Ecological management of winter weeds in pea-wheat-corn rotations

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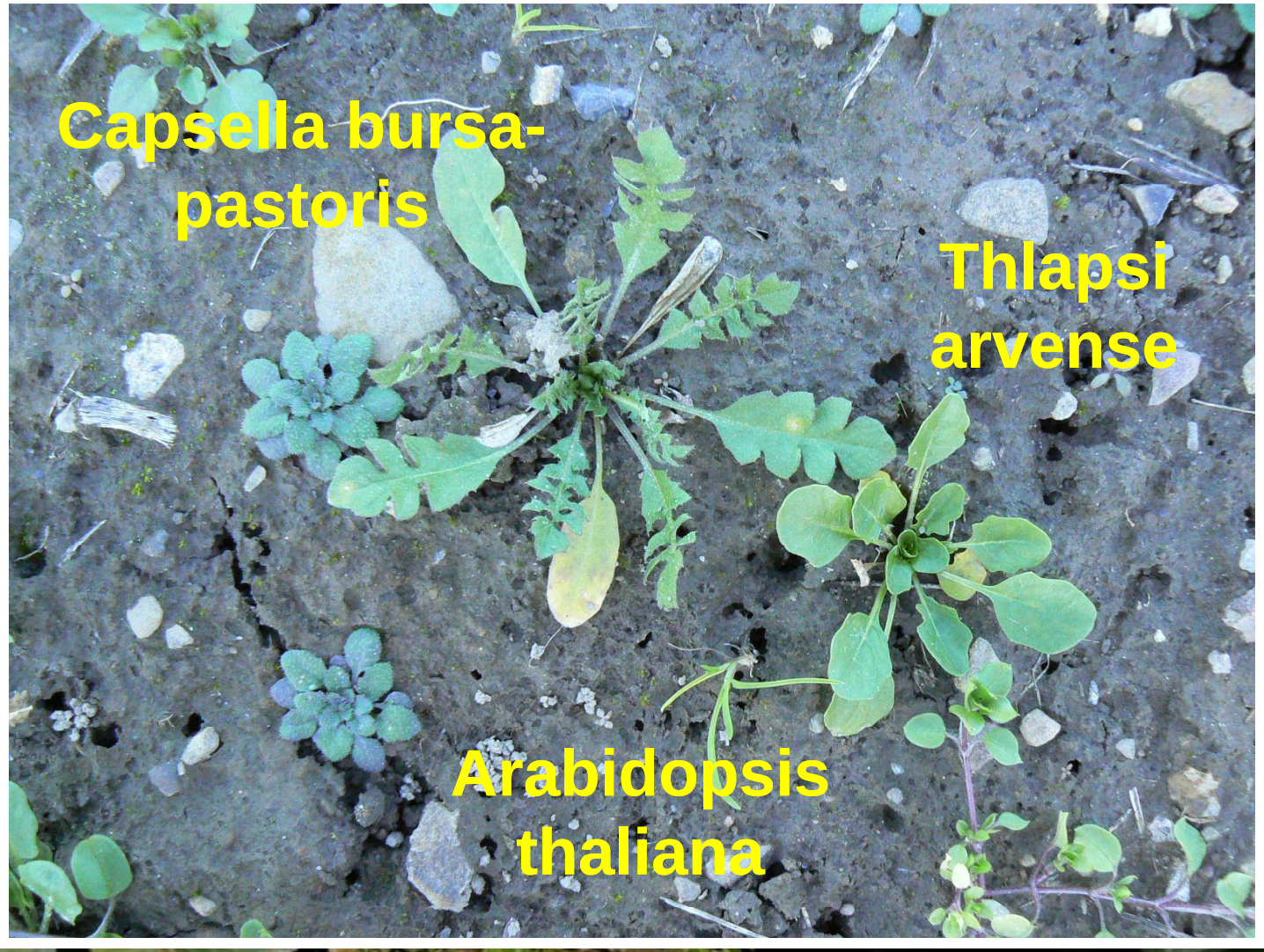
Introduction: winter annual weed problems

Interfere with winter annual and perennial crops

Introduction: winter annual weed problems



“Biological bridges” for insects and diseases?

