The decompaction programme on trees at Kew

TONY KIRKHAM reports on the "Conservation of Heritage Tree Programme", which was started 20 years ago, after observations made in the wake of the great storm.

On 16 October 1987 the storm that hit the southeast of England did untold damage to trees in many gardens, including Kew where we lost over 700 mature specimens. For many of us it was a catastrophe and we wondered if we would ever get the collections back to normal in our time; however there was good that came with the bad and since the storm many trees have benefited significantly from the arboricultural events that followed.

One tree, the Turner's oak (*Quercus* x *turneri*), at the north end of the Princess of Wales conservatory which was planted by Princess Augusta in the 1770s was showing signs of serious stress before the hurricane, thinning crown, small leaves, major dead wood throughout the canopy and lots of epicormic growth (suckers) along the scaffolds and the main trunk. During the night of the storm, the entire tree's root plate lifted out of the ground and was violently shaken before sitting back in the hole that it had been lifted from. I was so surprised to see such shallow root plates of upturned trees and it soon became apparent to me that most of the other veteran trees and younger specimens in

The Turner's oak *Quercus* x *turneri* pictured in 2008 with a revitalised, healthy crown from the decompaction exercise.

the arboretum were suffering from compaction caused by the many visitors' feet walking over the root plate to read the label or to hug the trunk. Also today we are using heavier and larger grass cutting machinery to mow the established swards around the trees.

Nature had demonstrated to us what was required; a decompaction programme around the trees to break up those hard, droughty, lifeless soils.

So in the spring of 1998 we identified ten heritage trees in the arboretum that we felt were suffering from compaction and began our new "Conservation of Heritage Tree Programme".

First a band of turf was stripped with a turf cutter around the drip line of the canopy; this would be a marker for the decompaction exercise whilst at the same time act as a barrier for the mulch, preventing it from spilling out onto the surrounding turf.

At regular one-meter intervals, with the use of a machine called a 'Terravent', we injected nitrogen gas through a probe that we inserted into the ground to a depth of approximately 150mm. As the gas finds its way out of the ground, it shatters the compacted soil, leaving open fissures, allowing for improved gaseous exchange and improved water percolation to the roots. Following the first blast, a second blast is made and a cocktail of 17 species of mycorrhizal fungi and a bio stimulant suspended at a rate of 450 grams in 500 litres of water is forced through the pre-made fissures to the root zone. Once the entire root plate has been injected, which could potentially be over 200 insertions, a mulch of Kew's homemade organic matter consisting of shredded wood and leaves mixed with horse manure and composted for up to 12 weeks is spread over the surface area to the ring of stripped turf, approximately 100mm deep to feed the mycorrhizae, prevent regrowth of the sward and to act as a cushion preventing re-compaction of the ground as well as protecting the soil from erosion and retaining moisture that encourages root growth.

Today the 'Terravent' is no longer used, as it has been taken out of production and as a result spare parts are difficult to obtain, so we set about finding an alternative means of decompacting root plates.

In America the norm today in the arboricultural world is proactive plant health care on established trees and a recent innovation is the Air-spade®, an excavation tool that has revolutionised the tree care industry. This machine uses an advanced air jet with compressed air to break up and clear away soil without damaging roots. We invested in a tool, hiring a compressor and began using it in our aeration programme in the spring of 2008.

As I write this I am convinced that this is the way forward, as it is an aggressive decompaction tool but with reduced operator fatigue, as it is not necessary to manually bang in the probe. It can be used in a variety of styles such as deep probing where the probe is pushed directly into the ground up to 1 metre deep, breaking up any compacted soil and vertical mulching, where mulch is spread over the surface and the Air-spade® is used to turn it into the

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An arborist at Kew using the latest piece of machinery in the decompaction armoury Airspade® on a young Cedar in the arboretum.

surface around the roots zone. The latter encourages strong, healthy roots that provide the tree with excellent opportunities for nutrient and water uptake, whilst at the same time increasing structural root development.

The aggression of the Air-spade®, is gentle enough not to damage roots, but will break up any rhizomes of honey fungus (*Armillaria mellea*) in the root zone which will help an infected tree overcome the stresses of infection.

So how are the treated trees performing since we first began the exercise in 1998?

Since the programme began 20 years ago we now have over 100 trees which are in our "Conservation of Heritage Tree Programme" which have been decompacted. These trees are mulched on a cycle as resources allow;

however mulch is only reapplied once the material from the previous mulching exercise has disappeared. This prevents anaerobic layers forming. Weeds are controlled with spot applications of a glyphosate based translocated herbicide such as 'Roundup' as the mulching layer becomes sparser.

The results are convincing us that this is the way forward with many trees that appeared to be in a mortality spiral and well beyond recovery making enormous progress and showing signs of improved growth and vigour. A mature 150 year old deodar cedar *Cedrus deodara* behind the Rose Garden infected with honey fungus and holding less than 10% of foliage was one of the first trees decompacted in 1998. Today this tree still survives with a crown density of approximately 60% and increasing each year. There is no doubt that this tree would almost certainly have died within two or three years had we not intervened.

Many of the other trees in the programme are producing up to 50cm of extension growth in the upper canopy, especially the oaks (*Quercus* spp.) and planes (*Platanus* spp.) and they continue to improve their vigour from year to year.

I am often asked which stage of the process I think is the one that is the most important and which one could go if one had to go. A difficult question, as there is no scientific breakdown to this exercise. Growing trees in an arboretum is not rocket science and many operations that we as managers carry out are based on observations in the garden and empirical trials. Trees naturally come from woodlands and forests, where they feed on the material that they generate; dead branches, fallen leaves and fruit which are broken down and made available to the tree as nutrients by naturally occurring mycorrhizal fungi. Trees are the best recyclers and we must allow them to use this ability in the garden. We immediately place them under stress when we plant them in the middle of a lawn, a street or a car park and we have to provide them with the best opportunities to grow as stress-free as possible.

I think the decompaction and mulching exercise is the most important because if we provide the ambient conditions for both the tree and the mycorrhizae, the natural mycorrhizal fungi present will find its way into the root zone and do its work.

At Kew we are mimicking nature by creating an artificial woodland floor under the canopies of the trees with incredible results and will continue to have the decompaction exercise as part of our arboricultural exercise in the arboretum.