BEAR RIVER ZEOLITE BRZ™

FOR SOIL AMENDMENTS AND FERTILIZERS

Three products for recreational, agricultural and home applications:

BRZ™ Soil Amendment

Amended BRZ™

Molly Magic

Recreational Turfs and Grasses

Agricultural Crops

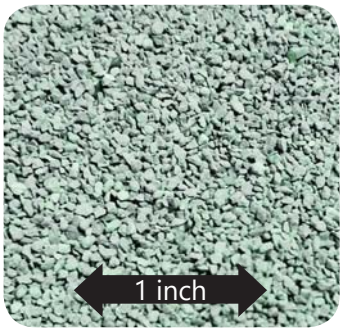
Lawns and Gardens

BEAR RIVER ZEOLITE, PO Box 643, 47 Cox Gulch Road, Thompson Falls, MT 59873
406-827-3523 • FAX: 406-827-3543 • www.bearriverzeolite.com • tfl3543@blackfoot.net

BRZ™ SOIL AMENDMENT

Bear River Zeolite BRZ™ Soil Amendment is a naturally occurring volcanic rock that contains clinoptilolite. The rock is drilled, blasted, crushed and screened to various sizes.

SPECIFICATIONS



BRZ™ 14 x 40

Clinoptilolite	>90%
Potash	4.19% (plant available but not water soluble)
Calcium	1.60 - 2.02% which is a pH buffer and plant nutrient
Sodium	<0.5% (not water soluble)
CEC (Cation Exchange Capacity)	190 to 220 meq/100 gram (as ammonium)
Surface Area	High surface area, 24.9 square meters/gram
Water Retention (maximum)	Absorbs up to 55% of its weight in water
Bulk Density	Approximately 55 - 60 pounds per cubic foot
pH	8.64
Specific Gravity	2.1 - 2.2 gm/cc
Hardness	Low clay, hard (Mohs No. 4), abrasion resistant

- BRZ™ is OMRI listed (Class: Crop Fertilizers and Soil Amendments, Product Number: ber-3083) and classified as GRAS (generally regarded as safe).

  CAUTION: Water must be added shortly after application. BRZ™ will adsorb existing water out of the soil and create a dry condition that may harm the plant. As with any fine dust, wear a mask to avoid inhalation and gloves to prevent drying of skin.

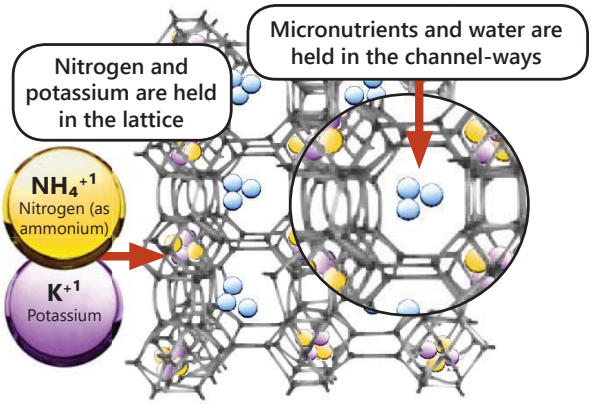
BENEFITS

Packaging	50 pound bags, 1 ton totes, and bulk
Particle Sizes (mesh)	8 x 40, 14 x 40, -14, -40

Holds Over 55% of Its Weight in Water:

- Conserves water from irrigation and rainfall
- Moisture is held in the growth zone

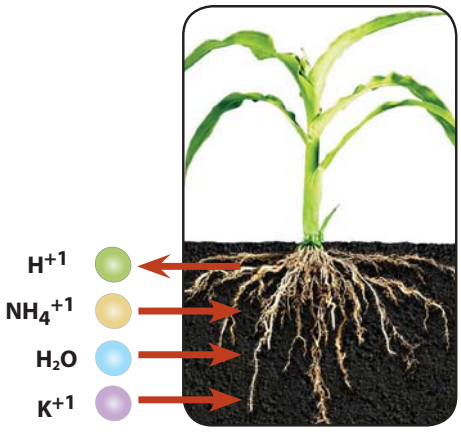
The High CEC (Cation Exchange Capacity) of BRZ™ allows it to hold nitrogen (ammonium) from applied fertilizer, reducing nitrogen losses.