Winter annuals as contaminant: Corn chamomile

“Daisy”
Anthemis arvensis

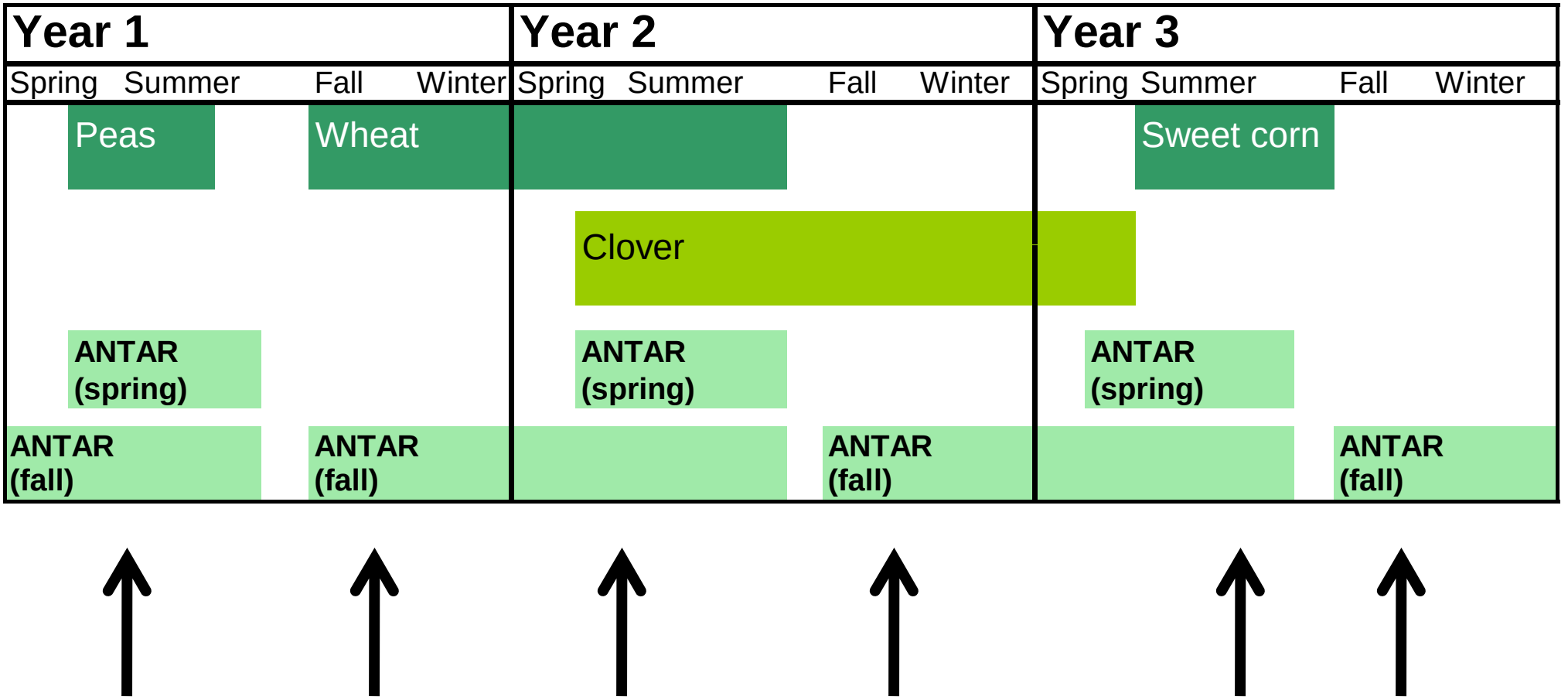
Flower bud contaminant
Rejected by processor

Biology: Life cycle

Fall Spring June July Aug. Sept.


