

Selecting juglone-tolerant plants

Landscaping Near Black Walnut Trees

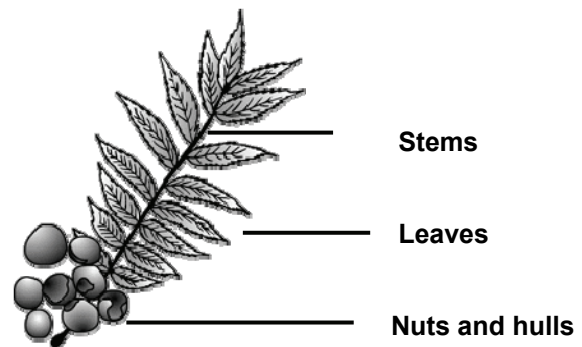
Black walnut trees (*Juglans nigra*) can be very attractive in the home landscape when grown as shade trees, reaching a potential height of 100 feet. The walnuts they produce are a food source for squirrels, other wildlife and people as well. However, whether a black walnut tree already exists on your property or you are considering planting one, be aware that black walnuts produce juglone. This is a natural but toxic chemical they produce to reduce competition for resources from other plants. This natural self-defense mechanism can be harmful to nearby plants causing “walnut wilt.”

Having a walnut tree in your landscape, however, certainly does not mean the landscape will be barren. Not all plants are sensitive to juglone. Many trees, vines, shrubs, ground covers, annuals and perennials will grow and even thrive in close proximity to a walnut tree.

Production and Effect of Juglone Toxicity

Juglone, which occurs in all parts of the black walnut tree, can affect other plants by several means:

- Through root contact
- Through leakage or decay in the soil
- Through falling and decaying leaves
- When rain leaches and drips juglone from leaves and branches onto plants below.



Juglone is most concentrated in the buds, nut hulls and roots and, to a lesser degree, in leaves and stems. Plants located beneath the canopy of walnut trees are most at risk. In general, the toxic zone around a mature walnut tree is within 50 to 60 feet of the trunk, but can extend to 80 feet. The area affected enlarges outward each year as the tree grows.

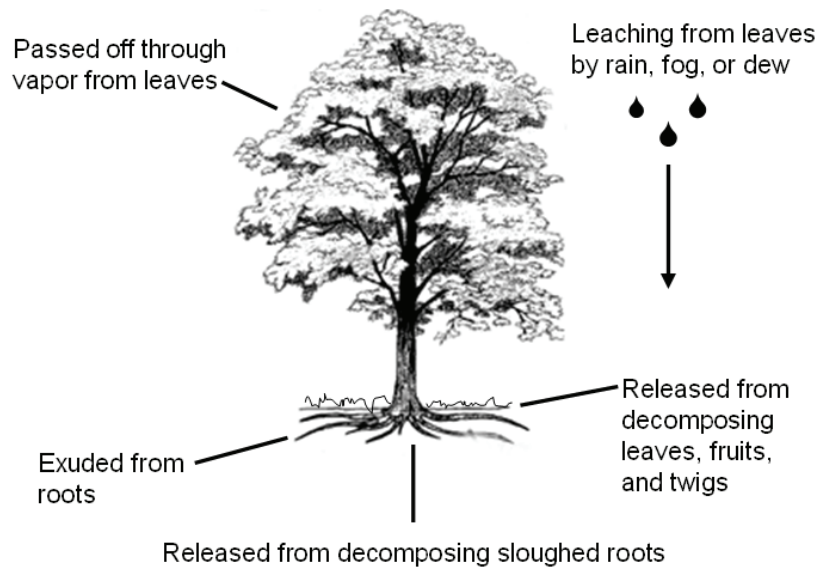
All parts of the black walnut tree produce toxic juglone to varying degrees.

Juglone acts as a respiration inhibitor. Affected plants cannot exchange carbon dioxide and oxygen properly, which deprives them of needed energy for metabolic activity. The resulting wilting cannot be reversed. Particularly sensitive to juglone are vegetables such as tomatoes, potatoes, eggplants and peppers, and ornamentals such as lilacs, peonies, rhododendrons and azaleas.

