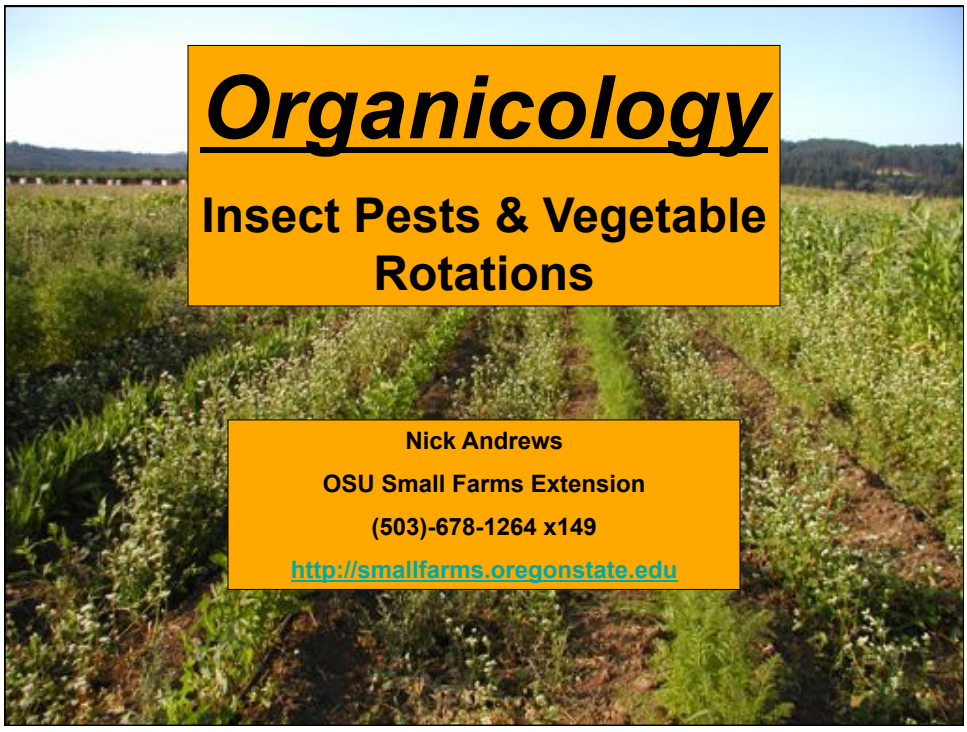


Organicology

Insect Pests & Vegetable Rotations

Nick Andrews

OSU Small Farms Extension

(503)-678-1264 x149

http://smallfarms.oregonstate.edu

Insect Traits that influence susceptibility to rotation effects

1. Low mobility is paramount
2. Narrow host range & strong preferences
3. Modest longevity & fecundity

Landscape characteristics influence natural enemies

1. Mobility
2. Host Range & Preferences
3. Longevity and Fecundity

Beneficial habitat and adult food sources are related to rotation

Sunflower, buckwheat and wild Cruciferae insectary plantings

Beetle bank

Calendula, orache, *Alyssum* insectary strips, among vegetable crop rows

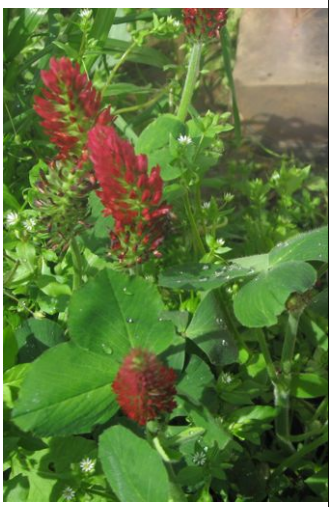
Photos from IPPC Farmscaping for Beneficials Project

Annual cover crops can provide good adult food sources at critical times

Phacelia

Common vetch

Wild mustard



Crimson clover & chickweed

1. Mobility

Less mobile insects may be more susceptible to rotation effects if the farm is big enough or plots are isolated enough to reduce migration from an infested crop to the next crop

1. Mobility
2. Host Range & Preferences
3. Longevity and Fecundity

2. Host range & Preference

Insects with a **narrow host range** can be "dodged" to minimize population build-up. Many pest insects cannot survive if host plants are absent for a generation.

- Minimum distance varies depending on the mobility of the species, and has to be large enough to isolate the subsequent crop from the previous infested crop.
- Be aware that some crops are more tolerant of insect feeding, but are still hosts (i.e. cabbage maggot & cabbage aphid on cabbages and turnips).

