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In This Issue

Stop Making These Arborvitae Mistakes! Common transplant problems of arborvitae.

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Figure 1. Arborvitae are commonly used as a screen or windbreak in the Midwest landscapes.

Arborvitae (*Thuja spp*.) fulfill several crucial roles in the landscape, especially windbreaks and screens (Fig. 1). Their relatively fast growth habit, wide variety of available forms, and inexpensive price point make them one of the most common conifers in the Midwest landscape. Due to the ubiquitous use of arborvitae, and their perceived problems, the Green Industry observes many issues on jobsites, specifically on specimens transplanted recently.

Transplant Shock occurs when the root system of a plant can't supply enough water to the foliage. This is very common with many species, and usually mimics drought stress. The severity of transplant shock depends on species, soil type/quality, available moisture, temperature, growth stage/age of the plant, root loss from the nursery, as well as many other factors. Transplant shock will increase during times of high transpiration (increase in temperature and/or decrease in humidity), which is why plants installed during high temperatures require much more maintenance due to watering needs.

Figure 2. In heavy soils, drainage can be an issue in newly transplanted plants. This picture is the root ball of a B&B arborvitae that had poor drainage in the planting hole.

As the climate is changing in the Midwest, with both flooding (typically in the spring) and droughts (typically in the summer) becoming more common, the maintenance considerations of transplanted arborvitae need to be reevaluated. Irrigation should be considered when installing arborvitae due to increased drought events in the summer. Grade of the planting site needs to be considered prior to installation of plants due to the increased flooding events. Many of the soils in the Midwest contain a high clay content with little drainage, thus planting holes can become 'bathtubs' during times of increased rainfall (Fig. 2).

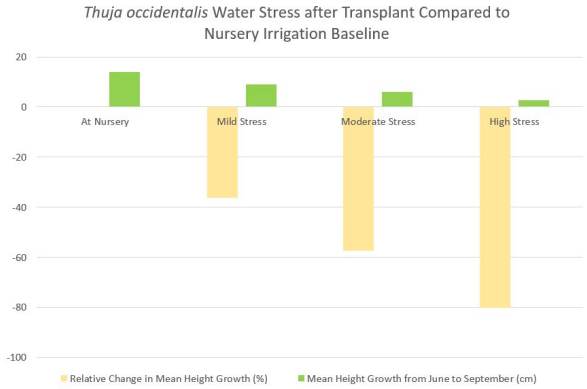
Some of the most common arborvitae problems in the first five years after transplant include:

- Soil moisture issues (typically drought)
- Winter burn
- Planting depth
- Root ball size relative to top growth
- Shade intolerance

Soil moisture:

Excess or minimal soil moisture can cause stress on arborvitae, especially on recently transplanted plants. Irrigating during periods of drought is necessary to prevent shock and stress, especially on arborvitae. Tran et.al. (2018) found that in comparison to ideal conditions in a nursery, landscape water

deficits on *Thuja occidentalis* causing mild, moderate, and high stress conditions; decreased growth by 36, 57, and 80%, respectively. In this same study, the mean growth from June to September in the nursery under mild, moderate, and high water stress conditions, was 14, 9, 6, and 3 cm, respectively (Fig. 3). In addition to reduced growth, water stress can cause significant dieback or even complete death of recently transplanted arborvitae (Fig. 4).



Adapted from Tran et.al., 2018

Figure 3. The relative change in mean height growth (%) and mean height growth from June to September (cm) of four water stress treatments of 0, 25, 50, and 75% of Thuja occidentalis. (Tran et.al., 2018)

Figure 4. Water stress can cause dieback and death on arborvitae. Most conifers have delayed symptoms, so many times it's too late to correct the problem once symptoms are visible.

Winter burn:

Winter burn is common on several coniferous species, including arborvitae, and occurs when winds desiccate foliage due to lack of an established root system. Irrigation should continue until freezing temperatures prevent irrigation events so that conifers enter dormancy with less water stress. By preventing stress during the growing season, winter burn will be minimized over the winter months. Spring planted arborvitae have time for more establishment of the root system prior to going into the winter but they require more attention during summer to assure even soil moisture.

