



BIOSOL[®]

& BIOSOL MIX[®]

All Natural Organic Fertilizer

In order for reclamation to be truly successful, the processes of primary production and decomposition must be restored as quickly as possible following a disturbance and must be self-sustaining over the long term. The long term success of any revegetation program truly depends on being able to improve on-site growing conditions, i.e., re-establish bioactivity within the growing medium, ... the soil.

Traditional approaches to re-establishing vegetation on disturbed sites have included regular maintenance fertilization programs in which mineral fertilizers are applied at regular intervals ranging from 1 to 3 years. A problem with this approach is that it is very difficult to wean re-establishing vegetation from this program. Furthermore, experience is showing that repeated applications of mineral fertilizers actually deplete the soil of its life supporting organic component resulting in a decline in vegetation density.

In recent years, several products have emerged that claim to promote reactivation of biological activity in damaged or degraded soils. None, however, has shown an ability to truly influence and sustain site fertility more than a group of fertilizers generally referred to as bio-organic. Among this group is the organic fertilizer BIOSOL®. In field trials conducted at various locations throughout western Canada, this author has found that sites treated with BIOSOL® consistently show increased levels of healthy,

vigorous vegetation in excess of that demonstrated by the several mineral fertilizers similarly tested. Perhaps even more impressive is the fact that depending on the severity of degradation of a site, self-sustaining natural biological activity can be reinstalled in disturbed soil with a minimum of treatments.

With environmental quality increasingly being addressed in legislation specific to reclamation/revegetation and landholders/operators being held responsible for reclamation success for long

periods of time, industry is actively seeking alternatives to mineral fertilizers. Biosol is considered to be ecologically superior to mineral fertilizers because of its slow uniform release and low heavy metal values. BIOSOL® is also deemed more environmentally appropriate than other organics. The rapid nitrogen release and solvent action of mineral fertilizers render them inappropriate for use in watersheds where there is potential to contaminate potable water supplies.

"...this author has found that sites treated with BIOSOL® consistently show increased levels of healthy, vigorous vegetation in excess of that demonstrated by the several mineral fertilizers similarly tested."

In the opinion of this author, BIOSOL® can truly influence and sustain site fertility to achieve a cost effective, permanent and environmentally compatible cover of vegetation on disturbed sites.

***B.P. (Brian) Adams, BSF, Bioengineering
Managing Director***

NUTRIENT RATIO

N-P-K = 6-1-3

Specifications

Organic Substance	>70%
Nitrogen (total)	> 6%
Nitrogen (water soluble)	<0.5%
Phosphorus (P ₂ O ₅)	1-2%
Soluble Potash (K ₂ O).....	3-4%
Carbon/Nitrogen Ratio	6:1
PH Level	5-6

Biosol nutrients are not derived from nor contain any animal waste or animal by-products.

OMRI (Organic Materials Review Institute) listed for certified organic farming.

Composition

96% fungal biomass (dry mycelium), 1% water, and 3% potassium-magnesia.

Properties

Slow release of the organically bound nitrogen provides sufficient supply of this vital nutrient to plants. There is a positive effect on the formation of humus, root mass, and the living microbial biomass. This results in far lower concentrations of nitrate in ground water than mineral fertilizers.

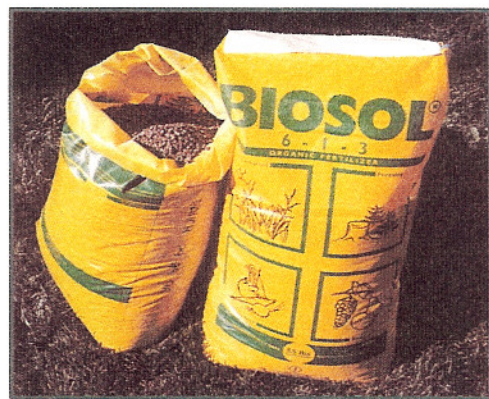
Unlike many natural fertilizers, BIOSOL® is easy to transport and to use. The product is packaged in sturdy plastic bags or one ton super sacks. BIOSOL® is granulated and suitable for all standard application methods, including hydroseeding. BIOSOL® will not burn seed or existing vegetation and does not have to be watered after application.