BRZ™ lattice and channel-ways

The plant releases hydrogen (H^{+1}) during growth, which exchanges with ammonium (NH_4^{+1}) and potassium (K^{+1}) held in the BRZ™ lattice, which is plant accessible but not water soluble.

Available water (H_2O) is loosely held in the open pore spaces of the BRZ™ in the growth zone.



Improves Soil Conditions

- BRZ™ helps prevent compaction, increases infiltration, and helps the aeration of deep root systems due to its high surface area and porosity.
- BRZ™ has more cation-exchangeable potassium than any other natural clinoptilolite in the U.S.

Visually blends into lawns, and golf greens better than white material.

- BRZ™ is pale green in color, unlike many zeolites that are white.

APPLICATIONS

Use BRZ™ Soil Amendment to boost nutrient levels of poor quality soils with your amendment in field or top dressed prior to field application.

BRZ™ Soil Amendment can be spread by hand broadcasting or by other devices. Although top dressing works, generally it is better to mix the BRZ™ Soil Amendment in the top 2 to 4 inches of soil with a rototiller, spike tooth harrow, or a disc harrow. Plowing BRZ™ Soil Amendment in, places it deeper than necessary. For row crops such as corn or soybeans, BRZ™ Soil Amendment can be applied with a side disc or by side banding.

AMENDED BRZ™

Amended BRZ™ is a nitrogen and/or phosphate soil amendment for large application areas. Amended BRZ™ is preloaded with nitrogen or other amendments by special order. The product is also available without amendment for on-site customization by customers.

Packaging	50 pound bags, 1 ton totes, and bulk
Particle Sizes (mesh)	8 x 40, 14 x 40, 30 x 60, -14, -40
Amendment	2.5% nitrogen in the form of UAN32 (32% nitrogen - 50% urea - 50% ammonium nitrate)
Optional Amendments	Ammonium sulfate or other ammonium sources

BENEFITS

Holds applied nitrogen and phosphate as a result of Its high CEC (Cation Exchange Capacity)

- The required nitrogen fertilizer is reduced by the nitrogen held in the Amended BRZ™.
- Amended BRZ™ will hold nitrogen which helps prevent the pollution of the water table by nitrates and nitrites.
- Nitrogen from rainwater and subsequent fertilization application will recharge Amended BRZ™.

APPLICATIONS

Amended BRZ™ can be applied as a top dress, drilled in, plowed in, or side banded.

Construction of new golf course greens and tees, and large areas of turf, such as parks and sports fields.	For golf courses, replace 10 to 20% of the sand with an equal volume of Amended BRZ™. This should be applied in the top 2 to 4 inches of the soil. For top dressing, approximately 30 to 60 pounds should be applied per 1,000 square feet or 1,200 to 2,500 pounds per acre.
Enhance aerification after plugging	Apply 60 to 150 pounds of Amended BRZ™ per 1,000 square feet or 2,500 to 6,500 pounds per acre.
Crops and grasses	Successful improvements have been realized with as little as 1 ton of Amended BRZ™ per acre. Generally, 2 to 10 tons per acre are applied depending on the composition of the soil.

On-site amendment blending

BRZ™ soil amendment can also be purchased for amendment blending by the buyer to address specific soil deficiencies and/or problems. Recommended guidelines are listed below.

- Nitrogen (UAN32, ammonium sulfate, ammonium phosphate), potassium, carbon, manganese oxides, iron oxide, zinc, copper, selenium, etc. can be added to BRZ™ soil amendment in a fertilizer blender or sprayed into the BRZ™ soil amendment during blending if the source is a liquid.
- Field blending of the BRZ™ soil amendment with a nitrogen source may not be as efficient as blending in a fertilizer blender. Some of the nitrogen can leach through the soil rather than being exchanged in the BRZ™ soil amendment.
- Dry ammonium sulfate can be applied efficiently in a fertilizer blender by first dry blending the BRZ™ soil amendment with ammonium sulfate granules and then spraying in 10-15% by weight of water.

