Weed Science Principles for Vegetable Crops

Russell W. Wallace, Ph.D.
Extension Vegetable Specialist

Definitions of a “Weed”

1. Any plant that is growing out of place.
2. A plant that has no known benefit to man.
3. A plant that has not learned to grow in rows.
4. The Creator’s torture of man.

Proboscidea louisianica (Nutt.) S. Wats.
aka = “Devil’s-Claw”

Why Control Weeds?

1. Weeds are competition for:
   1. Nutrients
   2. Moisture
   3. Light
   4. Space

2. Destroy equipment
3. Reduce quality of produce
4. Reduce “profits” to grower/gardener
Methods of “Weed Control”

1. Chemical
2. Cultural
3. Mechanical (physical)
4. Biological
5. Preventative

Chemicals

Use of manufactured herbicides to control perennial and annual weed species.

Flame weeders
### Timings of Chemical Sprays

1. Preplant incorporated (PPI)
   - Applied before planting, mixed into the soil.
2. Preemergence (PRE)
   - Applied to soil before planting/weed emergence
3. Postemergence (POST)
   - Applied after crop emerges.
4. Post-Directed (P-DIRECT)
   - Applied after crop emergence, directed around crops.
5. Lay-by
   - Sprayed to soil around crop before or after emergence.

### Classifications of Herbicides

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grass killers</td>
<td></td>
</tr>
<tr>
<td>Broadleaf killers</td>
<td></td>
</tr>
<tr>
<td>Contact</td>
<td></td>
</tr>
<tr>
<td>Systemic</td>
<td></td>
</tr>
<tr>
<td>Selective</td>
<td></td>
</tr>
<tr>
<td>Non-Selective</td>
<td></td>
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</table>

### Principles of Herbicide Selectivity

<table>
<thead>
<tr>
<th>Principle</th>
<th>Description</th>
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<tbody>
<tr>
<td>Herbicide placement</td>
<td></td>
</tr>
<tr>
<td>Anatomical differences</td>
<td></td>
</tr>
<tr>
<td>Foliar retention</td>
<td></td>
</tr>
<tr>
<td>Protected growing points</td>
<td></td>
</tr>
<tr>
<td>Differential susceptibility</td>
<td></td>
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<tr>
<td>various plant growth stages</td>
<td></td>
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<tr>
<td>Dormancy of crop at time of application</td>
<td></td>
</tr>
</tbody>
</table>
Principles of Herbicide Selectivity

Use of antidotes (safeners)
   Examples (Eptam, Dual Magnum)

Localized application of absorbents
   (activated charcoal)

Internal factors
   - Differential translocation to site of action
   - Absorption or accumulation at inactive sites
   - Differential metabolism by crop
   - Differential quantity/kind of seed reserves
   - Resistance at site of action

Examples of Herbicide Selectivity

What Happens to Herbicides After They Are Sprayed?

Volatilize and dissipate through air.

Remain on leaf surface as liquid or crystal

Penetrate leaf cuticle (waxy layer) and stay there.

Penetrate leaf cuticle, enter cell wall and move apoplastically through xylem system

Penetrate leaf cuticle, enter cell wall and move symplastically (through phloem system).
**Areas of Herbicide Absorption**

- Foliage (leaves) - POSTEMERGENCE
- Seedling shoots
- Roots (root hairs) - PREEMERGENCE

**Spray Additives: Surfactants, Wetting Agents, Stickers, Spreaders**

- Uniform spreading of spray solutions.
- Help spray to remain on leaf surface.
- Assure that droplets do not remain suspended on leaf hairs.
- Partially solubilize the plant surface to allow better penetration.

**Classifications of Herbicides**

- Wettable Powders (WP)
- Emulsifiable Concentrates (EC)
- Water Dispersable Granules (WDG)
- Granules (G)
- Soluble Powders (SP)
- Liquids (L)
- Microencapsulated (M)
- Aqueous Suspension (AS)
**Herbicide Active Ingredients**

<table>
<thead>
<tr>
<th>Trade Name</th>
<th>Active Ingredient</th>
<th>Mode of Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roundup</td>
<td>Glyphosate</td>
<td>EPSP synthase</td>
</tr>
<tr>
<td>Gramoxone</td>
<td>Paraquat</td>
<td>Cell membranes</td>
</tr>
<tr>
<td>Treflan</td>
<td>Trifluralin</td>
<td>Mitosis root inhibitor</td>
</tr>
<tr>
<td>Dual Magnum</td>
<td>s-Metolachlor</td>
<td>Shoot inhibitor</td>
</tr>
<tr>
<td>Select</td>
<td>Clethodim</td>
<td>Lipid Synthesis</td>
</tr>
<tr>
<td>Sandea</td>
<td>Halosulfuron</td>
<td>Amino acid synthesis</td>
</tr>
<tr>
<td>Aatrex</td>
<td>Atrazine</td>
<td>Photosynthesis inhibitor</td>
</tr>
<tr>
<td>Weedone</td>
<td>2,4-D</td>
<td>Growth Regulator</td>
</tr>
</tbody>
</table>

**Cultural**

- Smother crops *(living)*
- Crop rotation
- Hand pulling
- Hoeing
- Mowing
- Water management
- Mulching *(dead)*
**Mechanical (physical)**

- Cultivation
- Plastic films
- Weed fabrics

**Mechanical (physical)**

- Spider gangs
- Tine weeders
- Brush hoe

**Biological**

Utilizing natural enemies for control of weeds

1. Insects
2. Diseases
3. Mammals
4. Fish
5. Birds
6. Natural compounds found in organisms
Biological weed control uses host specific diseases and insects to integrate with and to reduce herbicide use.

Preventative
1. Obey local, state, federal and international laws regulated seed transportation.
2. Use certified weed-free crop seed.
3. Use weed-free manure and hay.
4. Clean cultivation and harvesting equipment between fields.
5. Eliminate weed infestations near or around irrigation ditches or cultivated fields.
6. Practice “zero tolerance”.

Integrated Weed Management:
The use of two or more of the recognized weed control categories.