

From seeds to weeds:



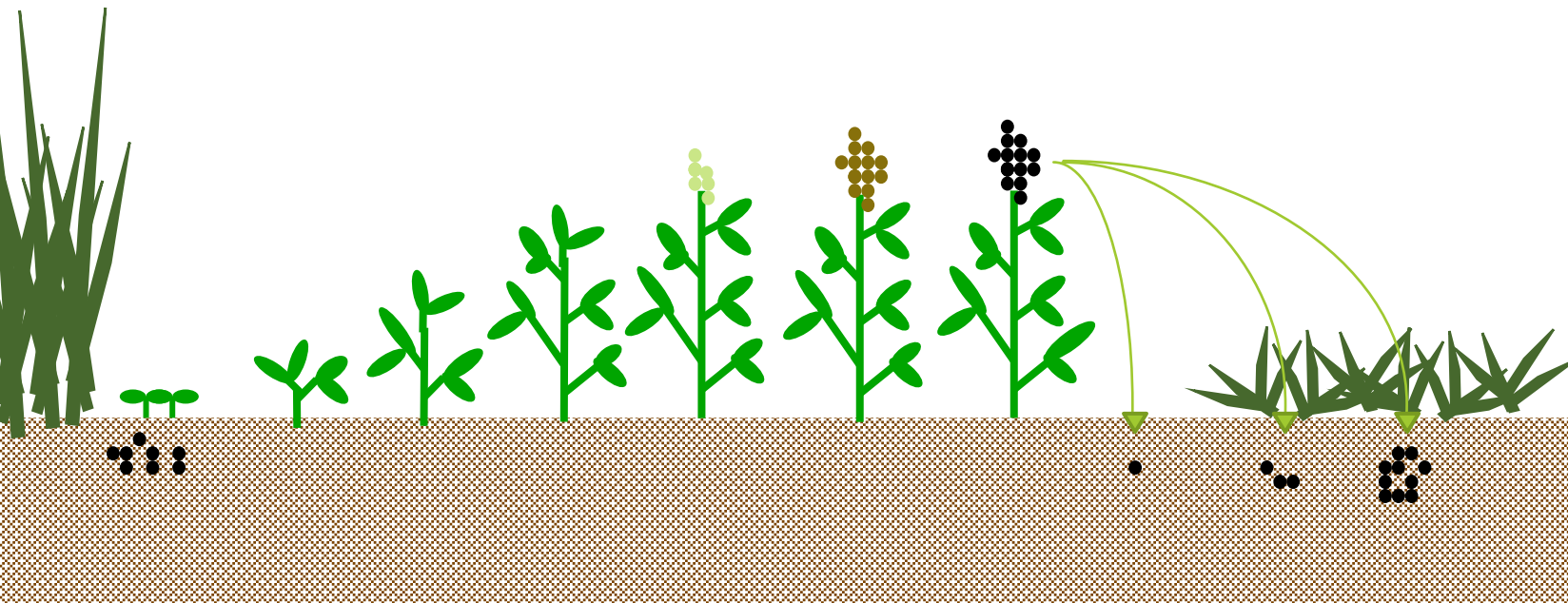
Factors influencing organic
weed management
throughout the lifecycle

**Erin Hill, Dept. of Plant, Soil, & Microbial
Sciences**

Summer annual lifecycle



How does a cover crop influence the weed community?



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Physical



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Physical

- Competition
- Mulch effect
- Altered soil environment
 - Nutrient availability
 - Soil moisture



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Chemical

- Allelopathy



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Chemical

- Allelopathy

Biological

- Weed seed predation
 - Soil surface
 - Within soil matrix
- Weed seed degradation

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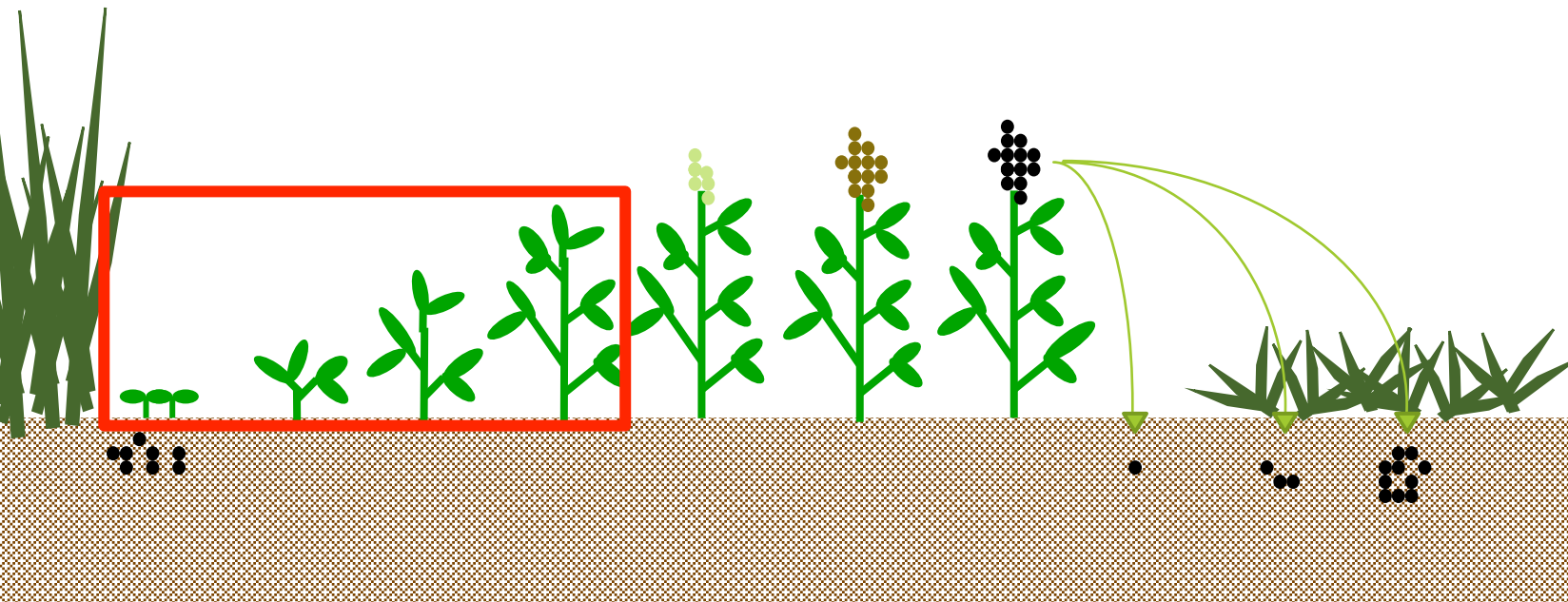
Chemical