RECOMMENDED PRE-TESTING

Determine available nutrients and characteristics by testing soil.

Additional testing prior to use:
For large areas: Several 10 foot by 10 foot test plots should be marked out with stakes. Different amounts of the product should be used to determine the ideal application rate. For 100 square feet (10' x 10'), 4.6 pounds would represent 1 ton per acre, 9.2 pounds would be 2 tons per acre, etc. For certain high value crops and especially for sandy soils up to 10 tons of product are used per acre. In hydroponics application and specialized applications, as much as 90% of the product is mixed with 10% of the soil by volume.

MOLLY MAGIC RETAIL PRODUCT

Molly Magic is BRZ™ that can be purchased unamended or amended with 3% nitrogen in retail packaging for small areas, such as gardens, lawns and for retail sales at garden supply stores.

Packaging	22 pound (10 Kg) bags
Particle Size (mesh)	14 x 40
Coverage	One 22 pound bag will cover 175 square feet of lawn or 105 pounds of potting soil

BENEFITS

Molly Magic:

- Enhances fast and sustained growth
- Acts as a carrier to supply essential nutrients and water
- Increases soil porosity for aeration
- Retains nutrients in the growth zone where plants can access it as needed

APPLICATION

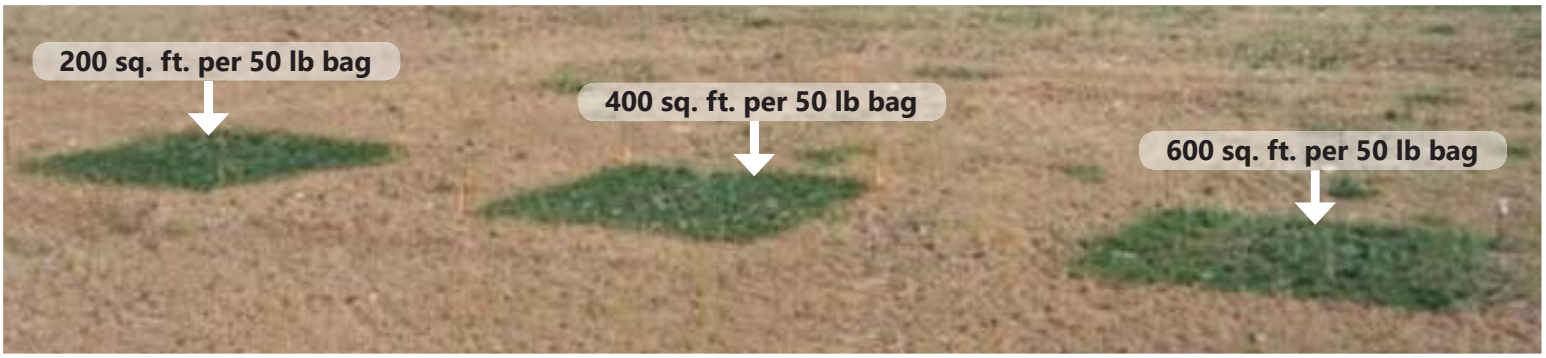
Molly Magic can be surface broadcast or mixed in the top 3 to 4 inches of soil. Always w**ater thoroughly after applying Molly Magic to create a moisture reservoir.**

 **New Lawns**	Till in 10 to 15 pounds per 100 square feet in the top 3 to 4 inches of soil before seeding or laying sod.
 **Existing Lawns**	Broadcast 10 to 15 pounds per 100 square feet.
 **Flower Gardens**	Till 10 to 15 pounds per 100 square feet into the top 6 inches of soil before seeding, planting, or transplanting.
 **Vegetable Gardens**	Till 10 to 15 pounds per 100 square feet into the top 6 inches of soil before seeding, planting, or transplanting.
 **Potting Soils**	Thoroughly mix 2 to 3 pounds with 10 pounds of potting soil.

FIELD TESTS

MOLLY MAGIC FIELD TEST - USAC RECLAMATION SITE

Molly Magic was field tested in 2002 as part of the Field Test USAC Pond Reclamation Field Test (see below).



