

Specific vegetable production issues

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Core concepts

- Right plant, right place (and time)
- Soil tilth & bed preparation
- Early heat is good (greenhouse and/or row covers)
- Soil fertility and proper irrigation matters
- So does plant spacing
- Weeds, insects, and diseases can be devastating
- Grow it well and harvest it right



Fertilizer basics (1)

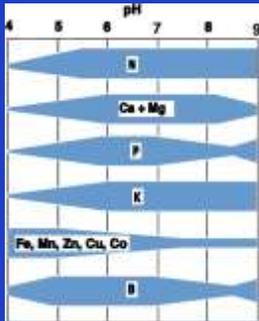
How is fertilizer applied?

- ❖ Broadcast
- ❖ Banded
- ❖ Side-dressed
- ❖ Liquid or foliar



Fertilizer basics (2)

- Soil test?
- pH is important - most vegetables prefer a pH of 6.5-7.0
- Lime corrects low pH
- Liming rate: 80-150 #s of lime per 1000 square feet once every three years.
- Why dolomite?
- Wood ashes? How much?



Courtesy:
Cornell University

Fertilizer basics (3)

- Nitrogen is very important!! Why?
- There are both organic and conventional nitrogen sources
- N deficiencies can be corrected if caught early



Courtesy: CIMMYT

Is compost fertilizer?

- Yes and No
 - What happens in the composting process?
 - What is the value of compost?
 - How can you get in trouble with compost?



Direct Seeding

- Planting time dependent on soil temperatures, pests, and market.
- Plant seed as deep as the seed is wide.
- Seed info will tell you how far to space the seed.
- Keep seed moist until plants germinate.
- Soil crusting!!



Spacing & Thinning

- Space seeds as recommended on the packet.
 - Dense planting will promote disease.
- Small-seeded crops will need thinning (whoever gets the light, wins!):
 - Carrots
 - Radishes
 - Beets
 - Lettuce



Weeds

Weeds do most of their damage when seedlings are small

The most important time to watch for weeds is the 3-4 weeks after planting your seeds



Weeding matters (esp. early!)

	Unweeded	Weeded
Carrots	28 lbs	503 lbs
Onions	3.6 lbs	68 lbs
Cabbage	129 lbs	233 lbs
Potatoes	53 lbs	148 lbs

So why might you love transplants?



Adding heat to your vegetables

- Transplants (also help with weeding)
- Raised beds
- Cloches
- Floating row covers
- Hoophouse
- Etc.



Row Covers

- Exclude insect pests
- Reduced evapotranspiration
- Reduced soil crusting
- Good for beans, beets, carrot, cole crops, corn, lettuce, parsley, potato, radish, scallions, and spinach



Post harvest rules

- Harvest at the right time
- Few crops improve after harvest
- Stored crops usually lose quality
- The longer you store a crop, the more market risk you take



More post harvest comments

- Getting rid of "field heat" as quickly as possible is key to most crop storage
- Gentle handling reduces disease in storage
- Most crops have general temperature ranges that they do well in.
- Same with humidity



Basics of plant problem diagnosis

- Abiotic or biotic (or combined)
- Get the problem identified
- Develop short term and long term responses

Diagnostic resources

- A hand lens, a shovel, a camera, & a knife
- OSU Extension faculty
- Field personnel from companies
- OSU Plant Clinic
- Several key web sites:
 - <http://pnwhandbooks.org/plantdisease/>
 - <http://pnwhandbooks.org/insect/>

Basic disease management concepts

- Disease triangle
- Disease cycle/weak link
- Resistance
- Rotation
- Protective sprays
- Well-grown plant



Basic insect concepts

Insect pyramid

- Desirable host
- Presence of insects
- Absence of predation/suitable environment
- Impact of damage
- Scouting to quantify population
- Change predation relationships (long-term) on farm
- Insecticide treatments

Insectary plantings

Aim to supply flowers all season, some examples:

- Brassicaceae ie. sweet alyssum
- Carrot family ie. coriander
- Compositae ie. sunflower, calendula
- Legumes ie. crimson clover
- Others ie. phacelia and buckwheat



Photos from IPPC Farmscaping for Beneficials Project:
http://ipmnet.org/BeetleBank/Farmscaping_for_Beneficials.html

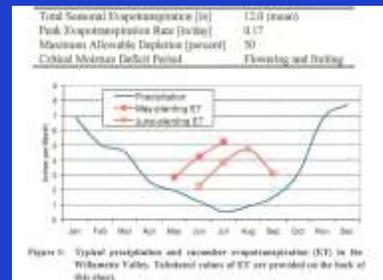
Cucumber growing

- Need heat - not frost hardy
- Often transplanted. Spacing 8-12" within rows with rows 48-72 inches apart.
- Often grown with plastic mulch and drip irrigation. Row cover early.
- Needs about 100 to 150 actual pounds of N per acre. Other fertilizer as per test.
- Can be trellised.
- Slicers vs pickling cukes



Trellis panels
for cucumbers
are tied to T-
posts

Plastic mulch



Harvest and post harvest handling

- Harvest on a regular schedule
- Remove ones that are too large and discard
- Subject to chilling injury below 50 degrees for more than a few days.
- Storage decay – aggravated by injury in harvest
- Storage life at 50-55 degrees is ~10 days
- Prefers high humidity
- Ethylene sensitive

Winter and summer squash

- Very productive in our region
- Winter squash take a lot of space
- Fairly high nutritional and water demand
- Storage potential for winter squash



Cucurbit problems

- Powdery mildew
- Angular leaf spot
- Storage diseases
- Several virus diseases
- Buy disease resistance in seed lines when available
- Cucumber beetle
- Pollination failures
- Bitterness
- N and/or Ca deficiency

Abiotic (non-living) problems:

Weather (frost, hail, sunburn, water stress)
 Herbicide injury
 Reaction to protectant chemicals
 Mechanical injury
 Root environment
 (esp. poor drainage)
 Mineral deficiency
 or toxicity



Bitter cucumbers (and sometimes zucchini)

- Genetic component
- Response to stress
 - Too cold
 - Too hot
 - Too much water
 - Too little water
 - Disease



A few comments on cucumber beetles, of which we have the Western Striped Cucumber beetle



...and the Western Spotted Cucumber beetle



...or both together



The Western Spotted Cucumber beetle has a huge plant host range whereas the Western Striped Cucumber Beetle is much more focused on cucurbits.

Damage can include stem and root feeding (especially hard on young plants), foliage feeding and blossom and pollen feeding.



- Both beetles over winter as fertilized females.

- Females begin laying eggs in the early spring.

- Eggs are placed at the base of a host plant. They hatch in 7-10 days.



- Larvae feed on roots for 2-3 weeks before pupating.

- Adults emerge in three weeks and about 80 days.

- There are two generations/year.



Cucumber beetles also transmit bacterial wilt and cucumber mosaic virus. Other diseases may also be moved by their feeding.



Cucumber beetle control:

Biological: tachinid flies,
nematodes

Cultural: row covers

Chemical (organic): pyrethrum
(Pyganic) and spinosad (Entrust)

New approach: Combining
cucurbitacin

attractants with an insecticide
(no organic products yet).

Kairomones.



Powdery mildew

Powdery mildew management:

Scout older crown leaves

Apply fungicides when indicated

Select resistant varieties where possible



Angular leaf spot

Angular leaf spot*Angular leaf spot*

Angular leaf spot bacterium overwinters on diseased plant material or on seed. Symptoms on fruit smaller than on leaves. May be an entry point for other soft rot organisms.

Control:

Rotation
Sanitation
Resistance
Copper products
Seed treatment



Alternaria leaf blight is a fungus that tends to attack older leaves first. Small spots start out brown and turn to black as the disease progresses. There is a target-like appearance to the spots. Can also rot fruits.

