

The background features a stylized landscape. The top half shows several overlapping, semi-transparent green mountain peaks of varying heights. Below the mountains is a bright yellow field with a fine, textured pattern. The bottom edge of the yellow field is irregular, resembling a torn paper effect.

Alternatives to Chemical Pesticides for the Garden's *Dirty Dozen*

Andy Hughes 2014

Survey of Gardeners

- MOTHER EARTH NEWS ran a survey in the Fall of 2012 to learn more about what works and what doesn't when it comes to limiting insect damage in organic vegetable gardens.
- About 1,300 gardeners from across North America responded.
- The survey revealed 12 widespread garden pests that give gardeners grief. It gives details, including down-in-the-dirt advice on how to manage each pest.
- I cross referenced with the Purdue Extension bulletin E-21-W Managing insects in the home vegetable garden
- I also reviewed online resources about these pests and alternatives to chemical pesticides, and also found some excerpts from Jerry Bakers book "Terrific Garden Tonics"

12 - Whitefly



12 - Whitefly

- 36 percent of reported as a problem. Not as big a problem in the Midwest. However, I did talk with a local master gardener who had problems with them.
- The average whitefly is around 1/16 inch and resembles a tiny moth.
- The insect typically feeds by injecting its tubular mouthpiece into a plant.
- The various whitefly species feed on different plants, including fruits, vegetables and flowers.

12 – Whitefly

alternatives

- Insecticidal soap earned a high effectiveness rating (90 percent).
- Method: Blast whiteflies from leaf undersides with a strong jet of water. Then apply a weak solution of insecticidal soap, preferably late in the afternoon. Thoroughly spray to wetting on all plant parts, including undersides of leaves Repeat treatment weekly or bi-weekly.
- READ PRODUCT LABEL
- May be used on edible crops up to and including the day of harvest.
- Many respondents said they use Dawn or other dishwashing liquids rather than regular insecticidal soap.
- Note: Some research has found that repeated use of soap or detergent sprays can reduce yields.

12 – Whitefly

alternatives

- Use yellow sticky traps to collect whiteflies lurking among tomatoes, peppers, sweet potatoes or cabbage family crops. A half-and-half mixture of petroleum jelly and dishwashing detergent, spread over small boards painted bright yellow, is sticky enough to catch little whiteflies.
- A handheld vacuum is a good way to remove whiteflies from plants because it will remove both nymphs and larvae.

#12 Whitefly alternatives

- Silver Metallic Plastic Mulch has been University proven to increase yields up to 20 percent and lowers insect problems. The extra light from the reflection repels insects, including Whiteflies.
- Silver Mulches reflect sunlight up into the undersides of the canopy, thereby increasing photosynthesis, leading to rapid growth. Both harvest yields and coloring of fruit increased with Silver Mulch.
- Use drip irrigation with this mulch

12 - Whitefly alternatives

Flower Defender Tonic

Bad bugs feed on lots of different flowers, so it's smart to be ready for them with my Flower Defender Tonic. This power-packed mix will wipe out just about any garden bugs—GUARANTEED!

INSTRUCTIONS: Mix the dishwashing liquid, tobacco tea, mouthwash, and hot sauce in a 20 gallon hose-end sprayer, filling the balance of the jar with warm water. Then bathe all of your bloomers with this bug-busting elixir to send those pesky pests running for the hills!

INGREDIENTS:

1 cup of dishwashing liquid
1 cup of tobacco tea*
1 cup of antiseptic mouthwash
¼ cup of hot sauce
Warm water

**To make tobacco tea, place half a handful of chewing tobacco in an old nylon stocking and soak it in a gallon of hot water until the mixture is dark brown.*

#11 - Corn earworms



If you see dark spots on the end of your corn ears, you may have a corn earworm problem.

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#11 - Corn earworms

- 37 percent of respondents considered this as a serious pests.
- They grow to be nearly 1-1/2 inches long when mature. They vary considerably in color from light green to tan, brown, pink, maroon, or nearly black, with light and dark stripes running lengthwise on the body, which is lighter on the underside. The head capsule is light brown.
- The larvae prefer to feed on the tips of corn ears. They enter corn ears only through the tip, not through the side or shank.