1. Mobility
2. Host Range & Preferences
3. Longevity and Fecundity

2. Host range & Preference

Insects with **wider host ranges** are more difficult to manage with rotations even if they lack mobility.

- Many other plants are hosts.
- This allows background populations to maintain damaging levels in the absence of the crop host plant.

1. Mobility
2. Host Range & Preferences
3. Longevity and Fecundity

2. Host range & Preference

Insects with **strong feeding or egg laying preferences** can be attracted to different areas using trap crops.

1. Mobility
2. Host Range & Preferences
3. Longevity and Fecundity

3. Longevity & Fecundity

- Long-lived insects with low reproductive rates (i.e. wireworm) may only respond very slowly to rotations with populations dropping over several years or decades.
- Short-lived insects with high reproductive rates (i.e. aphids or thrips) may build up very quickly in one crop making rotation less effective.

1. Mobility
2. Host Range & Preferences
3. Longevity and Fecundity

1. Mobility
2. Host Range & Preferences
3. Longevity and Fecundity

Interaction between traits

Low mobility & relatively narrow host range

Higher mobility & wider host range

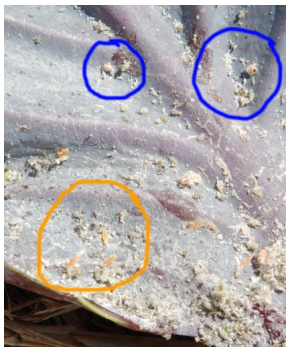
1. Mobility
2. Host Range & Preferences
3. Longevity and Fecundity

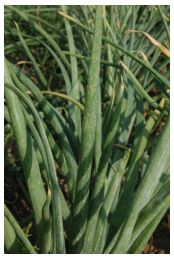
Interaction between traits

Low mobility & relatively wide host range

1. Mobility
2. Host Range & Preferences
3. Longevity and Fecundity

Interaction between traits



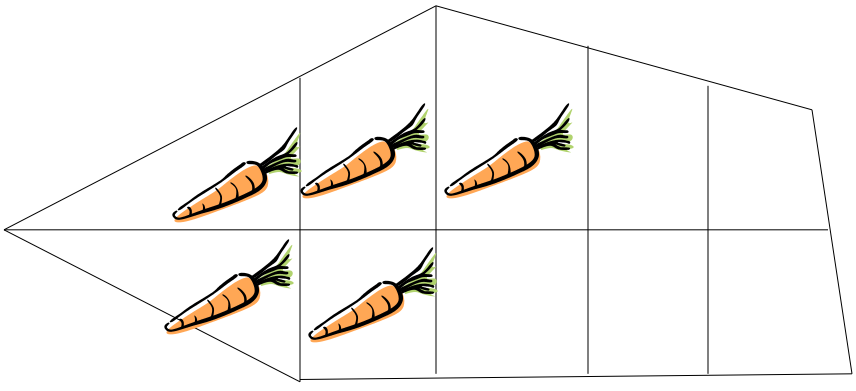


Narrow host range, BUT high mobility, short lifespan, high fecundity

1. Mobility
2. Host Range & Preferences
3. Longevity and Fecundity

Less susceptible	Somewhat more susceptible
aphids, thrips	Flea beetles, carrot rust fly, cabbage maggot, cucumber beetle, symphylan, wireworm

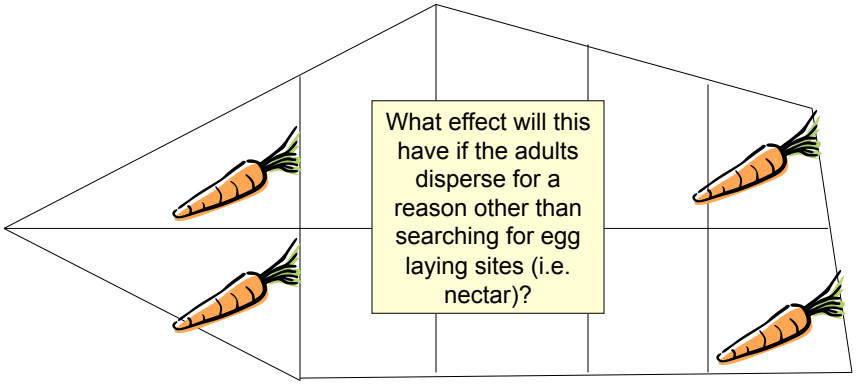
Creeping Rotation



Insects with limited mobility can easily transfer from crop to crop and build up on the farm

