edu
662-325-2993, Box 9776, MS State, MS

IPM Coordinator – Dr. Clarence Collison
chc2@ra.msstate.edu
662-325-2085, Box 9755, MS State, MS 39762

References

2. 2001 Weed Control Guidelines for Mississippi, Mississippi State University Extension Service and Mississippi Agricultural and Forestry Experiment Station, Publication 1532.2-01
3. Cotton Seedling Disease Control, Mississippi State University Extension Service, Publication 802
4. Mississippi Agricultural Statistics, Mississippi Department of Agriculture and Commerce, Supplement 34.
5. MSU/Careers
6. NASS/USDA.GOV

Compiled by:
Edna Ruth Morgan
Extension Professor
Box 9655
Mississippi State, MS 39762
Phone 662-325-8716
email: ruthm@ext.msstate.edu

Acknowledgements

Sincere appreciation is expressed to Dr. Blake Layton, Extension Cotton Entomologist, who gave unselfishly to this project which was being conducted while his wife was undergoing treatment for cancer. Dr. Clarence Collison, IPM Coordinator and Head of Entomology and Plant Pathology at Mississippi State University is thanked for his guidance and many contributions throughout this project. Without the work of all the people involved in cotton production in the great State of Mississippi, this crop profile could not have been compiled. Expressions of gratitude are expressed to each of them.