Biotic Triangle

- Pest Present
- Plant Susceptible
- Environmental Conditions Right

#11 - Corn earworms

alternatives

- Several experienced gardeners pointed out the value of choosing varieties that have tight ear tips.
- Many got relief by using instruments ranging from oil cans to eyedroppers to add a few drops of canola or olive oil into the tips of ears, right when the silks start to show.
- Others reported using a standard solution of Bt in the same way.
- Some cut off the portion of the ear that was damaged.

#11 - Corn earworms alternatives

- *Bt (Bacillus thuringiensis)* is a natural, non-pathogenic (not infectious to humans) bacterium that is found naturally in the soil. It produces crystals and spores which are toxic to many species of insects.
- *Bt* has been found to be safe to all higher animals tested.
- *Bt* is largely used in agriculture, especially organic farming.

#11 - Corn earworms

Bt

Even though the toxin does not kill the insect immediately, treated plant parts will not be damaged because the insect stops feeding within hours. *Bt* spores do not spread to other insects or cause disease outbreaks on their own.

1. Insect eats *Bt* crystals and spores.



2. The toxin binds to specific receptors in the gut and the insect stops eating.



3. The crystals cause the gut wall to break down, allowing spores and normal gut bacteria to enter the body.



4. The insect dies as spores and gut bacteria proliferate in the body.



Bt action is very specific. Different strains of *Bt* are specific to different receptors in insect gut wall. *Bt* toxicity depends on recognizing receptors, damage to the gut by the toxin occurs upon binding to a receptor. Each insect species possesses different types of receptors that will match only certain toxin proteins, like a lock to a key.

#10 - Cucumber beetles



Take care to protect your cool, crunchy cukes from cucumber beetles, the No. 10 worst pest in home gardens.

KEITH WARD

#10 - Cucumber beetles

- 39 percent of gardeners named them as serious garden pests
- Transmit deadly bacterial wilt destructive garden pests to members of the cucurbit family, including cucumbers, watermelons, muskmelon, pumpkins and squash.

#10 - Cucumber beetles

alternatives

- Neem oil, good garden cleanup (removing all plant debris) and handpicking and were all rated as effective controls.
- Poultry received many honorable mentions.
- Row covers earned more widespread use for the control of cucumber beetles than for any other pest, with more than 80 percent of people who had tried row covers reporting them to be effective.
- 64 percent of people who'd tried yellow sticky traps reported these work.

#10 - Cucumber beetles

alternatives

- 70 percent of gardeners who'd tried companion planting said this method works for controlling cucumber beetles.
- According to a study done by Alabama State University, the combination of three different companion plants produced a reduction by half in beetle population. These three plants include; radish, tansy and nasturtium. All three of these plants can be easily grown from seed and should be planted in 3-foot-wide rows between the rows of desired crops.

#10 - Cucumber beetles

alternatives

- Interplanting beneficial species that attract pollinators such as buckwheat, cowpea and sweet clover.
- Integrated Pest Management - Using a combination of controls is called and is often the most effective way to control a population of pests. Using a combination of companion planting and beneficial pollination planting will give you the best natural control for the cucumber beetle.

#10 - Cucumber beetles

alternatives

- **Neem oil** is one of the most widely used pesticides in organic farming today. Coming from the Neem Tree, indigenous to the Indian sub-continent. It contains several fungicide and insecticide compounds, but the most widely studied is Azadirachtin. This is the compound giving Neem oil insecticide its potent insect control qualities. Azadirachtin has been shown as highly toxic to over 200 types of insect, acting as a growth inhibitor and antifeedant.
- Obviously, not feeding slows down the insects and the growth inhibitor stops them from molting. So immature stages of insects, often not affected by conventional insecticides, are prevented from progressing to adulthood. This stops the breeding cycle and reduces the future number of insect pests in your garden, as well as destroying the current population.
- Neem oil also deters some insect pests, because the smell of the oil simply puts them off the idea of feeding on your plants. Neem is described as having a 'strong' smell, it is quite unpleasant with a hint of peanut and garlic. Crickets and other larger insect pests do not find it appetizing.