The photo above shows the differences in the three application rates in 2003. The growth is greener in the 200 square feet per 50 pound test plot. All three areas had substantial and healthy growth after one year with just the 2002 application.

BRZ™ SOIL AMENDMENT IN USGA GREENMIX FIELD TEST

Tifton Physical Soil Testing Laboratory (Tifton, Georgia) November 01, 2002
Tests were conducted and reported for physical and particle analysis of a 90/10 sand/peat mix and a USGA (United States Golf Association) soil amendment mixed with BRZ™ Soil Amendment at 10%, 15%, and 20%, by volume.

NCDA (North Carolina Department of Agriculture) soil chemical analysis
Tests were also conducted by NCDA on a soil from a newly planted nursery green which was built with 20% BRZ™ Soil Amendment on half of the green and a sand/soil/peat mix on the other half. A soil sample from a green currently in play on the same course (G2 bent on 85:15 sand: peat mix) was also measured.

RESULTS
As expected, the BRZ™ Soil Amendment and greensmix performed better on both the physical tests and the chemical analyses than any of the other mixes; sand/peat, or sand/peat/soil.

Tifton Physical Test Notes:
- Saturated hydraulic conductivity increased as much as 2" per hour
- Capillary & non-cap pore space increased
- Water Retention at field capacity improved with BRZ™ Soil Amendment
- The greensmix improved as more BRZ™ Soil Amendment was added

NCDA Chemical Analysis Notes:
- The Cation Exchange Capacity improved significantly with the BRZ™
- Soil available potassium levels were raised
- Calcium levels were elevated vs. sand/peat but slightly less than mix on green currently in play

OBSERVATIONS
The physical and chemical performance of a greensmix is better with the addition of BRZ™ Soil Amendment.
- The performance of the mix improved as higher volumes of BRZ™ Soil Amendment were added.
- BRZ™ Soil Amendment with amended greensmix should be easier to maintain with less irrigation water and fertilizer applications,
- BRZ™ Soil Amendment can potentially reduce labor, play disruption and costs to maintain the greens.
- A reduction in fungicide application might also be possible due to the desiccant and antipathogenic properties of BRZ™ Soil Amendment.

For the newly established NCDA green, 100% turf coverage of the surface occurred three weeks earlier and the health of the turf and root system was visually evident.
- Color, density and leaf textures were more stable on the half of the new nursery green treated with BRZ™ Soil Amendment.
- Building a green with 5 to 10 percent BRZ™ Soil Amendment will speed establishment, improve long-term performance, and save money.

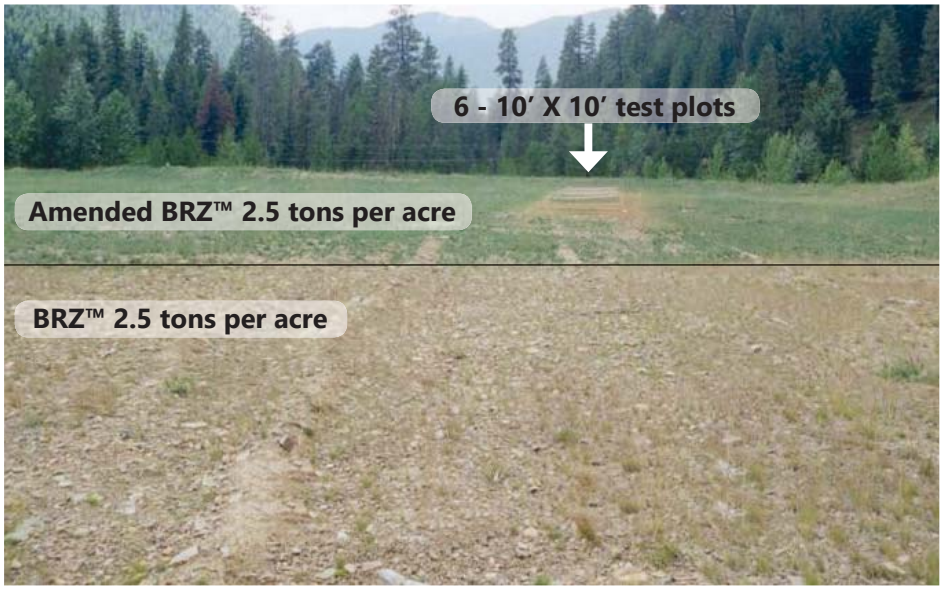
AMENDED BRZ™ FIELD TEST

USAC TAILINGS POND RECLAMATION SITE 2002

The United States Antimony Corporation (USAC) site was reclaimed and planted in 1999. No reseeding or fertilizing has been done since the original planting.