CALIFORNIA CERTIFIED ORGANIC FARMERS, INC. HAS APPROVED AND CERTIFIED BIOSOL® FOR USE IN ORGANIC FARMING. IT HAS ALSO BEEN APPROVED IN COLORADO, WASHINGTON, OREGON AND MASSACHUSETTS.

GENERAL DESCRIPTION

Manufacture

During the manufacture of penicillin, a fungal biomass (mycelium) is obtained by the fermentation of raw materials such as: soybean meal, cottonseed meal, sucrose, lactose, trace elements and vitamins under constant sterile conditions. The fungus strain used is *Penicillium Chrysogenum*. After the Penicillin is removed, the remaining biomass is dried at 110 to 130 degrees centigrade for 3 to 4 hours. During this process the residual antibiotic is eliminated and the moisture is reduced by 3 to 6%. Then, 3% potassium-magnesia, from a naturally occurring source, is added to the dried biomass (dry mycelium). Finally, the mixture is granulated and placed in 55 pound recyclable plastic bags.



BIOSOL® is packaged in 55 pound recyclable bags for easy transport or one ton super sacks.

NUTRIENT RATIO**N-P-K = 7-2-3****Specifications**

Organic Substance	>80%
Nitrogen (total)	>7%
Nitrogen (water soluble)	<0.5%
Phosphorus (P ₂ O ₅)	2%
Soluble Potash (K ₂ O).....	3%
Carbon/Nitrogen Ratio	6:1
PH Level	approximately 5.4

Biosol Mix nutrients are not derived from nor contain any animal waste or animal by-products.

Composition

96% fungal and bacterial biomass,
4% water.

Properties

Slow release of the organically bound nitrogen provides sufficient supply of this vital nutrient to plants. There is a positive effect on the formation of humus, root mass, and the living microbial biomass. This results in far lower concentrations of nitrate in ground water than mineral fertilizers.

BIOSOL MIX®, like its counter-part, is easy to transport and to use. The product is packaged in sturdy plastic bags which may be recycled. BIOSOL MIX® is granulated and suitable for all standard application methods, including hydroseeding. BIOSOL MIX® will not burn seed or existing vegetation and does not have to be watered after application.

BIOSOL MIX® accommodates the need for a slightly faster nitrogen release rate. In some cases this attribute, combined with a lower price, offers an attractive alternative to BIOSOL®.

GENERAL DESCRIPTION**Manufacture**

During the manufacture of various antibiotics, enzymes, proteins, etc. a nutrient broth is extracted from the active ingredients. The broth then undergoes a second fermentation of 20 - 24 hours in which the dissolved nutrients are bound in a bacterial biomass. The biomass is then separated with decanters and bentonite is added. The mass is then dried at 110 - 130° C for approximately 4 - 6 hours. Then it is mixed with a 50% fungal biomass (see BIOSOL® general description, please note that potassium magnesia is not added to BIOSOL MIX®), granulated and filled into 55 pound (25 kg) recyclable plastic bags.



BIOSOL MIX® is packaged in 55 pound recyclable bags for easy transport or one ton super sacks.

RESEARCH PROVEN!

BIOSOL AND BIOSOL MIX RESEARCH SUMMARIES

HUMUS GROWTH — *BUILDS HUMUS 7 TIMES FASTER THAN NATURAL SUCCESSION*

Five years after one application of Biosol Mix & Biosol, the microbial biomass equaled 37 and 34 years of natural succession.

ROOT FORMATION & NUTRITIONAL CONDITION — *FORMS A MORE COMPLEX ROOT SYSTEM FOR PLANTS*

Biosol is perfectly well tolerated by plants, which responded with better growth, a deeper green of the needles, the formation of a more complex root system, and a well balanced nutritional condition.

