Post-Directed Herbicide Options in Cotton

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2004 Cotton Herbicides by Target Weed

Grasses

Preemergence: Pendimethalin, Prowl, Prowl H, Treflan, trifluralin
Postemergence: Poast, Fusilade, Select, glyphosate, DSMA, MSMA

Broadleaves

Preemergence: Poast, Treflan, diuron* (Karmex), prometryn (Caparol, Zorial Rapid 80)* (do not use PPI if dry planting cotton)
Postemergence: Aim, Buctril, Chateau, Cotoran (fluometuron), diuron, DSMA, EPT, glyphosate herbicides (e.g., Glyphosate Original, Roundup, Ultramax), Ignite, Staple, Suprend

Nutsedges

Preemergence: Zorial Rapid 80, Dual Magnum (yellow only)
Postemergence: DSMA, Envoke, glyphosate herbicides, Ignite (suppression), MSMA

Early Season Weed Control

• Goal: obtain height differential between cotton and weeds.
  • Preplant/preemergence herbicides (Prowl, trifluralin)
  • Topical (over-the-top) herbicides
  • Glyphosate (Roundup, Touchdown, generics)
  • Conventional/Staple
  • Liberty Link/Ignite

Early Season Postemergence Herbicide Options: Cotton Up To 6 Inches Tall

• Roundup Ready cotton varieties (topical through 4th leaf)
  • Glyphosate @ 0.75 lb ae/A (salvage 1.17 lb ae/A)

• All cotton varieties (0 to 6"
  • Topical
    • Staple @ 1.5 to 1.8 oz/A (1.2 to 1.5 oz a.i./A) + NIS
    • Sloppy Post-direct:
      • Envoke @ 0.1-0.15 oz/A (0.0047-0.007 lb a.i./A) + NIS
      • after cotton has 5 true leaves
    • MSMA @ 2.7 pt/A (2 lb MSMA a.i./A) + NIS
    • Liberty Link Cotton - Fibermax cotton varieties
    • Ignite @ 40 oz/A (0.437 to 0.52 lb a.i./A) + AMS + NIS
• BNX cotton varieties - Buctril @ 0.5 to 1.0 lb a.i./A

Early Season Weed Competition, Salvage Operations & Yield Reductions

Desired Result From Early Season Herbicide Applications
## Mid-Season Post-Directed Herbicide Options: Cotton 6 To 12 Inches Tall

- **All cotton varieties (6" to 12")**
  - **Diuron** 0.8 pt/A (0.4 lb ai/A) + NIS
  - **Envoke** 0.150.25 oz/A (0.00470.007 lb ai/A) + NIS
  - **Goal** 1-2 pt/A (0.25 to 0.5 lb ai/A) + NIS
  - **Aim, Chateau, ET** (more restrictive labels, hoods)
  - **MSMA** @ 2.7 pt/A (2 lb ai/A) + NIS (usually a tank mix partner)
  - **Prometryn** 1 pt/A (0.5 lb ai/A) + NIS
  - **Staple** @ 1.5-1.8 oz/A (1.2 to 1.5 oz ai/A) + NIS

## Tank Mixes
- **Glyphosate 0.75 lb ae/A (RR), Ignite 40 oz/A (Liberty Cotton)**

*Non-selective “Chemical Hoe” Herbicides – Accurate post-directed spray application or the use of hoods (e.g., Redball 410 & 420 hoods) and shields is necessary to avoid cotton injury.*

## Accurate Post-Directed Herbicide Applications

- **Crop injury** can be avoided by partially blocking postemergence herbicides from contacting crop foliage and accurately post-directing herbicide sprays.
- **Example of post-directed herbicide applications in an annual row crop using a Redball 420 hood.**

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### Hooded Sprayer in No-Till Cotton Planted into Barley Stubble

### Post-Direct Nozzles on Hooded Sprayer
Compressed Air Plot Sprayer

- Sprayer equipped with gauge wheels to allow accurate height control of broadcast boom and post-direct boom.
- Gauge wheels also cause the sprayer to track in the bottom of the furrow maintaining nozzle placement with respect to the cotton seed line.
- Drop tubes with single swivels spaced 6 to 12 inches from crop row can be used to post-direct herbicides.

Post-directed and Layby Herbicide Options: Cotton 12 to 24 Inches Tall or Greater

- Herbicide (add adjuvants) 
- Soil Texture:
  - Aim - 1 to 1.6 oz/A all soil activity
  - Chateau - 2 oz/A all, moderate activity
  - Diuron - 0.8 to 1.6 qt/A coarse and medium
  - ET - 1 to 2 oz/A no soil activity
  - Prometryn - 0.9 to 1.6 qt/A coarse and medium
  - Goal - 1 lb/A all soil types
  - Suspend - 1 to 1.5 lb/A coarse and medium
    - (0.68 prometryn + 0.00875 trifloxysulfuron)
- Tank mixes
  - Prowl after last cultivation
  - PPO inhibitors + either prometryn or diuron
  - RR/glyphosate (e.g. grasses, nutsedges or large weeds) or Liberty cotton/ignite
- Consider layby herbicide-crop rotation restrictions.

Topical Roundup @ 1.17 lb ae/A AMS followed by Aim @ 0.016 lb ae/A + 1% COC at 12 in tall cotton

- Leaf injury
- Cotton injury
- Ranged between 0 (no soil activity) and 8.