Symptoms

The symptoms in plants sensitive to juglone range from stunting, yellowing, to partial or total wilting, to complete death.

- Tomatoes show symptoms of yellowing and discoloration of the leaves, as well as twisting and puckering. Discoloration and darkening of internal stem tissue can also occur.
- Walnut toxicity will result in complete death in fast growing annual plants such as potatoes or tomatoes.
- Toxic reaction often occurs quickly. Highly sensitive plants can go from healthy to dead within one or two days.
- For woody plants such as shrubs and trees, symptoms on new growth can be similar in appearance to those of annual plants
- Generally, the symptoms on older growth are more subtle and will appear as an overall decline of the plant, with eventual death possible.
- The effects of juglone toxicity sometimes mimic symptoms of various plant diseases and physiological disorders.



Controls

There is no chemical control available to stop the potentially toxic effect of juglone. *The only practical control is physical separation.* The best advice when gardening near black walnuts is to use caution. Understanding the site to be landscaped or developed into a garden is the first step in assuring the survival of plantings. General tips for planting around black walnuts include:

- **Garden location.** Locate gardens well away from black walnuts.
- **Raised beds.** Create and plant in raised beds to reduce root contact. This will require lining the bed using weed fabric and filling the raised bed with new amended soil.
- **Clean up is important.** Prevent twigs, branches, leaves, nuts, hulls, and stems from decomposing near planting areas.
- **Volunteer removal.** Pull out walnut volunteer seedlings.

- **Mulch precautions.** Do not use fresh black walnut leaves, bark and wood chips as mulch. Walnut bark can be used for mulch if it has been composted for a minimum of six months.
- **Plant selection.** Plant tolerant trees, shrubs, vines, ground covers, flowers and grasses under walnut trees, or in areas that might contain walnut trees. See the list on pages 4 to 5.
- **Adding to your compost pile.** You can compost walnut leaves because the toxin breaks down when exposed to air, water and bacteria. The toxic effect can degrade in two to four weeks. In soil, breakdown may take up to two months.
- **Is removal a solution?** No. Cutting down the tree will not solve the problem for a long time because juglone can persist in the wood until the roots are decomposed, which can take five years or more. Removing a walnut tree may not be practical when the tree is the focal point in a landscape.
- **Soil improvement.** Maintain high organic matter levels in the soil to improve drainage and to encourage healthy soil microbial populations that can metabolize toxins.

Plants Susceptible to Juglone

The following plants are observed to be susceptible to juglone produced by walnut trees. This list is based only on observation and experience, not scientific experiments. It should be used for guidance only, not regarded as definitive.

Trees

Alder, *Alnus glutinosa*
 Apple/Crabapple *Malus sp.*
 Basswood (linden) *Tilia americana*
 Birch, White *Betula papyrifera*
 Chokeberry, Red *Aronia arbutifolia*
 Magnolia, Saucer *Magnolia x soulangiana*
 Maple, Silver *Acer saccharinum*
 Mountain Laurel *Kalmia sp.*
 Norway Spruce *Picea abies*
 Pine (most) *Pinus sp.*
 Russian Olive *Elaeagnus angustifolia*
 Ornamental cherry cultivars *Prunus*

Shrubs

Amur honeysuckle *Lonicera maackii*
 Arborvitae *Thuja occidentalis*
 Azalea *Rhododendron sp.*
 Cotoneaster *Cotoneaster sp.*
 Hydrangea *Hydrangea sp.*
 Lespedeza *Lespedeza striata*
 Lilac *Syringa sp.*
 Nine-Bark *Physocarpus opulifolius*

Pipe Vine *Aristolochia macrophylla*
 Potentilla cinquefoil *Potentilla fruticosa*
 Privet *Ligustrum vulgare*
 Firethorn *Pyracantha sp.*
 Rhododendron *Rhododendron sp.*
 Viburnum (most) *Viburnum sp.*
 Yew *Taxus sp.*

