The root system

The root system is developed in the soil since soil can help establish their strand and protect the fragile roots from stressful conditions such as drought, nutrient deficiency, unfavourable temperature, etc. Hydrotropism is a directional growth response exhibited in terrestrial plants in which water or water vapour is the orienting stimulus. In hydrotropism the root caps perceive and respond to moisture gradient of the soil simultaneously which will then regulate the directional growth of the root towards or away from water.

A tropism is termed “ Positive” if growth is toward the signal and in this case higher moisture gradient and “ Negative” if it is away from it. (John Z. Kiss, 2007). Tropisms normally interact between each other and in this case, plants must overcome gravitropism first, since it is dominant on earth. (Jaffe et al. 1985) Other tropisms, such as thigmotropism, in which touch is the stimulus, interfere with hydrotropism. The root system is developed in the soil since soil can help establish their strand and protect the fragile roots from stressful conditions such as drought, nutrient deficiency, unfavourable temperature, etc.

Tropism is one of the most important adaptation method plants have acquired. (Yutaka Miyazawa et al. 2008) However there have not been many studies done on hydrotropism and the mechanism underlying it, despite it's importance. A study by Akie Kobayashi, Akiko Takahashi, Yoko Kakimoto, Yutaka Miyazawa, Nobuharu Fujii, Atsushi Higashitani, and Hideyuki Takahashi that was published in 2007 examines the roosts of arabidopsis mutant Mizu-Kussei1 (Miz1) which are impaired in hydrotropism but show normal gravitropism and elongation growth.

The results of this study suggest that hydrotropism takes and independent pathway from other tropisms, Since the roots of mutant Miz 1 and the wild type had similar root structures and morphology but the mutant showed reduced phototropism. in this experiment M1Z1, which encodes a protein containing the MIZ domain is mutated, the MIZ domain is highly conserved among terrestrial plants such as rice but are not found in known genomes of plants such as green algae, cyaonobacteria or animals.

It has also been observed that with no interference from gravitropism in gravitropic mutant plants, positive hydrotropism is exhibited. (Takashaki H. et al. 1996) Since hydrotropism is the affect of water and moisture gradient in plant growth, the result of this study can help improve agriculture, biomass production, etc. Therefore a hydrotropism - deficient mutant model, Arabidopsis thaliana, was chosen and studied to discoed the molecular mechanism of hydrotropism.

In this mutant a stronger response by the roots was seen when water was the stimulus comparing to when gravity is the stimulus, so hydrotropism overcame gravitropism. However the gene responsible for this mutation is yet to be discovered. (Eapen et al. 2003) Thaliana roots were placed in two different solutions. One with 1% wt/vol agar and the other was a saturated K2CO3 solution in a closed acrylic chamber so no moisture was entered. An extreme hydrotropic response was seen in the plants in 1% solution but not in the humidity saturated chamber. A. haliana roots were found to be responding really soon to moisture gradient after being exposed to it.

They have also shown that they can overcome Gravitropism. when Moisture present roots have quickly bent towards the moisture source (agar) but the MIZ1 did not show any response to moisture source. They in fact turned away slightly from the agar. When the roots of MIZ1 were completely placed in agar in humid air, the elongation rate increased significantly, which indicates that MIZ1 roots can elongate normally but they are incapable of hydrotropism.