Planting depth:

Through the last 20 years landscapers, arborists, and researchers have found that many trees were being transplanted too deep. The decline of the trees over time has become evident through both research and observations. The long-term issues are now well documented, but current research has shown that trees transplanted too deep also cause stress and reduced growth (Bryan, et.al., 2011 and Bryan, et.al., 2010) (Figs. 5 and 6). Not only will growth be reduced after transplant, but over time stem girdling roots will become prevalent in trees that are planted too deep.

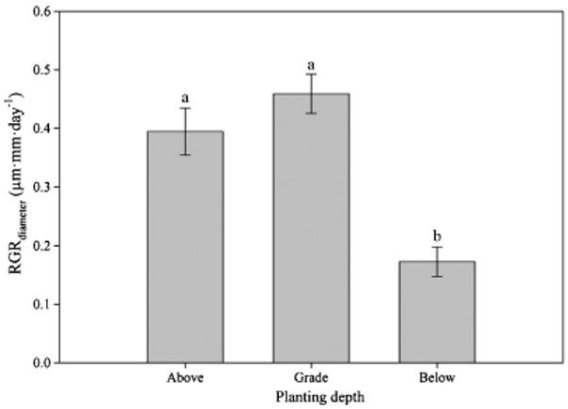


Figure 5. Effect of planting depth on relative growth rate of Quercus viginiana. From Bryan et.al. 2011.

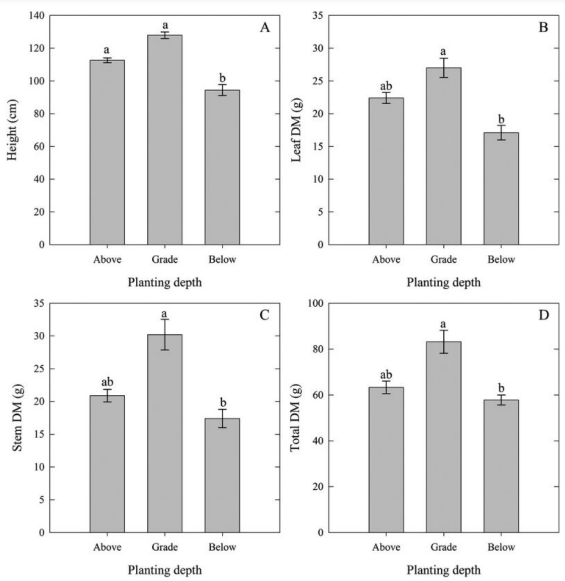


Figure 6. Effect of planting depth on (A) height (B) leaf dry mass (DM), (C) stem DM, and (D) total DM (leaf, stem, and root DM) of lacebark elm (Ulmus parvifolia). From Bryan et.al. (2010).

Root ball size:

When selecting arborvitae for ball and burlap planting in the landscape it's important to make sure the root system is of an adequate size to support the amount of top growth present. Trees with small root balls will lose more functional roots during digging operations and will be more prone to transplant stress over a longer period, even several years later.

Shade Intolerance:

As arborvitae age, the lower limbs begin to lose foliage due to the shade response. This occurs on many conifers due to the lack of sunlight that is intercepted from the lower limbs. On newly

transplanted arborvitae, a reduction in growth occurs when not in partial to full sun. Kennedy et.al. (2007) showed that shade of 25, 50, and 75% reduced total plant biomass, shoot biomass, and root biomass significantly compared to full sun on spruce, larch, and arborvitae. They found that arborvitae was most affected by the shade treatments by demonstrating the least amount of growth as shade increased (Kennedy, et.al., 2007) (Fig. 7). By planting in areas with minimal shade, this species will encounter less stress and more growth over the first two years after transplanting. It's also important to remember that when arborvitae are planted too close together they will shade out each other more quickly while also competing for root space, water and nutrients. Wider spacing may take longer for infill but will provide a more viable screen in the long run.

Shade Treatment (%)	Total Biomass (cm)	Shoot Biomass (cm)	Root Biomass (cm)
0	213.5 (a)	124.7 (a)	88.7 (a)
25	188.8 (b)	117.5 (ab)	71.4 (b)
50	159.4 (c)	106.2 (b)	53.1 (c)
75	88.1 (d)	59.8 (c)	28.3 (d)

Species	Total Biomass (cm)	Shoot Biomass (cm)	Root Biomass (cm)
Hybrid Larch	152.9 (b)	99.3 (b)	53.7 (b)
Sitka Spruce	112.7 (c)	66.8 (c)	46 (b)
Western Red Cedar	221.7 (a)	140.1 (a)	81.5 (a)

Means for each characteristic followed by different letters are significantly different at the $\alpha = 0.05$ level. Because there were no significant interactions, means are presented for each shade treatment (averaged over species) and for each species (averaged over shade). Adapted from Kennedy et.al., 2007.

Figure 7. The effect of shade impacts on biomass of spruce, larch, and arborvitae at 0, 25, 50, and 75% shading.

Tips for reducing stress of transplanted arborvitae:

- Irrigate weekly during times of little rainfall to assure even soil moisture throughout the root zone.
- Grade the planting site to remove areas of standing water.
- Check planting depth to reduce deep planting.
    - If necessary, remove soil/media from the top of root ball until the top most root or root flare is found.
- Mulch to a depth of 3" and avoid mounding around the base.
- Minimize stress by adding nutrients if indicated by a soil test*.
    - *After the first year of transplanting.
- Plant in partial to full sun.

Related Links:

- Top Arborvitae Aggravations: https://www.purduelandscapereport.org/article/top-arborvitae-aggravations/
- Feast or Famine: Landscape plants are struggling due to precipitation: https://www.purduelandscapereport.org/article/feast-or-famine-landscape-plants-are-struggling-due-to-precipitation-extremes/
- Arborvitae Needle Blight: https://www.purduelandscapereport.org/article/arborvitae-needle-blight/
- Start Preparing Trees for Winter and Next Year: https://www.purduelandscapereport.org/article/start-preparing-trees-for-winter-and-next-year/
- Common Abiotic Problems of Ornamentals: Transplant shock: https://www.purduelandscapereport.org/article/common-abiotic-problems-of-ornamentals-transplant-shock/
- Winter Burn: https://hort.extension.wisc.edu/articles/winter-burn/
- Wire Baskets: Leave them or remove them? https://www.purduelandscapereport.org/article/wire-baskets-leave-them-or-remove-them/

References:

Bryan, D.L., Arnold, M.A., Volder, A., Watson, W.T., Lombardini, L., Sloan, J.J., Alarcon, A., Valdez-Aguilar, L.A., Cartmill, A.D. 2010. Planting Depth During Container Production and Landscape Establishment Affects Growth of *Ulmus parvifolia*. American Society for Horticultural Science. Vol. 45 Issue 1. 7 pgs.

Bryan, D.L., Arnold, M.A., Volder, A., Watson, W.T., Lombardini, L., Sloan, J.J., Alarcon, A., Valdez-Aguilar, L.A., Cartmill, A.D. 2011. Planting depth and soil amendments affect growth of Quercus virginiana. Urban Forestry and Urban Greening. 10: 127-132.

Kennedy, S., Black, K., O'Reilly, C., and Dhubain, A. 2007. The impact of shade on morphology, growth, and biomass allocation in *Picea sitchensis*, *Larix x eurolepis*, and *Thuja plicata*. New Forests 33, 139.

Tran, N., Stoochnoff, J., Graham, T., Downey, A., and Dixon, M. 2018. Irrigation management to enhance the quality, efficiency, and survival of transplanted nursery trees. Acta Hortic. 1205. Pgs. 447-452.

Keep Honeylocust Trees from Becoming a Pest Nightmare

(Cliff Sadof, csadof@purdue.edu)

Trees need to be tough to survive the abuse we put them through in cities. Often planted parking lots and on streets, they are stressed by drought in the summer and de-icing salts in the winter. Honeylocust trees are a great choice for cities because in addition to their pleasing shape and fall color, they are remarkably tolerant to salt. Moreover, their thin canopy allows grass to grow and simplifies the cleanup of leaves in the fall. Despite these attributes, these trees are highly susceptible to a wide range of insect pests. Tree health and appearance can be maintained through careful planning and attentive management.

Honeylocust trees have a fine leaf texture that lets in enough light for turfgrass to flourish beneath their canopy.

Honeylocust plant bug injury on honeylocust.

Managing Honeylocust Pests.

Mimosa webworm on honeylocust.

Active in May and June honeylocust plant bugs (HLPG) can distort and disfigure young, expanding leaves when they suck on leaf tissue. Although these insects can be found every year, they rarely cause enough damage to significantly thin tree canopies. As such, control is rarely needed. This is fortunate because effective products like foliar pyrethroids (bifenthrin, permethrin etc) and soil applied neonicotinoids (imidacloprid, dinotefuran) will kill beneficial insects that other pests under control.

With two generations a year (June, August), the mimosa webworm caterpillars will fold leaves and cover the canopy with brown, unsightly webs. Wandering caterpillars dangling on silk strands in late summer can be a nuisance on city streets. Defoliation can weaken the tree but is unlikely to kill it. Focus management efforts on the first generation to reduce the number present in the second generation. If few webs are present and within reach, it is possible to prune out injury. When webs are too numerous or out of reach insecticide may be needed to avoid unsightly injury. Foliar applications require the services of a professional with spray equipment that can reach the canopy. See the reference at the end of the article for a list of biorational products that can be used to protect trees without killing beneficial insects. In sites where foliar sprays are not possible, trees can be protected with injections of emamectin benzoate or soil applications of acephate.

Soft scale insects can threaten the health of honeylocust trees when they suck out plant sap and excrete copius amounts of liquid excrement (aka honeydew) on branches, leaves, and creating a sticky mess the ground below. When the honeydew gets covered with black sooty mold, the tree and the cars parked beneath them appear to be covered in soot. Water stress and heat generated by paved surfaces make trees in parking lots and streets especially susceptible to these pests. Control these pests by applying a foliar spray of an insect growth regulator, like pyriproxyfen, when the insects are in the crawling stage in late May. See the reference on scale insects at the end of the article for details.

Calico (right) and European fruit lecanium (left) scales are common problems on honeylocust.

Honeylocust spider mites can be a problem later in the summer on honeylocust.

Spider mites are not insects, but in the absence of predators can cause enough damage to defoliate trees in mid-summer. Mites live and feed on leaves by piercing leaf tissue and lapping up the liquid that bubbles up from the wounds. With multiple generations, they can grow from an egg to an egg laying female in about a week during the heat of the summer. Early season applications of broad-spectrum insecticides, like the neonicotinoids (imidacloprid, Spinosad) and pyrethroids often set the stage for mite problems. Although miticides are to reduce mite populations available (See reference at end of article), it is best to avoid the problem by using the tips described to reduce pesticide use against scale insects, mimosa webworms and honeylocust plant bugs.

Finally, when possible, avoid over planting honeylocust trees by planting them in small groups rather than lining entire streets. In this way, it is more difficult for pests to infest and spread between trees.

For more information:

See PurduePlantDoctor.Com and,

Mimosa Webworm
https://extension.entm.purdue.edu/publications/E-11/E-11.html

Spider Mites on Ornamentals:
https://extension.entm.purdue.edu/publications/E-42/E-42.html

Scale Insects How to Fix Problems with Scale Insects – Purdue Landscape Report.

Flood Damage to Trees

(Lindsey Purcell, lapurcel@purdue.edu)

Each year flooding from excessive precipitation occurs and create challenges for us and trees. The extent of damage from prolonged exposure to wet and waterlogged soils depends on the season and can have a legacy effect. Flood damage to trees can generally occur from prolonged saturated soils, physical damage from the flood waters and acute, extreme environmental conditions and tree reactivity.

Warm season flooding can create increased risks for tree survival.

Most trees and plants are not adaptable to flooded conditions and each species can have varying degrees of tolerance. Some species such as bald cypress, sycamore and even silver maples can tolerate prolonged wet conditions. These trees are known as riparian species and well-suited for wetter than normal conditions.

The physiological impacts on trees from flooding include poor aeration where water moves into the pore spaces that held gas such as oxygen, conditions unsuitable for plant growth. This leads to an accumulation of CO2, methane, and other gases, instead of good oxygen exchange above ground. Anaerobic conditions develop during flooding. This develops by anaerobic organisms replacing aerobic organisms. The results are denitrification, where bacteria remove the nitrates and nitrites from the soil, and reduction of available micronutrients such as manganese, iron and sulfur.

Flood damaged trees express symptoms such as reduced or no growth, poor leaf expansion, smaller leaves, chlorosis, and premature leaf drop with decline in growth being the primary issue. A reduction in root growth can be expected as well especially with the appearance of decay pathogens. Phytophthora is a root attacking fungi that tolerates low soil oxygen levels and stimulated by tree decline leading to root loss. This loss of root mass through the attack and decay leaves the tree prone to drought and windthrow with post-flooding conditions.

Dormant season floods are less damaging due to lack of leaves and colder water temperatures.

Flood damage on trees depends on many factors which include season, water quality and temperatures as well as the condition of the trees when they experience these damaging conditions. Flooding during the growing season is far more harmful than winter flooding. Warm season flooding magnifies the injury because of plant respiration and continuing water loss through the leaves. The higher the temperatures the faster the tree will feel the oxygen deficiency and the top of the tree will dehydrate. Just a little over two-weeks of submersion can lead to decline and death of some trees. Some species can tolerate up to 6 weeks of submersion.

The legacy effect of flooding is important to identify. Siltation is a concern to tree health as soil fill left behind from flooded waters can collect and deposit over roots systems. If the trees don't respond with the formation of new root systems in these elevated locations, they will decline and die. Conversely, soil erosion can be a concern as some trees will be left with bare roots and exposed roots plates. This creates a poor anchorage system and leaves trees more susceptible to windthrow. Secondary pest problems are a concern as well. Due to the reduced tree vigor and changing growing conditions, opportunistic pests can become a problem for several years after the flooded conditions.

Post-flooding management practices are important to initiate quickly to reduce the impacts of flooding on trees, especially if these conditions occur during the growing season.

- Contact an ISA Certified Arborist to help with the assessment of tree survival and structural conditions which could present unacceptable risk levels. Expect trees to die suddenly, decline and die in the current year, or decline over the next few years.
- Conduct a soil test to determine if there are any elemental deficiencies from the prolonged wet conditions. Provide supplemental nutrition as indicated by the soil tests.
- After flooding recedes, apply a light dose of nitrogen, approximately 0.5 -2.0 pounds of nitrogen per 1,000 square feet. Very small amounts of calcium sulfate can be added to return sulfur to the soil, if indicated by the tests.
- After this application, do not fertilize with nitrogen again until after full leaf expansion in the next growing season. In each of the next three years, apply 2-4 pounds of nitrogen per 1,000 square feet.
- Reduce or refrain from any pruning that removes live green tissue. These leaves are needed for carbohydrate production and food supplies.
- Monitor for fungal and insect attacks on stressed trees and take informed action. Both the trees under attack and the surrounding trees may need rescue or preventative treatments.

For more information visit:

Trees Are Good!
Indiana Arborist Association

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