



Lima Bean Fields Infested with ALS-Resistant Amaranths/Pigweeds in Delaware

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How Problems with ALS-Resistant Amaranths Developed

Amaranth species are some of the most wide-spread weed species in Delaware and the region, infesting vegetable crops as well as grain crops. Amaranths include redroot pigweed, smooth pigweed, Palmer amaranth, and waterhemp. Amaranths are capable of quickly becoming the dominant species in a field due to its high seed output, producing over 100,000 seeds per plant.

A number of herbicides are effective on amaranths if applied in a timely fashion. However, there are amaranth biotypes that are resistant to some of the most commonly used herbicides in commercial agriculture. One such group of herbicides is Group 2 (ALS-inhibiting) herbicides. This group includes the SU (sulfonylurea) and IMI (imidazolinone) herbicides. ALS stands for acetolactate synthase-inhibiting herbicide, since these herbicides inhibit the function of this plant enzyme. Herbicides in this group include: Pursuit, Raptor, Sandea, Accent, Matrix (or Resolve), FirstRate, and others. In lima beans, Pursuit, Raptor, and Sandea are labeled and have been extensively used for broadleaf weed control.

A number of interrelated issues have resulted in the development and spread of Group 2 resistant amaranths in Delaware:

- ALS herbicides were commercialized in the mid-80s, and therefore have been used for over 20 years.
- ALS herbicides have been used extensively in soybeans. Prior to the development of Roundup Ready soybeans, Group 2 herbicides were the most widely used soybean herbicides.

Also, they were commonly used as postemergence herbicides in corn. Research in vegetables showed good crop safety and improved weed control, resulting in herbicide registrations for vegetables in mid-90s. Group 2 herbicides soon became the preferred option for broadleaf weed control in labeled vegetables.

- The use of cultivation has been reduced in the last 20 to 25 years with weed control relying more on herbicides.
- Fields with Group 2 resistant amaranths produced seeds that were spread from field to field with equipment.
- Around 2010, Palmer amaranth began infesting fields, and it was resistant to Group 2 herbicides as well as Group 9 (glyphosate), and it quickly became widespread in southern Delaware.

Soil-applied herbicides currently labeled for lima beans do not provide full-season control of ALS-herbicide resistant amaranths. Dual, Treflan, and Prowl will provide some early season control of amaranths, but do not provide full-season control (control will last 4 to 6 weeks). Basagran is very inconsistent on amaranths, having activity only on plants less than 1 inch tall.

Control Strategies for Group 2 Herbicide-Resistant Amaranth in Lima Beans

1. **Avoid Als-Resistant Amaranths With Careful Field Selection.** If possible, do not plant lima beans in fields known to be infested with ALS-resistant amaranths.

Sandea, Pursuit, or Raptor will not control ALS-resistant amaranths populations. Keep records of fields where ALS-resistant amaranths has been a problem.

2. **Develop Rotations Where Amaranths Can Be Effectively Controlled.** This is best done with corn or soybeans. Limit use of Group 2 herbicides in rotational crops and plan amaranth control programs around other herbicide groups. Plan rotations carefully since many vegetable crops do not have herbicides available to control ALS-resistant amaranths. While amaranth seeds remain viable in the soil for a number of years, the vast majority of the weed seeds will decay within 3 to 5 years.
3. **Use Residual Herbicides With Amaranth Activity.** For lima beans, Treflan, Prowl, and Dual Magnum are labeled and have amaranth activity. While they may not provide full-season control, they will suppress amaranth growth and improve the effectiveness of cultivation.
4. **Plan To Cultivate In Fields Known To Have Als-Resistant Amaranth.** Cultivate early, probably twice. Do not set the cultivator too deep so that you minimize disruption of the herbicide layer.
5. **Reduce Or Eliminate Spreading Seeds With Equipment.** If you suspect ALS-resistant amaranths (or any other hard-to-control weed) are present in a field, limit seed production. Mowing, tillage, or non-selective herbicides should be used immediately after harvest to stop additional seed production. Be sure to clean the equipment before it moves from the suspected field so that the infestation remains contained.

How effective is rope-wicking or electric weeder? Rope wicking, wiper bars, or electric weeders are harvest aids, not a viable weed control option. These strategies will only kill large weeds, those plants that do not come in contact with the wick/bar/units will not be controlled. And those that are controlled will have already impacted yields. To improve the effectiveness of rope wicking, be sure to wipe in opposite directions and travel no faster than 2.5 mph for heavy weed densities.

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Harvest Aids

In fields with ALS-resistant pigweed escapes, one tool that is available is a wiper bar that applies glyphosate over top of the lima bean crop as a harvest aid to reduce weed biomass going through harvest equipment and reduce seed production. Since most of the Palmer amaranth and waterhemp is resistant to glyphosate, this approach will not work on these species.