

### Integrated Pest Management for Commercial Horticulture

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2014

#### Introduction

We have been pretty much Japanese beetle free for the past 6 years and it has been great. Something happened in 2013 that is changing this blissful period. The drought periods in the summers of 2007 - 2012 kept the Japanese beetle populations suppressed and we saw only isolated cases of Japanese beetle damage. It started raining on a regular basis during the egg laying time for adult Japanese beetles in 2013 and there was a higher survival of Japanese beetle grubs in the soil which means more Japanese beetles in 2014. The cold temperatures of -7 F in January for a couple of days did nothing to reduce this grub populations. They moved deep into the soil to overwinter and did just fine.

Meanwhile, people have been planting ideal food in landscapes for the adult beetle. The bush type roses such as Knockout and Double Knockout roses have made a big hit in commercial planting sites and have been used extensively in landscapes over the last couple of years. These roses just add to the food sources for Japanese beetles in 2014. Little leaf linden trees, crabapples, rose of Sharon, hibiscus, and cherry trees are all favored hosts for Japanese beetle adults. If you are growing fruit bearing sweet and sour cherry, blueberry plants, apple trees expect a visit from Japanese beetles this year

#### We Learn From Past Experiences

Back in 2005 we saw a brutal onslaught of Japanese beetles that left a path of devastation in the Washington/ Baltimore corridor. The beetle populations had been building over the last 4 years, but in 2005 we received reports of record setting levels of damage in the landscapes. One landscape manager reported that within 5 days after they saw the first Japanese beetle emerge on June 24th, they were finding 14 -16 ft tall little leaf lindens completely defoliated. Nurseries visited in Frederick and Carroll Counties on June 30 had so many adult beetles on susceptible trees species that when we shook the branches the sky was clouded by swarms of escaping beetles. The population levels of Japanese beetles were at epidemic proportions on the East Coast in the 1940s - 1960s before settling into generally low levels for many years. This pest activity fell into a persistent, but almost "low incidence" pest status in many communities.



**Japanese beetle adults feed on a variety of plants, including zinnias**

We are still seeing low populations in the oldest, established communities, but high levels in the newly developed neighborhoods. In the south and mid-west of the United States, however, the Japanese beetle is still a relatively recent pest, where expanding populations are wrecking havoc in many landscapes.

This beetle was one of the early invasive species, but we did not call them this term then. Native to Japan, the Japanese beetle was first observed in the United States in New Jersey in 1916 by two Canadian entomologists visting in New Jersey who described them as a "curious southern species of beetle". Little did these two Canadian entomologists realize how wide spread the Japanese beetle would be over the next century. Japanese beetle populations are entrenched and damaging plant material from Iowa and to Illinois, Kentucky, Alabama, northern Georgia to South Carolina. The range of the beetles continues to expand with localized infestations in many other states including Colorado. Colorado now has thousand cankers disease killing walnuts, emerald ash borer killing ash trees and Japanese beetles feeding on many of the remaining tree and shrub species growing in this arid land. You thought you had it tough, try growing anything other than rocks in Colorada lately.

Aggressive programs to eliminate this introduced pest in these isolated outcroppings have been effective but expensive. Constant vigilance and early interdiction will be a continuing process to keep Japanese beetles from spreading to new areas in the United States.

## Japanese Beetle Life Cycle

After mating, adult females live 30-45 days, and their peak flight activity is finishing up in August. They feed and lay eggs throughout the summer, ultimately laying 40-60 eggs in the soil. When females lay eggs they are rather flattened, slightly wrinkled and oval. Eggs are laid only 1 to 3 inches in the soil, a relatively shallow depth. As soon as eggs are laid, they start to absorb moisture from the adjacent soil and increase in size quickly as long as moisture levels are adequate. One to four eggs are laid at a time, with additional egg laying occurring every few days for over a month in mid-summer. The eggs are hatching in August, and it is good time to look to controlling newly hatched larvae in August and September in turfgrass areas.