TIED UP TNT

Application of 2% Biosol with compost resulted in a decrease of 72%-83% for the total amount of TNT and the water extractable amount of TNT.

PH CONCENTRATION — *REDUCES PH OR SALT CONCENTRATIONS IN SOIL*

The positive effects of Biosol may have been able to reduce ph or salt concentrations in the soil solution, or improved physical stability due to the formation of stable aggregates.

TREE FERTILIZATION — *INCREASES CANOPY OF TREE AND SHRUBS*

Due to its slow release characteristics BIOSOL is considered superior to soluble inorganic fertilizers for high elevation sites with soils of low absorption capacity and high leaching potential.

IRON DEFICIENCIES

Biosol and Biosol Mix fertilizers alleviate iron nutrition deficiencies of the plants when the level of available iron is low. In another trial in a vineyard it was observed that chlorosis (iron deficiency) of grapes was reduced after fertilization with Biosol.

DISEASE RESISTANCE — *REDUCES FUNGAL DISEASES IN THE TURF • REDUCES IRON CHLOROSIS IN TURF*

Dry fungal biomass of dried mycelium (Biosol) is not only an organic fertilizer providing nutrients to crop plants and improving humus in the soil, but also a good inducer of resistance against root diseases such as Fusarium wilt. Its application may have multiple effects for both crop nutrition and crop protection. It was recently reported that dried mycelium applied to the soil protected corn plants against fusarium.

NEMATODE CONTROL — *CONTROLS NEMATODES IN SOIL*

Dry fungal biomass of dried mycelium (Biosol) seems to provide partial control of nematodes under natural conditions. Partial control may gradually build up to almost complete control of the nematode in the following season if treatments of dry mycelium are repeated. Such a strategy may well fit in with nematode control in Organic farming.

PLANT GROWTH

Dry mycelium was proved by this study, as well as other studies to behave as an efficient organic fertilizer. Plant growth was enhanced several fold in treated plots compared to controls. DM significantly reduced galling by 40%-53%.

ROOT & SHOOT GROWTH

Shoot growth of tomato was enhanced relative to controls by 150%-173%. Shoot fresh weight was increased by 159%-251%.

*To read or review updated research results please visit our website at
www.rockymtnbioproducts.com/research*

