



Reducing Seedbanks to Improve Weed Management

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Integrated Pest Management
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Outline

- Prevent seeds from entering your soil
- Deal with seeds already in your soil



Clean fields





Prevent weed seed production



- These farmers control weeds only enough to avoid yield loss

- These farmers prevent weed seed production

Economic threshold for controlling weeds?

- Based on single-season:
 - Economic threshold: 1 weed per 30' of crop row
 - BUT under threshold could still add millions of weed seeds per acre

A photograph of two people in a field. In the foreground, a man with long dark hair, wearing a blue baseball cap and a green t-shirt, is holding a large, thick carrot with green leaves. He is looking towards the right. In the background, another person wearing a yellow t-shirt is visible, looking towards the man with the carrot. The field is filled with tall green grass and some white flowers. The background is a dense line of trees.

Early-season hoeing

“You can get a great crop even with late season weeds, so the incentive to control them is low”

- Peacemeal Farm

A photograph of a vegetable field. In the foreground, there are several rows of young green plants, likely lettuce or similar leafy greens, spaced out in neat rows. The soil is light-colored and appears to be well-tended. In the background, there is a large, covered structure that looks like a greenhouse or a covered walkway, with a white covering. Beyond that, there's a green field and some trees in the distance under a clear sky. The overall scene is bright and sunny, suggesting a clear day.

Full-season hoeing

“Every year, I find that I need to weed less than I did the year before”

