

X-ray vision; newest research method in sports grass Research method from space travel applied in Sports turf

In a leading study led by Dr. Jim Brosnan of the University of Tennessee (USA) a research technique used in space has been applied to document and study unaffected root growth. Recently, a research has been done using this method to evaluate the effects of Aqua Aid's Worm Power Turf on root development.

At the moment, crops are being cultivated in space in so-called "soilless media"; in containers without sand, loam or clay. This system, developed for NASA, uses artificial root zone profiles from polystyrene in which plants grow and are systematically provided with nutrients and water. The advantage of this method of cultivation is that no pollution occurs and processes can continue without the influence of external factors. This is important to enable long-term life outside our planet.

This research has shown that this system is also very suited to observe root development without disturbing the root mass. Generally, tests in laboratories and test stations are done by cutting profile samples. Once cut, the profiles are washed and then analysed. The disadvantage of this way of testing, is that by cutting the profile and then washing it, parts of the root mass are damaged and/or broken off. These damaged/lost roots cannot be assessed and are therefore not included in the overall assessment. In addition, the profile cannot be placed back in the ground without damage, so therefore it can no longer be used as a reference. As a result, the quantification of root mass using this classic method is not 100% accurate.

X-ray technology offers a new way to study turf root growth without this extensive, destructive sampling. Screening Corporation have patented a method to study root growth in a profile by using X-ray technology. The process is fairly straightforward; plants are placed in X-ray transparent root zone profiles filled with polystyrene granules comparable in size to coarse sand (0.5-1.0 mm diameter). These granules are supplied with moisture and nutrients by drip irrigation. Throughout the evaluation, X-ray images are taken regularly to document a clean, undisturbed assessment of the root growth. Polystyrene does not affect X-radiation and is therefore invisible on the image (see image on the right).

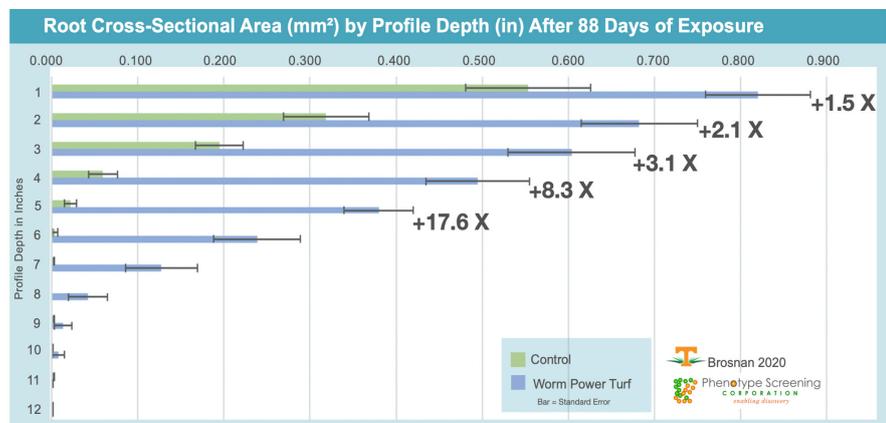




In 2020, researchers from the University of Tennessee and the Phenotype Screening Corporation conducted a joint study to evaluate the effect of a vermicomposting organic liquid extract (Worm Power Turf) on *poa annua* root growth. Pre-sprouted *poa annua* (annual meadow grass) seedlings were planted in polystyrene root zone profiles. The profiles were placed in a controlled growth chamber, with day temperatures of 26-28 °C and night temperatures of 16-22 °C, while provided with 14 hours of light. These root zone profiles were supplied with a complete nutrient solution via a drip irrigation system.

After acclimation to this growing environment, the plant profiles were divided into two groups. One group received the standard nutrient solution plus Worm Power Turf (8.5%), the control group received only the standard nutrient solution. Treatments were randomized with six replicas of four subsamples each. All root zone profiles were studied 66 and 88 days after treatment (DAT) by X-ray image analysis. All images were analysed using imaging software. (Rueden et al. 2017) The total root length and cross-sections of the root (at different depths in the profile) were compared to the standard of the mean. After image analysis, the roots were dried in a forced air oven and weighed to determine the root mass.

After analysis of the X-ray data, the plants treated with Worm Power Turf were found to have a significant increase in both root length as well as root mass, compared to the control group. (figure below) At 2" (5cm), the average increase of root surface was doubled, and this progressed to an average root surface at 5" (12.5CM) that was 16x larger than the control group. Also visible in this figure are the enlarged root lengths per profile depth; from 6 "(15CM) untreated to 11" (27.5CM) in the treated group. In addition to these results, the average root surface had doubled, see figure..., and the dried root mass also showed an increase of more than 90% in the treated plant profiles.



Complete Nutrient Solution* - The Complete Nutrient Solution (CNS) was a 75% Hoagland Solution. A Hoagland Solution provides nutrients for plant growth, including both macro-micronutrients.

This research clearly shows the stimulating effects of Worm Power Turf on the root growth of a plant, achieving an important goal; more root mass means a stronger plant and a strengthened internal defence system.

This research is a good example of the potential of X-ray technology to gain knowledge of grass root growth. Comparable research could also be carried out with other grasses and varieties in order to learn more not only about root growth in general, but also the effects of all sorts of biostimulants on the root evaluation, without disturbing the growth profile.

Source reference:

Article "X-Ray vision? A New Approach to Studying Turfgrass Root Growth", by Jim Brosnan, Ph.D. & Brandon Horvath, Ph.D., University of Tennessee & Dan McDonald Phenotype Screening Corporation.