Control:

Rotation
Drip irrigation
Appropriate fungicides



Scab (gummosis)

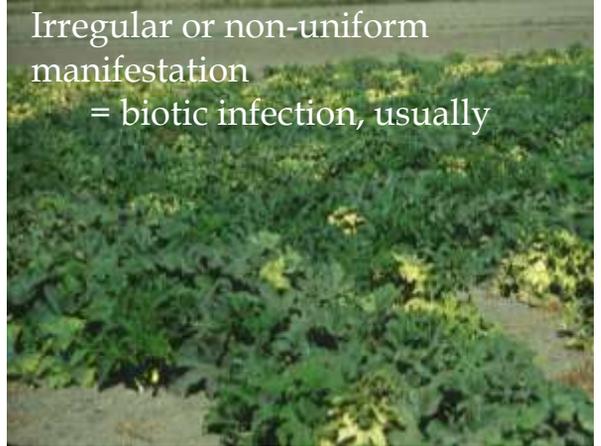
Fungus over winters in debris. Spread by rain, wind, insects and tillage. Spots numerous and turn from pale green to white. Leaf cracks. Infected fruit shows oozy drops. Spots decay further into flesh.



Control:

Rotation
Plow down debris
Appropriate fungicide

Irregular or non-uniform
manifestation
= biotic infection, usually



Storage rots



Alliums

- Fall planted: garlic, over-wintering onions in August, shallots, leeks in June/July for winter harvest.
- Spring planted: Bulb onions, green onions, some shallots



Garlic

- Many varieties: Soft neck and hard neck
- Planted from cloves in the fall on beds
- Lime, fertilize pre-planting and light compost mulch after planting
- Usually doesn't emerge until January
- Weed throughout the winter
- Fertilize several times in the spring
- Slugs
- Harvest in mid-July

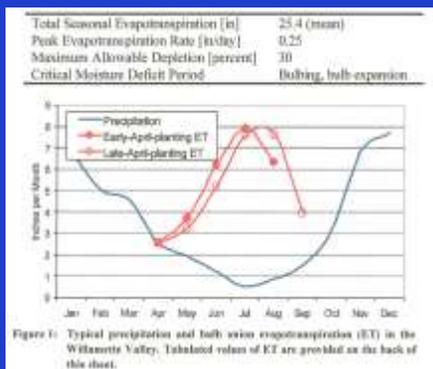


Partial budget for small-scale garlic production

Production costs	Yield in tons/acre			
	3	4	5	6
Land rent	\$150.00	\$150.00	\$150.00	\$150.00
Tillage	\$200.00	\$200.00	\$200.00	\$200.00
Fertilizer (organic)	\$200.00	\$200.00	\$200.00	\$200.00
Line	\$120.00	\$120.00	\$120.00	\$120.00
Hand planting	\$150.00	\$150.00	\$150.00	\$150.00
Herbicide	\$100.00	\$100.00	\$100.00	\$100.00
Hand weeding	\$130.00	\$130.00	\$130.00	\$130.00
Seed costs (1,000 #@\$1.00/#)	\$1000.00	\$1000.00	\$1000.00	\$1000.00
Total	\$2050.00	\$2050.00	\$2050.00	\$2050.00
Variable post-production costs				
Harvest & cleaning @ .30/#	\$1800.00	\$2400.00	\$3000.00	\$3600.00
Packaging & storage @ .10/#	\$600.00	\$800.00	\$1000.00	\$1200.00
Marketing costs @ .05/#	\$300.00	\$400.00	\$500.00	\$600.00
Total	\$2700.00	\$3600.00	\$4500.00	\$5400.00
Total Costs	\$4750.00	\$5650.00	\$6550.00	\$7450.00
Break-even costs	\$0.79	\$0.71	\$0.66	\$0.62

Bulb onions

- Direct seeded or transplanted starts/sets
- Very poor competitors against weeds – early weeding crucial, especially with direct seeding
- Long day onions for this latitude
- Can handle frosts
- Need good, fertile soil (check fertilizer guides for details)



Onions continued

- Harvested late September when tops start to fall
- Usually cured with their tops on, in the field or in a barn on racks with good air circulation. Tops removed later.
- Storage qualities vary considerably among cultivars – know your market!