- Hurricane Flats Farm

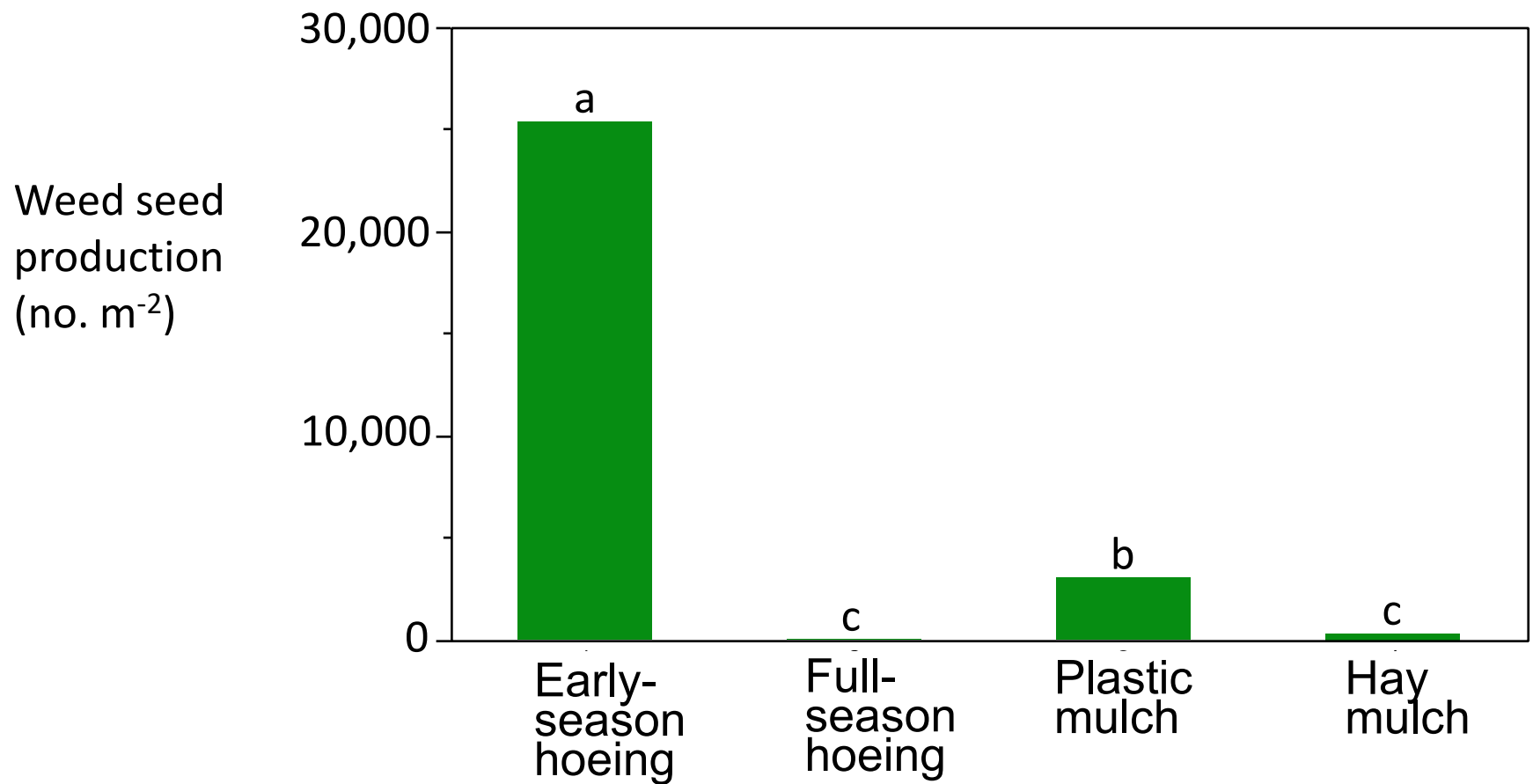
Farm summaries

| Strategy | Weed Seedbank (no. m ⁻²) | Soil Organic Matter (%) | Land in Production (ac) | Full-Time Summer Employees (no.) |
|---------------------|--------------------------------------|-------------------------|-------------------------|----------------------------------|
| Early-season hoeing | 38,482 | 6.0 | 25 | 10 |
| Full-season hoeing | 3,065 | 3.8 | 10 | 2 |