- Allelopathy

Biological

- Weed seed predation
 - Soil surface
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Cover crops → Weed growth



Cover crop planting scheme



Red clover
'Marathon'
10 lbs/a



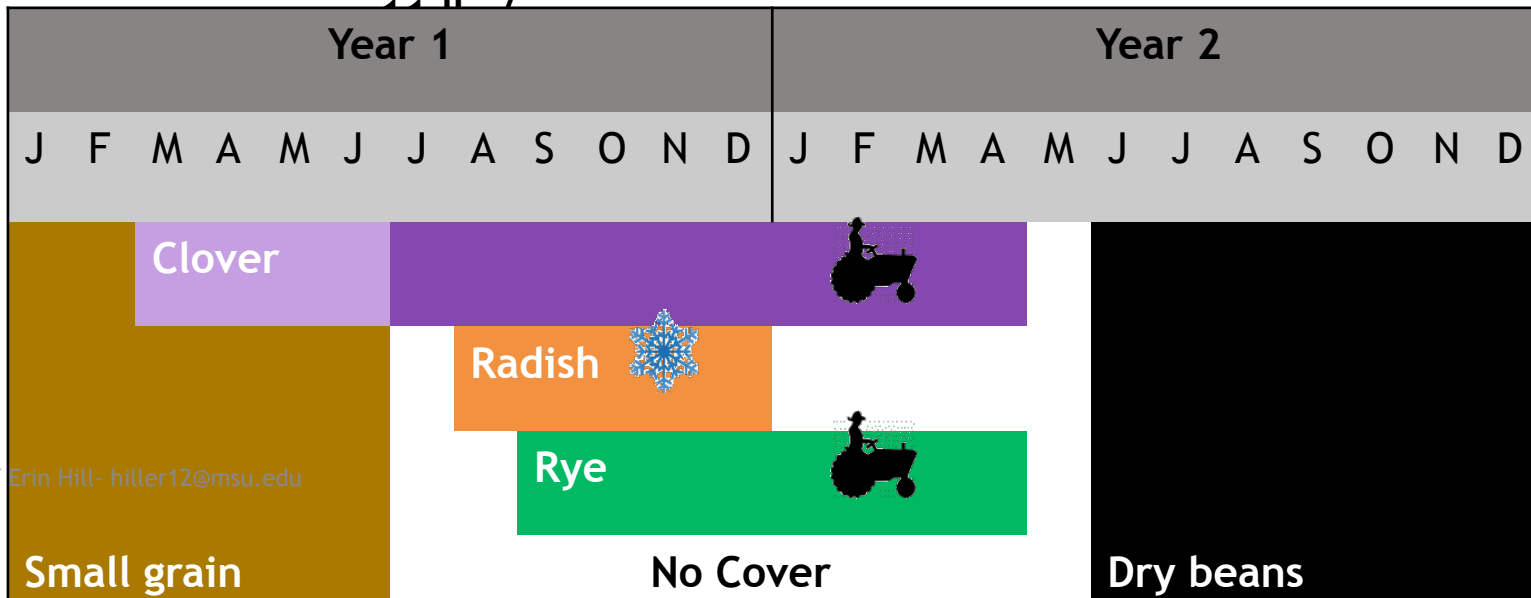
Oilseed
radish
'Groundhog'
14 lbs/a



Rye
'Wheeler'
90 lbs/a



No cover



Timing of measurements: Weeds

Pre-season	June	July	August	September	October
Peak cover crop biomass	@ Planting	2 nd trifoliat e (V2)	1 st flowe r (R1)	1 st full length pod (R5)	Harvest