Annuals

Petunia *Petunia sp.*

Perennials and Bulbs

Colorado Columbine *Aquilegia caerulea*
 Chrysanthemum *Chrysanthemum morifolium*
 Coral bells *Heuchera sp.*

Fruit

Blackberry *Rubus sp.*
 Blueberry *Vaccinium sp.*
 Domestic grape *Vitis sp.*
 Pear *Pyrus communis*

Vegetables

Alfalfa
 Asparagus
 Cabbage
 Cucumber
 Double-flowered Cole vegetables
 Eggplant
 Pepper
 Potato

Rhubarb
 Tomato

Plants Resistant or Tolerant to Juglone

The following plants are observed to grow well in close proximity to walnut trees. This list is based only on observation and experience, not scientific experiments. It should be used for guidance only, not regarded as definitive.

Trees

American Beech *Fagus grandifolia*
 American Elm *Ulmus americana*
 American Holly *Ilex opaca*
 American Hornbeam *Carpinus caroliniana*
 Black Gum *Nyssa sylvatica*
 Black Locust *Robinia pseudoacacia*
 Black Maple *Acer nigrum*
 Black Oak *Quercus velutina*
 Boxelder *Acer negundo*
 Callery Pear *Pyrus calleryana*
 Carolina Silverbell *Halesia carolina*
 Catalpa *Catalpa bignonioides*
 Chestnut *Castanea dentata*
 Dogwood, Flowering *Cornus florida*
 Flowering Dogwood *Cornus florida*
 Fringetree *Chionanthus sp.*
 Goldenrain *Koelreuteria paniculata*
 Hackberry (Common) *Celtis occidentalis*
 Hawthorn *Crataegus sp.*
 Hemlock *Tsuga canadensis*
 Hickory *Carya sp.*
 Honeylocust *Gleditsia triacanthos*
 Japanese Maple *Acer palmatum*, & cvs.
 Lenten/Christmas Rose *Helleborus sp.*
 Mulberry *Morus sp.*
 Norway Spruce *Picea abies*
 Ohio Buckeye *Aesculus glabra*

Pawpaw *Asimina triloba*
 Persimmon *Diospyrus virginiana*
 Poplar *Populus sp.*
 Purple Leaf Sandcherry *Prunus cistena*
 Red Maple *Acer rubrum*
 Red Oak *Quercus rubra*
 Redbud *Cercis canadensis*
 River Birch *Betula nigra*
 Sassafras *Sassafras albidum*
 Sycamore *Platanus occidentalis*
 Tree of Heaven *Ailanthus altissima*
 Tuliptree *Liriodendron tulipifera*
 White Ash *Fraxinus americana*
 White Oak *Quercus alba*
 Willow *Salix sp.*
 Witchhazel *Hamamelis sp.*

Evergreens

Arborvitae *Thuja sp.*
 Canadian Hemlock *Tsuga canadensis*
 Chinese Juniper *Juniperus chinensis*
 Red Cedar *Juniperus virginiana*

Herbaceous Perennials, Spring Wildflowers and Bulbs

Anemone, American Wood *Anemone quinquefolia*
 Aster *Aster sp.*

Plants Resistant or Tolerant to Juglone (cont.)

Herbaceous Perennials, Spring Wildflowers and Bulbs cont.