Field comparison of strategies



Weed seed production







Waterhemp field trials



Photo: Jaime Cummings



Photo: Jaime Cummings

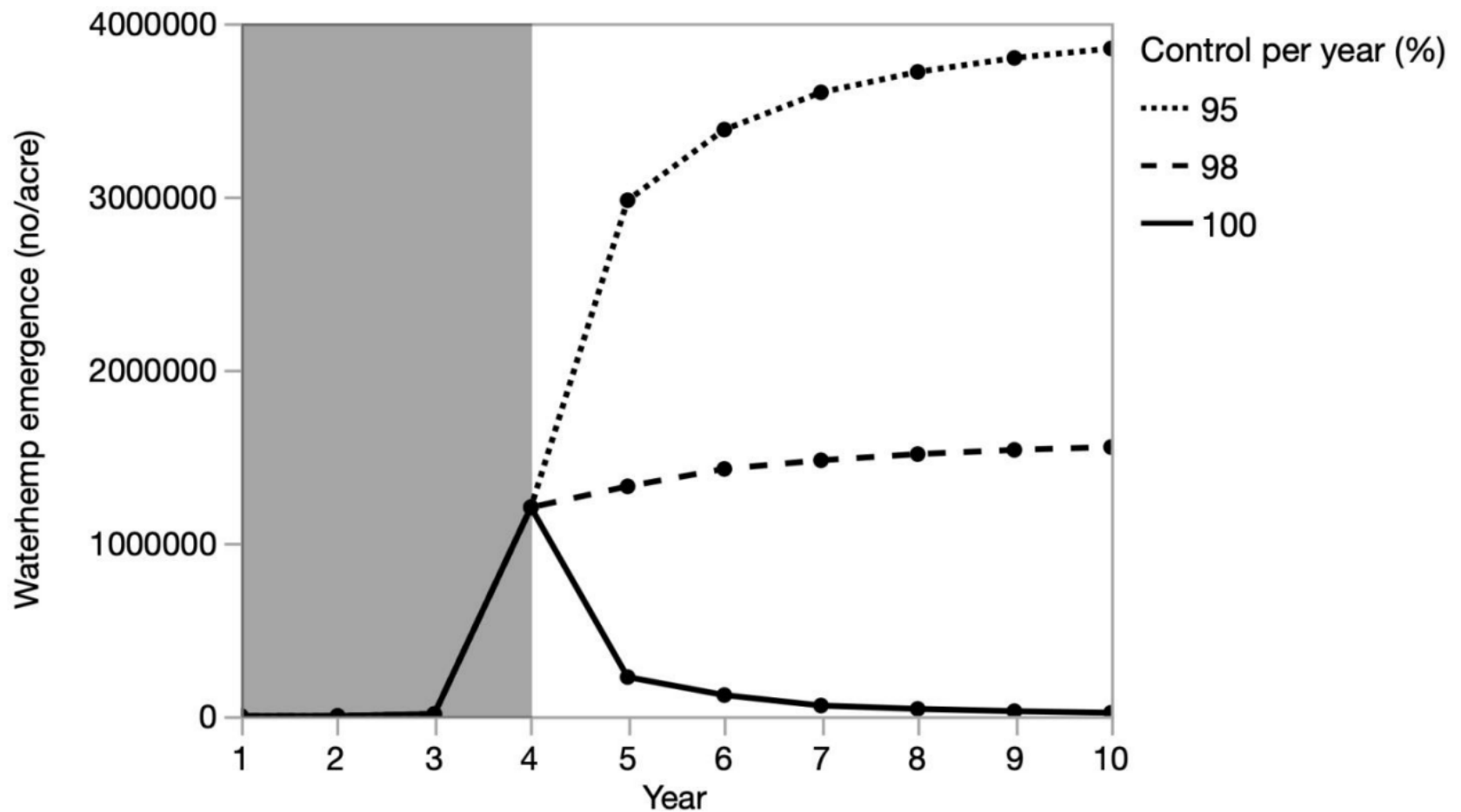


Table 3. Effectiveness and estimated custom applicator cost for each treatment.

| Treatment | Pre-emergence | Post-emergence | 2019 waterhemp control (%) | 2020 waterhemp control (%) | Cost (\$USD/A) |
|-----------|----------------------|----------------------------------|----------------------------------|----------------------------------|----------------|
| 1 | – | – | 0 | 0 | 0 |
| 2 | ResolveQ | – | 40 | 24 | 23 |
| 3 | Atrazine | – | 76 | 40 | 18 |
| 4 | Callisto | – | 89 | 76 | 26 |
| 5 | Acuron | – | 99 | 93 | 46 |
| 6 | HarnessMax, Atrazine | – | 99 | 100 | 40 |
| 7 | – | Acuron | 92 | – | 46 |
| 8 | – | Status, ResolveQ | 92 | – | 52 |
| 9 | – | Atrazine, Callisto | 99 | 47 | 23 |
| 10 | Acuron | Status, ResolveQ | 100 | 99 | 84 |
| 11 | Acuron | Row Cultivation | 100 | 100 | 62 |
| 12 | Callisto | Row Cultivation, Interseeding | 100 | 94 | 85 |

- [Effective Waterhemp Control Programs and Compatibility with Interseeding in Corn: 2020 Trials](#)
- [Controlling Herbicide Resistant Waterhemp in Soybeans: 2020 Trials](#)

Model based on weed biomass





A photograph of a field filled with tall, green weeds, likely Amaranth, with yellowish seed heads. The background shows a clear blue sky and a line of trees in the distance. The text is overlaid on the image.

Control the escapes

(Especially if herbicide resistance is suspected)

- Hand rogueing
- Mow tops
- Spray topping
- Electrical weed control (Weed Zapper)
- Mow or till in worst patches
- Separate seeds at harvest



Chaff cart

- Captures 80% of weed seed



Integrated Harrington Seed Destructor



Processed Soybean Chaff
Date: 10/15/2014
Location: 10/15/2014
Project: 10/15/2014
Operator: 10/15/2014
Comments: 10/15/2014

Unprocessed Soybean Chaff

Unprocessed Soybean Chaff
Date: 10/15/2014
Location: 10/15/2014
Project: 10/15/2014
Operator: 10/15/2014
Comments: 10/15/2014

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Operator: 10/15/2014
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Prevention

- “The cheapest way to control Palmer amaranth is to never get it in the first place” – PA farmer