Japanese beetle grub

Photo: Jim Baker, North Carolina State University, Bugwood.org

Grubs hatch in 10-12 days and feed on turfgrass roots until the fall. By late October to November, when soil temperatures drop, grubs cease feeding and move downward 15 – 30 cm (6 to 12 inches) into the soil to overwinter. Many people commented that the single digit temperatures of January and early February surely killed the white grubs. Unfortunately, the grubs go deep into the soil, often below the frost line, so there is little mortality that occurs from winter cold.

Come spring, when soil temperatures warm up, grubs move up toward the soil surface and continue feeding on grass roots. Grubs mature from late May through June and molt to pupae in the soil. One generation occurs each year.

## Turf That Attracts Japanese Beetles

Ten months of the year the Japanese beetle grub is hidden away beneath the turf areas of a landscape or nursery, silently cutting away the root system of the grass. Grubs prefer healthy turf in full sun that is well irrigated and fertilized. If grub populations are low or the turfgrass is receiving enough water to keep it growing vigorously, the damage to the turf may go undetected.

Japanese beetles feed on all cool season grasses, but they seem to prefer perennial ryegrass and hard fescues. Researchers in Kentucky found that Kentucky bluegrass is nutritionally inferior as a food source, but if fed upon, recovers from Japanese beetle damage faster because of its spreading growth habit compared to perennial ryegrass.

Incidentally, perennial ryegrasses with endophytes do not seem to have a high enough level of toxin in their roots in order to prevent grub attack. Endophytes may, however, boost ryegrass recovery following grub attack.

## Plants That Attract Japanese Beetles

Japanese beetle adults begin their annual activity by mid June (approximately), with peak activity in mid-July. Adults prefer ornamental plants in full sun, and typically feed in groups. Certain plants in the landscape are magnets for Japanese adults. For example, if a little leaf linden, a horse chestnut, Japanese flowering plum, rose or crape myrtle are in the landscape, expect Japanese beetle adults to be frequent visitors and will consume generous amounts of foliage. The following list includes the top 10 favorite plant foods of Japanese beetles (source: APHIS): 1) American linden, 2) Crabapple, 3) Apple, 4) Japanese maple, 5) Norway maple, 6) Rose, 7) Crape myrtle, 8) Pin oak, 9) Birch, and 10) *Prunus* spp (Plum, Apricot, Cherry, Peach). Secondary preferred host plants include black walnut, willow, grape, horsechestnut, hibiscus, blueberry, sassafras, Virginia creeper, and summersweet (*Clethra*). Notice that the list of secondary preferred plants includes some wild plants that might be found in nearby hedgerows.

The top 5 preferred herbaceous plants include 1. Hollyhock (*Alcea rosea*), 2. Dahlia (*Dahlia* spp.) 3. Hibiscus (*Hibiscus* spp.), 4. Common mallow (*Malva rotundiflora*), and 5. Evening-primrose (*Oenothera biennis*). Adults also feed on annual flowers, including zinnia (*Zinnia elegans*), common four-o'clock (*Mirabilis jalapa*) and French marigold (*Tagetes patula*).

## Controlling Adult Beetles in 2014

The key with controlling adult Japanese beetles is to use a material that either repels the adult beetles from feeding or kills them quickly before they can inflict much damage to the foliage. One additional challenge is how to reduce damage to plants with materials that have the least impact on pollinators and beneficial organisms.

Once adults start damaging foliage, wounded plant tissues release volatiles detected by additional beetles that attracts them to feed on the plant. If a slow killing pesticide is used, adults can cause a fair amount of damage and increase the feeding aggregation of other adults on the plant.

Read labels on pesticide containers to see if they impact pollinators. Do not spray plants that are in bloom with materials that have on the label “do not spray when a plant is in bloom”. EPA is requiring all of the neonicotinoids to have a bee box with a warning precaution on the label. Presently, there will be no pre-caution listed for soil drench applications of neonicotinoids since there is not adequate information available on whether soil applications are carried into pollen or if so, at what level.