In July of 2002, the five acre site was divided into two equal portions of two and one half acres each. BRZ™ 14 x 40 was applied on one half. The other half received BRZ™ 14 x 40 amended with nitrogen in the form of UAN32.

The BRZ™ treatments were spread with a tractor using a three point hitch, PTO drive broadcast spreader at a rate of 2.5 tons per acre.



2002 BRZ™ TEST - USAC RECLAMATION SITE

FIELD TEST CONDITIONS

No soil was imported to the site from off the premises. All soil was borrowed from above the mill site, where it was dug from the side of the mountain on United States Antimony Corporation property.

Soil description

75% C zone classification made up of fractured phylites from the Prichard Formation. C zone soils are composed of poorly sorted rock with no nutrient value; 15% is made up of B zone material. This is the same material as C zone but broken down into a finer particle size; approximately 5% of the soil is made up of humus, which is broken down pine forest material.

Weather

The weather was hot and dry for approximately two weeks after the applications. The season remained hot and dry with minimal precipitation (refer to table at right).

Within two weeks after the late July rain, the amended side of the site began to turn dark green and grow profusely. Photos taken on August 29th, 2002 record the differences in color and growth between the two halves of the site.

In October the temperature dropped below zero and two inches of snow fell. The dark green color from the growth remained until snow covered the site.

MONTH	RAINFALL (inches)
July	0.40
August	2.05
September	0.10
October	0.30

USAC TAILINGS POND RECLAMATION SITE 2003

Nothing further was done to the site in 2003.

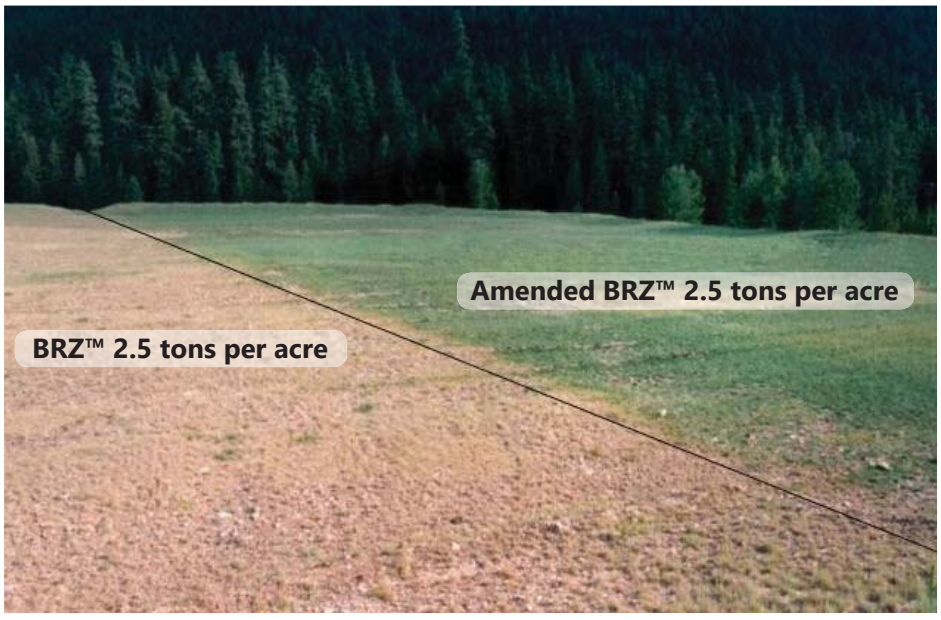
FIELD TEST OBSERVATIONS

The grass appeared from its' snow cover still green, appearing to have wintered well.