Prevent spread from equipment



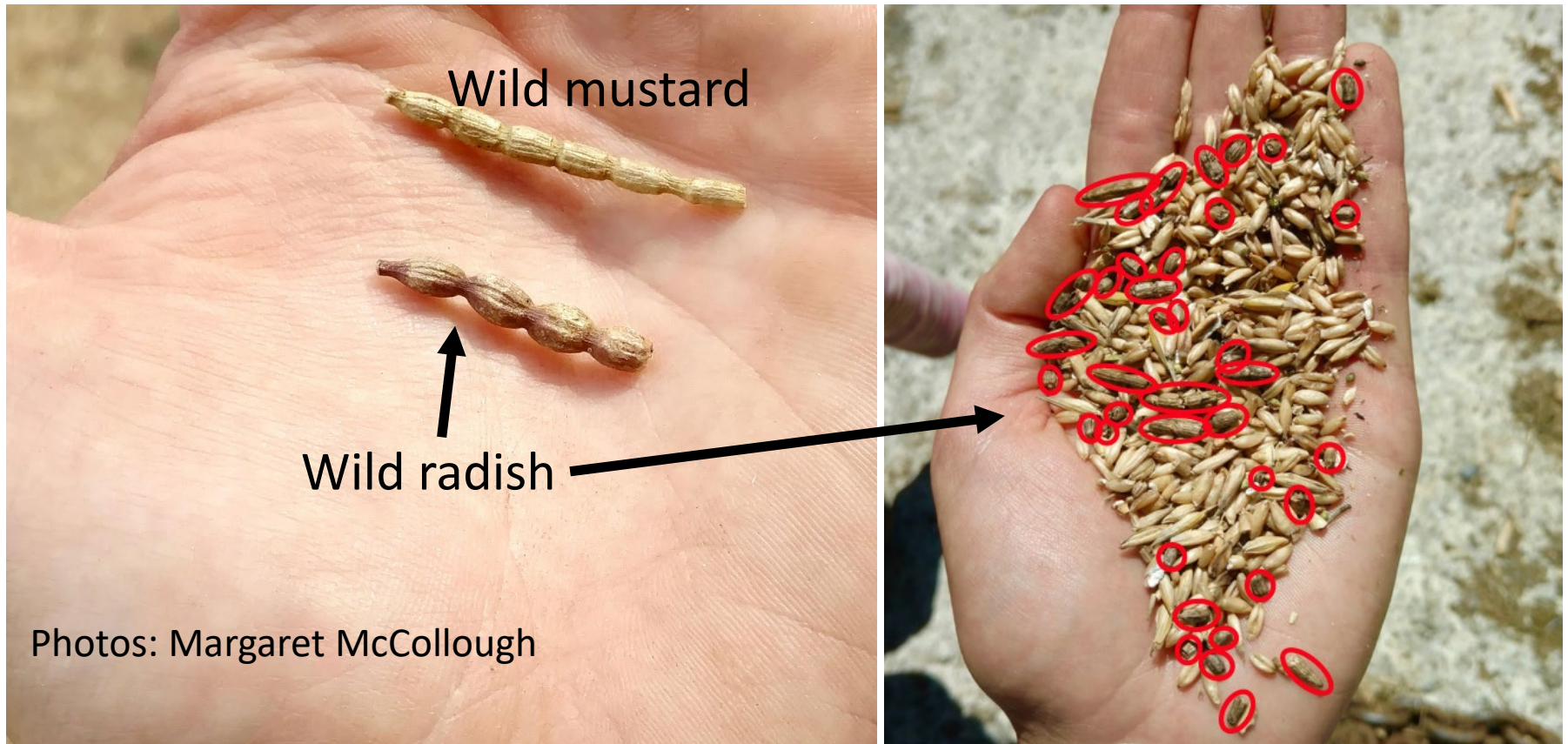
Prevent spread from combine

- 150 pounds of biomass left in combines
- Harvest weedy fields last
- Combine cleanout procedures online