Astilbe *Astilbe* sp.
 Bee Balm *Monarda* sp.
 Bell Flower *Campanula* sp.
 Big Merrybells *Uvularia grandiflora*
 Black-eyed Susan *Rudbeckia hirta*
 Bleeding Heart *Dicentra spectabilis*
 Bloodroot *Sanguinaria canadensis*
 Bugleweed *Ajuga reptans*
 Bush Clover *Lespedeza* sp.
 Buttercup *Ranunculus* sp.
 Christmas Fern *Polystichum* sp.
 Chrysanthemum (some) *Chrysanthemum* sp.
 Cinnamon Fern *Osmunda cinnamomea*
 Common Yarrow *Achillea millefolium*
 Coral Bells *Heuchera* sp.
 Cranesbill *Geranium* sp.
 Daffodil (some) *Narcissus* sp.
 Daylily *Hemerocallis* sp.
 Dog's Tooth Violet *Erythronium americanum*
 Dutchman's Breeches *Dicentra cucullaria*
 Epimedium *Epimedium* sp.
 Evening Primrose *Oenothera* sp.
 False Dragonhead *Physostegia* sp.
 Gentian *Gentian* sp..
 Glory-of-the-Snow Crocus *Chionodoxa luciliae*
 Goldenrod *Solidago*, sp.
 Gold Moss *Sedum acre*
 Grape Hyacinth *Muscari* sp.
 Grasses *most types*
 Hollyhock *Alcea rosea*
 Hosta (many) *Hosta* sp.
 Hyacinth *Hyacinthus*
 Jack-in-the-Pulpit *Arisaema*
 Jacob's Ladder *Polemonium reptans*
 Jerusalem Artichoke *Helianthus tuberosus*
 Joe Pye Weed *Eupatorium* sp.
 Lamb's Ear *Stachys byzantina*
 Leopard's Bane *Doronicum* sp.
 Liriope *Liriope* sp.
 Lobelia *Lobelia* sp.

Lungwort + *Pulmonaria* sp.
 May Apple *Podophyllum peltatum*
 Meadow Rue *Thalictrum* sp.
 Milkweed, Common *Asclepias syriaca*
 Orange Hawkweed *Hieracium aurantiacum*
 Ostrich Fern *Matteuccia struthiopteris*
 Pachysandra *Pachysandra* sp.
 Peppermint *Mentha piperita*
 Perennial Sunflower *Helianthus* sp.
 Periwinkle *Vinca minor*
 Phlox, Creeping *Phlox subulata*
 Phlox, Summer *Phlox paniculata*
 Primrose *Primula* sp.
 Sedges *Carex* sp.
 Sensitive Fern *Onoclea sensibilis*
 Shasta Daisy *Leucanthemum*
 Siberian Iris *Iris sibirica*
 Siberian Squill *Scilla sibirica*
 Sneezewort *Helenium*
 Snowdrop *Galanthus nivalis*
 Solomon's Seal *Polygonatum* sp.
 Spanish Bluebell *Endymion hispanicul*
 Speedwell *Veronica* sp.
 Spiderwort *Tradescantia virginiana*
 Spring Beauty *Claytonia virginica*
 Stonecrop *Sedum* sp.
 Sweet Cicely *Myrrhis odorata*
 Sweet Woodruff *Galium odoratum*
 Sundrops *Oenothera fruticosa*
 Thornless Honeylocust *Gleditsia triacanthos f. inermis*
 Trillium *Trillium* sp.
 Tulip ('White Volcano', 'Cum Laude', Parrot 'Blue Parrot', Greigii 'Toronto')
Tulipa darwin sp. (some)
 Turtlehead *Chelone*
 Violet *Viola* sp.
 Virginia Waterleaf *Hudrophyllum virginianum*
 Wild Ginger *Asarum* sp.
 Windflower *Anemone* sp.
 Winter aconite *Eranthis hyemalis*
 Wood Fern *Dryopteris* sp.
 Yarrow *Achillea* sp.

Plants Resistant or Tolerant to Juglone (cont.)

Shrubs

Adam's Needle *Yucca* sp.
 American Barberry *Berberis canadensis*
 Amur Honeysuckle *Lonicera maackii*
 Arrowwood Viburnum *Viburnum dentatum*
 Barberry *Berberis* sp.
 Beautybush *Kolkwitzia amabilis*
 Black Raspberry *Rubus occidentalis*
 Blackhaw Viburnum *Viburnum prunifolium*
 Currant *Ribes* sp.
 Elderberry *Sambucus* sp.
 Euonymus *Euonymus* sp.
 Exbury Rhododendron *Rhododendron*
hybrids
 Forsythia *Forsythia* sp.
 Fragrant Sumac *Rhus aromatica*
 Fringe Tree *Chionanthus virginicus*
 Hazelnut *Corylus americana*
 Honeysuckle *Lonicera* sp.
 Kerria *Kerria japonica*
 Koreanspice `Viburnum *Viburnum carlesii*
and cvs.
 Mapleleaf Viburnum *Viburnum acerfolium*
 Mockorange *Philadelphus* sp.
 New Jersey Tea *Ceanothus americanus*
 Ninebark *Physocarpus opulifolius*
 Peony (some) *Paeonia*
 Purple Raspberry *Rubus odoratus*
 Quince *Pseudocydonia oblonga*
 Rose of Sharon *Hibiscus syriacus*
 Shrubby St. John's Wort *Hypericum*
prolificum
 Smooth Sumac *Rhus glabra*
 Viburnum (most) *Viburnum*
 Wild Rose *Rosa* sp.