Jumping Rotation

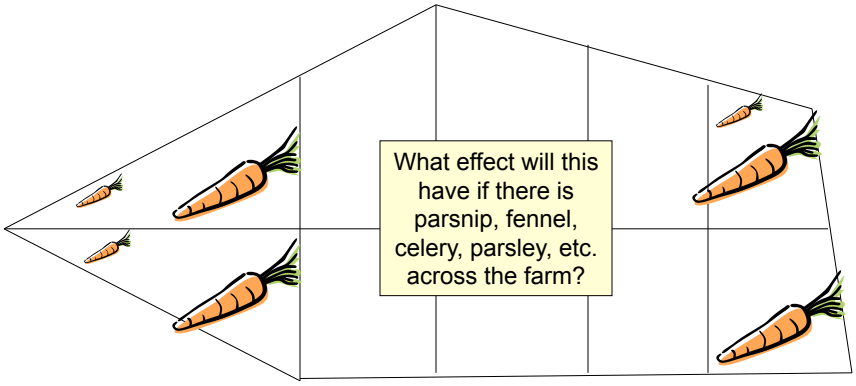
Dodge the adults looking for egg laying sites



Minimum distance varies with species depending on their mobility.

Jumping Rotation with Trap Crop

Trap and dodge the adults



Anecdotal evidence that trap crops MAY help this strategy work on smaller farms against some insects with narrow host range and limited mobility (i.e. carrot rust fly, cabbage maggot, flea beetle).

Organic carrot fly management

Control technique	Level of control
Crop isolation	Population reduced by 1/66 between 100 and 1000m
Exposed site	Damage in exposed fields approximately 50% less than in sheltered fields
Late sowing	Could be reduced by >80% if crops sown in mid-May
Early harvest	Early harvest could reduce damage to very low levels (<1%)
Resistant cultivar	Could reduce damage by up to 50% compared with susceptible variety. In future, levels of resistance may be > 75%
Crop covers	100% control, provided cover 1) is applied before flies enter the crop and 2) remains intact

Collier & Finch (2000)

Symphylan

Wide host range except that potatoes reduce populations. Limited mobility across the landscape makes them vulnerable to potatoes in rotation.

1. Mobility
2. Host Range & Preferences
3. Longevity and Fecundity

Table 2. Ranking of cucurbits by cucumber beetle preference.

Variety	Ranking	Variety	Ranking
Summer Squash		*Winter Squash*	
Yellow		Acorn	
Sunbar	1	Table Ace	6
Slender Gold	2	Carnival	7
Early Prolific Straightneck	20	Table King (bush)	12
Goldie Hybrid	32	Tay Belle (bush)	14
Sundance (yellow)	33		
Straightneck		Butternut	
Seneca Prolific	4	Zenith	13
Goldbar	5	Butternut Supreme	16
Multipik	37	Early Butternut	25
		Waltham	28
Crookneck		Buttercup	
Yellow Crookneck	8	Honey Delight	43
Sundance	34	Buttercup Burgess	44
		Ambercup	55
Scallop			
Peter Pan	9	Pumpkins	
		Baby Pam	10
Zucchini		Munchkin	11
Gold rush	39	Seneca Harvest Moon	15
Zucchini Select	40	Jack-Be-Little	17
Ambassador	41	Jackpot	18
President	45	Tom Fox	19
Black Jack	46	Baby Bear	21
Green Eclipse	50	Howden	22
Seneca Zucchini	51	Spirit	23
Senator	52	Wizard	24
Super Select	54	Ghost Rider	26
Dark Green Zucchini	56	Big Autumn	27
Embassy Dark Green Zucchini	57	Autumn Gold	29
		Jack-of-All Trades	30
Other summer squash		Rocket	31
Scallop	3	Frosty	35
Cocozelle	48	Spookie	36
Caserta	58	Connecticut Field	38
Melon		Happy Jack	42
Classic	59	Big Max	47
		Baby Poo	53

The higher the ranking number, the more the variety is preferred by cucumber beetles. Rankings: 1-14 nonpreferred, >45 highly preferred. Revised from Reference (19).

Cucumber beetle

High mobility and wide host range, but strong preference facilitates trap cropping

1. Mobility
2. Host Range & Preferences
3. Longevity and Fecundity