



RICH COUNTRIES

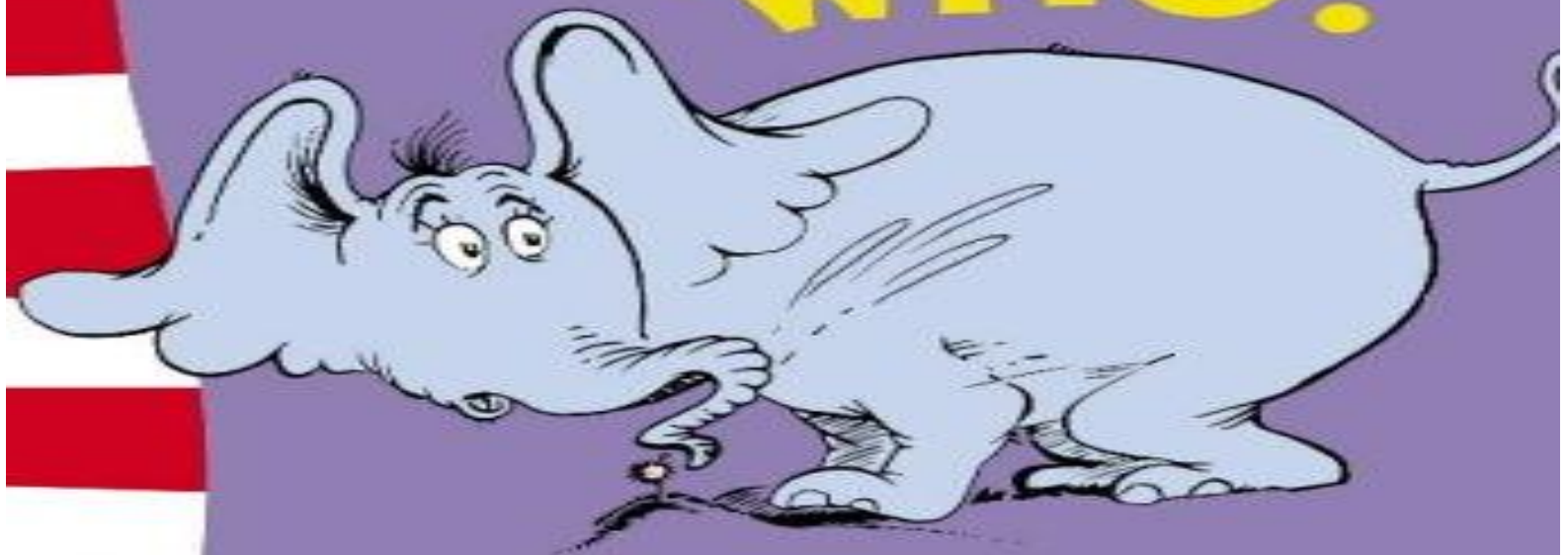
POOR COUNTRIES

ENVIRONMENTAL SPACE

MULTICULTURAL CLASSROOM



HORTON HEARS A WHO!



Dr. Seuss



“Our buildings, to you,
would seem terribly small
But to us, who aren’t big,
they are wonderfully tall.





save a spruce, help a birch, or prevent noxious dandelions and chickweed from taking over the world?

Central to the way we cared for our gardens and yards was a notion shared by tens of millions of other gardeners and, until you finish this book, perhaps you as well: nitrogen from an organic source is the same as nitrogen from an inorganic one. Plants really didn't care if their nitrogen and other nutrients came from a blue powder you mixed with water or aged manure. It is all nitrogen to them.

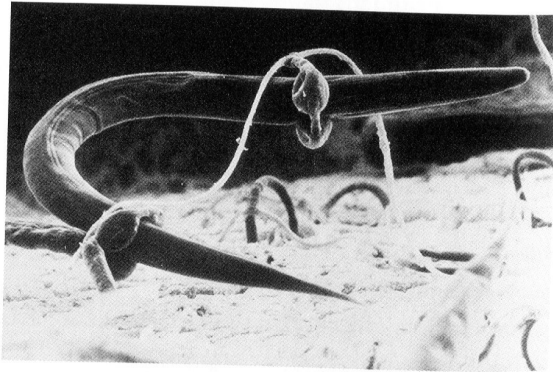
Then one autumn, after the gardens were put to bed and we were settling in for the winter, looking for something to hold our horticultural interest for the cold months, a gardening friend e-mailed two stunning electron microscope pictures. The first showed in exquisite detail a nematode trapped by a single looped fungal strand, or hypha. Wow! This was quite a picture—a fungus taking out a nematode! We had never heard of, much less seen such a thing, and it started us wondering: how did the fungus kill its prey? What attracted the blind nematode to the rings of the fungus in the first place? How do the rings work?

The second image showed what appeared to be a similar nematode, only this one was unimpeded by fungal hyphae and had entered the tomato root. This photo raised its own questions. Why wasn't this nematode attacked, and where were the fungal hyphae that killed off the first nematode?

A foraging, root-eating nematode, trapped by a fungal hypha. Courtesy

H. H. Triantaphyllou.

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than one type of predator, the chains are linked into webs—soil food we Ingham, an excellent teacher, became our guide to the whole world of comp communities in the soil. Through her we learned that the fungus in the fi photograph was protecting the plant's roots; if that wasn't enough to make stop and think, we learned the plant attracted the fungus to its roots in the fi instance! And we also learned what killed the fungus that would have pr vented the nematode from attacking the tomato root.

Naturally, we began to wonder what other heretofore-unseen things we going on down there in the soil. Might the world revealed to us by tools like tl electron microscopes affect how we care for the plants in our gardens, yard and lawns? We have all been dazzled by Hubble images of deep space, incompr hensibly far away, yet few of us have ever had the opportunity to marvel at th photographs produced by a scanning electron microscope (SEM), which pro vide a window to an equally unknown universe literally right under our feet.

We looked for answers, and soon realized that while we were out spreadin fertilizer and rototilling our garden beds by rote, an ever-growing group of sci entists around the world had been making discovery after discovery that pu these practices into question. Many scientific disciplines—microbiology, bacte riology, mycology (the study of fungi), myrmecology (the study of ants), chem istry, agriculture—came together in recent decades to focus jointly on under standing the world of soil. Slowly, their findings about what goes on in the soi are being applied to commercial agriculture, silviculture, and viniculture. It is time we applied this science to things we grow in our home yards and gardens.



With no fungal hyphae barring the way, a nematode penetrates a tomato root to feed. Photograph by William Weryin and Richard Sayre, USDA-ARS.