#10 - Cucumber beetles

Neem oil (continued)

- Less fussy eaters will try a taste of your plants, even after you have used the neem oil. They will only eat a little before the **hormone like action** of the oil starts to affect them. The first action is to stop them feeding. But, those insects won't vanish, they just won't actually be eating your plants. Then the growth disruptor's begin to act on the nervous system, preventing molting, and eggs hatching or stopping breeding altogether.
- Neem oil is **fully biodegradable**, so this is an Eco friendly insecticide over the long term. Secondly neem oil is not toxic for mammals. It can cause temporary infertility, but this is **ONLY** when ingested..
- Beneficials such as earthworms, butterflies and honeybees will not be affected by your use of neem as they are not ingesting the plant. They may be ingesting pollen but the quantities are so small that the neem is not thought to cause any harm.

#9 Grasshoppers



If you see grasshoppers — the No. 9 worst pest — hopping through your garden, you'd better hop to it with your control strategies!

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#9 Grasshoppers

- 40 percent of respondents say grasshoppers are a problem, and they seemed to be getting worse. Many report that increases in rainfall seemed to trigger an explosion in grasshopper populations.

#9 Grasshoppers

alternatives

- Chickens and guinea fowl reportedly give good control by gobbling grasshoppers, but keep an eye on your poultry helpers to make sure they don't harm crops.
- Neem oil did NOT list grasshoppers as one that it stopped.

#9 Grasshoppers

alternatives

- Diatomaceous Earth - is a naturally occurring, soft, siliceous sedimentary rock that is easily crumbled into a fine white to off-white powder. The fine powder absorbs lipids from the waxy outer layer of insects' exoskeletons, causing them to dehydrate.
- To keep from killing bees, dust on plants that do not have flowers such as lettuce, onions, cabbage, herbs, potatoes...etc. , or avoid dusting in a plant's later stages when the plants create flowers and begin to seed. Does not break down and will kill earthworms. Dust can irritate mucus membranes.

#9 Grasshoppers

alternatives

- Nosema locustae is a one celled parasite that infects and kills the hoppers when they ingest it. Mixed in wheat bran, a single treatment can last for several years. The disease is contagious and other grasshoppers become infected by cannibalizing diseased grasshoppers in the area.
- Sink glass jars into the soil. Fill to the halfway point with a mixture of 10 parts water to 1 part of molasses. The hoppers are drawn to the sweet smell of the molasses, they dive in and drown. Clean traps as needed.
- Pepper spray using jalapenos, habaneros or any HOT pepper to repel the adults. Include some castile soap in with this.
- Spray insecticidal soap mixed with beneficial nematodes directly on grasshoppers in the evening.

#8 Cutworms



An amazingly high percentage of gardeners reported getting good control of cutworms by using rigid collars around their plants.

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#8 Cutworms

- Cutworms are the larvae (caterpillars) of several species of night-flying moths. The larvae are called cutworms because they cut down young plants as they feed on stems at or below the soil surface.
- 41 percent of respondents found cutworms to be a concern.

#8 Cutworms

alternatives

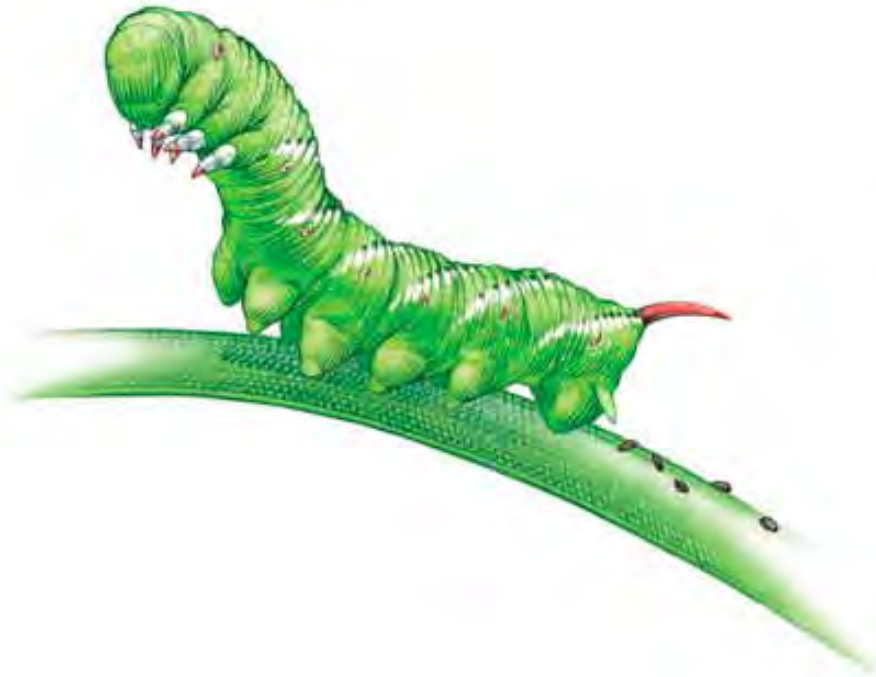
- Rigid collars (made from plastic drinking cups or cardboard tissue rolls) to protect young seedlings from damage were amazingly high (93 percent effectiveness rating).
- A common practice to reduce cutworm damage is to cultivate the soil's surface once or twice before planting and hope robins and other bug-eating birds will swoop in to gather the juicy cutworms.
- Big, sturdy seedlings are naturally resistant to cutworms, so many gardeners said they set out seedlings a bit late to avoid cutworm damage.