Registered products that give very good control of adult Japanese beetles include Sevin (=carbaryl), Astro (=permethrin), DeltaGard (=deltamethrin), Talstar (=bifenthrin), and/or Tempo (=cyfluthrin). All of these materials cannot be applied when plants are in bloom. If spraying large trees or shrubs, make sure there are not flowering plants in the area where drift from a application may carry onto the bloom.

A newer insecticide, Acelepryn (chorantraniliprole), is a systemic insecticide that is a FRAC group 28 insecticide that controls adult Japanese beetles. The present label lists control of the larval stage of Japanese beetle but did not list adult Japanese beetle on the label. Syngenta Company submitted a 2ee (emergency exemption) for Acelepryn which allows use as both a foliar and soil application to trees and herbaceous plants in the landscape. The label rate for foliar applications for Japanese beetle adults ranges from 1 – 8 oz/100 gallons of water. The soil rate is 0.125 fl oz to 0.25 fl oz per inch of trunk diameter (measure at 4 ft height). If you choose to use Acelepryn in 2014 then visit the website CDMS.net and for the Acelepryn label. You must download the Acelepryn 2ee and have it on file when applying it if you intend to use Acelepryn for adult Japanese beetle control. The label on the Acelepryn has no precautions concerning bee or other pollinators. Syngenta has submitted the paperwork to EPA to have adult Japanese beetles listed on the label. This change cannot happen until the next EPA review process occurs. Once approved, the new labels will list adult Japanese beetles and you will not need to download the copy of the 2ee from the web.

The impact of neonicotinoid class of insecticides on pollinating insects such as honey bees and native bees may be a concern. Of the neonicotinoid class of chemicals most of them including imidacloprid, dinotefuran, and thiamethoxam will have warning labels saying not to spray when plants are in bloom. To be on the cautious side, soil applications of neonicotinoids should be made after the plant flowers. It is not known presently if soil applications are carried into pollen or what levels are potential problems. Imidacloprid (=Merit, Mallet and many other brand names) has a label for Japanese beetle control. If you are applying this as foliar spray after a plant has bloomed

it should kill Japanese beetle for 2 – 3 weeks. Applying as a foliar spray after bloom time reduces the chance that pollinators will contact the insecticide. Foliar applications of the material do not result in long term persistence in the plant. When imidacloprid is applied as a soil drench, it acts differently and remains in a plant for longer periods of time. The problem is, if applied as a soil drench, imidacloprid has to be applied 2 – 3 months before an insect that you are trying to control is present. The chemical is very slow on uptake into woody plant material. The chemical could be present in flower blooms, thus impacting pollinators. Presently, there is no data to support this presence and at what level any is present. Soil applications of imidacloprid that are absorbed through roots result in the plant metabolizing the compounds. Some of the resulting breakdown products could be equally toxic or even more toxic to pollinators than the original compound but this is presently unknown. Also, imidacloprid when absorbed through roots of plants remains in the plant for 2 – 3 years.

So, to control Japanese beetles, if you choose to use imidacloprid, a foliar spray is used after the plant is finished blooming. This option works for single-season flowering trees, shrubs and herbaceous plants. For plants that continue to flower over a longer time, such as roses, hibiscus or zinnias, this would not be an appropriate material to use as a spray since the material would be found in the flower when pollinators would pick up the chemical. Soil applications before the plant blooms are not restricted by EPA labels.

Dinotefuran (=Safari, Transect), is also a neonicotinoid. It is more water soluble and is taken up by plants faster. It can be applied as a basal trunk spray and taken up into foliage in a couple of weeks. When dinotefuran is uptaken into the plant it also forms metabolites but they break down rapidly, compared to imidacloprid, and are non-detectable by the end of the season. Apply this material after a plant flowers and the chemical will be broken down before blooming next season.

If you wanted to use dinotefuran to control Japanese beetle adults, a soil drench or basal trunk spray can be applied just after bloom time to avoid any chance of impacting pollinators. The soil or bark application should last the rest of the growing season. If you choose to apply dinotefuran as a foliar spray, do this treatment after bloom time. The residual control on Japanese beetles is 2 – 3 weeks.