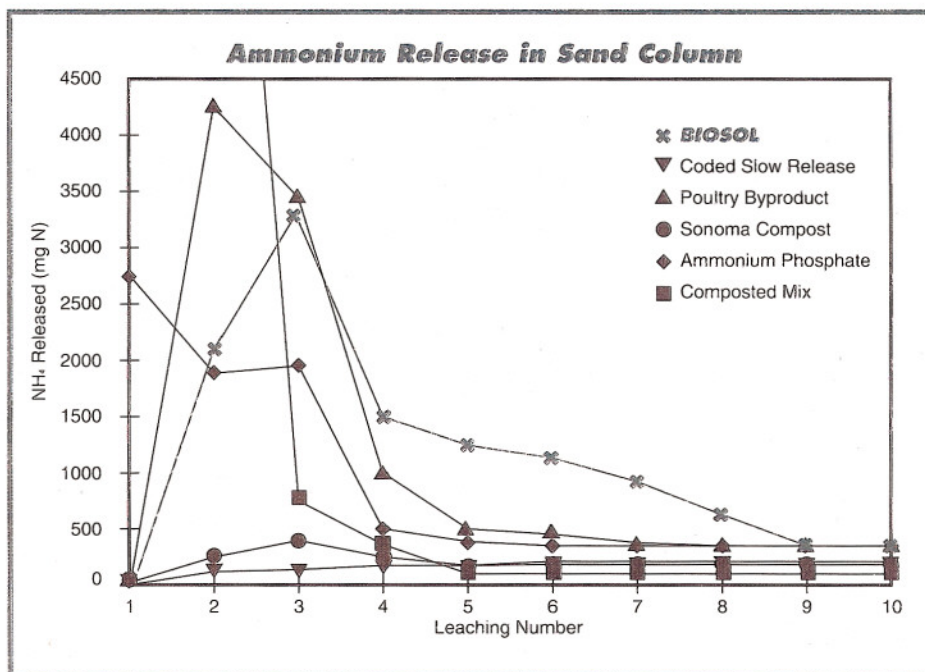
REVEGETATION OF DEGRADED SITES

By: Dr. Vic Claassen and Michael Hogan, UC-Davis Soils and Revegetation Group

Revegetation of drastically disturbed sites is often limited by long term nitrogen (N) availability (Bradshaw, 1987, Reeder and Sabey, 1987). Initial plant growth declines as the fertilizer amendments that are typically used become depleted. Because undisturbed, native soils store large amounts of N in their organic matter fractions, sufficient soil N levels must be regenerated on these disturbed sites in order for sustained growth to occur.

A research program at the University of California, Davis involves measurement of soil N levels associated with stable, perennial revegetated sites. The study focuses on decomposed granite and volcanic parent materials in the Sierra Nevada mountains around Lake Tahoe. The objective is to identify the soil N levels that are sufficient for sustained revegetation. Various organic amendments are then evaluated for their ability to replace the N and organic matter that was lost during disturbance. A slow N release rate is preferred for revegetation with natives and/or perennials since their growth rate is typically slower than that of annuals and invasive weeds.

Amendments are being screened in sand columns designed to compare the rates of N release with periodic leaching (i.e. rainfall) events. Preliminary data indicate that the organic amendments vary considerably in their N release rates. Several of the organic materials release N nearly as rapidly as the control material, ammonium phosphate. The fungal hyphal material reaches its maximum N release later than other organic amendments and has a longer residual mineralization curve. The initial release is attributed to mineralization of proteins in the fungal biomass, followed by slower mineralization of the N rich fungal cell wall material. This biochemical makeup may be important, since amendments with other organic formulations had faster release rates.



Release of N from organic amendments in sand leaching columns. Each organic material is loaded at a rate equivalent to 30kg N ha⁻¹ and was leached twice weekly with 1.4 pore volumes of distilled water. Key to treatments: Data are means of three replicate columns. (Hogan MP and Claassen VP, 1996. Agronomy Abstracts, Indianapolis, IN)

CASE STUDY: BATTLE MOUNTAIN

AWARD WINNING RECLAMATION PROJECT: BATTLE MOUNTAIN GOLD, NEVADA

Application Rates:

BIOSOL MIX®: 1,800 lbs. per acre

Native Seed Mix: 40 lbs. per acre

- Seed was worked into soil.
- BIOSOL MIX® applied dry.
- No mulch was added

BEFORE BIOSOL MIX®



5 MONTHS AFTER BIOSOL MIX®



5 YEARS AFTER BIOSOL MIX®

No additional fertilizer or maintenance after initial application.



CASE STUDY: BERTHOUD PASS

ROAD CUT ON BERTHOUD PASS, COLORADO

Elevation:	11,000 feet
Slope:	2-1
Soil:	Poor, rocky soil on one half and topsoil added on the other half.
Application Rates:	BIOSOL®: 1,800 lbs. per acre
	High Altitude Seed Mix: 43 lbs. per acre
	Straw Mulch: 1,500 lbs. per acre

In conducting this test, topsoil was added to one side of a plot while the other side was left in its original state with poor, rocky soil. The dotted line in the photo below of the site prior to the test indicates the dividing line between the two sides. Topsoil on the right, none on the left. The site was seeded, fertilized and mulched on September 17, 1987. No water was supplied other than natural rain and snowfall.

