

WALNUT TOXICITY

The black walnut tree (Juglans nigra) contains the phytotoxin juglone which can have a deleterious effect on plants when they are planted near the black walnut. Juglone is present in the roots, leaves, fruits and branches of Black Walnut. Other species in the walnut family also contain juglone but in lesser concentrations. They are, in decreasing order of concentration: English walnut (Juglans regia), butternut (Juglans cineraria), shagbark hickory (Carya ovata), and pecan (Carya illinoensis).

SYMPTOMS - Symptoms of walnut toxicity range from stunting, to partial or total wilting, to death of the affected plant. Frequently, susceptible plants in the home garden may be growing quite well, when in just a day or two they suddenly wilt or die. In an all too frequent scenario, a homeowner plants a successful garden for several years near a young black walnut. Then one year, susceptible garden plants nearest the tree become affected. Each year more of the garden suffers until it becomes impossible to grow plants such as tomato or potato. With herbaceous plants the wilt closely resembles a wilt caused by a bacterial or fungal pathogen. For example, symptoms on tomato include yellowing of foliage, twisting and internal discoloration; these symptoms are identical to those of Verticillium or Fusarium Wilt.

FACTORS INVOLVED IN THE TOXIC ACTION - According to a 1967 study, the juglone acts on susceptible plants by inhibiting respiration; the plant simply cannot breathe properly.

While juglone is present in the leaves, fruit hulls, bark and roots of walnut trees, a problem usually arises only when roots of these species are in very close proximity or contact with the roots of susceptible plants. A 1925 report noted that a walnut tree's root distribution could be mapped without removing any soil, merely by observing the wilting pattern in a tomato planting. More recent investigations have substantiated this phenomenon. The average limit of the toxic zone from a mature tree is 50 to 60 feet, but plants as far away as 80 feet have also been injured.

If the soil is removed from the root zone and all roots of the walnut are carefully screened out, susceptible plants can thrive in this soil. Thus, the toxin apparently is not secreted from the walnut roots into the surrounding soil. However, if a tomato crop is planted in soil where juglone's leaves, husks, bark or root pieces have been incorporated, the susceptible tomato plants will rapidly wilt as their roots contact walnut tissues.

SPECIES AFFECTED - While some plants are susceptible to juglone, others are not and can even thrive in the area of walnuts. The factors affecting susceptibility are not clear. However, deep rooted plants are more commonly affected by juglone than shallow rooted plants. The following lists note plants which have been shown to be susceptible and not susceptible to juglone toxin.

PLANTS SUSCEPTIBLE TO WALNUT TOXICITY

	Scientific Name	Common Name
Trees:	<u>Betula alba</u>	White Birch
	<u>Elaeagnus angustifolius</u>	Russian olive
	<u>Ilex verticillata</u>	Michigan Holly
	<u>Magnolia soulangiana</u>	Saucer Magnolia
	<u>Malus 'Hopa'</u>	Hopa Crabapple
	<u>Malus sp.</u>	Apples

Trees:	<u>Pinus resinosa</u> <u>Pinus strobus</u> <u>Sambucus canadensis</u> <u>Viburnum sieboldii</u>	Red Pine White Pine Common Elderberry Siebold Viburnum
shrubs:	<u>Aronia arbutiflora</u> <u>Azalea sp.</u> <u>Baptisia australis</u> <u>Hydrangea sp.</u> <u>Kalmia latifolia</u> <u>Ligustrum sp</u> <u>Pinus mugo</u> <u>Potentilla fruticosa</u> <u>Prunus tomentosa</u> <u>Prunus subhirtella</u> <u>Pyracantha sp</u> <u>Rhododendron sp</u> <u>Syringa sp.</u> <u>Viburnum opulus</u> <u>Viburnum plicatum</u>	Red Chokeberry Azalea Blue False Indigo Hydrangea Mountain Laurel Privet Swiss Mountain Pine Shrubby Cinquefoil Nanking Cherry Weeping Higan Cherry Pyracantha (Firethorn) Rhododendron Lilac European Cranberrybush Viburnum Double File Viburnum
Perennials:	<u>Aquilegia caerulea</u> <u>Aquilegia canadensis</u> <u>Chrysanthemum morifolium</u> <u>Lilium 'Enchantment' and</u> Other Asian Hybrids <u>Narcissus</u> <u>Paeonia sp.</u> <u>Rosa chinensis 'Minima'</u> <u>Tulipa 'Merry Widow'</u> <u>'West Point'</u>	Colorado Columbine Wild Columbine Chrysanthemum Lily Narcissus, Daffodil Peony Fairy Rose Tulip
Fruits:	<u>Gaylussacia sp.</u> <u>Rubus sp</u> <u>Vaccinium corymbosum</u> <u>Vaccinium sp</u>	Huckleberry Blackberry Highbush Blueberry Blueberry
Vegetables:	<u>Asparagus officinalis</u> <u>Beta vulgaris</u> <u>Lycopersicon esculentum</u> <u>Solanum tuberosum</u>	Asparagus Sugar Beets Tomato Potato