Spring cohort
Fall cohort

Corn chamomile in rotation

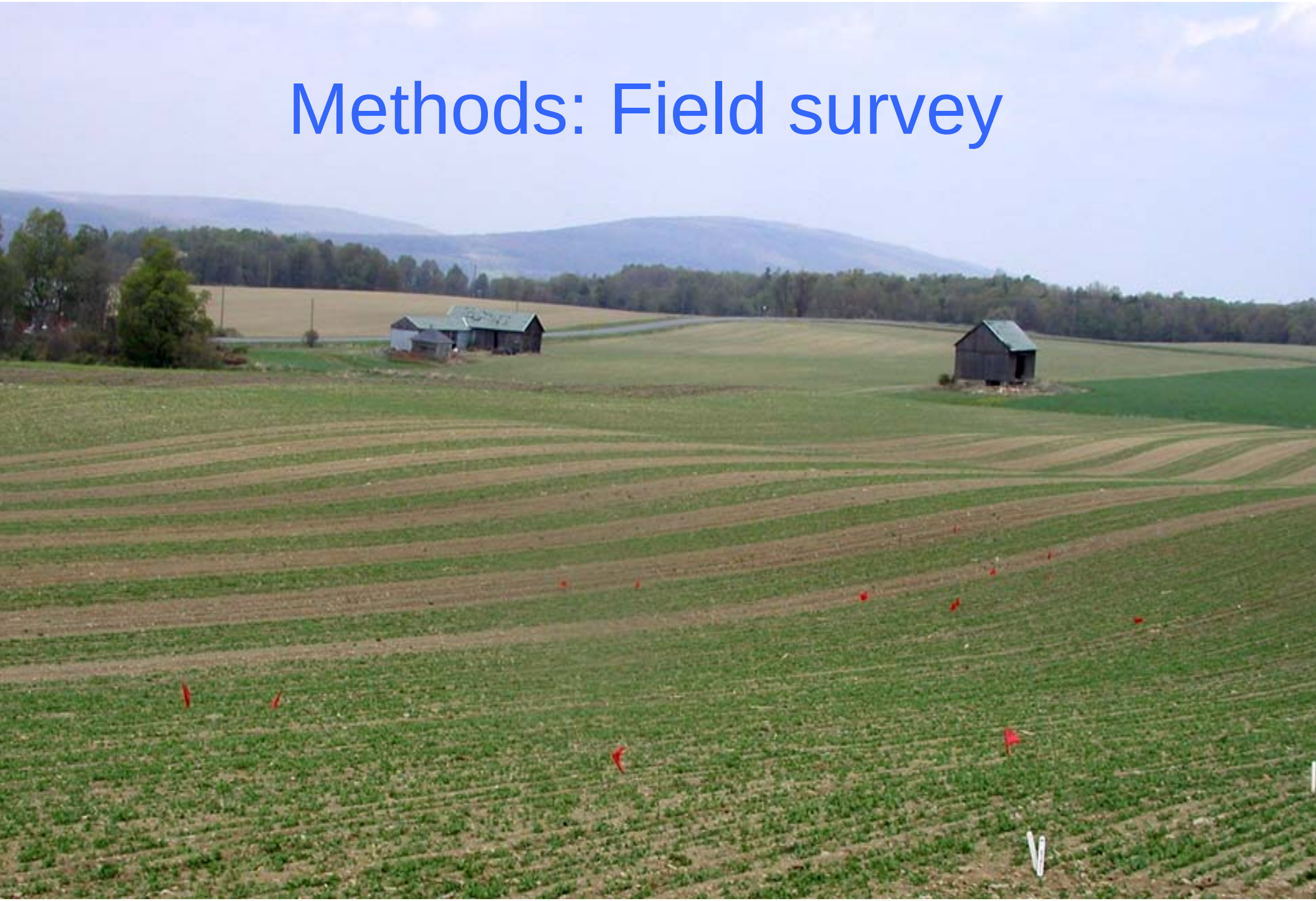


When and how to best manage?