After less than one year on August 22, 1988 the results were impressive (photo at top right). It is important to note that vegetation on the side without topsoil is essentially weed free and while the side with topsoil appears to have more dense growth, it also contains a large amount of weeds. Since the seed mix applied was free of weed seeds, it can be concluded that the weed seeds were present in the topsoil that was added.

Eight years later, a closeup of the plot without topsoil reflects continued healthy growth. No additional BIOSOL® or other fertilizers were added since the original application in 1987. The photo at bottom right was taken in August, 1996. The results of this test show that it is possible to achieve successful growth without the addition of costly topsoil to disturbed areas.



BEFORE BIOSOL®
Site before the test in 1987.



Closeup of original soil condition.

2003 IECA AWARD WINNING PROJECT

1 YEAR AFTER BIOSOL®



8 YEARS AFTER BIOSOL®

Closeup of test plot without topsoil.



19 YEARS AFTER BIOSOL®

CASE STUDY: SWIFT GULCH

SWIFT GULCH - AVON, COLORADO

Application Rates: BIOSOL®:

Native Dry Mountain Mix:

Straw Mulch:

Organic Tackifier:

1,200 lbs. per acre

50 lbs. per acre

1,800 lbs. per acre

150 lbs. per acre



BEFORE BIOSOL®

Approximately 3000 yards of fill was taken from this hill and no topsoil was available for replacement. The slope was hydroseeded with the above application rates. Excellent vegetation was established after only one year.



3 YEARS AFTER BIOSOL®



6 YEARS AFTER BIOSOL®

No additional fertilizer or maintenance after initial application.



12 YEARS AFTER BIOSOL®

CASE STUDY: ROAD CUT IN AUSTRIA

ROAD CUT IN AUSTRIA

Application Rates: BIOSOL®:	1,800 lbs. per acre
Native Seed Mix:	40 lbs. per acre
Soil Stabilizer:	200 lbs. per acre
Peat Moss:	300 lbs. per acre
• All products applied with hydroseeder.	

BEFORE BIOSOL®



1 YEAR AFTER BIOSOL®

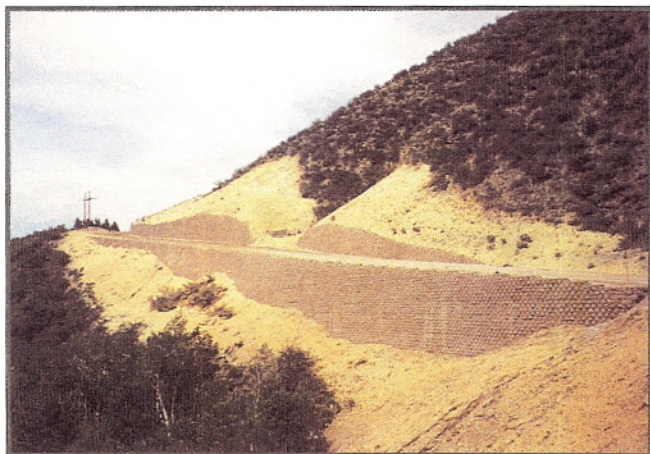


CASE STUDY: MOUNTAIN STAR

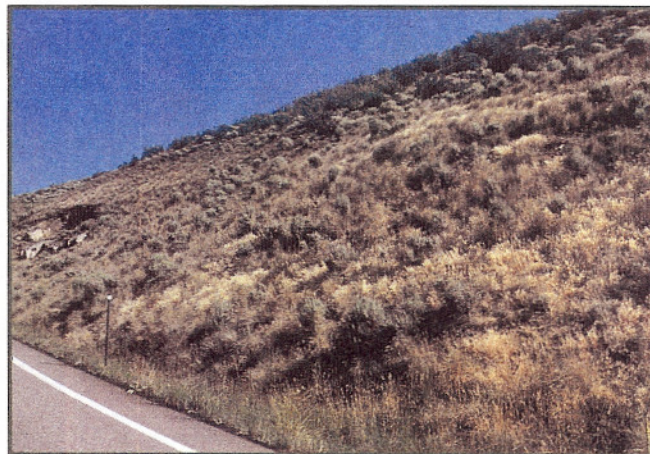
MOUNTAIN STAR - AVON, COLORADO

Elevation: 8,600 feet
Application Rates: BIOSOL®:
Native Seed Mix:
Straw Mulch:
Organic Tackifier:

1,300 lbs. per acre
50 lbs. per acre
2,000 lbs. per acre
150 lbs. per acre



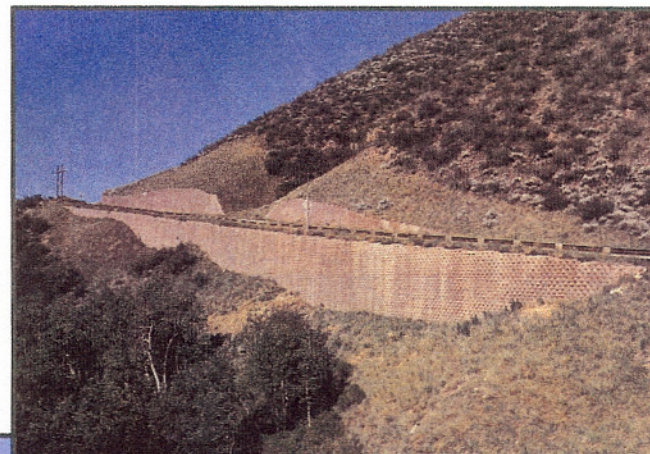
BEFORE BIOSOL®



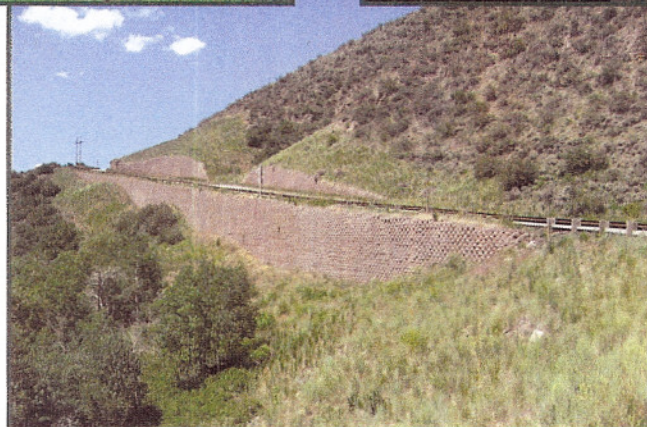
After one initial application and no maintenance fertilizer, our goal of returning the landscape to its natural surroundings was accomplished.



**2 YEARS
AFTER BIOSOL®**



**6 YEARS
AFTER BIOSOL®**



**12 YEARS
AFTER BIOSOL®**

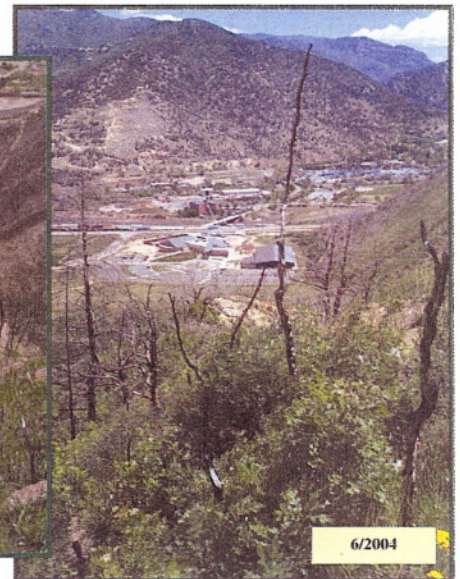
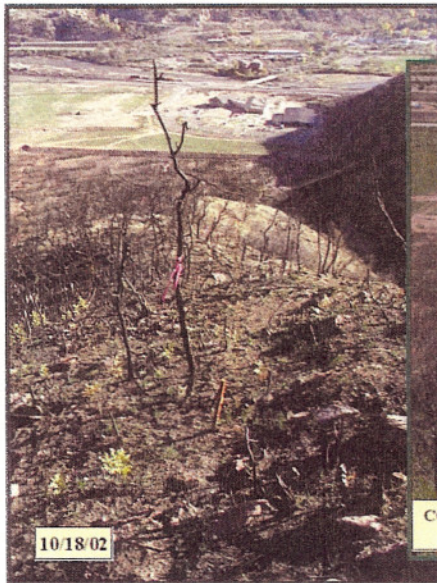
SUCCESSFUL POST-FIRE REVEGETATION

