

A Rock Dust Primer: Back to Basics

Remineralization Utilizes the Broad Elemental Spectrum Rock Dusts to Build a Foundation of Fertility

Rock dusts for remineralization should contain a diversity of nutritive minerals. Naturally occurring volcanic materials and rich glacial sediments can be suitable sources of rock dust. Basalts and glacial sands and gravels are examples of these types of geologic materials. Geologic materials have a long history as sources of fertilizer for growing crops. Calcium carbonate “lime” is perhaps the most famous. Granite dust is a traditional example of a rock dust used by farmers because of its known content of the nutrient potassium. Rock phosphate is another example of a mineral concentrate of phosphorus derived from ancient sediments. For remineralization the broad spectrum nutritive mineral compounds are often found in silica rich volcanic magma and ash, in sea and fresh water minerals built from remnants of living creatures such as algae, diatoms and crustaceans producing calcium and magnesium rich carbonates, in minerals derived from carbon rich humus sediments from ancient bogs, and in the naturally occurring mixtures of geologic materials found in alluvial and glacial sands and gravels. The best rock dusts provide a diversity of nutritive materials derived from natural minerals freshly crushed and blended in a gradation of fine particle sizes distributed widely in growing media.

Differences Among Rock Dusts

Over 30 years ago one of the founding fathers of remineralization, John Hamaker, promoted the use of glacial and alluvial rock dust sediments for remineralization. This choice was based on his objective of emulating glacial forces in revitalizing the planet through remineralization. However, volcanic geologic types such as the basalts and the complex metamorphic and sedimentary hard rocks and clays have been found to serve as well as the best regional glacial and alluvial sands and gravels. Quality of all rock dust materials should be quantified by purity, geochemical analysis, mineralogy and particle size. Glacial sediments often contain a higher percentage of hard minerals such as quartzite. As the glacial and alluvial sediments are transported from their original location over eons many of the softer minerals weather away, leaving a greater proportion of the harder, less nutritive materials intact. The unweathered magmas such as the basalt and other hard rock sediments derived from regional volcanism, ancient oceans, lagoons or inland bogs often retain rich mineral diversity and nutritive properties. Seen in this light both the single broad elemental spectrum hard rock or clay geology as well as the higher value glacial or alluvial sediments can serve Hamaker's objective of emulating natural forces to regenerate and revitalize the earth through remineralization.

Rock Dust Analysis: Fundamentals of Mineralogy and Geochemistry

A fully vetted rock dust will have both geochemical analysis and a basic petrology describing the classification of rock type if not the specific mineralogy. The best rock dusts will generally be those with good proportion and relative abundance of the major nutritive elements, an abundance of nutritive trace elements and very low concentrations of arsenic, lead and the natural radioactive heavy elements, the latter at levels near or below natural concentrations found in native soils. Silicate rock types below approximately 50% Silicon dioxide will often have a good concentration of nutritive minerals.

Nutrients in Rock Dusts Become Available to Plants Through the Action of “Weathering” which is Mechanical, Chemical and Biological

Unlike soluble chemical fertilizers, rock dusts for mineralization are largely insoluble silica rich minerals that become reactive in soils through a process called “weathering” produced by changes in pH, mechanical breakdown resulting from abrasion, changes in temperature such as freeze-thaw cycling, and the action of beneficial organisms both large and small. Examples of these beneficial organisms existing in healthy soils are earth worms and microorganisms such as bacteria and fungi.

What are the Differences Between Synthetic Fertilizers and Naturally Occurring "Rock Dust" Minerals?

Many synthetic fertilizers are acid salts or soluble sulfates of a very narrow elemental spectrum, often containing a single elemental nutrient in combination with Chlorine or Sulfur. Chemical fertilizers are usually a combination of three elements; N, P, and K (Nitrogen, Phosphorus and Potassium) delivered in soluble form. In contrast, the broad elemental spectrum rock dusts contain a naturally occurring distribution of dozens of macro and micro nutrients delivered in mineral form. There is little or no nitrogen in most rock dust materials although essential elements for fixing nitrogen in soils such as Molybdenum and Vanadium are present in many high quality rock dusts. The use of fixed carbon and humus with rock dusts is encouraged to help build soil biology and regulate the uptake of essential nutrients in plants. Soil remineralization is a method of encouraging a natural, resilient and self regulating growing environment which promotes long term sustainable fertility.