Key questions

- Where in rotation is seed production occurring?
- What are dormancy characteristics of seeds and likely persistence in soil?
- What are weak points in life-cycle and best opportunities for management?

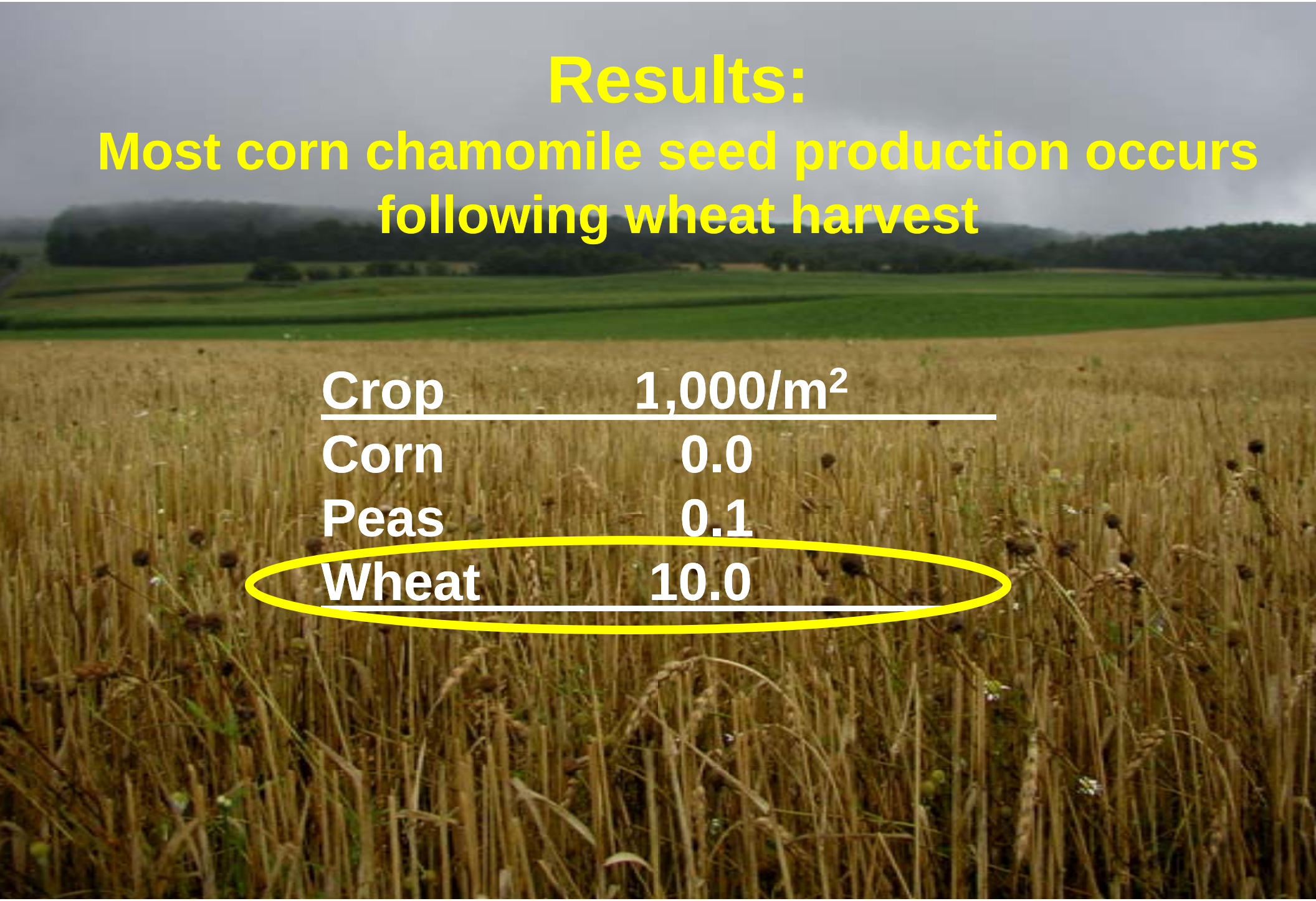
Methods: Field survey



Methods – Seed germination and viability

Seed germination by seed size
Petri dishes; growth chamber
30/25C; 4 replicates

Tetrazoleum testing for viability



Results:

Most corn chamomile seed production occurs following wheat harvest

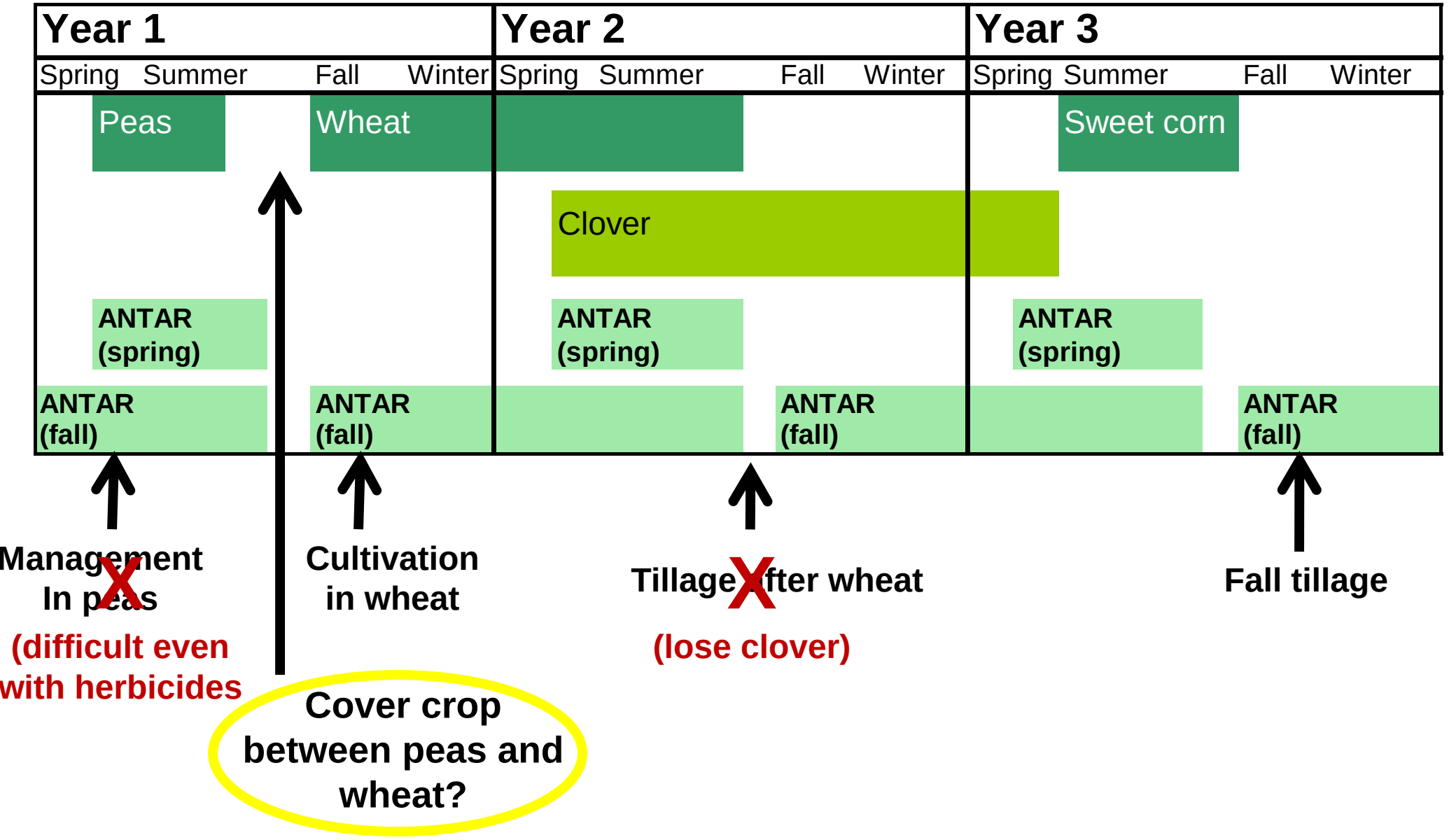
Crop	1,000/m^2
Corn	0.0
Peas	0.1
Wheat	10.0