#8 Cutworms

alternatives

- Another organic cutworm control method is using beneficial nematodes. Beneficial nematodes are microscopic segmented wormlike insects that attack pest insects and all stages of their offspring. They need a moist environment and can be applied simply by adding them to water and spraying them into your soil with a common pressurized pump sprayer.
- Beneficial nematodes won't harm earthworms, birds, plants or the environment. They occur naturally, but often not in high enough concentrations to help when we gardeners need them. Spraying your garden with beneficial nematodes is a little more expensive but is highly effective if done properly.

#7 Tomato hornworms



The tomato hornworm, a thorn in the side of many tomato growers, claimed the No. 7 spot in our list of the 12 worst garden pests.

ILLUSTRATION: KEITH WARD

#7 Tomato hornworms

- 42 percent of our survey respondents found Tomato hornworms to be a concern.
- They damage tomatoes, potatoes, peppers, eggplant and tobacco plants. They consume entire leaves, small stems, and sometimes chew pieces from fruit.
- Adult moths emerge in late spring, mate and deposit spherical green eggs on the underside of leaves. In 5 days hatching begins and the larva passes through five or six stages before reaching full growth in 3-4 weeks.

#7 Tomato hornworms

alternatives

- Bt and handpicking were the preferred control methods, and several folks commented that tomato hornworms are among the easiest garden pests to handpick (probably because they're large, easy to spot and produce a telltale, pebbly trail). .
- Gardeners named zinnias and borage as good companion plants for reducing hornworm problems.

#7 Tomato hornworms

alternatives

- Beneficial insects including lacewings, braconoid and trichogramma wasps, and ladybugs attack the eggs. Many gardeners report seeing tomato hornworms often covered with rice-like cocoons of parasitic braconoid wasps.
- *Bt - Bacillus thuringiensis, var. kurstaki*) is effective, especially on young caterpillars (larvae)
- Roto-tilling after harvest destroys overwintering pupae in the soil. This is especially effective since pupae are large and not buried very deeply in the soil. Results have shown that greater than 90% mortality is caused by normal garden tilling.

#6 Japanese beetles



Forty-six percent of our survey respondents reported battling Japanese beetles in their gardens.

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#6 Japanese beetles

- 46 percent of respondents reported working in the unwelcome company of Japanese beetles.
- They skeletonize leaves and demolish plants, especially roses and grapes. The larvae are white grubs that feed on organic matter and roots of grasses in the soil; they can cause a great deal of damage to your lawn.

#6 Japanese beetles

alternatives

- Handpicking was the most popular control method.
- Some gardeners grow trap crops of raspberries or other fruits to keep Japanese beetles away from plants.
- * Several commonly used interventions — garlic-pepper spray, milky spore disease, pheromone traps and row covers — had high failure rates.
- Numerous respondents said chickens, guinea fowl and ducks ended their problems with Japanese beetles
- In late spring, when Japanese beetle larvae are close to the soil surface, letting wild, bug-eating birds work over the area can have a lasting impact, too. Several readers shared that having nesting pairs of robins and bluebirds (which feed insects to their young) is the best way to keep Japanese beetles from getting out of hand.

#6 Japanese beetles

alternatives

- Parasitic nematodes (*Heterorhabditis* spp.) prey on the grubs, says David Shetlar, Ph.D., extension entomologist at Ohio State University. (He does not recommend milky disease spore products, which are often used to control grubs in lawns.) Apply nematodes to the soil in late August or early September, Dr. Shetlar advises, and make sure that the nematode product is fresh and the soil is kept continuously moist after it is applied.

