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The Greening of the Trail

A by-product of penicillin manufacture may be
the answer to revegetating stubborn alpine soils.

by David Rowan

Where there had been dry, brown, alpine soil — pitifully lacking in humus or any moisture-retentive organic material, and low in all nutritive substances, full of rocks — now there was the magic of green, a miraculous patch of emerald Ireland in the middle of a ski slope that otherwise was barren and lifeless.

The miracle-worker is the bi-product of the manufacture of another miracle-worker: penicillin. More specifically, it is a microbial biomass from the mycelial fungus *Penicillium chrysogenum* which is dried, treated, granulated and then marketed as Biosol[®], a product of Biochemie of Kundl, Austria.

For some seven years the product has been developed, scientifically tested, used and evaluated in Austria, with ski slope experts from around the world looking over their shoulders. Biosol is now available in North America, and considerable testing is underway in connection with this.

Indeed, it is not only the ski world that is interested: highway departments

have the same problems of revegetating disturbed soil, for instance. And there is an intriguing possibility that Biosol may have a spectacular regenerative effect on trees that have been weakened by acid rain.

A paper jointly written by Michael Manhart, an engineer with the Austrian ski resort of Lech, and Dr. Stefan Naschberger, of Biochemie, brings out an important point about the terrain with which ski resorts deal.

"Undisturbed alpine soil has extremely high humus contents, and therefore also high nutrient contents. This explains why the autochthonous [indigenous] flora is often species-rich and grows also without fertilization." But, when worked over by bulldozers in the development of ski runs, this top soil tends to get "buried under a layer of one or several meters of humusless raw soil, poor in nutritive substances." They point out that there is likely to be a "large proportion of stony material . . . which means that the humus content can be

reduced by up to 90 percent as compared to natural, undisturbed soil."

The data showed that the average humus content on prepared ski slopes at six Austrian ski resorts was 2.33 percent, whereas undisturbed soil at these same locations averaged 14.7 percent. The available data in North America showed an average of two percent humus on ski runs at Panorama Ski Area in the Canadian Rockies, and 1.7 percent in the ski runs at Vail — the latter measurement carried out by Soil Testing Laboratory in Fort Collins, Co., which also demonstrated extremely low levels of magnesium and potassium. "From the examples chosen," conclude Manhart and Naschberger, "it can be seen that soil conditions in the U.S.A. and Canada are by no means better than in the Alps. The fact that precipitation is low, and its seasonal distribution unfavorable, constitutes yet another problem."

The exact way that Biosol works is not wholly understood, but it should be

A Range Scientist Reviews Biosol

by Edward F. Redente, Ph.D.
Colorado State University

A critical ingredient for establishing new ski runs and maintaining existing runs is successful revegetation, ski run construction can lead to excessive soil loss due to water erosion which causes not only on-site problems but off-site impacts as well, such as increased stream sedimentation. Successful revegetation of ski slopes is the most economical and environmentally acceptable approach to control erosion and assure long-term slope stability. Many advances have been made in revegetation technology over the past ten years. Perhaps the most important has been the introduction of plant materials (seeds) of species that are highly adapted to high elevation sites. In addition, we have seen the development of new reclamation equipment, planting techniques and erosion control practices. At present

a new product has reached the market place that could make mineral fertilizer obsolete for ski slope revegetation. The product is called Biosol.

The application of Biosol provides an important source of organic matter and regular application of this product leads to an annual increase in humus of 0.2 to 0.3 percent. This build up of humus in the soil is critical for successful revegetation over the long term. This is especially true on high elevation ski slopes where topsoil is absent or poorly developed. Organic matter provides the nutrient and energy source for soil microorganisms to properly function in their role of releasing nutrients for sustained plant growth.

How Well Does Biosol Work?