Prevent spread from inputs

- Clean bedding and feed in dairy operations
- Grower-saved seed



Photos: Margaret McCollough

Prevent spread from borders

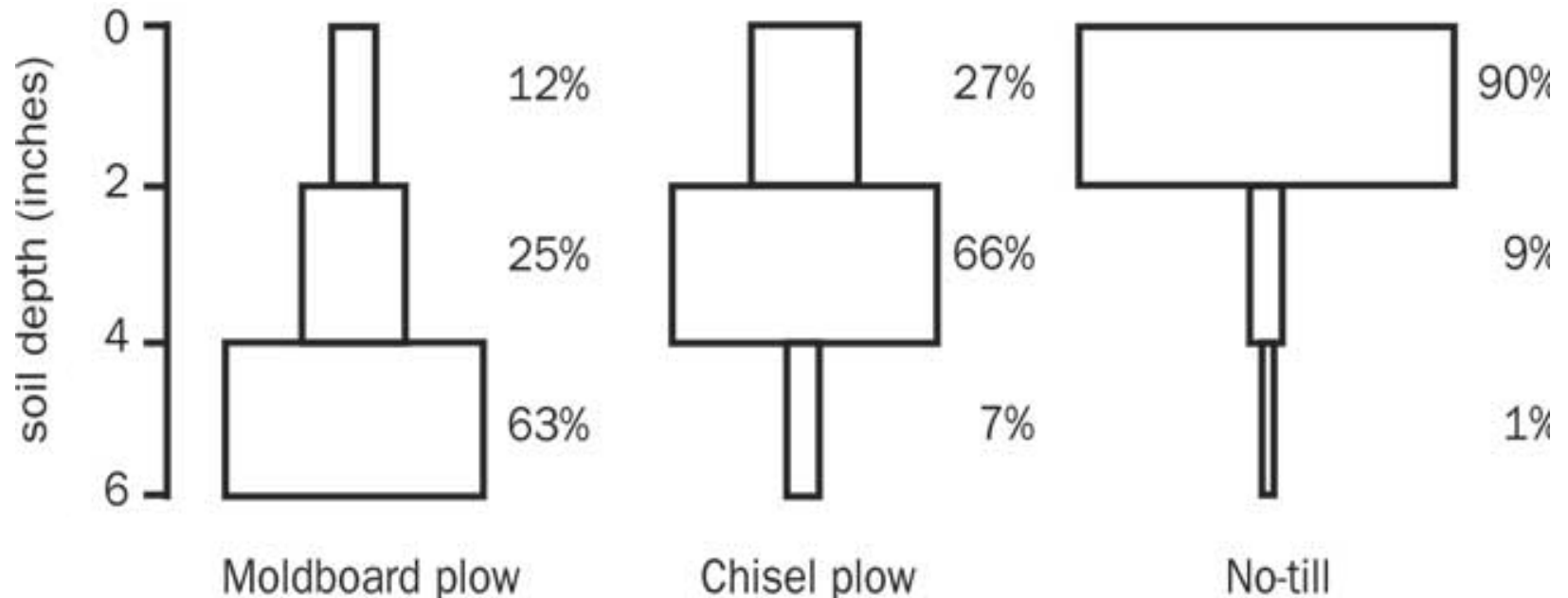


Part 2: How to deal with weed seeds already in your soil?