The difference was absolutely dramatic between the side treated with the unamended BRZ™ and the 3% nitrogen Amended BRZ™ side. It was obvious from the color and growth rate that the nutrient levels were sufficient on the Amended BRZ™ test side.

Elk and deer fed on the new growth daily. By counting the manure piles it was clear that 90% of the animal activity took place on the amended side of the site.

The grass turned brown and went to seed at the beginning of the regional hot dry period in mid July. At that time the grass still appeared to have enough nutrients for propagation to ensure good growth in 2004.



2003 BRZ™ TEST - USAC RECLAMATION SITE

TREATMENT OF HIGH SALINITY SOILS

INTRODUCTION

High salinity, sodic, and saline-sodic soils are worth very little or nothing. Other than oil and gas or mineral rights, the land is generally worthless.

SALINE SOIL PROBLEMS

- Soil salinity problems generally occur in semiarid or arid areas where there is not enough meteoric water to leach salts from the root zone of the plants.
- Saline soils may be reclaimed by providing good percolation, drainage, and good quality water to leach the salts.
- Saline-sodic soils behave differently than sodic soils and have different reclamation procedures.
- A saline soil is one in which there is an excess of soluble salts of calcium, magnesium, potassium, and sodium. They are generally sulfates, bicarbonates, or chlorides.
- Saline soils are a result of irrigating with high salinity water, a lowering water table that fails to leach the salts, surface migration of salts through a combination of capillary action and osmotic pressure from underlying saline deposits or soils, and evaporation of saline water bodies.
- When the concentration of salts in the soil solution equals or exceeds the osmotic concentration in the plant cells, water uptake is stopped and water moves out of the cells to create plasmolysis or "burning."
- Plants are more sensitive to high salinity during their germination and seedling stages than during later stages when they develop some immunity.
- Soil salinity measures all the ions in the soil (not just sodium), and it is measured by electrical conductivity (EC). The more the ions, the higher the salinity. It is measured in milliMhos (mmhos) per centimeter or millisiemens (mS) per centimeter. Some laboratories report it as milliequivalents per liter (meq/L). Cations are measured as milligrams in the laboratory and converted to milliequivalents to put the cations on an equal basis. The EC values in mmhos/cm or mS/cm are interpreted as follows:

EC LEVEL	PROBLEM
Below 2	No salinity problem
2-4	Restricts growth of sensitive crops
4-8	Restricts growth of many crops
8-16	Restricts growth of all but salt tolerant crops
Above 16	Only a few very tolerant crops make satisfactory yield

SODIC SOIL PROBLEMS

- When the percentage of sodium exceeds 15% of the cation exchange capacity of the soil, the soil is considered "sodic." The sodic condition retards or stops plant growth.
- Sodium, chloride, and boron are toxic ions for plants. Plants may display toxicity symptoms before they are effected by high salt concentrations.
- Sodium is generally toxic to plants at higher concentrations. The main problem with sodium is that it attaches to and disperses clays to restrict percolation.
- Soils with a high accumulation of sodium are characterized by having poor tilth and low permeability making them unfavorable for plant growth. When there is a high concentration of sodium, the ionic sodium attaches to clay particles and causes them to disperse and the permeability of the soil becomes very low.
- Sodic soils can be remediated by the application of gypsum or sulfur. In the case of gypsum, soluble calcium is provided to displace the sodium from the clay and to solubilize the sodium as sodium sulfate. In the case of elemental sulfur, there must be a reserve of free lime (calcium carbonate). The sulfur as a result of bacterial action forms sulfuric acid that attacks the calcium carbonate to provide calcium to displace the sodium from the clay, and solubilize the sodium as sodium sulfate. Generally, if the calcium carbonate content of the soil is less than 1.5% gypsum should be used; if the calcium carbonate content is between 1.5% and 2.5% either gypsum or sulfur can be used; and when the calcium carbonate content is greater than 2.5% sulfur is recommended. Again, the success of these amendments depend on the application of clean water.
- A sodic problem should be corrected prior to seeding.
- Plant growth is important for erosion control and phytoremediation (metals uptake)

SALINE-SODIC SOIL PROBLEMS

- Land application of produced water from conventional natural gas wells and coal bed methane gas wells has produced both sodic and saline soils.
- In the case of saline-sodic soils, it is likely that physical soil problems caused by the sodium (attaching to clays) restrict the leaching of the salts. This can be a significant problem even in wetter climates. Saline soils can be reclaimed in semi-arid and arid climates under the right conditions.

