

Organicology

Organic Vegetable Rotations for weed management

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How weeds and rotations interact

- Weeds respond to rotations in a fundamentally different ways than pests and diseases

Place on the food chain

- Many pests and particularly diseases (P&D) have a single or limited host range – cows never get aphids! i.e., crops from different genera mostly don't share diseases and pests
- P&D directly feed on / attack crops, i.e., they are higher up the food chain / trophic level
- P&D are therefore tightly 'linked' / dependent on their hosts

Place on the food chain

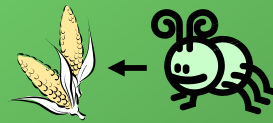
- Weeds in comparison do **not** directly feed on / attack crops, i.e., they are on the same rung of the food chain / trophic level, and are thus direct competitors
- Weeds therefore do not have the highly restricted, direct trophic linkages with crops that P&D have, i.e., they are cohabittees of the environment not 'predators'
- In the short term weeds are therefore mostly independent of crops
- In the longer term the farm ecosystem 'selects' weeds with similar life histories as crops

Mobility

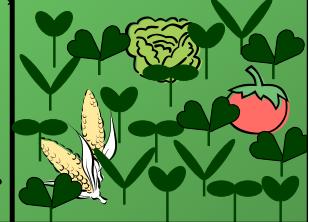
- P&D vary in their level of mobility from highly static, soil borne to highly mobile, flyers and floaters
- Weeds have exceptionally low mobility – 99.9% of annual weeds grow within a few feet of where their great, great, great, great, great, great, great, great, great, great, grandparent did, even the ones with 'fancy' dispersal techniques, e.g., wind-blown

How weeds and rotations interact

Direct, one-to-one predator-prey relationship between a crop and its variably mobile pests and diseases

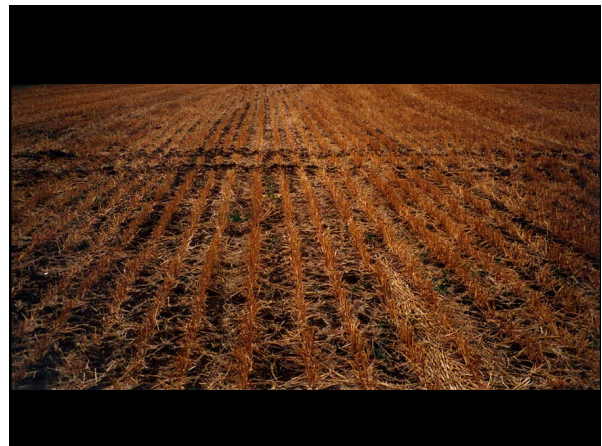


Indirect, many-to-many competitor relationship between crops and very low mobility weeds



How effective can rotations be?

- For a mixed farm system, i.e., annual crops alternating with multi-year pasture, rotations can have a very large weed suppressive effect
 - For pasture dominated systems no other weed management may be required at all in the cropping phase!



How weeds and rotations interact

- Good P&D rotation – lots of diversity
- Limited weed rotation – mostly summer annual crops
- Weeds therefore require different rotational design requirements than P&D

Know your enemy

- Understanding your **weeds lifecycles, their biology and ecology** is essential to be able to work out how rotations can, and cannot, be used to manage them

<http://ohiolinc.osu.edu/b919/0013.html>

For example, when are the main germination periods for your weeds?

Roberts, H. A., Ed. (1982). Weed Control Handbook. Oxford, Blackwell Scientific Publications.

Weed	J	F	M	A	M	J	J	A	S	O	N	D
<i>Aethusa cynapium</i> (Fool's parsley)												
<i>Aspocarpus myosuroides</i> (Black-grass)												
<i>Anagallis arvensis</i> (Scarlet pimpernel)												
<i>Aphanis arvensis</i> (Parsley-piert)												
<i>Astilax patula</i> (Common orache)												
<i>Avena fatua</i> (Wild-oat)												
<i>Avena ludoviciana</i> (Winter wild-oat)												
<i>Capella bursa-pastoris</i> (Shepherd's-purse)												
<i>Chenopodium album</i> (Fat-hen)												
<i>Chrysanthemum segetum</i> (Corn marigold)												
<i>Fumaria officinalis</i> (Common fumitory)												
<i>Galeopsis tetrahit</i> (Common hemp-nettle)												
<i>Gallium aparine</i> (Cleavers)												
<i>Matricaria matricarioides</i> (Pineappleweed)												
<i>Matricaria inodora</i> (Scented mayweed)												
<i>Medicago lupulina</i> (Black medick)												
<i>Papaver rhoeas</i> (Common poppy)												
<i>Plantago major</i> (Greater plantain)												
<i>Poa annua</i> (Annual meadow-grass)												

