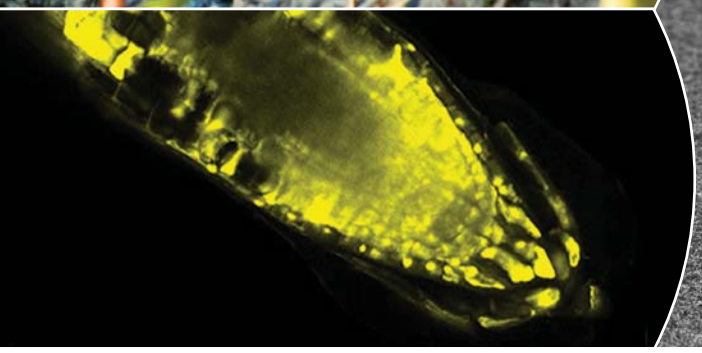
GEOfabrics®

CuTex

Copper Composite Root Barrier



High-performance geosynthetics

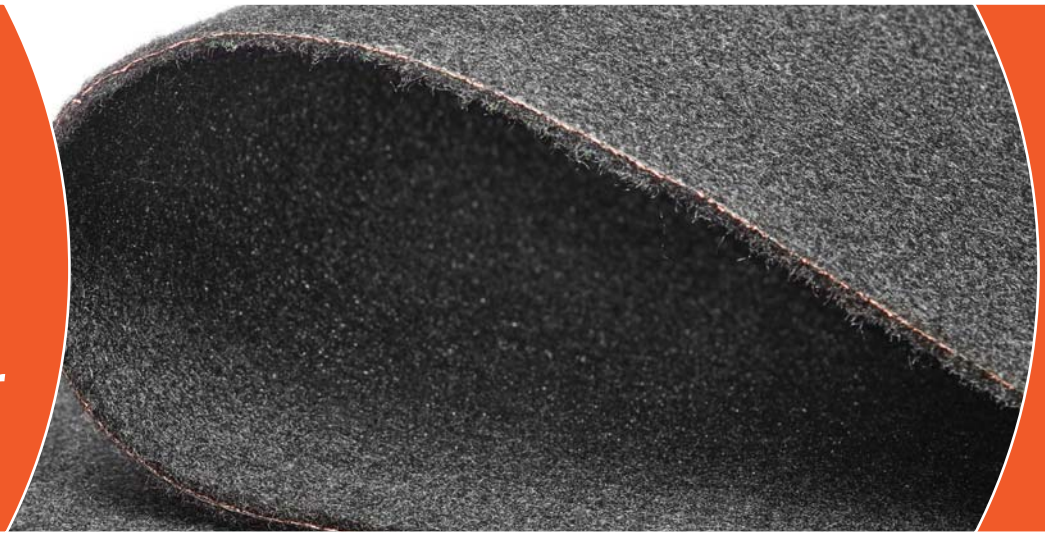
Geofabrics and CuTex

Geofabrics Limited is a British manufacturing company established in 1992. From the outset the objective was to manufacture high-performance geosynthetics to the highest possible standards and provide engineering support to ensure a value engineered solution to complex problems within civil applications.

The company's ethos is to exceed the expectations of our customers with our products and support services. Product development is achieved by analysing the customers application, determining the properties that are required, manufacturing the solution and testing it to prove it meets those performance criteria. Today the company manufactures a diverse portfolio of class leading geotextiles and geocomposites supplied into a wide range of civil engineering and construction applications.

The introduction of CuTex into the Geofabrics product portfolio supports this approach.

