2018 Spring Webinar Series
2 p.m. CST

EXTENDING KNOWLEDGE >> CHANGING LIVES
Upcoming Webinars

• April 4 – North Dakota Cottage Food Law Update
  – Julie Wagendorf, Director, Food and Lodging Division, North Dakota Department of Health

• April 11 – Pesticide Safety: Minimizing Exposure
  – Andrew Thostenson, Pesticide Program Specialist, NDSU Extension Service
FSMA Produce Safety Grower Training Workshop

– April 5, 8 am to 5 pm

– Held at ND Farmers Union in Jamestown, ND

– Trainers: Connie Landis-Fisk; Holly Mawby; Julie Garden-Robinson

– Register online on the NDSU “field to fork” website
  • www.ag.ndsu.edu/fieldtofork
  • $25, including meals and snacks)
Zoom Controls

- Mute/unmute
- Open chat box
- Chat box
- Question/Answer Controls
Please Complete the Survey

• Please complete the short online survey that will be emailed to you after today’s webinar. It will take just a couple minutes!

• Be sure to sign up for an opportunity to win a prize in the drawing. After submitting the survey, a form to fill out with your name/address will appear.

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Weed Management and Soil Fertility for Organic Vegetable Production

Dr. Greta Gramig
Associate Professor, NDSU Department of Plant Science
Weed Scientist, Gardener
What Causes Weeds?

- Human perspectives
- Disturbed soils lacking vegetative cover
- Immigration / Enemy release
- Low diversity ecosystems
- Lack of resource niches
- Co-evolution
• Holistic Paradigm:
  – Weeds are plants that evolved to occupy particular niches (generally disturbed areas)
  – Weeds are SYMPTOMS of a SYSTEM imbalance
  – Correct the SYSTEM, correct the SYMPTOM
  – Weeds may sometimes have positive functions

• Results of Holistic Approaches
  – Weeds always present, but yields largely protected
  – Reduction of inputs, more reliance on ecosystem services to achieve fertility and pest management
  – Focus on remedying underlying CAUSES of weeds
  – Recognize that weeds may have a place in agroecosystems
Weeds - Always a Challenge!

- Organic gardeners contend with many weed problems, because they cannot use herbicides.
- However, most home vegetable gardeners, whether organic or not, will probably rely mostly on non-chemical weed management techniques.
Newly Tilled and Planted Garden
But......
Then
Come the Weeds!
Perennial vs. Annual Weeds

• Annual weeds generally have long simple taproots and can often be easily killed by hoeing or hand pulling.

• Perennial weeds often have complex horizontal root networks and can’t be easily removed via tillage, hoeing, hand pulling.

• Annual weeds can also be suppressed fairly readily with mulch, but even the best mulch usually won’t completely stop perennial weeds.
Managing Perennial Weeds

• Prevention is key. Start **CLEAN**. Don’t plant crops into established perennial weeds.

• Dig to **remove** the plants, roots and all. A garden fork works well to loosen roots.

• Smother with heavy mulch or weed barrier, then remove emerging shoots immediately and often-starve the roots.

• For bad weed patches, cover soil with clear plastic and allow to solarize over a summer.
Physically Remove Weeds!
Solarizing
Set Aside Fallow Each Year
Grow a Competitive Cover Crop
• Unlike perennial weeds, annual weeds cannot be eliminated—the soil is loaded with seeds.

• **Suppress emergence** with mulches, cover crops, or competitive crops

• Without suppression, annual weeds need to be **removed** via tillage, hoeing, mowing, or hand pulling.
To Suppress Weeds: Try a Cover Crop!

- Fall planted rye is great for holding N, breaking up heavy clay soils. Suppresses weeds.
- Legumes like sweetclover are great for adding N.
- Mustard family cover crops can help mitigate soil pests.
- Buckwheat grows quickly, makes P more available.
Weeds as Cover Crop? As Mulch?

- A dense stand of annual weeds can be cut or pulled and used as a mulch.
- A weed mulch will suppress weeds and break down, adding nutrients to the soil.
Field Pennycress
Field Pennycress Mulch
Mulches: A Physical Barrier Against Weed Emergence

• Plastic mulch (clear, black, colored)
  – Relatively inexpensive
  – Suppresses most annual weeds well
  – Does not improve soil
  – Contributes to plastic waste

• Organic mulches (hay, straw, leaves, etc.)
  – Usually some cost involved, except for leaves
  – Weed suppression varies with type and depth
  – Depending on C/N ratio, can rob N from soil
  – Can harbor pests like slugs and mice
Straw/Hay