Thinking like an annual weed

- For a perennial plant, like a tree, the permanent (longest lived) part of its lifecycle is the plant (tree) – its seeds are short lived 'throw-aways'

Thinking like an annual weed

- For an annual weed, the permanent (longest lived) part of its lifecycle is the seed - growing weeds are short lived 'throw-aways'
- Therefore, the weed plants growing in a crop are not the fundamental issue – the weed seed bank in the soil is the 'root' of your problems
- A weed plant is just a weed seed's way of making a whole lot more weed seeds!
- "One years seeding is 'seven' years weeding"

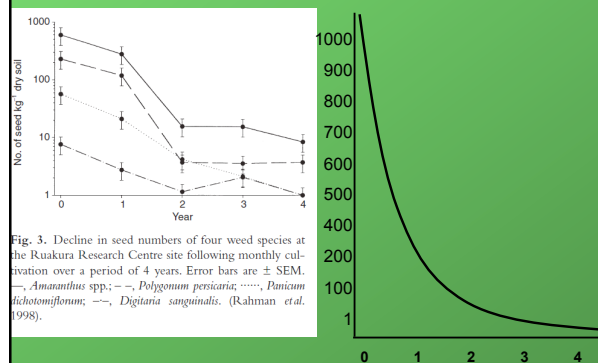
What really hammers annual weeds?

- Perennial crops, especially pasture
 - No tillage to promote germination, highly competitive 'crop', weeds can be killed, or at least prevented from seeding by grazing and/or mowing, large depletion of the 'weed-seed bank' in the order of 50 – 95% per year
- Annual crops other than vegetables, e.g., cereals, especially fall-planted
 - Highly competitive smothering out weeds
- The problem is none of these are vegetables

When the weed seed rains

- The amount of weed seed rain varies among crops, e.g.,
 - Transplanted lettuce – often harvested before seed sets
 - Pumpkins – long term, and weed escaping initial control can produce tens of thousands of seeds
- Need to plan on having easy weed crop after a seed rain crop – and ability to change if unexpected seed rain occurs

How fast are seeds lost from the bank?



What really hammers perennial weeds?

- Tillage! – most perennial weeds can't handle regular soil disturbance.
 - A few troublesome perennial weeds can survive and spread under tillage
- For perennial weeds that survive under annual cropping a return to perennial crop, i.e., pasture, can be very effective, except that precludes growing vegetables

Problem perennials

- Quack grass – can be dramatically reduced by a full year (i.e., over summer) of a competitive legume, e.g., red clover
- Bindweed is palatable to stock and is less competitive against perennials, such as alfalfa, in a mowing or grazing situation for 2 + years
- Canada thistle can be as problematic under pasture as cropping – multi tactic approaches with a significant tillage / sub soiling component

Cover crops

- Cover crops can be very effective tools as part of an integrated weed management system
- However, in cropping systems, most cover crops are grown overwinter and therefore do not interact / have a large effect on the summer annual weeds that are the most problematic in summer vegetables
- They are good against winter annual weeds reducing weeds in winter crops

Summer cover crops

- Where the opportunity arises or needs dictate summer annual cover crops can be valuable tools
- Multiple quick growing cover crops alternating with false seed beds and fallows
- Full season cover crops that can be mown or managed to prevent weed seed rain
- Undersowing crops with cover crop or pasture is also a very valuable technique

Summary

- Rotations can manage annual crop weeds all by themselves – but only if you have a rotation with a significant pasture phase
- Within an annual crop dominated system there are fewer ways to manage weeds with rotations compared with pests and diseases
- You need to understand your weeds biology and ecology

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