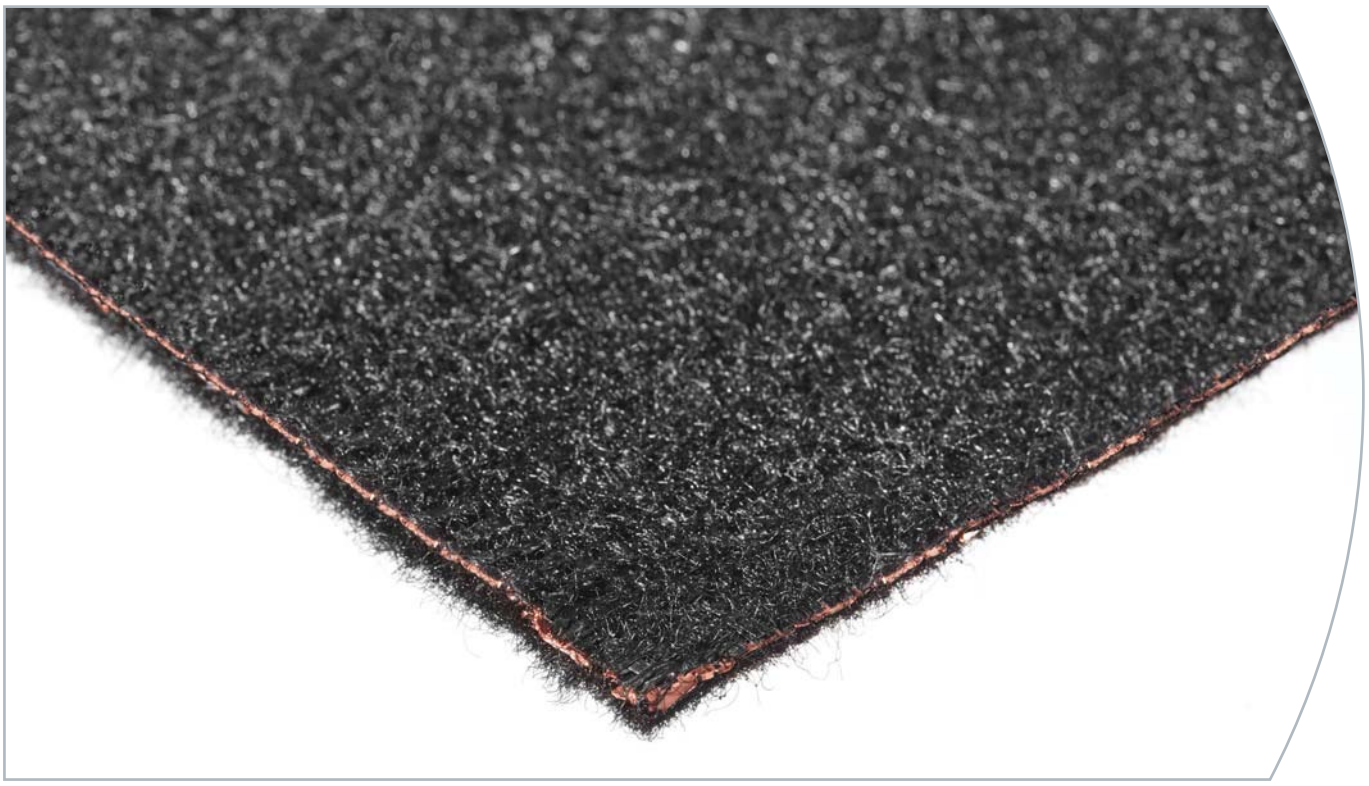
CuTex
The copper composite root barrier



CuTex is a permeable geocomposite root barrier system consisting of a specially formulated copper sheet mechanically encapsulated between two high strength geotextiles. CuTex acts by safely releasing Cu2+ ions to inhibit root growth. The copper ions create a localised zone of inhibition which when approached by root tips causes them to undergo a progressive collapse.

The copper acts as a signal layer that all plants avert their growth from. CuTex only releases minute quantities of the copper ion and is a safe, yet effective root growth blocking material.

CuTex can provide direct protection from invasive weeds and plants. Particularly the risk posed by Japanese Knotweed to environments such as utilities' infrastructures and foundations, across a wide range of industries including construction, highways, rail and water.



Cross section of CuTex showing the mechanically encapsulated copper layer.

CuTex Testing

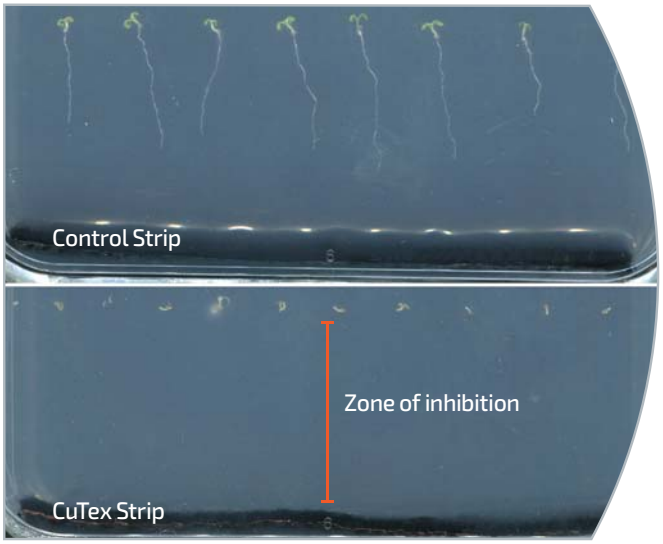
The Centre for Plant Sciences at the University of Leeds independently assessed the effectiveness of CuTex as a root barrier to Japanese Knotweed, and other invasive plant species. The research was designed to answer three principal questions:

- **Does CuTex inhibit root growth?**
- **Does the effectiveness of CuTex increase with time?**
- **Is CuTex safe?**

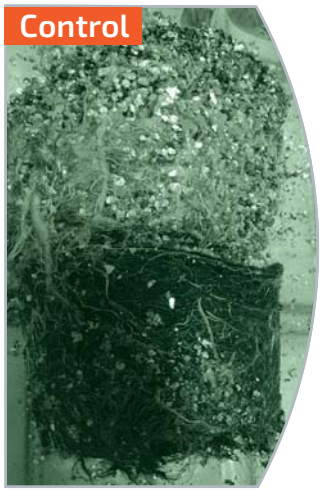
Does CuTex inhibit root Growth?

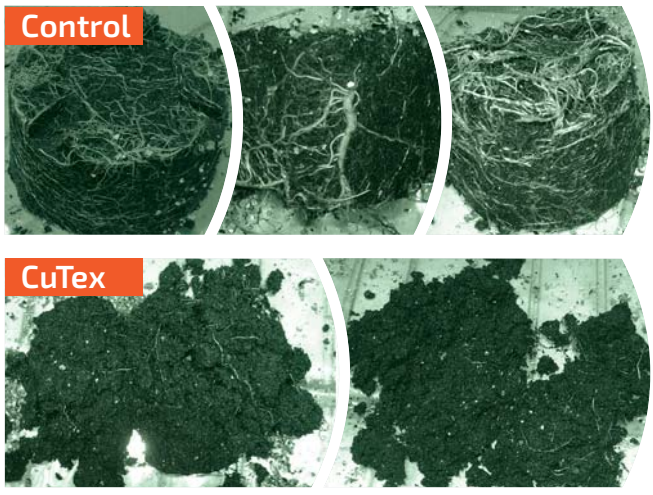
Answer: YES

In order to assess whether CuTex can effectively inhibit root growth the University used a range of approaches with different plant species. Testing in a sterile culture using Arabidopsis Thaliana demonstrated how CuTex creates a 'zone of inhibition' whereby roots grow towards this zone, but then ceased at a distance of approximately 1.5cm from the composite. Even when seedlings were established at different distances all roots stopped at this zone, and seedlings trying to establish within the zone failed to do so.



The most effective demonstration of CuTex was a setup using an upper layer of vermiculite and a lower compost layer separated by CuTex. The vermiculite contains no nutrients to support the development of the plant, and thus the long-term growth and survival of the plant depends on growing through the CuTex. The experiment was conducted using a number of plant species, including Japanese Knotweed, with the CuTex being assessed against a control fabric.



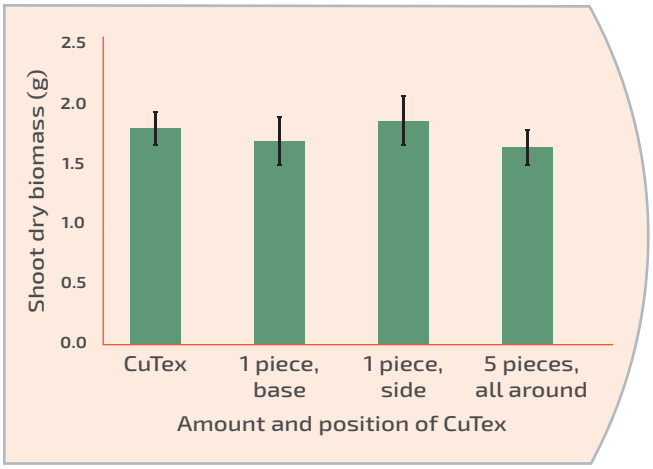


CuTex Testing

Does the effectiveness of CuTex increase with time?

Answer: YES

CuTex in soil will effectively form a chemical barrier as the Cu2+ ions diffuse into the soil. It was hypothesised that the effectiveness of the CuTex increases with time. This was tested by pre-incubating CuTex in an agar media for a period of 4 weeks following which time seeds were sown. The plates where the CuTex had been allowed to incubate indicated a much stronger and larger zone of inhibition abolishing the growth of the seeds.



Is CuTex safe?

Answer: YES

The bio-safety of CuTex was tested by assessing how it affects the overall health and growth of plants. Whilst CuTex prevents plants from growing through the composite and within the zone of inhibition, the effects were shown to be relatively localised. CuTex was not shown to negatively affect the biomass of surrounding plants.

Japanese Knotweed

Japanese Knotweed is a strong-growing herbaceous plant native to Japan, Taiwan, China, and the Korean peninsula. It was introduced into Europe in the mid-19th Century as an ornamental plant. The plant has thrived in fertile European soils and is now classified as an aggressive weed species. The plant has a significant negative impact on the environment where it occurs. Japanese Knotweeds stout rhizomes can push through asphalt, building foundations, cracks in concrete, retaining walls and even drains.

It out-competes other species affecting landscaping programmes, it disturbs the aesthetics through the accumulation of litter in dense thickets which encourages vermin and it increases the maintenance costs of buildings. It can also disturb local ecosystems by blocking migration of native plants and animals. This can add huge costs to development and regeneration schemes.

Contaminated soil must be treated as controlled waste. Additionally, the plant is capable of obscuring railway signals and road signs as well as causing trip hazards in paving. Hence, Japanese Knotweed can cause excessive costs for remediation, lead to prosecution and/or compensation claims, especially from neighbouring sites, physical damage to buildings, hard surfaces and harm to the environment (through the repeated applications of herbicides).

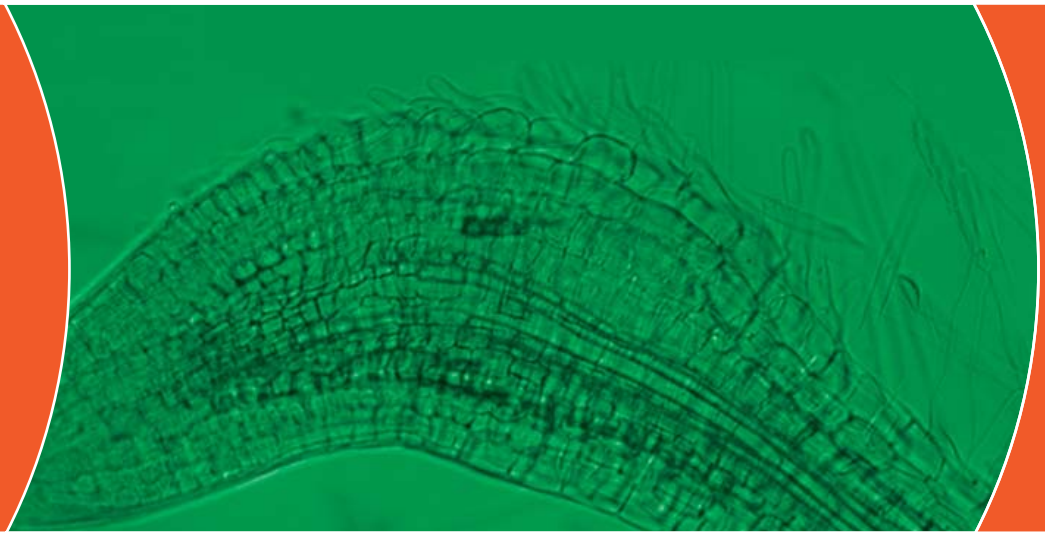
It is not illegal to have Japanese Knotweed on your land; however, legislation requires that you:

- Prevent invasive non-native plants on your land from spreading into the wild and causing a nuisance
- Prevent harmful weeds on your land from spreading on to a neighbour's property

You can be fined up to £5,000 or face a prison sentence of up to 2 years for allowing contaminated soil or plant material from any waste you transfer spreading into the wild.

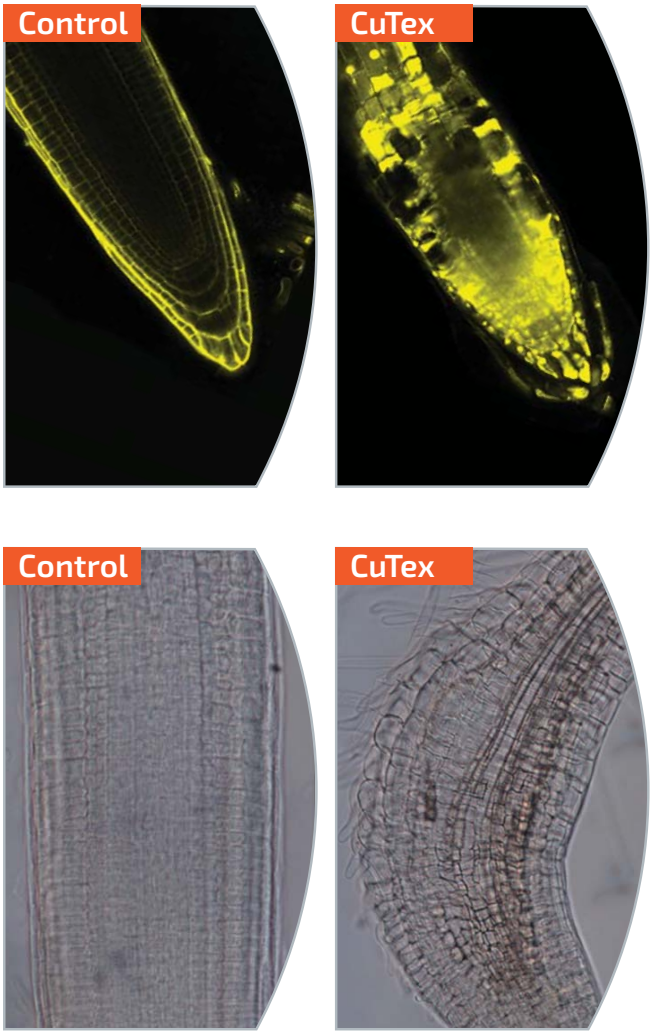
CuTex

How does it work?



CuTex functions not only as a physical barrier, incorporating strong and durable geotextiles, but also as a chemical barrier. It acts by releasing Cu2+ ions into solution. Confocal laser-scanning microscopy and differential contrast interference microscopy was used to analyse the morphology of root tips grown in the presence and absence of CuTex. The results demonstrated that when root tips approach the zone of inhibition they undergo a progressive collapse. The dividing cells at the very tip of the root (the meristem) die off and the cells above the meristem differentiate.

The localised copper toxicology only affects the root exposed to the zone of inhibition making CuTex a safe and effective material for blocking root growth. Over time CuTex releases Cu2+ ions into the soil creating an effective chemical barrier.



Laser scanning microscopy and differential contrast microscopy show progressive collapse of root system.

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Designed and printed by ICM Creative Communications 11137/04/18