#5 Squash vine borers



Many gardeners use crop rotation and grow resistant varieties to protect their crops from squash vine borers, the fifth worst garden pest.

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#5 Squash vine borers

- 47 percent of the survey respondents said they had problems with Squash vine borers
- It is a key pest of winter squash, gourds and pumpkins. Unfortunately, it is **usually noticed only after it has done its damage**. Symptoms appear in mid summer when a long runner or an entire plant wilts suddenly. Infested vines usually die beyond the point of attack.
- Sawdust like frass near the base of the plant is the best evidence of squash vine borer activity. Careful examination will uncover yellow brown excrement pushed out through holes in the side of the stem at the point of wilting. If the stem is split open, one to several borers are usually present.

#5 Squash vine borers

alternatives

- The best reported control methods were crop rotation and growing resistant varieties of *Cucurbita moschata*, which includes butternut squash and a few varieties of pumpkin. The *C. moschata* varieties are borer-resistant because they have solid stems.
- Open-pollinated varieties of summer squash (zucchini and yellow crookneck, for example) may fare better than hybrids, because OP varieties are **more likely to develop supplemental roots where the vines touch the ground**. Many gardeners dump soil over these places, so if squash vine borers attack a plant's main stem, the plant can keep on growing from its backup root system. Because borers attack stems, compact hybrids, which tend to grow from one or two main stems, are naturally more susceptible.
- One tactic is to wait out the borer's egg-laying season. "To avoid squash bugs and squash vine borers, planting vining crops late and covering them with row covers until the first flowers was effective for some"

#4 Cabbageworms



The fourth-ranked garden pest, cabbageworms attack brassicas with a vengeance. If you see these white butterflies in your garden, protect your crops before the moths lay their eggs.

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#4 Cabbageworms

- 47 percent “disapproval” rating.
- If you see these little white butterflies in your garden, take action to protect your brassicas before this moth lays eggs.

#4 Cabbageworms alternatives

- Two widely accepted biological pesticides, **Bt** (*Bacillus thuringiensis*) and **spinosad**, received remarkably high effectiveness ratings: 95 percent for Bt and 79 percent for **spinosad**.
- **Row covers** had a reported success rate of 82 percent, while companion planting and garlic-pepper spray had disappointing failure rates in excess of 30 percent.
- Several respondents said they rely on **paper wasps** to control cabbageworms. “They’re friendly, docile and voracious eaters of cabbageworms. My garden is full of cabbage butterflies, but I’ve yet to see a single worm; the wasps beat me to it” To attract paper wasps, **place bottomless birdhouses in the garden to provide nesting sites**. Gardeners in the South, Mid-Atlantic and Midwest noted that cabbageworm populations drop if yellow-jacket nests are nearby, which enhances the success of fall cabbage-family crops.

Spinosad

- **Spinosad** is substance that works as a neurotoxin in many (but not all) insects. Susceptible insect species that are exposed to spinosad become excited to the point of exhaustion, stop eating immediately and die within two days. Similar to Bt, spinosad breaks down in sunlight, so late-day applications will better expose insects to the toxins. Spinosad has a longer period of residual effectiveness compared with Bt, often providing good protection from pests for five to seven days. Generally, spinosad is most effective against insect larvae, so it's important to look carefully for eggs and feeding insects before you spray.
- The Organic Materials Review Institute currently lists 21 approved spinosad products, including the following for use in the garden: Entrust Naturalyte Insect Control, Green Light Lawn and Garden Spray with Spinosad, Monterey Garden Insect Spray, and others. Several more have been approved for control of fire ants..
- A note of caution: Although spinosad is not as broad-spectrum nor as long-lasting as many synthetic insecticides, it can kill bees and other beneficial insects along with pests. So use it sparingly – only when you think you have to, and not on plants when they are flowering and attracting bees.

#3 Aphids



Aphids, the No. 3 ranked pest, were a problem for 50 percent of our survey respondents.