Results: Large seeds are dormant and have thick seed coats

	Germ-ination	Via-bility
→	20%	85%
→	70%	82%

→ Large seeds likely very persistent

Opportunities for management



Buckwheat residue effects on ANTAR and wheat

Wheat

No effect on wheat in green-house

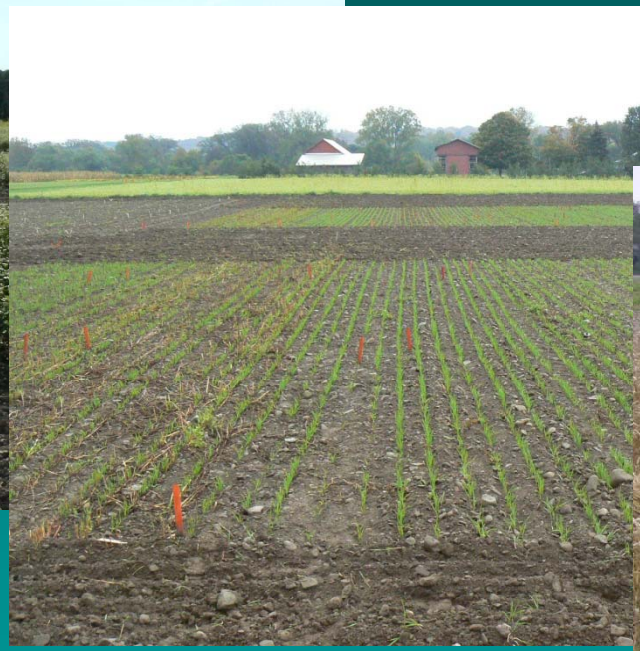
Corn chamomile

Reductions in emergence and growth in ¾ of studies

Buckwheat Bare

Buckwheat effects on wheat

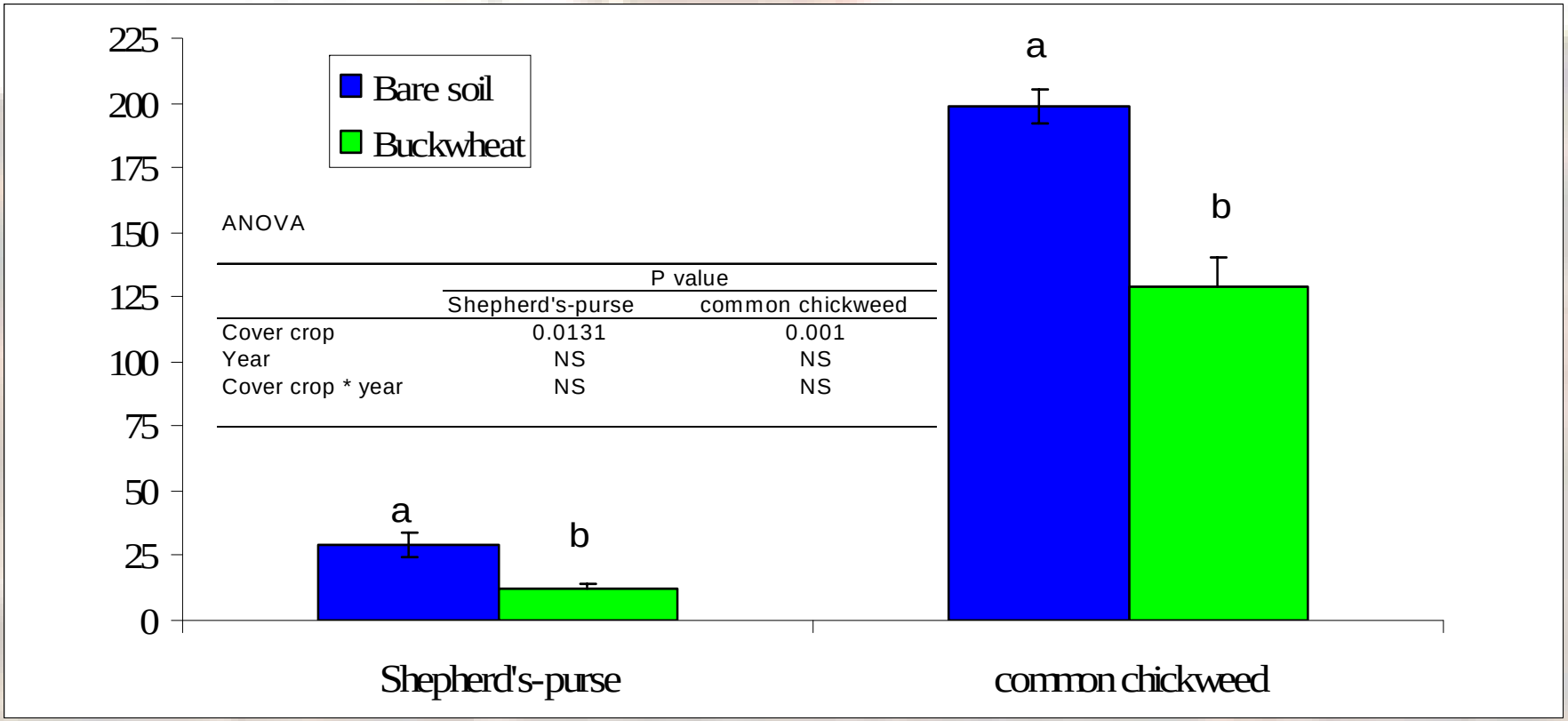
Bare soil versus
Buckwheat
Drilled in
Late July



Flail mowed/Disked
Wheat planted
September

Wheat harvest
July

Buckwheat residue effects on winter weed emergence



Buckwheat residue effects on wheat yield

Treatment	2005-06			2006-07			Yield
	29 DAS		DW	29 DAS		DW	
	Emergence	Ht	38 DAS	Emergence	Ht	38 DAS	
	#	(cm)	(g)	#	(cm)	(g)	(t/ha)
Bare soil (Weed free)	344	19	1.2	235	17	1.5	6.4
Weedy early	328	19	1.1	226	17	1.7	6.5
Buckwheat early	298	16	1.1	254	15	1.7	6.6
Weedy late	300	19	1.1	208	16	1.8	6.1
Buckwheat late	322	15	0.6	208	15	1.6	6.2
Buckwheat late (no-till)	312	16	0.6	208	15	1.4	6.2
Contrast							
Buckwheat vs non-buckwheat	NS	<.0001	0.0001	NS	0.004	NS	NS
Buckwheat early vs non-buckwheat	NS	0.001	NS	NS	0.023	NS	NS
Buckwheat late vs non-buckwheat	NS	<.0001	<.0001	NS	0.009	NS	NS
Buckwheat early vs buckwheat late	NS	NS	0.0002	NS	NS	NS	NS
Buckwheat late conv. vs no-till	NS	NS	NS	NS	NS	NS	NS

Key questions

- Where in rotation is seed production occurring?

  → **Wheat**

- What are dormancy characteristics of seeds and likely persistence in soil?

  → **Dormant and persistent**

- Implications for management?

  → **Avoid seed production!**

  → **Aggressive management in fall**

  → **Potential for buckwheat**

On-going related research

- Winter cover crops and climate effects on winter annuals
- Management of winter annuals in leafy-green high tunnel production.
- Buckwheat x strip tillage effects on weeds and snap beans

Thanks

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Results: large seeds from overwintering cohorts are most dormant