Deal with weed seeds



Deal with weed seeds





Get them to germinate:
Stale seedbed



Heat

Steam: \$2000/A

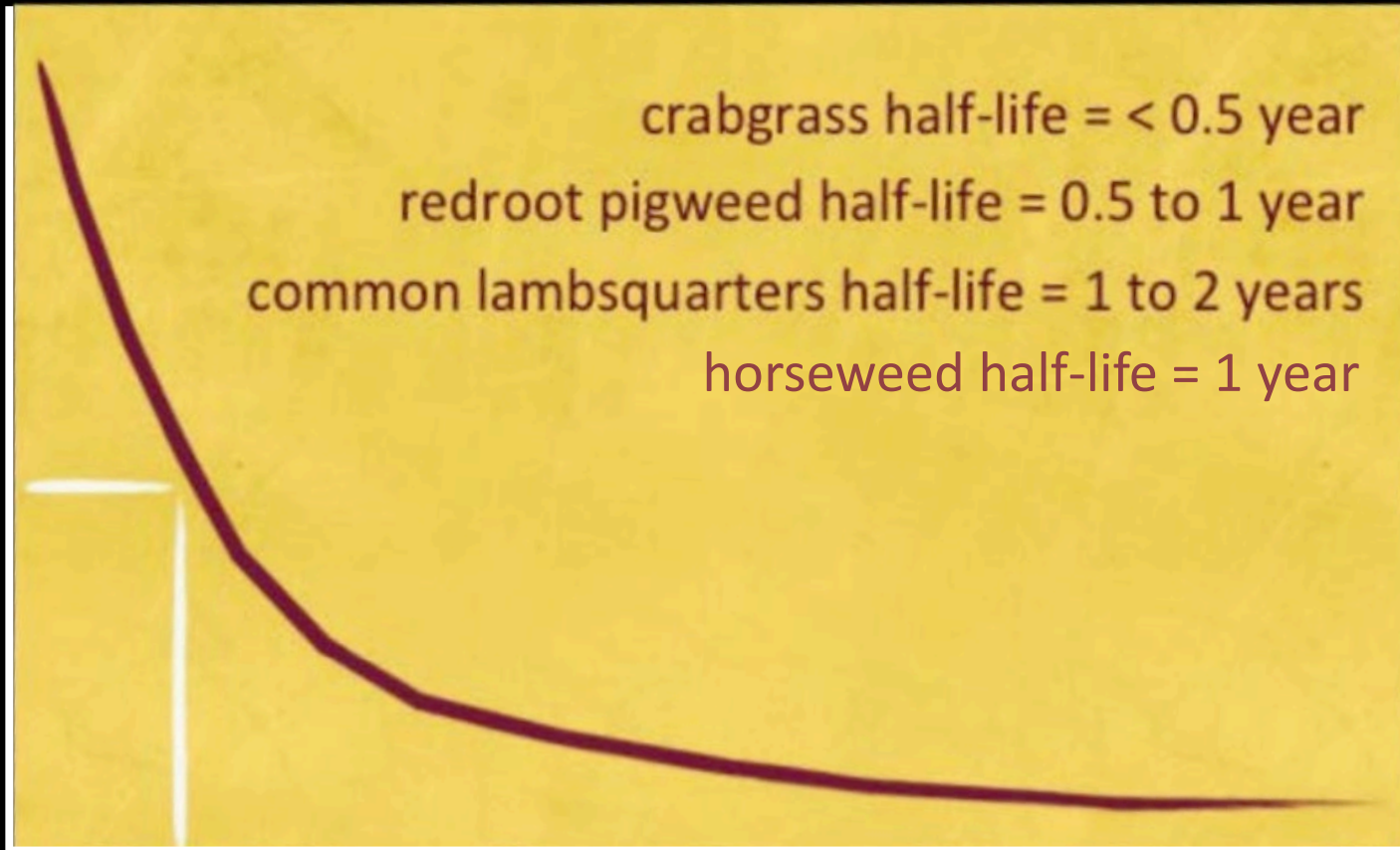


Solarization: \$700/A + month of no crops



Weed seed longevity

Viable
weed
seeds



← "half-life"

Time

Seed predation



Carabid beetles
Crickets
Worms



Sparrows
Finches



Rodents

How effective are seed predators?

- 52% of seeds eaten on average (Davis et al., 2011)
- 38% reduction in seedling emergence (Blubaugh and Kaplan, 2016).

Which seeds are preferred

- Larger predators prefer larger seeds
- Foxtails - relatively large seeds, highly palatable
- Common ragweed, giant ragweed (40% loss over winter due to rodents)
- Field pennycress – Carabids consumed 23% of the seeds per week in late summer
- My takeaway: most species are eaten

(summarized by Mohler et al., 2021)

Maximize seed predation

- Avoid post-harvest tillage so seeds remain on surface (Birthisel et al., 2015)
- Provide habitat refuges like no-till hedgerows, grassed drainage ways (Mohler et al., 2021)



Winter predation by birds





Conclusions





New Project



Provide 50 farms with:

- Seedbank analysis
- Comparison between farms
- Photos and Achilles' heels of each species
- Tailored management recommendations



Acknowledgements

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Or check out the New York State IPM website!

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Management by species

- Galinsoga – lack of dormancy
- Horseweed – tiny seed
- Perennials are less reliant on seeds
- Weed species may determine your crop selection