Acetamiprid, labeled for foliar applications only, is another highly water soluble neonicotinoid for adult Japanese beetle control and should only be applied to plants after they have finished blooming. It is the only neonicotinoid that will not have a pollinator precaution statement on its label.

## Reduced Risk Pesticides for Adult Control

The federal E.P.A. classifies certain chemicals as reduced risk if they have minimal impact on human health and the environment. Some of the reduced risk pesticides that can be used for Japanese beetle adult control are azadirachtin, spinosad, and pyrethrin.

Azadirachtin, sold under several names including Azatin XL, Neemazad, Aza-Direct and Ornazin, is a botanical insecticide that is derived from seed from the neem tree. Applications of azadirachtin act as a feeding deterrent and we have obtained 3 – 4 days of repellency with foliar applications on plants susceptible to Japanese beetles.

Pyrethrin is sold under the names Pyreth-It and Pyganic. The pyrethrins are a pair of natural organic compounds normally derived from *Chrysanthemum cinerariifolium* that have potent insecticidal activity. Pyrethrins are neurotoxins that attack the nervous systems of all insects. When present in amounts not fatal to insects, they still appear to have an insect repellent effect. They are non-persistent, being biodegradable, and break down on exposure to light or oxygen. This material works as a direct contact pesticide, so sprays have to be directed onto the beetle. The best time to treat is during morning hours when beetles are stationary. If pyrethrins hit pollinators directly they will kill them. Since it has no-residual effect, once it is dry it has no impact on pollinators.

Pyola, a combination of pyrethrins and canola oil (from Gardens Alive and other suppliers) was effective in research conducted by Dan Potter and Rebecca Baumler Willis at the University of Kentucky.

## Control Option Coming in 2014

Mainspring (cyanoantraniliprole) is in the same family (FRAC 28) as Acelpryn and will be labeled with EPA for use in greenhouses, interiorscapes and production nurseries for controlling several insects including adult Japanese beetles. The proposed label has no precaution concerning bees or other pollinators. The ideal spray timing targets adults when they first appear and before damage occurs.

Repeat applications are often desirable weekly on high value plants, particularly if the ideal spray window was missed. Since larvae develop in turf, treatment of turf areas is also recommended as a dual control.

Japanese beetle traps containing floral and sex attractant lures that attract adult beetles are used as a monitoring tool. Traps have been misused by the public who mistakenly believe they control beetles, but beetles have been shown to often land and feed on plants close to traps.

## How About Japanese Resistant Plants?

Many littleleaf lindens (*Tilia cordata*) and American lindens (*Tilia americana*) were completely defoliated in mid-Atlantic landscapes in 2004. By late July, only brown skeleton-like veins remained from the leaf petioles of numerous street trees, including the linden cultivars ‘Greenspire’, ‘Olympic’, ‘Redmond’ and ‘Prestige’. However, silverleaf lindens (*Tilia tomentosa*) growing in the same landscape had little, if any, Japanese beetle feeding injury. The foliage of silverleaf linden (and cultivars) is just a little thicker with small hairs on the foliage that apparently makes it unattractive to adult beetles.

Another resistant tree to try is the Japanese tree lilac, *Syringa reticulata*. The tree lilac is well adapted to urban soils and blooms in mid-summer. The late lilac, *Syringa villosa*, grown as a shrub or trained as a small tree is also a good choice. Both species of *Syringa* are very resistant to Japanese beetle feeding.

Using species that are seldom attacked by the Japanese beetle can reduce damage to nursery plants. The top 10 least preferred plants are: 1) Magnolia, 2) Redbud 3) Dogwood 4) Red maple, 5) Northern red oak, 6) Burning bush, 7) Holly, 8) Boxwood, 9) Hemlock, and 10) Lilac. (Source: APHIS). Other least preferred landscape plants include false cypress, yew, juniper, forsythia, clematis, red maple, euonymus, tuliptree, ornamental pears, and most oaks (white, scarlet, red, and black)

## Japanese Beetles: On Their Way Back in Maryland

by:

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