Leeks

- Direct seeded or transplanted in late spring through the end of June
- Very winter hardy and can stay in field for harvest over time
- Fair amount of cleanup work with leeks
- Modest market demand, though increasing
- Whole plant is sold minus some root and top trimming



Allium problems

- Botrytis (fungus)
- Fusarium (fungus)
- White rot (fungus)
- Poor irrigation (esp. at bulbing)
- Thrips
- Onion maggot (rarely)
- Weed suppression



Onion thrips damage: More common on stressed plants

Fusarium basal plate rot

- Seed borne
- Worse in wet springs
- > problem
- Sanitation and rotation



Garlic rust

- > problem since early 2000
- Fungal disease spread in wind and from infected plant debris
- Worse in rainy springs
- Huge issue now in W. Oregon
- Few controls except debris management and rotation for the organic grower



Botrytis or gray mold

- Clove borne
- > by wet springs
- Storage disease
- Air circulation critical
- Good planting stock
- Irregular black sclerotia stay in soil for some years.
- Sanitation/rotation



White rot

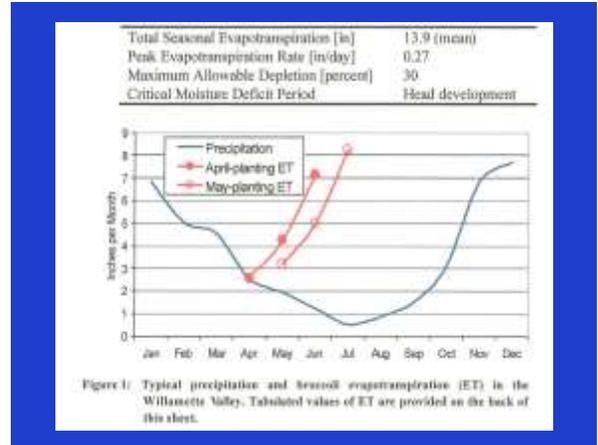
- Affects most alliums
- Worst disease
- Long soil life (10+ years)
- Moves on plants and/or cloves
- No treatments



Broccoli and associated crops

- Cold hardy (varies)
- Generally transplanted
- Spacing of 8-10" within the row and 12-14" between rows
- Lime well to reduce club root
- Follow fertilizer guide and soil test results
- Maintain uniform soil moisture





Broccoli etc. problems

- Imported cabbage butterfly
- Cabbage root maggot
- Cabbage aphids
- Cabbage flea beetles
- Club root
- Boron deficiency
- Poor heads due to late harvest
- Poorly cooled after harvest

Boron issues in cole crops

- A nutrient needed in very small quantities
- Symptoms & quality loss in broccoli, cauliflower, and other crops
- Hollow stems and poor heads
- Carefully calibrate boron applications to soil or as a foliar spray
- Some varietal resistance



Club root of crucifers

- Long rotations
- > pH with lime
- Some resistance
- Grow in the best possible manner to outgrow the problem



Cabbage flea beetles

- More a spring problem
- Serious on transplants and seedlings
- Some insecticide options
- Row covers early



Flea beetle damage

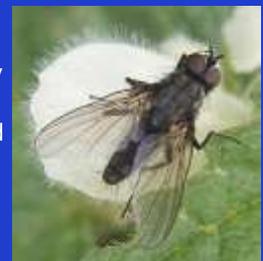
Aphids and whiteflies

- Pierce & suck sugars
- High reproductive rate
- Overwinter or blow in
- Row covers?
- Insecticides
- Predators
- Not consumer friendly
Cleanup before sale?



