Herbicide-resistant horseweed (marestail) in Michigan

Keys to management in no-till soybean

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Horseweed (*Conyza canadensis* L.), also known as marestail, is an annual weed that can follow a winter or summer annual life cycle. While horseweed can emerge in the fall, we have observed more horseweed emergence from early spring through summer (March through August). Horseweed matures in late summer, allowing for greater competition with crops. Horseweed traditionally starts out as a rosette, however, we have observed plants emerging in more of a bolted form in the spring and summer. Horseweed bolts in April-June, flowers in July-August, and sets and disperses seed from August through October. These plants not only reduce soybean yield, but large mature plants may interfere with soybean harvest. Each plant can produce up to 200,000 seeds that travel long distances in the wind. Up to 86% of seeds produced can germinate right off the plant and 59 to 91% of fall emerging seedlings can survive the winter, causing problems in the next spring's crop.

Michigan no-till soybean field infested with horseweed

Herbicide resistance in horseweed:

Horseweed resistance to the ALS-inhibitors (Group 2), triazines (Group 5), and glyphosate (Group 9) have been identified in Michigan. However, horseweed **resistance to multiple herbicides** including, **glyphosate** and **ALS-inhibitors**, are common in Michigan. These multiple resistance profiles make it difficult to manage horseweed, since glyphosate will not control horseweed in the burndown application or postemergence in Roundup Ready soybean. If ALS-resistance is present the use of PRE or POST applications of Classic (*chlorimuron*), FirstRate (*cloransulam*), or other ALS-inhibitors will not effectively control horseweed. Horseweed management strategies need to rely heavily on effective burndown treatments that include 6 to 8 weeks of residual control from PRE herbicides, as well as, the use of soybeans with other herbicide-resistant traits for postemergence herbicide options.

Fall emerging horseweed | Spring/summer (June) emerging horseweed | Horseweed bolting in spring | Seedhead prior to seed dispersal

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Consider planting LibertyLink, LibertyLink GT27, Enlist E3 or XtendFlex soybean

Glufosinate (Liberty Ultra, others) is one of the most effective postemergence herbicide options for control of multiple-resistant horseweed. Soybean that are LibertyLink, LibertyLink GT27, Enlist E3 or XtendFlex can be treated with glufosinate postemergence. To effectively control horseweed in soybean with these traits the following recommendations need to be followed.

- Effective burndown and residual herbicides outlined on the following pages are needed prior to planting.
- Apply Liberty Ultra (24-34 oz/A) POST prior to horseweed exceeding 6-inches in height. Ammonium sulfate (AMS) should always be included, unless prohibited by tank-mix partners. Use the higher glufosinate rate to control taller plants or plants that have escaped initial control. Follow with a second POST application of Liberty Ultra as needed.

Remember glufosinate products can only be applied over-the-top of soybean that are glufosinate-resistant.

Enlist E3 soybean:

In addition to glufosinate resistance, Enlist E3 soybean are also resistant to the choline salt of 2,4-D and glyphosate. The use of Enlist One (2,4-D choline) or Enlist Duo (2,4-D choline + glyphosate) in Enlist E3 soybean provides additional options for horseweed control. From MSU research we have observed effective horseweed control when these recommendations are followed.

- Tank-mix and apply Enlist One (32 oz/A), Enlist Duo (4.75 pt/A), or another effective burndown herbicides with a residual (PRE) herbicide prior to planting or emergence of Enlist E3 soybean.
- Apply Enlist One (32 oz/A), Enlist Duo (4.75 pt/A), Liberty Ultra (24-34 oz/A) or a combination of Enlist One + Liberty Ultra POST prior to horseweed exceeding 6-inches in height. Follow with a second POST application of any of these products if needed.

Guidelines and ***additional precautions*** for use of Enlist One and Enlist Duo in Enlist E3 soybean are outlined in Table 2G of the MSU Weed Control Guide (E0434).

Steps for successful horseweed management in soybean

Step 1: Control emerged horseweed prior to planting!!

