

AG NEWS & VIEWS

RANGE

Know the Soil's Condition Before Reseeding Rangeland



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Why do rangeland plantings fail? Seems like a simple question, but the answer is not that simple.

WHY RESEED RANGELAND?

In the Southern Great Plains, the decision to reseed rangelands is usually made because one of three situations has occurred:

- 1)** the site or pasture has had considerable ground disturbance following brush management,
- 2)** the site or field is being converted from cropland to rangeland, or
- 3)** the site or pasture has degraded to the point that not enough desirable species remain to support adequate production. The amount of desirable species present on the site is often represented as a percentage of

the total production expected on the site. The U.S. Department of Agriculture Natural Resources Conservation Service recognizes 15 percent desirable species as a tipping point to assess if a site can be rehabilitated with management or has degraded to the point of reseeding. Note that generally, with the exception of cropland conversion, the need to reseed rangeland is largely a result of mismanagement leading to degraded soil.

WHAT HAPPENS ABOVE-GROUND?

After the decision to reseed has been made, this is what commonly happens in the Southern Great Plains: The pasture goes through the process of site preparation, which generally means it is plowed/disked multiple times to prepare a firm, weed-free seed bed.

The site is then rolled with a cultipacker. Next, the site is seeded with either a Brillion seeder, grassland drill or a broadcast seeder. The species selected is generally a low-diversity mix of the four main tall warm-season perennial grass species (little bluestem, big bluestem, Indiangrass and switchgrass). Occasionally, there is a midgrass or forb in the mix such as sideoats grama or Illinois bundleflower and a nurse plant (green sprangletop or Sorghum alnum) planted at 1 pound per acre over the mix total. The site is then rolled with a cultipacker again. Finally, we wait on the rain. And we wait some more. Stand establishment following this process can take anywhere between one to three years, or even never. Tens of thousands of acres go through this process every year in the Southern Great Plains.

The problem is not necessarily the process outlined above. And sometimes the planets align, and it all works. The trouble is it rarely works in year one. Often, it takes multiple years to establish, if at all. The reason for failure is usually blamed on lack of rain, the seed was planted too deep, too much competition, etc. Those are not the kind of odds I want to play when paying approximately \$100 per acre or more for the practice. So, what is the mechanism for success? The mechanism begins with changing how we see the system.

WHAT HAPPENS BELOW-GROUND?

The soil is much more than a medium for us to grow plants. For years, we have focused on the soil's physical and chemical properties (texture, pH, etc.) and largely ignored the biological component. Properly functioning soils are alive and teeming with life, and these soil microbiomes take time to fully establish. Once mature, a functioning phytobiome (the plant plus all of its microbes) can be resilient to climate-imposed stress and promote plant productivity and longevity.

Organic matter is the primary building block for soil organic carbon. Organic matter consists of both simpler carbon compounds like root exudates and more complex ones such as plant residues. Biological function in our soils is largely driven by the availability of soil organic carbon, with root exudates serving as the primary food source for many of the microbes. Other more complex carbon compounds such as cellulose and lignin are processed by microbes with the enzymatic machinery to convert these plant materials into a wide variety of partially decomposed materials, some of which can be utilized and processed into simpler carbohydrates by other microbes and some of which persist for longer periods of time: months to years, even decades.

In many cases, the microbes themselves (bacteria, fungi, protozoans, nematodes, etc.) are significant contributors to the soil organic carbon. Increases in soil organic carbon lead to increased soil structure, infiltration, soil water-holding capacity and nutrient cycling, as well as reduced erosion and other desirable ecosystem services. Increased nutrient cycling and availability is largely the result of symbiotic relationships developed between plants and soil microbes. In exchange for root exudates,



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soil bacteria can mineralize and mobilize nutrients derived mainly from inorganic sources, thus modulating the nutrient pools and making them available to nearby plants. Soil fungi also play very important roles in functioning plant communities, both as recyclers of organic matter into its nutritional components and as beneficial symbionts, extending the reach of plant root systems and probing soil spaces too small for root entry. These relationships allow plants to reach new patches of inorganic nutrients such as phosphorus, tap into a wider soil moisture pool, and may enable access to organic nutrient pools typically unavailable to the plant host. In the end, our ability to understand and manipulate the phytobiome is absolutely crucial to our efforts to improve soil health and maintain plant productivity.

HOW DOES SOIL HEALTH EFFECT RANGELAND SEEDING?

When reseeding, we are changing an ecological system. We must begin with a better understanding of the ecological system we are attempting to change. Degraded soil systems mainly support plant species adapted to thrive in soils that

have reduced ecological function. These are plants that thrive in soils with limited biological diversity. Yet, as we discussed above, the condition of the soil and its ability to properly function determines what plants are able to grow and persist on any given site. This is why seeding big bluestem into degraded soils is a recipe for failure. Big bluestem is highly dependent on associations it builds with soil fungi. If the soil is degraded to the point where that association cannot occur, big bluestem will largely not persist. Many of our tall warm-season grasses are dependent on similar associations. This critical understanding reflects the long-standing role these plant-microbe relationships play in prairie ecosystems. Indeed, tallgrass prairies are some of the most ecologically functional and biologically diverse ecosystems on the planet. We must remember that the ability of the indigenous plant life to thrive in their native environment requires more than just soil and water; it requires synergistic soil biology.

HOW DO WE REMEDIATE DEGRADED SOILS?

There are a couple of options. If we know the soil is in a degraded condition and we want to build the biology, we must provide the food source. We must build organic matter. This can be done by managing a cover crop on the site for a season or two, then no-till plant your desired species mix in the correct season. Another option is to look at increasing the diversity of the initial mix by adding mid-seral plants that will persist while the biology develops. Other options exist. The point is to build the soil's capacity to support the plants you want to grow. With any rangeland seeding effort, understanding the initial condition of the soil is the starting point. Then, decisions can be made from there. Knowing this can save thousands of dollars and years of potential production. 🐾