Topical Roundup @ 1.17 lb ae/A AMS followed by Prowl @ 0.016 lb ae/A + 1% COC at 12 in tall cotton

- Note leaf injury

Topical Roundup @ 1.17 lb ae/A AMS followed by Chateau @ 0.031 lb ae/A + Roundup @ 0.75 lb ae/A + AMS at the 12 in tall growth stage of cotton
Herbicide Mechanisms Dependent on Light That Cause Lipid Peroxidation:

1. Herbicides that inhibit/destroy carotenoids:
   - e.g., norflurazon, fluridone, clomazone, isoxaflutole
2. Herbicides that inhibit electron flow in photosystem II:
   - e.g., triazinestrones, phenylureas, hydroxybenzonitriles, uracils
3. Herbicides that capture electrons from photosystem II:
   - e.g., paraquat, diquat
4. Herbicides that affect chlorophyll biosynthesis through protoporphyrinogen IX (inhibition of chlorophyll synthesis and concentration increase in toxic precursor):
   - e.g., oxyfluorfen (Goal), lactofen (Cobra), flumioxazin (Chateau), carfentrazone (Aim), sulfentrazone (Authority), pyraflufen ethyl (ET)
5. Herbicide that inhibits glutamine synthetase in nitrogen assimilation:
   - e.g., glufosinate (Ignite)

A large group of herbicides inhibits protoporphyrinogen oxidase in the chlorophyll biosynthesis pathway.

Susceptible plants accumulate toxic levels of protoporphyrinogen IX which reacts with oxygen in light to form singlet oxygen.

Singlet oxygen causes rapid lipid peroxidation.

Chlorophyll Biosynthesis Inhibitors:

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Protox Inhibitors

- Protoporphyrinogen oxidase inhibitors (Protox inhibitors) cause localized, contact symptoms in plants.

Oxyfluorfen (Goal) on beans.

Precision Cultivation - Quick Hitch Guidance Systems

Torsion Bar Weeders

Un-treated Oxyfluorfen (Goal) on beans.
In-row Weeding
Before cultivation After cultivation

Precision Cultivation Adoption
- Precision cultivation demonstrations were conducted in Arizona and several systems were purchased.

Precision Cultivation – Potential Problems
- However, many growers who purchased quick hitch guidance systems are no longer using them.
- Greatest difficulty is with the sensing technology (i.e., the mechanical wand used to sense the location of the crop row).
  - Small cotton (less than 8 to 10 in tall) could not be reliably sensed with a mechanical wand; the cotton was not strong enough to guide the wand.
  - Gaps in the seed row further compounded the problem of sensing where the crop row is located.
- Cotton must be 12 inches tall with bark on the lower stem to use precision cultivation with in-row weeding.

Future of Precision Cultivation
- All of the above factors discouraged the use of precision cultivation.
- However, recent advances in computer, optical science and the development of Global Positioning Systems make precision cultivation more practical.
- Herbicide technology has also improved greatly in some crops such as cotton.

Future of Precision Cultivation
- Differential GPS and centimeter level accuracy using Real-Time Kinematic (RTK) can accurately control a tractor/cultivator without mechanical sensing guides.
- A digital camera and optical sensor in ECO-DAN Guidance Systems can also keep a cultivator accurately following a crop seed line without a mechanical sensing element.
- Perhaps time to reinvestigate precision cultivation.
## EcoDan Precision Cultivation

*Sample Field Operations*

<table>
<thead>
<tr>
<th>Wet Plant Operation</th>
<th>Dry Plant Operation</th>
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<tbody>
<tr>
<td>Flat ground</td>
<td>Flat ground</td>
</tr>
<tr>
<td>PRE Herbicide &amp; disk</td>
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<tr>
<td>Pre-irrigate</td>
<td>Mulch and shape bed</td>
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<tr>
<td>Mulch and shape bed</td>
<td>Plant irrigate</td>
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<tr>
<td>Plant irrigate</td>
<td>Plant irrigate</td>
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<tr>
<td>Topical herbicide: 2-3 lf</td>
<td>Topical herbicide: 2 to 3 lf</td>
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<tr>
<td>Cultivate</td>
<td>Cultivate</td>
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<tr>
<td>Irrigate</td>
<td>Irrigate</td>
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<tr>
<td>PD Herbicide&lt;sup&gt;2&lt;/sup&gt;</td>
<td>PD herbicide</td>
</tr>
<tr>
<td>Cultivation (precision)&lt;sup&gt;2&lt;/sup&gt;</td>
<td>Cultivation (precision)&lt;sup&gt;2&lt;/sup&gt;</td>
</tr>
<tr>
<td>Layby Herbicide</td>
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<tr>
<td>Often not necessary in fields with low weed pressure</td>
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<tr>
<td>J may be able to use precision cultivation and in-row weeding but cotton must be 12 inches tall with bark on the lower stem</td>
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## Future of Precision Cultivation

The future of precision cultivation partly depends on:
- Improvements in and cost of competing technologies (e.g., Roundup Ready crop technology).
- Adoption of no-till, reduced till or conservation tillage practices.
- Greater reliance on chemicals.
- Shift in weed species to more tolerant species.
- Herbicide resistance.
- Cost of tillage in both economic terms (capital in tractors, labor, fuel, etc.) and biological terms.
- PM10 dust.