Choosing a Gradation of Rock Dust Based on Use

Gradation of rock dust means the size and distribution of particles based on an analysis of pulverized stone or sand and gravel screenings. The highly micronized gradations resembling flour or talcum powder are a prized gradation of rock dust. However, the largest particle size in a distribution of effective rock dust gradations may pass through a 1/4" screen with the highly micronized dust included, or it can be finer, i.e., 1/8"-0.

Choose a gradation based on end use. The courser fractions, which can accurately be described as 'grits-to-dust', are an excellent choice for building structure in silty or sandy soils or flocculating clays as well as mineralizing potting mixtures for starting plants or for creating soil-less media. The finer blended gradations should be utilized for germination beds, potting mixes for seedlings, top dressing or side dressing planting beds, forage or pasture. The highly micronized stone flours should be reserved for specific applications such as composting, top dressing potted plants, and for aqueous suspensions such as teas, drenches and foliar sprays.

Choosing an Application Rate

Application rates will vary according to usage, soil type and condition. Field trials indicate that a direct benefit exists between application rate and increase harvest weight starting at very low rates and running up through very high rates, up to 200% increase in harvest weight over the controls. (Goreau et. al, New Harmony Farm 2012) Rock dust for remineralization has traditionally been utilized at very high rates, up to 10 tons per acre. However the science indicates that low rates of high value rock dust containing a highly micronized fraction will have immediate and lasting benefits. For professional soil management the use of soil tests, careful analysis of rock dust geochemistry and mineralogy, identifying 'limiting factors' in current growing practices, and a careful comparison of available regional rock dusts for targeted use can provide measurable lasting benefits. For a less scientific approach, a liberal application of the best rock dust in a suitable gradation works well. Because of low solubility and near neutral pH The risk of 'burning' or damaging crops within maximum application rates is virtually nil.

Here are some metrics for determining application rates:

43,560 square feet/acre.

1 ton/acre converts to 5 lbs/100 square feet.

Choice of particle size, specific geologic make up, proximity of the source and economics will also determine annual usage. There is no harm in remineralizing over time, but dramatic and immediate results have been shown with heavy applications in year one.

Any addition of high value rock dust will increase nutrient content of soils and improve crop yields and nutrient content. Those results are directly linked to application rates, the health of the soil biota and carbon content.

Remineralization is the Process of Building a Foundation of Fertility

Here are some general guidelines:

In tillage for remineralization purposes; Between 5 and 10 tons/acre (25 - 50 lbs / 100 sq. ft.) of a coarse stone dust passing 1/4" screen (1/4"-0) or finer. Apply at once or build to these rates over several seasons. An objective of 10 tons is a good goal in most situations. Economics and management strategy will define application rates as much as anything. Maximum rates for top dressing are generally capped at 5 tons/acre (25 lb./ 100 sq. ft.) with an 1/8"-0 gradation or finer utilized for this purpose.

The more highly micronized fractions will work faster as the surface area is greater for each pound of material. So an application rate of a stone flour or a blend of a fine 'grits-to-dust' gradation (1/8"-0) can be reduced in the first year to achieve the same growth response.

Subsequent applications will build mineral content over time. The fines will be assimilated and use up and the coarse fractions will weather out, providing a continuous source of mineral based nutrients.

For use in aqueous suspensions such as teas and drenches or foliar sprays:

Between .5-1 lb/gal of the highly micronized stone flours may be used. Wetting agents are recommended for foliar applications to spread the solution over the leaf surfaces.

Note for professional land managers: Check State Agency of Agriculture guidelines for any maximum rates of application relative to content of metals. Some guidelines limit annual metal loads. Compare geochemical analysis of the rock dust you are using to any state guidelines before adopting maximum application rates.