APPROACH TO PROBLEM

We will assume that water is not available due to the cost of irrigating, the fact that it is an arid area with little rainfall, or the possibility that the well or surface water is saline. This excludes the approach of decreasing the salinity by leaching. The lack of water also preempts the reduction of the sodium by applying gypsum or sulfur.

This scenario leaves another approach: to decrease the content of the salt by applying a cation exchange amendment to absorb the sodium and allow the germination and seedling growth of salt tolerant species. To test this theory, a Canadian group spread a layer one eighth to one quarter of an inch thick of a 30% clinoptilolite product over the soil. At one eighth inch this would amount to 12 tons per acre (tpa), and this application rate would only be economic for a very limited market. What grass was available grew very well. A 90% plus clinoptilolite product such as BRZ™ should reduce the amount of zeolite used. Hopefully the application rate could be cut to 2.5 to 6 tpa depending on the amount of the salinity.

PROPOSED TEST

A sodic area should be mapped into a 10 foot by 10-foot square grid using steel rebar posts. At least three replicates of each test should be planted. The tests should include varying amounts of zeolite, perhaps 2.5, 5, and 7.5 tpa top-dressed. Additional testing options could include:

- Simultaneous and delayed seeding
- Areas where native grasses are already established but are doing poorly
- Typical crops currently being used in surrounding areas such as canola, corn, wheat, barley, timothy, or brome
- Testing of some of the alkali-adapted species (in the table below)

Inland salt grass	Alkali grass	Hordeum brachyantherum
Newhy hybrid wheatgrass	Nuttall alkaligrass	Elymus triticoides
Tall fescue	Tall wheatgrass	Agropyron smithii
Meadow barley	Distichlis spicata	Puccinellia distans
Creeping wildrye	Agropyron hoffmannii	Puccinellia nuttaliana
Western wheatgrass	Festuca arundinacea	Agropyron elogatum

CONCLUSIONS

While the proposed process is the result of physical activities, the reactions are still largely chemical. The calcium and potassium from the Amended BRZ™ will exchange with the sodium in the sodic soil. In order for the process to continue, the sodium forced off of the exchange process becomes “soluble” sodium rather than “exchangeable” sodium and some leaching of the sodium must still be accomplished for the exchange to continue. The efficiency of this process will be governed by a number of factors including the soil particle size or texture, natural and man made salt content of the soil, Amended BRZ™ size and application rate, and the availability of water. Remediation can be accomplished in semi-arid and arid climates.

Soils high in clay content are most adversely affected by the presence of sodium and salts. Sodium only has effects on soil clays. Soils that are sandy are largely unaffected by sodium. High clay content soils are difficult to leach salts through even in the absence of sodium. The addition of Amended BRZ™ will help ameliorate the effects of high clay content.

Sodium in the absence of significant salts, causes clays to swell and/or disperse and translocate through the soil profile. If only swelling has occurred, the effects of high sodium are reversible. Dispersion and translocation of clays due to sodium are generally irreversible. Salts have a negative impact on soils. However, salts tend to flocculate soil clays and negate the swelling and dispersion. The key is to balance the level of salts so that they do not become a toxic issue.

The application rate for the zeolites can be calculated on both a chemical and physical basis. Application rates should be based on a cation exchange goal. Knowing the sodium level of the soils and the exchangeable calcium, magnesium, and potassium level of the zeolite allows for the calculation of the amount of zeolite needed. Testing is very important in determining the best size fraction and application rates for the zeolite in relation to improving the soil hydraulic properties in addition to allowing for the most efficient chemical exchange.

Additional Information on file at Bear River Zeolite Co.