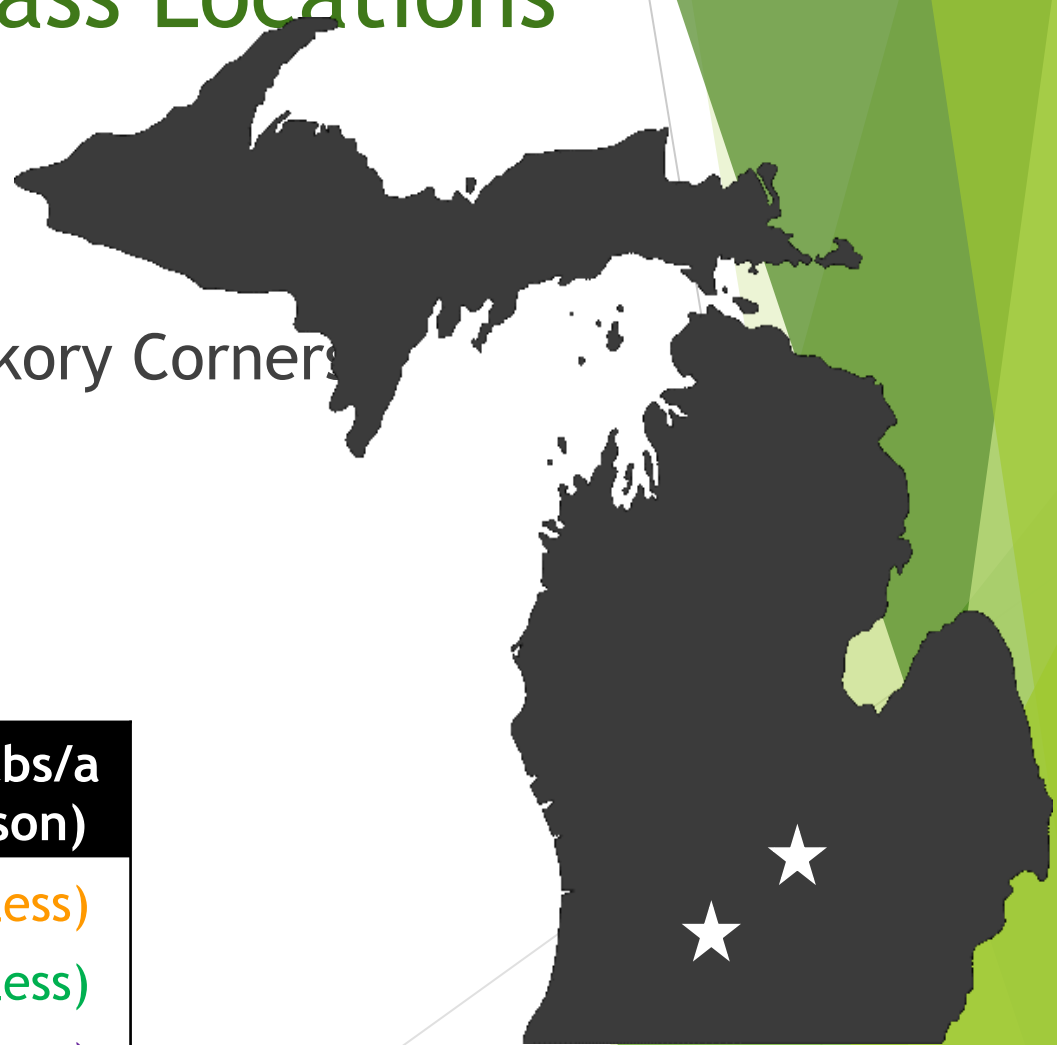
Spring weeds

In-season
weeds



High Cover Crop Biomass Locations

- ▶ MSU campus: East Lansing
- ▶ Kellogg Biological Station: Hickory Corners
- ▶ 3 site-years each



Cover crop	Average biomass -lbs/a (on-farm comparison)
Oilseed radish	3,600 (2,800- 22% less)
Cereal rye	9,600 (2,800- 71% less)
Medium red clover	6,900 (3,100- 56% less)

Property of Erin Hill - erinhill@msu.edu

Cover crops → Weed growth

**Compared to no cover control*

	Clover	Radish	Rye
Spring weed biomass			
Weed populations in dry beans			
Weed biomass in dry beans			

Cover crops → Weed growth

**Compared to no cover control*

	Clover	Radish	Rye
Spring weed biomass	Higher when summer seeded (<4,000 lbs/a)	Similar to no cover (3/6 sy)	Negligible spring weeds
Weed populations in dry beans			
Weed biomass in dry beans			

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Weed populations in dry beans

Weed biomass in dry beans



2011 MSU



2012 MSU

Cover crops → Weed growth

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Weed populations in dry beans	V2- higher (3/6 sy) R1- higher (5/6 sy)	No difference	Usually no difference
Weed biomass in dry beans			

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Weed biomass in dry beans	V2 & R1- higher (2/6 sy)	No difference	Usually no difference

Cover crops → Weed growth

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Negatively correlated with:

Radish biomass

**Rye N content
C:N ratio**

Cover crops → Weed growth

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Positively correlated with:
Clover biomass
N content

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Positively correlated with:

Clover biomass

N content

Other considerations: Fall seed inputs, seed distribution

Cover crops → Weed growth

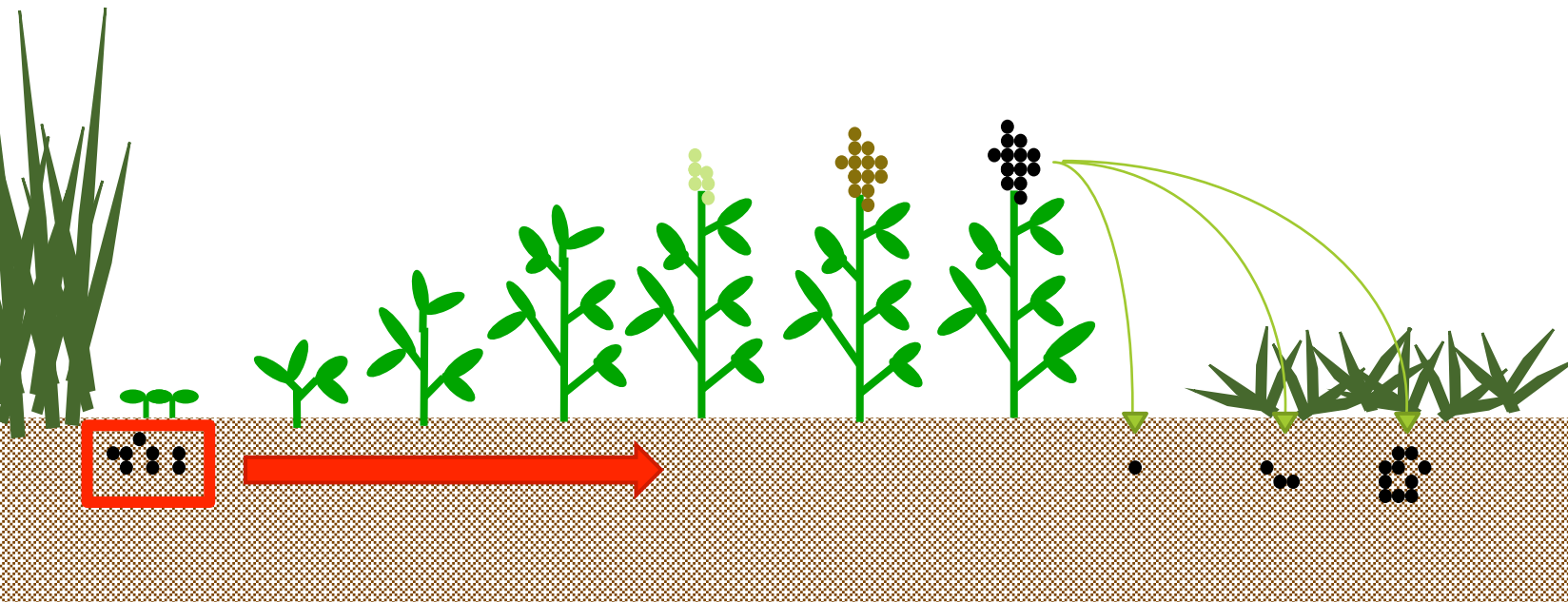
**Compared to no cover control*



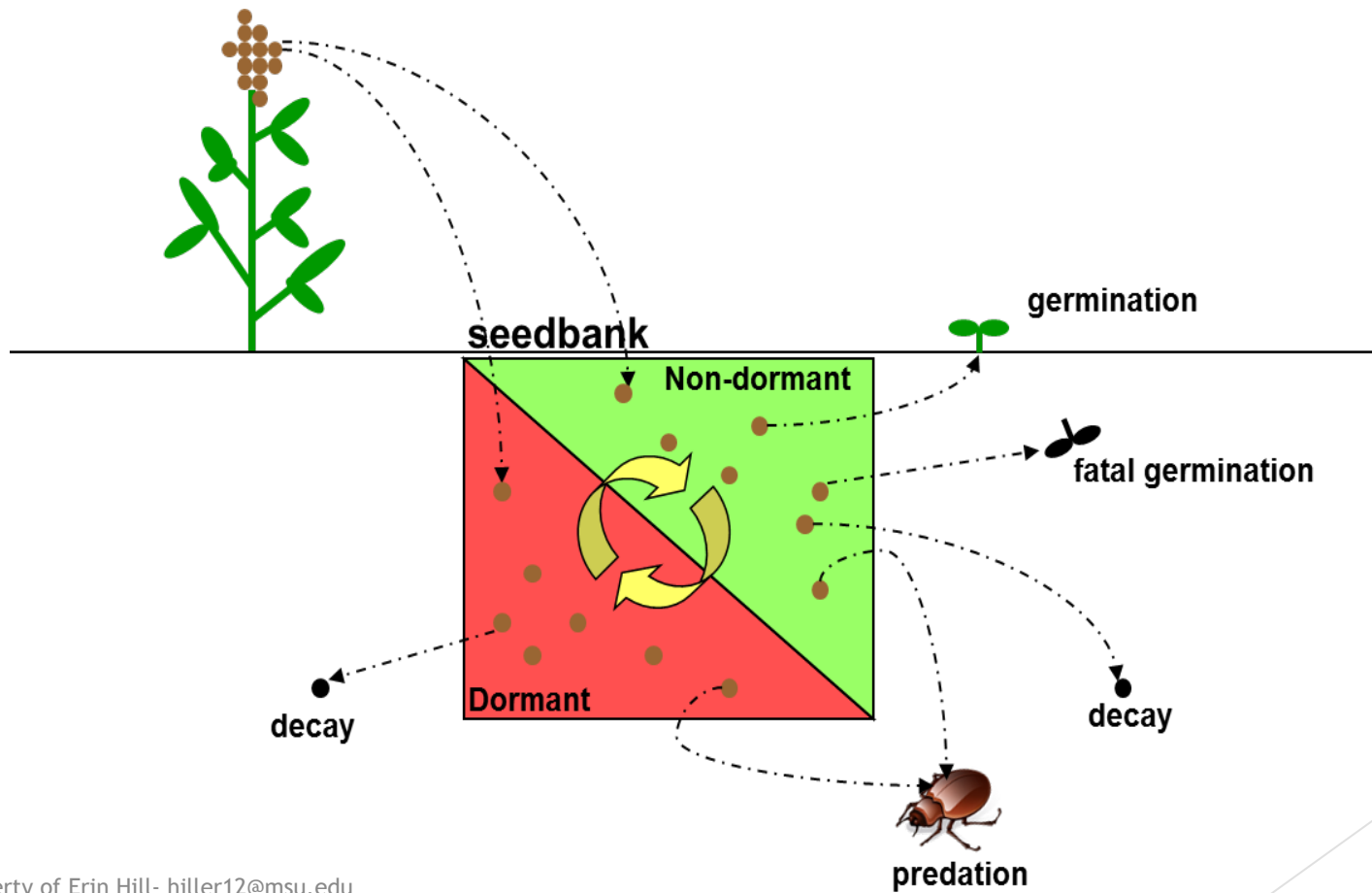
**Clover plot with greater c. lambsquarters pressure
2012 MSU**