- Needs to be several inches thick to suppress weeds.
- Decomposes relatively quickly—adds nutrients.
- Hay adds more nutrients than straw.
- Both (but especially hay) can contain weed seeds.
- Both may harbor pests.
- Can be expensive.
Wood Chips

- Wood chips can sometimes be free.
- Wood chips suppress weeds at 2-3” deep.
- Over time, wood chips may increase fungal dominance among soil microorganisms.
- Wood chips are coarse, hard to move aside, and interfere with vegetable seedling emerge.
- Wood chips may acidify the soil.
- The C:N ratio is relatively high, so adding extra N might be necessary.
- Some tree species (e.g., black walnut) contain compounds that are toxic to vegetables.
Deciduous Tree Leaves

- Leaves are free and suppress most annual weeds very effectively.
- Leaves can be easily moved and managed in the garden.
- Leaves form thick mats that can hold in too much moisture—shredded leaves alleviate this problem.
- Slugs love leaf mulch.
- Relatively high C:N ratio.
Newspaper and Cardboard
Unusual Materials
Cocoa Bean Hulls, Hemp Hurd
Plant From Starts, Not Seeds

- Planting starts gives crops a head-start.
- Many crops can be started ahead of time.
- A small cold frame can help with producing economical starts.
- Plant later-allow weeds to emerge then remove them.
‘Lasagna’ No-Till Gardening
Straw Bale Gardening (Joel Karsten)
Soil Fertility 101

• Plants need N, P, K (macro); Ca, S, Mg (secondary); Fe, Cu, Mn, B, Cl, Zn, Mo, Ni (micro).

• Get a soil test. https://www.ndsu.edu/soils/services/soil_testing_lab/how_to_soil_sample/

• Compost, manure, fish emulsion, kelp meal, rock dusts (Azomite), epsom salt (MgSO₄), commercial organic fertilizers, KMS, gypsum (Ca and S), dolomite (Ca and Mg), many others!

Home Composting for OM, N-P-K, and Many Micros Too!

- Start with layer of straw or twigs (for air flow).
- Layer or mix ‘green’ (1/3) and ‘brown’ (2/3) materials.
- Don’t use meat, bones, pet waste, perennial weeds, diseased plants, weed seeds.
- Keep moist, cover if very rainy.
- Turn occasionally (can skip if lazy like me but slower.)
Arbuscular Mycorrhizal Fungi (AMF) and Weeds

- Most crop plants benefit from symbiotic associations with AMF.
- Many weeds do not form these associations.
- Previous studies have indicated that AMF presence can decrease weed growth.
- To encourage AMF: reduce tillage and synthetic fertilizers, grow cover crops.
Be Nice to Your Soil: Stop Tilling!!!

- Nothing is more detrimental to soil health than tillage!
- Causes loss of organic matter, kills beneficial soil fungi, destroys soil structure.
- Keep the soil covered at all times, dig only as needed to plant crops and pull weeds
- Need to retrain our eye-bare black soil is not good for a healthy garden.
Links Between Weeds and Soil Fertility

Weeds Guardians of the Soil

by Joseph A. Cocannouer

Author of Trampling Out the Vintage

- Weeds are indicators of soil conditions.
- Weeds that root deeply mine soil for nutrients (terminate before seed production occurs).
- Weeds can break up heavy soils and add organic matter, acting like cover crops.
Weeds as Indicators

• Each weed species differs physiological in terms of requirements for growth.

• Therefore, weeds can be indicators of soil conditions such as fertility, moisture status, structure, and salinity (EX: kochia loves salt).

• For example, field bindweed indicates compacted or crusted soil structure.

• Legumes such as black medic or clover indicate low soil N content.
Weeds and Nitrogen Use

- Many weedy species are adapted to high soil N
- One study found that 15 weed species had greater response to N than wheat
- Common lambsquarters, redroot pigweed, kochia, and wild mustard had the greatest response to increased N, both root and shoot
- Bob Quinn, MT organic farmer observation about kochia
Resource Pool Diversity Hypothesis

- Plant species coexistence may be in part due to diversity of resource niches.
- Previous studies show that plants coexisting in N-limited environment use different forms of N (NO₃, NH₄, and amino acids).
- What types of N are present in most agroecosystems?

Drawing by Kristi Silber

http://www.mnartists.org/artwork/plant-competition
Recap

- Perennial weeds: remove or starve roots.
- Annual weeds: suppress or remove, do not allow seed production.
- Mulches or cover crops suppress weeds well AND can also add valuable soil nutrients.
- Test soil to know what nutrients you should add.
- Try out home composting for free nutrients.
- Stop tilling your garden soil – try no-till methods.
Questions / Comments?
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www.ag.ndsu.edu/fieldtofork