This author has seen the fantastic results of using Biosol in the U.S. and

in Austria. Ski slopes treated with Biosol show consistently greater plant production, higher ground cover and more vigorous and healthier vegetation than areas similarly treated with inorganic fertilizer. In fact, the more difficult the site is to revegetate the more dramatic the difference is between Biosol and another commercially available fertilizers. Biosol, without question produces a more biologically active soil which results in more fertile conditions and more vigorous plant growth.

Extensive research has been conducted by scientists at the University of Innsbruck and the University of Salzburg. Published results are available and show conclusively that Biosol is superior in producing more fertile soil and greater and more rapid plant growth than inorganic and other organic fertilizers tested.

thought of basically as an organic fertilizer. According to the manufacturer's specifications, it contains at least the following nutrients, expressed as percentages of dry substance:

Organic substance	70 percent
Nitrogen,	6
organically based	
Phosphorus	1.5
Potassium	3.25

The difference between this product and a chemical fertilizer with equivalent values of nitrogen, phosphorus and potassium is the 70 percent organic content, which becomes the basic building block for the formation of humus. The organically fixed nitrogen is released with the help of microorganisms at a rate determined by the soil temperature and moisture. As Manhart/Naschberger point out, "Biosol acts slowly and in accordance with the demands of the plants. Some residual activity is clearly noticeable in the second year."

Apart from its fertilizing capability, Biosol acts as a soil stabilizer by playing an enabling role in the inter-related cause and effect of improved moisture retention and higher germination rate. In turn, this helps with erosion control.

In germination tests of red fescue seed, complete with the simulation of the cold weather and poor soil conditions one might expect on a ski trail, it took the Biosol-treated medium 44 days to get 70-80 percent germination, whereas after the same period the untreated

soil had only generated 35 percent germination.

How does all of this translate in practical terms to ski areas? First of all, the old methods of liming, seeding and fertilizing are not all out of the window. These are still basic, and the research and experience of the past 20 years is invaluable, sound and still right on target. But in a product like Biosol our industry has a new tool for revegetating and maintaining key spots that, for whatever reasons, are unresponsive to conventional treatment.

David "Augie" Augusiewicz, Summer Construction Foreman for Vail/Beaver Creek, who has been to Europe to observe Biosol results and has had his own test plots at Beaver Creek, says he has logs of sections of trails he is treating or plans to treat, "but at about \$700 per acre, you don't cover the whole resort. It's an excellent product, long-lasting and gives you a quick green-up on rocky spots where you get no spring water. It's great stuff. Looks like a thick layer of top soil after you've put it down."

The cost factor that Augie mentions is something of a variable for several reasons. First is the rate of application, which will depend on the site-specific need. Typically, this will range from 1,300 to 1,800 lbs/acre for first application, with follow-up applications at a considerably lower rate. Other variables are quantity discounts and the exchange rate on the dollar.

For planning purposes, Augie's figure

of \$700 per acre is good rule of thumb, remembering that it might be anywhere from \$500 to \$800.

The methods of applying Biosol include dry broadcasting and hydroseeding. The choice is a function of size of area to be covered, its gradient and accessibility. End results seem to be identical.

In Europe, there is a preference for applying Biosol in conjunction with a soil stabilizer consisting of a liquid plastic (polybutadiene oil), especially on very steep slopes. Terravest is one trade name. Again, back to Manhart/Naschberger: "Today, regeneration by hydroseeding with Biosol and Terravest is becoming more and more popular . . . if necessary, magnesium and lime have to be added . . . After the components have been mixed together thoroughly, the mixture is evenly spread over the area to be revegetated by spraying under high pressure. This method . . . is neither expensive nor labor-intensive, and in most cases the results obtained are better than those of conventional methods."

No opinions on this have been hardened by North American experts, where dry broadcasting of Biosol alone has been the rule in the limited applications to date. ■

For more information about Biosol consult the following North American sales sources: *In the U.S.:* Rocky Mountain Bio-Products, Inc., P.O. Box 608, Edwards, CO 81632, (303) 926-3363. *In Canada:* Can-Green Services, Suite 502-600-1 St. N.E., Calgary, