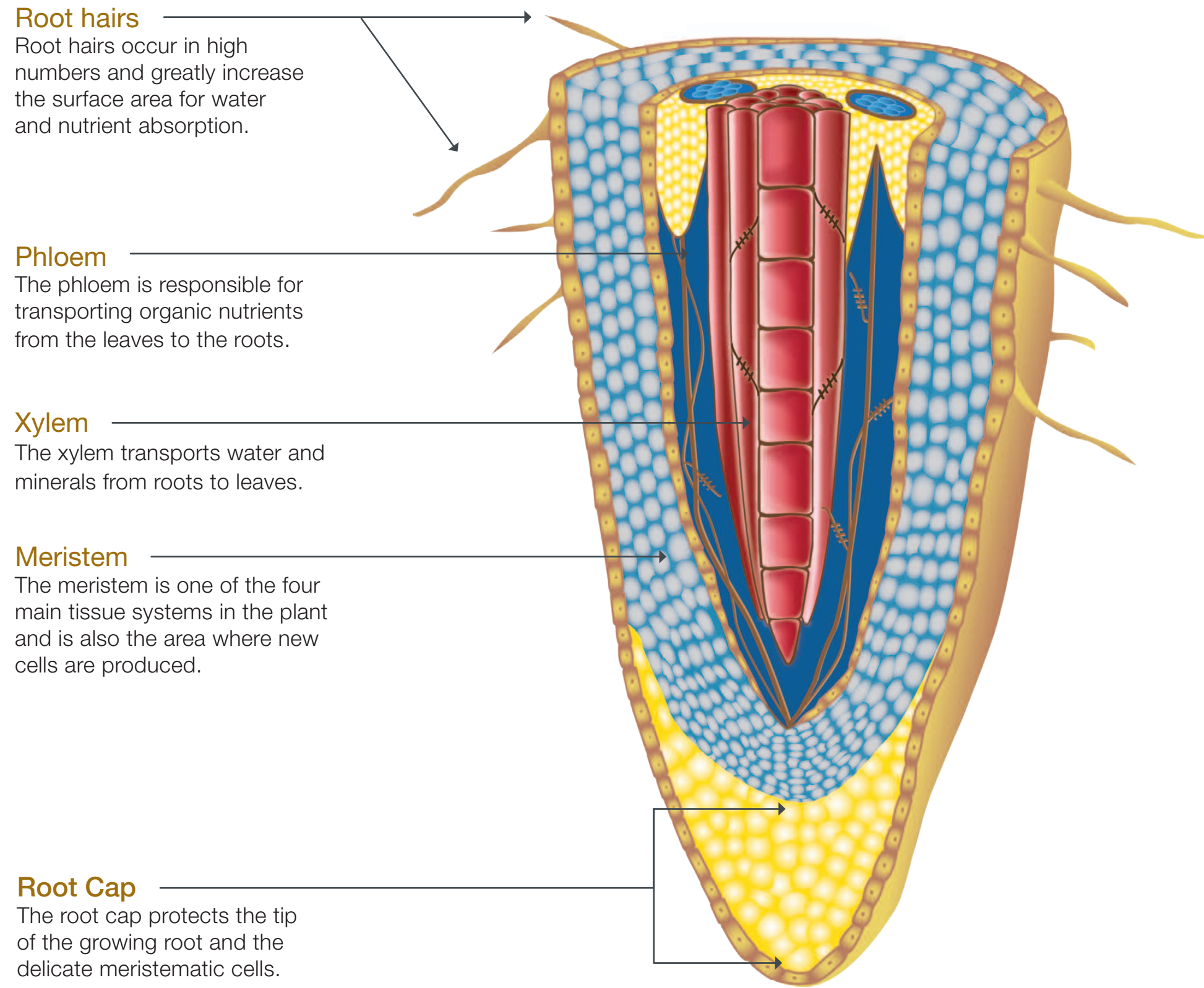


Strong, Healthy Root Systems Lead to Higher Productivity, Increased Profit Potential

More and more research is pointing to root health as the key to increasing crop productivity in the future. Why? Healthy roots lead to:

- Protection against yield-robbing insects and diseases below the soil surface
- The development of stronger stems and foliage that better withstand environmental stress
- More efficient water and nutrient uptake
- Protection of the crop's genetic potential

Roots are responsible for several important jobs, including anchoring and supporting the plant in the ground. They also hold soil in place, break up soil to create pathways for better water filtration, and absorb water and nutrients.



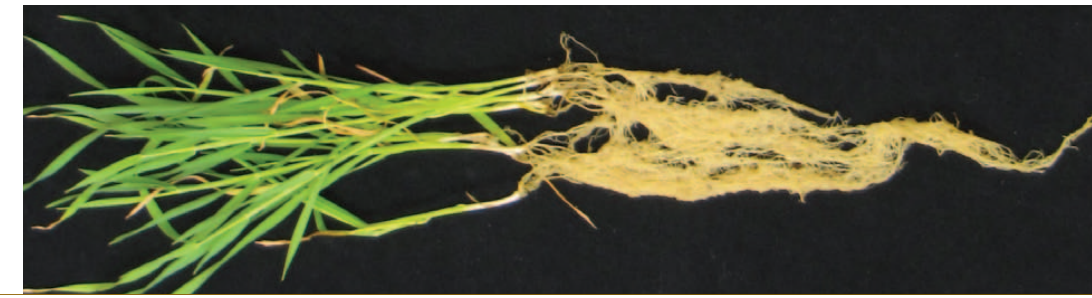
Root Health, According to the Experts

“Root health is a term that plant pathologists have used for many years to describe a plant root that has very little disease. Healthier, more robust root systems help plants better utilize available nutrients and moisture.”

—Wayne Pedersen, Ph.D.,
emeritus plant pathologist, University of Illinois

“Root health means that plants can live up to their full genetic potential, and can utilize water and nutrients in the most efficient way. Root health means that growers can get the best economic return on their inputs, and can use the most sustainable practices with the least environmental impacts.”

Tim Paulitz, Ph.D.,
research plant pathologist, USDA-ARS,
Washington State University



Key Pests Impacting Root Health in Cereal Crops

Underground diseases and insects are the prominent threats to the development of a strong, healthy root system. Key pests to watch for in wheat and barley include:



Rhizoctonia bare patch in wheat

Rhizoctonia infects the entire root system and is quickly establishing itself as one of the most prominent soilborne pathogens afflicting U.S. cereal growers. *Rhizoctonia* is capable of causing 20 to 40 percent yield loss. This fungus can cause preemergence or postemergence damping-off of seedlings, as well as plant wilting. Infected stems often break in the lesioned area, and roots may die from a firm, dry brown or red-brown decay.

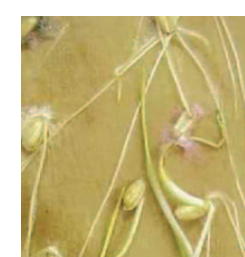


Pythium infected seeds, untreated

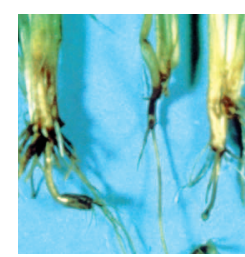
Pythium is one of the most prevalent disease pathogens attacking cereal crops and often misdiagnosed as winter injury, poor soil fertility or toxicity from crop residue. *Pythium* feeds on the root system and results in spindly plants with shortened and distorted leaves, fewer tillers and smaller heads. *Pythium* is difficult to control once rot has begun, and rapid death of crops occurs once infection occurs. Delayed emergence and poor plant development are common symptoms of *Pythium*.



Pythium infected seeds, treated with mfenoxam + difenoconazole



Fusarium attacks the outside of the seed and the seed embryo in wheat and many other crops. These infection points act as inoculum for a new round of infection in the next crop when conditions are favorable. However, the immediate threat is to the seed. If infected, the seed may die, germinate poorly or encounter seedling blight as it germinates.



Common root rot causes stunting and sometimes wilting of infected wheat, barley and oat seedlings. Later, these plants turn yellow and die. Roots of diseased seedlings are rotted, red-brown in color and may be covered with a mass of white, gray or pink mold.



Wireworms are the shiny yellow larvae of click beetles and have the capability to reduce stands up to 80 percent. Wireworms feed on roots and underground shoots of small grains, especially those planted on land previously in sod. They attack as soon as the seed is planted in the soil, boring into seeds and young seedlings, which then suffer scarring, weakening the plant.



Syngenta Offers Cereal Growers Strong Fungicide Seed Treatment Solutions That Also Boost Rooting Power and Enhance Disease Protection

Ongoing research and a firm commitment to root health and pest defense has led Syngenta to develop sedaxane, its first active ingredient created specifically as a seed treatment. A member of the SDHI class of fungicides, sedaxane, found in the VIBRANCE™ fungicide family of cereals seed treatments, delivers longer-lasting protection against yield-robbing diseases and aids in the development of stronger, healthier root systems that lead to increased crop productivity and consistently better yields. The built-in Rooting Power™ of VIBRANCE brands helps develop robust root systems that more efficiently absorb and utilize water and nutrients. As a result, stems and foliage are healthier and can better withstand environmental stresses, which leads to enhanced and consistent yield performance.

The VIBRANCE fungicide family of cereals seed treatments features VIBRANCE Extreme seed treatment fungicide and CruiserMaxx® Vibrance Cereals seed treatment insecticide/fungicide.



- Stimulates quality root systems that deliver better emergence, stand, nutrient uptake and stress tolerance for enhanced Rooting Power
- Combines sedaxane with difenoconazole and mfenoxam to deliver extended protection against a broad spectrum of early-season seedborne and soilborne diseases
- Helps ensure a healthier start to deliver better yields under a wide range of environmental conditions
- Offers excellent seed safety for optimal seedling development and root growth
- Produces healthier, stronger stems and foliage that can better withstand stresses from weather, diseases and insects
- Contains the optimal combination of systemic action and soil mobility for excellent disease protection and root health



- Provides unsurpassed protection against a wide range of insects and diseases, including best-in-class *Rhizoctonia* activity, to help boost Rooting Power
- Features sedaxane with thiamethoxam, mfenoxam and difenoconazole in a convenient formulation effective at a single use rate
- Offers consistent yield performance and stability under a wide range of growing conditions through an enhanced formulation
- Provides a resistance management tool as it adds another seed treatment mode of action from the SDHI class of fungicides to the Syngenta Seedcare portfolio
- Delivers the Cruiser® Vigor Effect through the thiamethoxam component to help enhance germination, increase vigor, improve stand establishment and deliver better yield potential
- Contains higher rates of fungicides and insecticide to raise the level of performance against *Pythium* and wireworms vs. the closest competitor
- Offers ideal systemicity and soil mobility which creates a “halo of protection” around the seed and root system



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