Tillage or effective burndown herbicide applications are the only two methods available to control emerged horseweed prior to planting soybean. For tillage to be effective it needs to be close to the time of planting, thoroughly mixing the top few inches of soil to uproot any existing horseweed plants. Vertical tillage tools are not effective. However, due to horseweed being mostly a problem in no-till or reduced till fields most growers will need to use effective burndown treatments for horseweed control. In some cases, in fields with historical horseweed problems two applications may be needed (fall followed by spring applications).

Effective burndown treatments (Fall):

- Best applied when horseweed is in the rosette stage, prior to 4-inches tall.
- Fall treatments should be used to control emerged horseweed, but a spring burndown treatment will still be needed. These treatments reduce variability from spring only treatments.
  - Use 2,4-D, dicamba, or Sharpen as the base herbicides in fall treatments. Tank-mixtures with other herbicides (i.e., glyphosate) will be needed to control other winter annual and perennial weeds.

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Step 1: Control emerged horseweed prior to planting *(continued)*

Effective burndown treatments (Spring prior to soybean planting):

- Horseweed needs to be managed prior to planting.
- Preplant herbicide treatments should be applied when horseweed plants are less than 4-inches tall.
- The most consistent options for horseweed control have more than one effective herbicide site of action.

Options with one effective herbicide:

- 2,4-D ester (1 pt) + glyphosate + AMS (7 days or more prior to planting)
- Sharpen (1 oz) or *saflufenacil* products (Zidua PRO or Verdict) + glyphosate + MSO + AMS
- Liberty Ultra (24 to 34 oz) + AMS
- Enlist One (32 oz) + glyphosate + AMS or Enlist Duo (4.75 pt) + AMS in ***Enlist soybean.*** See guidelines as outlined in Table 2G of the MSU Weed Control Guide (E0434).

Options with more than one effective herbicide:

- 2,4-D ester (1 pt) + Sharpen (1 oz) + glyphosate + MSO + AMS (7 days or more prior to planting)
- 2,4-D ester + Gramoxone + *metribuzin* + COC (7 days or more prior to planting)
- Sharpen (1 oz) or *saflufenacil* products + Liberty Ultra + MSO + AMS
- Liberty Ultra + *metribuzin* + AMS
- Gramoxone + *metribuzin* (at least 8 oz) + COC
- Other combinations of effective burndown treatments, as long as label restrictions are followed.

Step 2: Include effective residual (PRE) herbicides with burndown treatment

- The use of effective residual herbicides is essential for horseweed control until the soybean canopy develops. Options with only one effective active ingredient provide more variability in residual control. Utilizing more than one effective active ingredient is more consistent.

Options with one effective herbicide:

- **Group 5 herbicides:** *metribuzin* (at least 8 oz) and *metribuzin* premixes (i.e., Boundary, Tendovo, Tripzin ZC) can be applied with any of the burndown treatments. Additional *metribuzin* may need to be added to premixes to increase the *metribuzin* rate to at least 8 oz/A. DO NOT exceed the recommended *metribuzin* rate for the soil type.
- **Group 14 herbicides** can be applied with any of the burndown treatments, except Sharpen (*saflufenacil)* products unless applied 14 days prior to planting soybean. Group 14 herbicides include:
  - Valor or *flumioxazin* products: Afforia, Envive, Fierce, Fierce XLT, Surveil, or Valor XLT
  - *Sulfentrazone* products: Authority Assist/Edge/Elite/First/Supreme/XL, BroadAxe XC, or Sonic
  - Sharpen (1.5 oz) can be applied, but only if applied 14 d prior to planting and soil O.M. >2%, see label.

Options with more than one effective herbicide:

- Best residual control of multiple-resistant horseweed will be from tank-mixtures or premixtures that contain two effective herbicides.
  - *Metribuzin* + Valor (*flumioxazin*)
    - Premixtures: Dimetric Charged, Fierce MTZ/Kyber Pro, Trivence
  - *Metribuzin* + *sulfentrazone* - Sonic Boom

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