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#3 Aphids

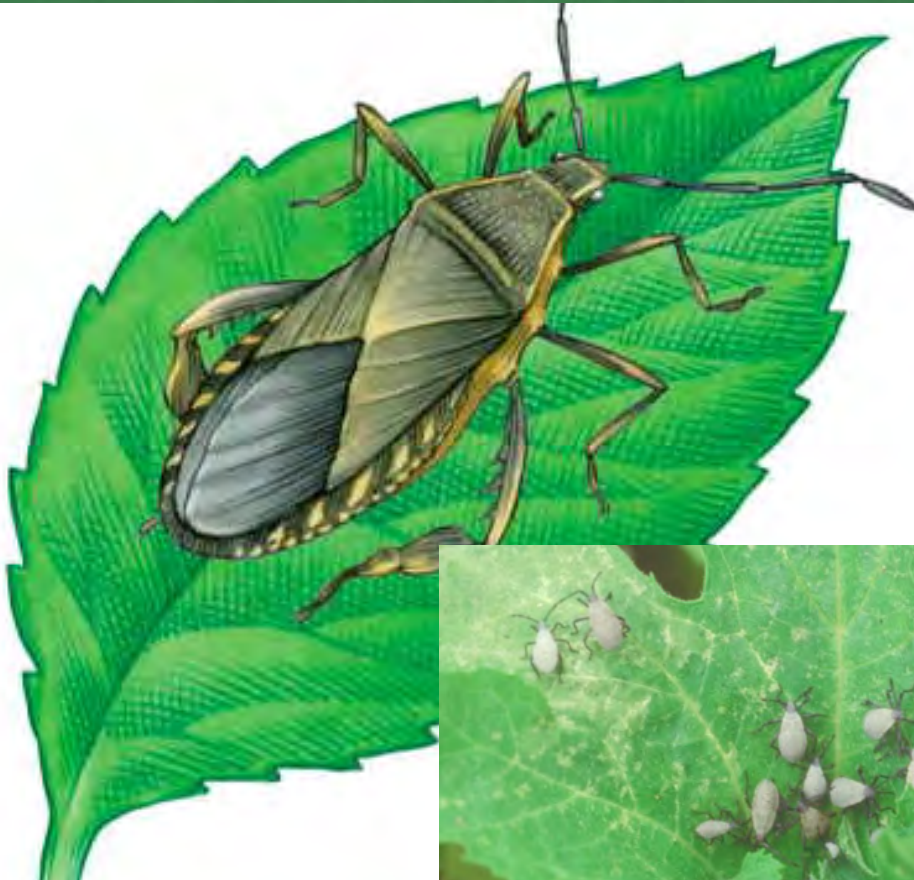
- 50 percent of respondents had problems with Aphids
- Aphids are soft-bodied insects, about a tenth of an inch long. They're typically green or black, though you may also run into gray or black ones in your garden, depending upon where you live
- They suck the sap from the stems and leaves of your plant and excrete honeydew. They can weaken the plant, but, even worse, they also spread diseases as they move from plant to plant. And, they reproduce quickly!

#3 Aphids

alternatives

- The success rates of various control techniques were quite high.
- Active interventions, including pruning off the affected plant parts, a blast of water from the hose, and applying insecticidal soap, were reported effective
- Passive methods, such as attracting beneficial insects by planting flowers and herbs were recommended. Several readers noted the ability of sweet alyssum and other flowers to attract hoverflies, which eat aphids
- Silver Metallic Plastic Mulch

#2 Squash bug



Squash bugs took the No. 2 spot in our ranking of pesky pests.

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#2 Squash bug

- 55 percent of respondents saying the slimy critters give them trouble year after year
- Feed on all members of the cucurbit family, which included cucumbers, melons, pumpkins, and summer and winter squash
- The adults overwinter in garden debris and begin laying eggs in early summer.
- Squash bugs lay eggs on the undersides of leaves in evenly spaced groups.

#2 Squash bug alternatives

- Most gardeners reported using handpicking as their primary defense, along with cleaning up infested plants at season's end to interrupt the squash bug life cycle.
- Reduce squash-bug numbers, and their damage, by killing their eggs before they have a chance to hatch.
- The value of companion planting for squash bug management was a point of disagreement for respondents, with 21 percent saying it's the best control method and 34 percent saying it doesn't help.
- Of the gardeners who had tried it, 79 percent said spraying neem on egg clusters and juvenile squash bugs is helpful.
- About 74 percent of row cover users found them useful in managing squash bugs.