Vines

Bittersweet *Celastrus* sp.
 Clematis *Clematis* sp.
 Dutchman's Pipe *Aristolochia durior*
 Grape *Vitis* sp.

Honeysuckle Vine *Lonicera* sp.
 Morning Glory *Convolvulus* sp.
 Red Cardinal *Ipomoea multifida*
 Sweet Autumn Clematis *terniflora*
 Virginia Creeper *Parthenocissus* sp.
 Virgin's Bower *Clematis virginiana*

Annuals

Fibrous begonia *Begonia*
 Tuberous *Begonia* 'Nonstop' variety
 Horned Violet *Viola cornuta*
 Impatiens *Impatiens* sp.
 Johnny Jump-up *Viola tricolor*
 Morning Glory 'Heavenly Blue' *Ipomoea*
 Pansy *Viola wittrockiana*
 Pot Marigold *Calendula officinalis*
 Zinnia *Zinnia* sp.

Fruits

Peach, Nectarine, Cherry Plum *Prunus* sp.
 Pear *Pyrus* sp.
 Black Raspberry *Rubus occidentalis*
 Quince *Cydonia oblongata*

Vegetables

Beans
 Beets
 Carrots
 Corn
 Melons
 Onions
 Parsnips
 Squash

Sources

- “Black Walnut Toxicity to Plants, Humans and Horses.” Ohio State University Extension Fact Sheet. Ohio State University. <http://ohioline.osu.edu/hyg-fact/1000/1148.html> (October 2009)
- “Green Tips.” Department of Horticulture, Michigan State University. <http://web1.msue.msu.edu/msue/iac/greentip/blackwal.htm> (October 2009)
- “Plants Tolerant of Black Walnut Toxicity.” The Morton Arboretum. http://www.mortonarb.org/index.php?option=com_content&view=article&id=887&Itemid=6 (March 2010)
- “Toxicity of Black Walnuts Towards Other Plants.” Yard and Garden Brief. University of Minnesota Extension Service. <http://www.extension.umn.edu/yardandgarden/ygbriefs/h407blkwal-tox.html> (October 2009)
- “Walnut Wilt.” Plant Disease Diagnostic Clinic, Cornell University. <http://plantclinic.cornell.edu/FactSheets/WalnutWilt/walnutwilt.htm> (March 2010)
- Dana, Michael N. and B. Rosie Lerner “ Black Walnut Toxicity.” Department of Horticulture, Purdue University Cooperative Extension Service. <http://www.hort.purdue.edu/ext/HO-193.pdf> (October 2009)
- Delahaut, Karen. “Juglone Tolerant Plants.” University of Wisconsin Urban Horticulture. <http://www.uwex.edu/ces/wihort/landscape/juglone.htm> (October 2009)
- Leuty, Todd. “Walnut Toxicity.” Ontario Ministry of Agriculture, Food, and Rural Affairs. http://www.omafra.gov.on.ca/english/crops/facts/info_walnut_toxicity.htm (October 2009)
- Relf, Diane. “Mulches for the Home Vegetable Garden.” Virginia Cooperative Extension. <http://www.ext.vt.edu/> (October 2009)



K-STATE
Research and Extension
Master Gardener
Johnson County

Extension Master Gardener Hotline

(913) 715-7050

Email: garden.help@jocogov.org

For your lawn, garden and horticultural questions