Spreading Methods for Rock Dust

Pulverized rock powders can be spread in traditional drop spreaders with large openings in the trough. Any damp lime spreader wagon or truck mounted sand and salt spreader will effectively spread any gradation of rock dust except the dry stone flours. The grits-to-dust gradations can be spread like lime, in live floor lime spreaders and augur driven applicators. Any rock dust may be spread by hand. Highly micronized stone flours can be entrained in water for foliar or irrigation applications or to create slurries and conveyed using diaphragm or rotor-stator pumps. Rock dust can also be added to manure spreaders on top of the load if spreading from conventional spreaders.

Micronized rock dust can be added to liquid manure systems at the time of pumping or in the spreading tanker. Rock dust can be added to compost raw materials to build a remineralized compost fertilizer. Please note: Pulverized rock powders will not spread in cone type three point hitch setups. These require granulated or pelleted materials. Caution! Rock dusts often contain silica. Dry stone powders present a breathing hazard. Wear suitable respirators, work up wind and limit exposure.

Fortifying Compost with Rock Dust

Good results have been achieved using 15-20 lbs. micronized high silica, calcium rich rock dusts/ cubic yard of compost raw material. Mix different geologic sources together to take advantage of each, or use them one at a time. Building compost with rock dust is an excellent way to assimilate the minerals within a complex biologic system, making the nutrients available to the plants and feeding the essential beneficial microbes which in turn build fertility in soils and nutrient content in crops. True remineralized compost will be built with minerals (not just mixed in post digestion). There is a difference!

Working Seasonally with Rock Dust

Spring tillage is traditional. Apply rock dust powders with other soil amendments to new or established planting beds at the same time. Fall tillage or top dressing applications are extremely valuable. Rock dust incorporated in the fall assimilates over the winter and is available during the spring growing season. Apply with planting of overwintering tubers such as garlic, broadcast over hay land, or pasture. Apply whenever cover crops are tilled in preparation for new plantings. The charge of micronized minerals will stimulate microbial populations and make the nutrients more available to the new crop. Micronized rock powders can be suspended in water for “fertigation” and foliar use any time during the growing season. Top dressing or side dressing can be done during the season at any time. Adding a fine covering of stone flour gradations of rock dust to the soil surface of potted plants and watering in every month is good practice, especially during seasons of vigorous growth.

Measuring the Benefits

Annual soil testing should show improvements in both available nutrients and overall nutrient density in soils. Overall improvement in plant vigor should follow the assimilation of minerals in the rock dust. Brix refractometer readings should improve, indicating higher sugar and mineral content in plant sap. Higher sugar and mineral content will improve disease and insect resistance as well as drought and frost resistance. Tissue analysis of produce and forage should indicate increased mineral and nutrient value. Produce tastes better. Herd health of livestock fed remineralized forage

and feeds will improve, reducing vet bills, reducing mortality and increasing profitability. Remineralizing soils is the first step to remineralizing living things, whether they be microflora in soils, animals or human beings. Remineralization is a foundational practice of nutrient dense food production. The benefits can be measurable and cumulative.

Global Reach of the Local Practice of Soil Remineralization

Scientific studies have shown that remineralized soils capture carbon and nitrogen (Tang, Goreau et.al 2012) and fix them in soil as carbonates and complex organic compounds created by microorganisms through biologic activity. Remineralization with naturally occurring and readily available rock dusts in combination with fixed carbon sources such as biochar provide an immediate and workable solution to the immediate problem of reducing atmospheric greenhouse gases such as CO₂ by building fixed carbon in soils. Reducing atmospheric carbon and building fertility in soils serves to stabilize regional and global climate through the revitalization of the temperate zone, with measurable benefits locally and globally. Carbon capture through sustainable farming practices such as remineralization and sustainable biologic growing techniques using living soil and fixed carbon has long term world wide benefits, one acre at a time.

A note about the author: Thomas Vanacore is the founder and CEO of Rock Dust Local, a regional source provider of rock dust minerals, clays, humate, biochar and other inputs for biologic growing practices. This article is copyrighted 2015 by Thomas Vanacore. The author grants permission for the contents to be reproduced, copied or reprinted for non commercial and educational use.