Property of Eric Hill, bitter.12@msu.edu

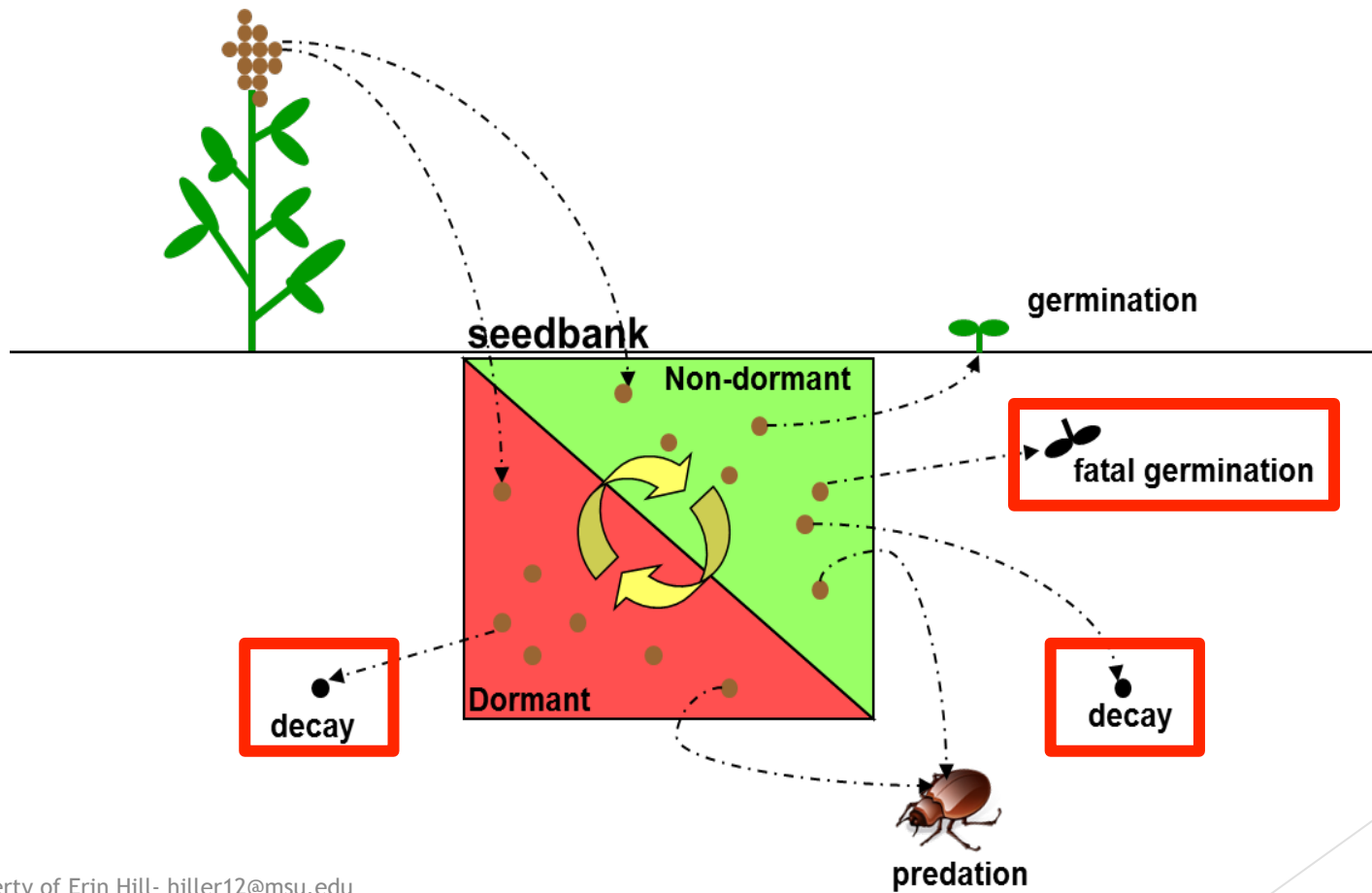
Cover crops → Weed seed persistence



Weed seed fates

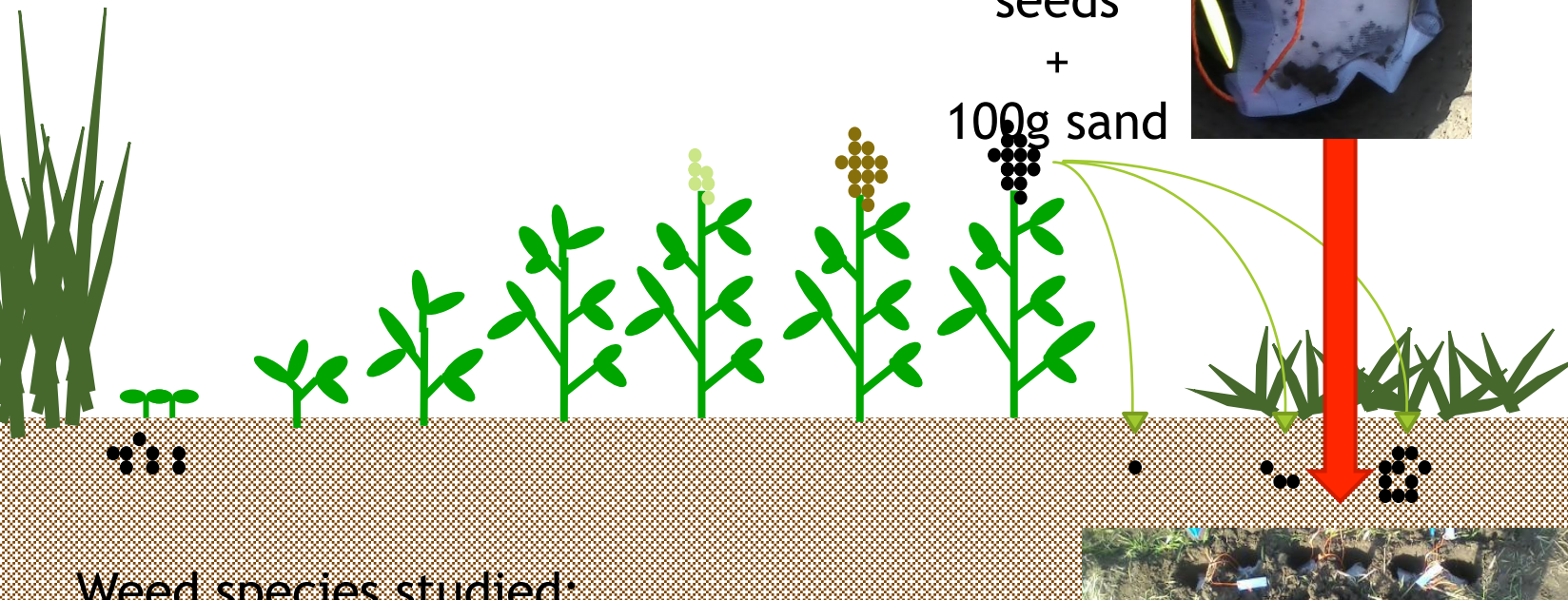


Weed seed fates



Cover crops → Weed seed persistence

200 fresh
weed
seeds
+
100g sand



Weed species studied:

- Common lambsquarters
- Giant foxtail
- Velvetleaf

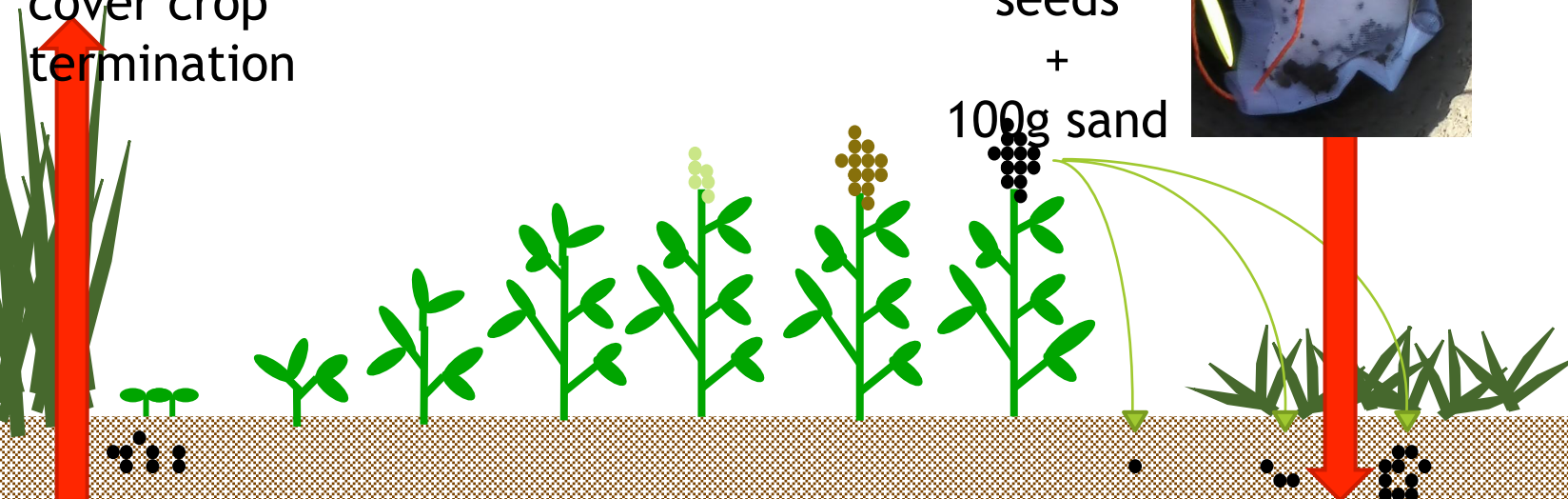
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Cover crops → Weed seed persistence

Bags were excavated prior to cover crop termination

200 fresh weed seeds + 100g sand



Weed species studied:

- Common lambsquarters
- Giant foxtail
- Velvetleaf



Cover crops → Weed seed persistence

Cover crops
studied:
cereal rye
medium red
clover
no cover

High “micro-site” rate



High rates of cover crops altered weed seed mortality

‡ Fisher's protected LSD ($P \leq 0.05$).
* Drought year

Year	Cover crop	Weed species		
		Common lambsquarters	Giant foxtail	Velvetleaf
Percent mortality (%)				
*2012	No cover	62.0	73.0	42.7
	Clover	64.8	75.2	46.5
	Rye	56.5	61.1	36.4
	LSD‡	NS	9.9	5.8
2013	No cover	36.0	95.7	5.7
	Clover	58.3	86.1	9.1
	Rye	31.3	91.8	8.8
	LSD	9.4	NS	NS

High rates of cover crops altered weed seed mortality

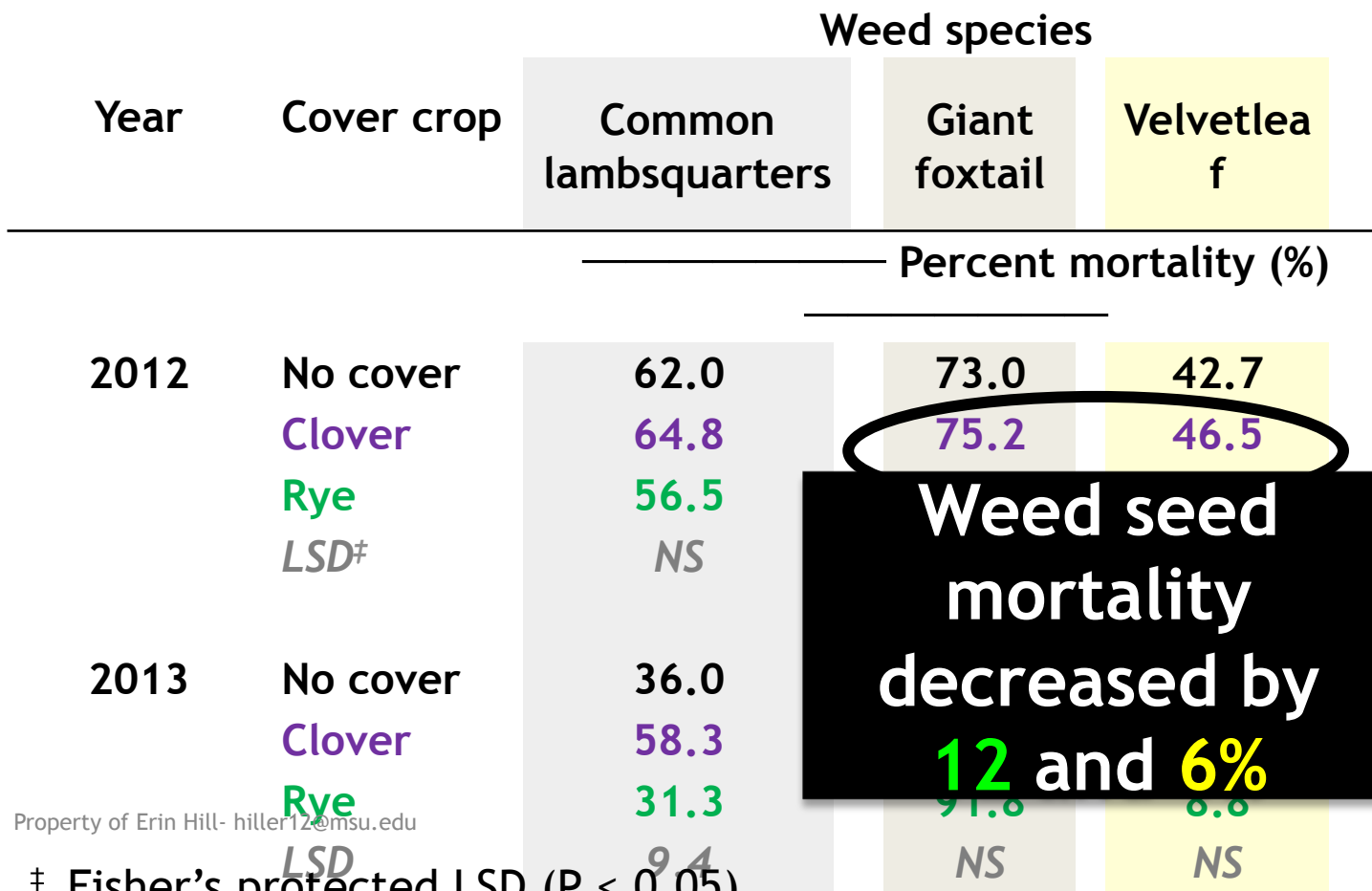
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Weed seed mortality increased by 25%

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[‡] Fisher's protected LSD ($P \leq 0.05$).

High rates of cover crops altered weed seed mortality



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High rates of cover crops altered weed seed mortality

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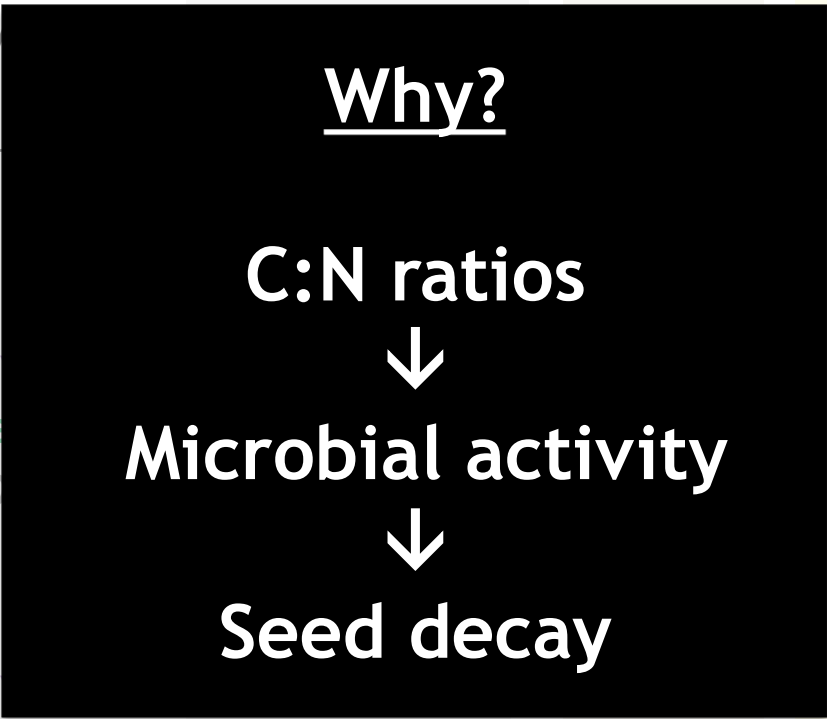
Mortality High / Low compared to 2012

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[‡] Fisher's protected LSD ($P \leq 0.05$).