PLANTS RESISTANT TO WALNUT TOXICITY

Trees:

<u>Acer palmatum'</u>	Japanese Maple
<u>Acer palmatum</u> , 'Dissectum'	Cutleaf Japanese Maple
<u>Catalpa bignonioides</u>	Common Catalpa
<u>Cercis canadensis</u>	Redbud
<u>Cydonia oblonga</u>	Quince
<u>Juniperus virginiana</u>	Red Cedar
<u>Tsuga canadensis</u>	Canadian hemlock

Shrubs:

<u>Clematis</u> 'Red Cardinal'	Clematis
<u>Forsythia</u>	Forsythia
<u>Hibiscus syriacus</u>	Rose' of Sharon
<u>Lonicera tatarica</u>	Tartarian honeysuckle
<u>Parthenocissus quinquifolia</u>	Virginia Creeper
<u>Rhododendron</u> 'Exbury Hybrid' 'Gibraltar', 'Balzac'	Hybrid Azaleas

Perennials:

—

<u>Ajuga reptans</u>	Bugleweed
<u>Alcea rosea</u>	Hollyhock
<u>Astilbe sp.</u>	Astilbe
<u>Campanula latifolia</u>	Bellflower
<u>Chrysanthemum sp.</u>	Chrysanthemum
<u>Doronicum Sp.</u>	Leopard's Bane
<u>Galium odoratum</u> :	Bloody Cranesbill
<u>Geranium sanguineum</u>	Jerusalem Artichoke
<u>Helianthus tuberosus</u>	Daylily
<u>Hemerocallis fulva</u>	Hosta
<u>Hosta fortunei</u>	Hosta
<u>Hosta lancifolia</u>	Hosta
<u>Hosta marginata</u>	Hosta
<u>Hosta undulata</u> 'Variegata'	Siberian Iris
<u>Iris sibirica</u>	Beebalm
<u>Monarda didyma</u>	Sundrops
<u>Oenothera fruticosa</u>	Sensitive Fern
<u>Onoclea sensibilis</u>	Cinnamon Fern
<u>Osmunda cinnamomea</u>	Garden Phlox
<u>Phlox paniculata</u>	Jacob's Ladder
<u>Polemonium commutatum</u>	Polyanthus primrose
<u>Primula x polyantha</u>	Lungwort
<u>Pulmonaria</u>	Bloodroot
<u>Sanguinaria canadensis</u>	Gold moss
<u>Sedum acre</u>	Sedum
<u>Sedum spectabile</u>	Lambs Ear
<u>Stachys byzantine</u>	Spiderwort
<u>Tradescantia virginiana</u>	Trillium
<u>Trillium grandifolia</u>	

Annuals:	<u>Begonia sp.</u> <u>Calendula sp.</u> <u>Ipomoea sp.</u> <u>Viola cornuta</u> <u>Viola x wittrockiana</u>	Begonia Calendula Morning Glory Horned Violet Pansy
	<u>Zinnia elegans</u>	Zinnia
Vegetables & Fruits:	<u>Daucus carota</u> <u>Phaseolus vulgaris</u> <u>Rubus occidentalis</u>	Carrot Bean Black Raspberry
Bulbs:	<u>Crocus sp.</u> <u>Muscari sp.</u> <u>Narcissus</u> 'Cheerfulness', 'Geranium', 'Sundial' and 'Feb. Gold' <u>Scilla siberica</u> <u>Tulipa</u>	Crocus Grape Hyacinth Daffodil Blue Squill Tulip
Other:	<u>Poa pratensis</u>	Kentucky Bluegrass

CONTROL - Because Michigan lies on the natural range of black walnut, it is not unusual for homeowners to have this plant in their backyard. This tree is relatively fast growing, makes a satisfactory landscape tree and produces edible nuts. Faced with choosing between a tree or a garden, homeowners should remember that chopping down a tree is not the immediate solution, unless all root pieces are painstakingly removed.

Barriers to root growth may be an alternative to tree removal. Where susceptible species survived alongside wilted ones, it was observed that a rock or old concrete foundation had kept the roots from contacting the susceptible plants: Placing a wood or concrete barrier in the soil between your tree and the garden may separate the roots.

If toxicity is a problem because of present or past tree plantings, limit your garden selections to relatively shallow rooted species. Tomatoes and potatoes are deep rooted and very susceptible to juglone. Frequent light watering will promote shallow rooting and may help alleviate some problems.

When landscaping a new homesite and you want both a walnut tree, and a garden, plant the tree in the front yard and the garden in the rear. Do not use the leaves and husks as mulch for your vegetable garden.

Prepared by: Mary A. Wilson, Genesee County Extension Horticultural Agent.

Sources: "Black Walnut Toxicity in Plants", HM-10; Horticulture Newsletter, Vol II, No II.; "Allelopathy: Chemical interactions Between Plants." American Nurseryman., January 15, 1986; "Under the Black Walnut Tree", Horticulture, October, 1986.