#2 Squash bug alternatives

- Several respondents pointed out that delaying squash planting until early summer and growing the young plants under row covers results in far fewer problems with this pest. This makes sense because natural enemies of squash bugs become more numerous and active as summer progresses.
- Three readers shared this tip: In the cool of the morning, place open pizza boxes beneath squash plants. Jostle the plants and let the adult and juvenile squash bugs fall into the boxes, and then slide your captives from the boxes into a pail of soapy water.
- Create a simple Squash Bug Squisher out of two thick boards and a hinge

#1 Slugs



In our nationwide pest control survey, slugs took top honors as the most bothersome pest.

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#1 Slugs

- **Slugs** took top honors as the most bothersome pest in home gardens, with 55 percent of respondents saying the slimy critters give them trouble year after year.
- With their rough, file-like tongues, these mollusks devour several times their own body weight in one night, leaving gaping holes in leaves, torn foliage, and-yuck!-slime trails in their wake. Hostas and lettuce are their most common targets, but corn, beans, strawberries, annual flowers, and many other garden favorites are susceptible to attacks.

#1 Slugs alternatives

- Handpicking was highly rated as a control measure (87 percent success rate), .
- An easy home remedy that received widespread support was beer traps (80 percent success rate). A study by Whitney Cranshaw, Ph.D., professor of entomology at Colorado State University, nonalcoholic Kingsbury Malt Beverage was found to attract the most slugs. A yeast bait trap of 1 cup water, 1 teaspoon sugar, 1 teaspoon flour, ½ teaspoon dry yeast works well for traps.
- Using a board with newspaper soaked in sugar water under it will attract slugs so they can be taken away. Check trap in the early morning.
- Iron phosphate baits – example Sluggo (86 percent). Ingesting it causes slugs to stop feeding and to retreat underground, where they die within three to six days
- Diatomaceous earth (84 percent). This lethal powder is extremely sharp and cuts their undersides, causing dehydration

#1 Slugs alternatives

- Opinion was divided on eggshell barriers (crushed eggshells sprinkled around plants), with a 33 percent failure rate among gardeners who had tried that slug control method.
- Relying on bigger predators — such as chickens and ducks appears to be the most dependable way to achieve long-term control
- Slugs love Red Clover concludes a recent study from Harper Adams University College in Shropshire, England. Researchers found that when this alternative source of food was planted next to beds, slugs were lured toward the sacrificial clover and away from more valuable plants. Resilient (and beautiful), red clover grows in a wide variety of soils.
- Mini “electric fence” 9v battery and double wire

Colorado Potato Beetle



Colorado Potato Beetle

- This pest favors potatoes, but it also feasts on tomatoes, eggplants, peppers, and petunias. The beetle and its larvae don't actually go after the tubers. Instead they feast on the plants' leaves and shoots, inhibiting their ability to photosynthesize and reducing potato yields. Adults are yellowish orange with black spots behind their heads and 10 black stripes on their wing covers. They overwinter in the soil and emerge in late spring and walk to host plants, where they lay clusters of yellow, oval-shaped eggs. The larvae hatch and feed for up to 3 weeks before they pupate in the soil. There may be as many as three generations per year in the South, while farther north, one to two generations is typical.

Colorado Potato Beetle

alternatives

- The easiest and best way to prevent damage to your potato crop is to create a barrier between the pest and the plants with a lightweight floating row cover. Place the row cover over the potatoes after planting and leave it on until you are ready to harvest.
- Place a heavy layer of straw mulch around your potato plants. Research indicates that the mulch inhibits the Colorado potato beetle's ability to actually find your potatoes, and the mulch acts as a microenvironment that encourages the beetle's natural predators, including ground beetles, which feed on larvae, and lady beetles and lacewings, which feed on eggs and larvae.
- Surrounding your potato patch with a plastic-lined, V-shaped trench can also reduce the number of adults that reach your plants in spring. As they emerge from the soil and head for the plants, they fall into the trench and can't get out. Destroy them.
- **Spinosad** works on the larvae.

Resources

- <http://www.motherearthnews.com/organic-gardening/organic-pest-control.aspx>
- <http://www.slideshare.net/Fairlee3z/companion-planting-guide-jeremiah-ridge-chilton-county-alabama>
- <http://www.groworganic.com>
- <http://www.sustainabletable.org/263/pesticides>
- Purdue Extension bulletin E-21-W – Managing insects in the home vegetable garden