SPECIFICATIONS FOR COAL SEAM FIRE REVEGETATION

Application Rates: *All amounts are per acre quantities:*

- Elevation: 5,746 feet
- 1000 lbs. Wood Mulch
- 400 lbs. Biosol All Natural Organic Fertilizer
- 60 lbs. SuperTack Organic Tackifier
- 50 lbs. of seed

"After one year 70% of our seed had germinated" Dan Sokal, BLM



"After two years the plots were difficult to find due to the re-growth despite the fact they were marked with 18-inch wooden stakes." Steve Bennett, BLM



APPLICATIONS

REVEGETATION OF DISTURBED AND HEALTHY SOILS WITH LOW HUMUS CONTENT

Mining Reclamation, Road Cut Revegetation, High Altitude Revegetation

- BIOSOL® and BIOSOL MIX® are used for both primary and secondary fertilization.
- BIOSOL® and BIOSOL MIX® stimulate micro organisms.
They can be dry broadcasted or applied with a hydroseeder.
There is no appreciable difference in the results.
- BIOSOL® and BIOSOL MIX® should always be applied topically.

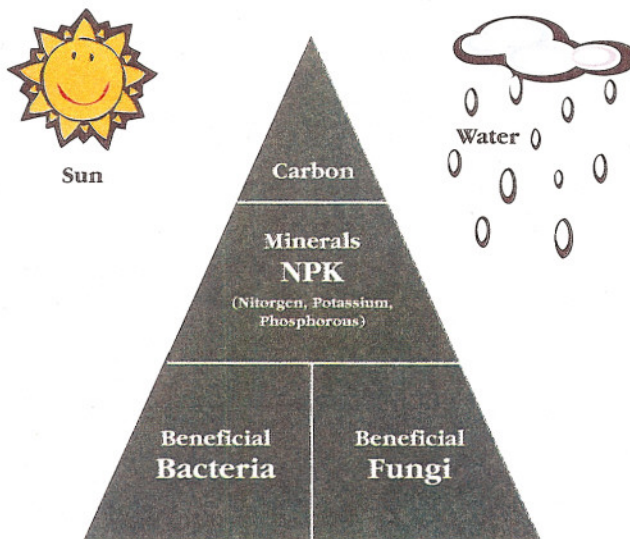
Application Rates: 1,300 - 2,000 lbs. per acre, primary fertilization.
800 - 1,300 lbs. per acre, secondary fertilization.

Other Uses: Ski run vegetation
Landscaping - trees and turf
Forestry
Native grasses
Gardening - flower and vegetable
Certified organic farming

To see all applications and application rates visit
www.rockymtnbioproducts.com

What makes BIOSOL® different?

THE 100% ALL-PURPOSE NATURAL ORGANIC FERTILIZER



Biosol fertilizer pyramid

BIOSOL PROVIDES 4 OF THE 6 ESSENTIAL CONDITIONS NEEDED FOR HEALTHY LIVING SOIL.

BIOSOL® was developed the same way slow release vitamins were developed for humans. It's slow uniform release mimics the natural growing cycle of plants making nutrients more readily available for root absorption.

AUTHORIZED DISTRIBUTOR



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