Cabbage root maggot (fly)

- Very serious pest – several cycles
- Worst on cabbage family root crops (turnips, rutabagas, radishes) and cauliflower/broccoli
- Few useful insecticides
- Row covers
- Rotations and winter residue management





Cabbage maggot adults and larvae



Cabbage maggot, eggs at base of stem



Hylemya brassicae (Bouché)

1 cm



cabbage maggot



Imported cabbage butterfly

- Common
- Caterpillar feeding damage
- Insecticides (inc. Bt)
- Row covers



Imported cabbage butterfly larvae



Cabbage butterfly larva



Lettuce and mixed greens

- Major crop of small farms
- Many new varieties and species
- Mostly transplanted
- High labor requirement
- Maintain uniform moisture
- Whole head and cut leaf production
- Suitable for winter (protected) production



Lettuce problems

- Slugs
- Damping off
- Calcium deficiency (tip burn)
- Downy mildew
- Anthracnose
- Soft rot in storage
- Ethylene reactions (russet spotting)
- Improper harvest and storage



Slugs of several types



Beets, spinach and chard

- Crusting (poor emergence)
- Thinning
- Boron deficiency on beets
- Beet/chard/spinach leaf miner
- Spinach timing re bolting to seed



Beet or chard or spinach leafminer

- Fly maggot that "mines" the leaf
- Row covers
- Insecticides
- Timing of planting
- Sanitation



Carrots and Parsnips

- Crusting (poor stand emergence)
- Thinning
- Uneven watering effect
- Poor soil for normal carrot growth
- Carrot rust fly



Thinning carrots

- Depends a bit on row spacing
- Timing is important
- Leaf area development and photosynthesis



Misshapen carrots

- Rocky or heavy clay soil
- Too much nitrogen
- Genetics
- Uneven watering



6.23d Carrot rust fly; older larvae affect the lower third of carrot roots.



6.23a Carrot rust fly, larvae and feeding injury on a carrot root.

Carrot rust fly larvae

Best managed with row covers to prevent egg laying

Some insecticides available



Peas and beans

- Direct seeded
- Poor emergence (soils too cool)
- Bush and pole varieties
- Pea vine weevil
- Pea enation virus
- Gray mold on beans

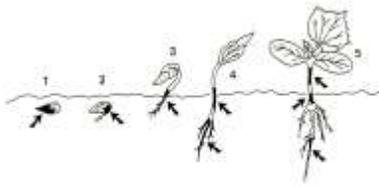


Pole beans

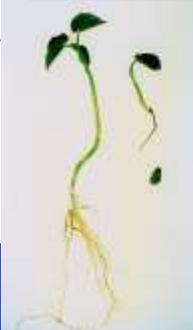


Bush beans





Root infection at emergence



Fusarium root rot



Gray mold (Botrytis) and white mold (Sclerotinia)



Pea leaf weevil





Pea enation mosaic virus

Sweet corn

- Generally direct seeded but can be transplanted
- Poor emergence
- Thinning/spacing
- Nitrogen deficient
- Poor pollination
- Several insects



Seed corn maggot



Corn earworm

Potatoes

- Variety selection (costs/returns)
- Uniform watering
- Hilling to prevent greening
- Hollow heart
- Various diseases



Potato:
Hollow heart



Common scab



Rhizoctonia blight "scurf"



Bacterial ring rot



Tuber flea beetle



Symphylans and damage

Tomatoes and peppers

- A warm tomato is a happy tomato
- Excellent market for specialized varieties
- Start 40-50 days before transplanting
- Season extension techniques key
- Even moisture very important
- Trellis tomatoes and possibly stake peppers
- Lime and fertilize according to test



Tomatoes in high tunnel





Tomato and pepper problems

- Early and late blight
- Blossom end rot
- Cracking
- Cat facing
- Sunburn (peppers)
- Miscellaneous storage rots
- Aphids



Sunburn on peppers



Blossom end rot



Blossom end rot (not a rot but a calcium disorder)



Cat facing: weather related



Tomato pollination problem - weather related



Late blight



Late blight

Copper
before
infection

Little
resistance





Herbicide injury

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The competitive gardening subculture