High rates of cover crops altered weed seed mortality

Year	Cover crop	Weed species		
		Velvetleaf	Common ragweed	Redroot pigweed
				Mortality (%)
2012	No cover	42.7	46.5	5.8
	Clover	31.3	91.8	8.8
	Rye	9.4	NS	NS
	LSD			
2013	No cover	5.7	9.1	8.8
	Clover	31.3	91.8	8.8
	Rye	9.4	NS	NS
	LSD			

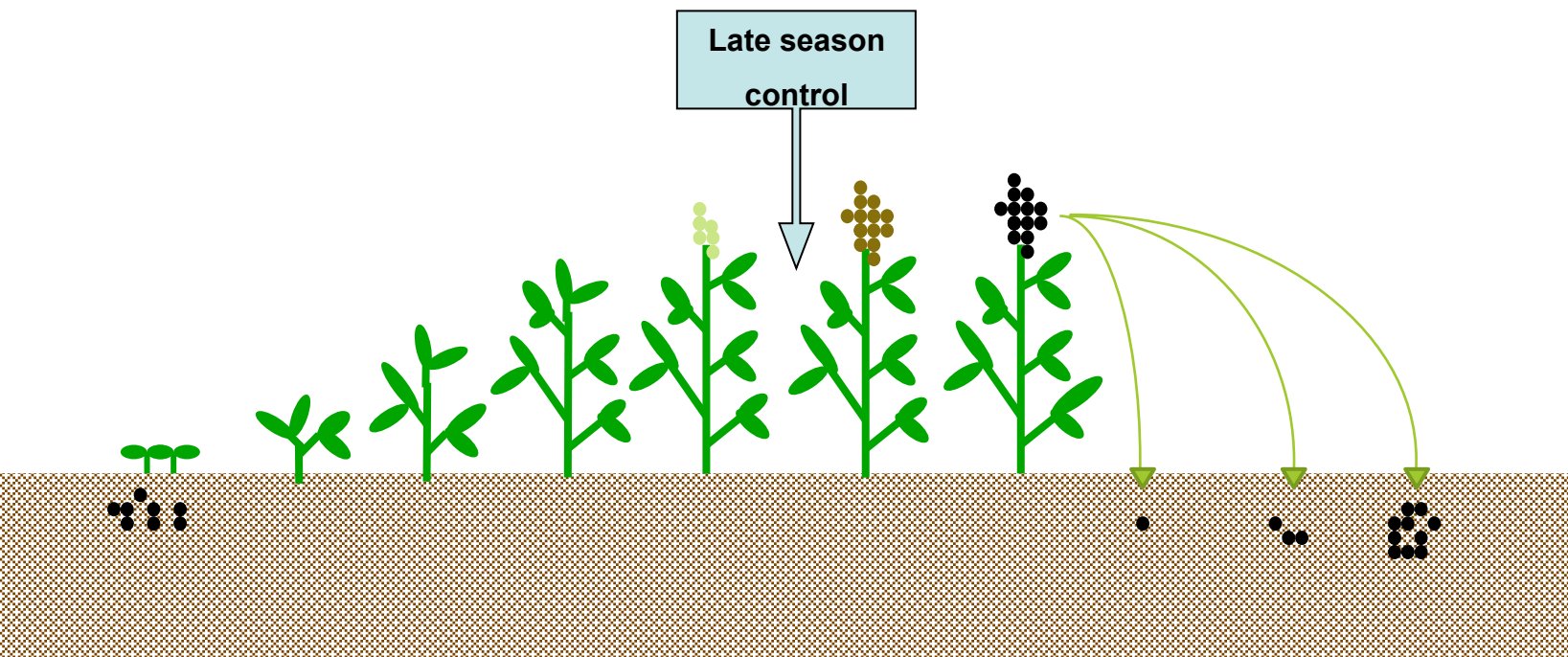


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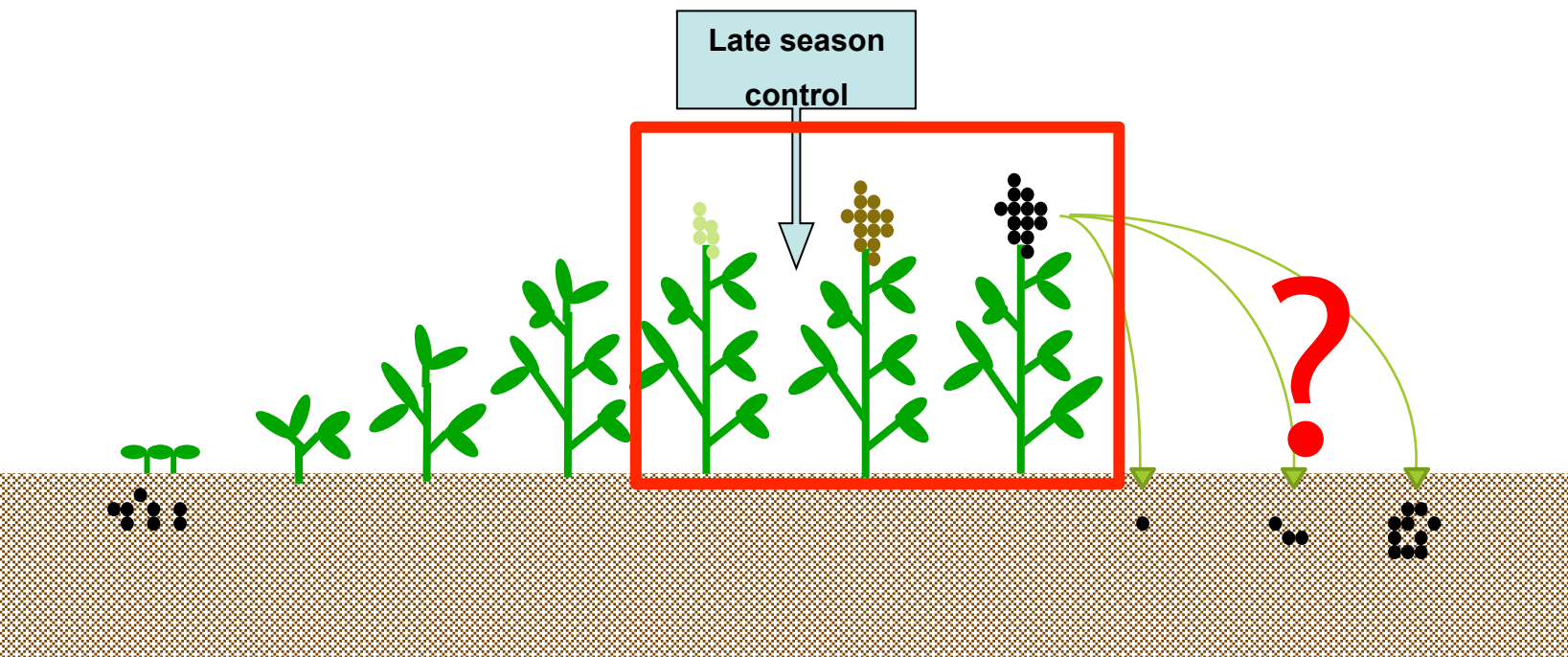
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How does late-season control affect additions to the weed seed bank?



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Do seeds form on weeds as they dry down?



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Weed species	Termination methods	Termination timings
Canada thistle	Cut (hoe)	Flowering
C. lambsquarters	X Chop (mow)	X Immature seed (white/green)
Giant foxtail	Spray with glyphosate	Early mature seed
Jimsonweed		
Velvetleaf		



Canada
thistle



C.
lambsquarters

Flower
difficult to
see

Giant foxtail



Jimsonweed



Velvetleaf



Flowering

Immature



Mature



Canada
thistle

C.
lambsquarters

Giant foxtail

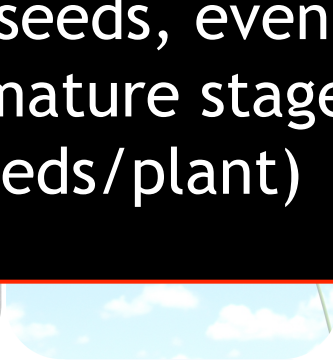
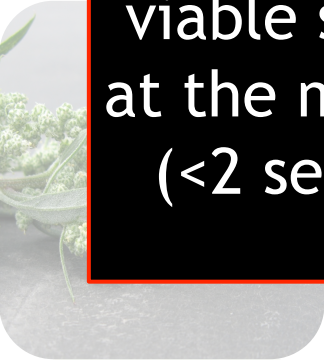
Jimsonweed

Velvetleaf

Flowering



Immature



Mature



Canada thistle
produced very few
viable seeds, even
at the mature stage
(<2 seeds/plant)

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Common lambsquarters	Chop (mow)	Immature seed (white/green)
Giant foxtail	Spray with glyphosate	Early mature seed
Jimsonweed		



Do seeds form on weeds as they dry down?

- ▶ Termination method did not influence viable seed production



YES, seeds form on weeds as they dry

Species Location/Year	Termination timing		
	Flowering	Immature	Mature
—————average viable seeds plant ⁻¹ —————			
C. lambsquarters			
MI 2011	.	35 a	6,817 b
MI 2012	.	6 a	12,279 b
Jimsonweed			
MI 2011	0 a	264 b	2,486 c
MI 2012	0 a	111 b	6,093 c
DE 2012	0	1,291	.
DE 2013	0	3,344	.
Velvetleaf			
MI 2011	0 a	0 a	123 b
MI 2012	0 a	49 b	607 c
DE 2013	0	#	.

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99% ↓

94% ↓

96% ↓

YES, seeds form on weeds as they dry down

Species Location/Year	Termination timing		
	Flowering	Immature	Mature
—————average viable seeds plant ⁻¹ —————			
Giant foxtail			
MI 2011 [‡]	5	69	191
MI 2012	0 a	10 a	925 b
DE 2012	232	.	.
DE 2013	1198 a	7611 b	.



MI

DE

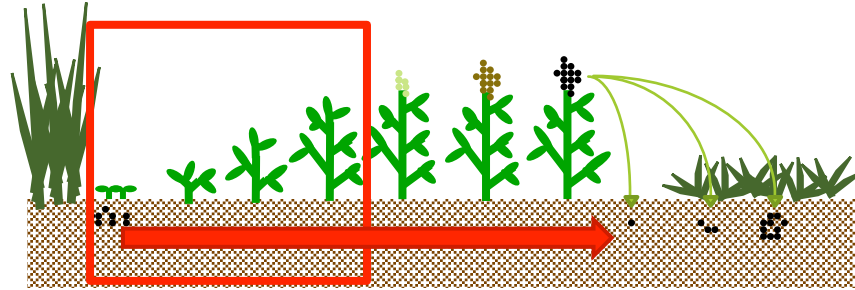
Seed production @
flowering varied
based on definition
of “flowering”

YES, seeds form on weeds as they dry down

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	Flowering	Immature	Mature
—————average viable seeds plant ⁻¹ —————			
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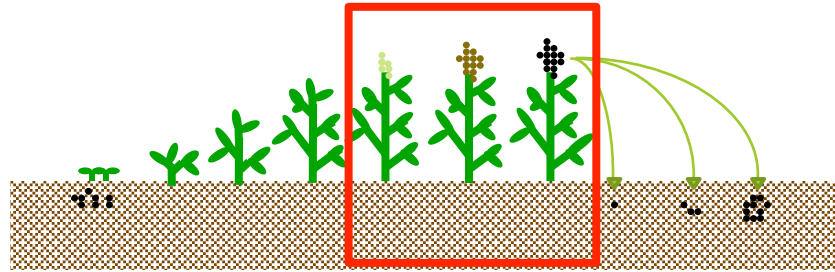
82% ↓

Conclusions



- ▶ Cover crops can influence weed communities when biomass is high
 - ▶ Clover
 - ▶ Can increase weed populations in dry beans
 - ▶ Can decrease weed seed viability
 - ▶ Cereal rye & Oilseed radish
 - ▶ Rarely influenced weed population in dry beans
 - ▶ Rye can prolong seed longevity

Conclusions



- ▶ Late season weed management operations can still add to the weed seed bank
 - ▶ Remove weeds at flowering if possible
 - ▶ Beyond flowering consider removing plant material from the field



Questions?

Erin Hill- hiller12@msu.edu

Other resources:

MSUweeds.com/organic

Midwest Cover Crops Council-

MCCC.msu.edu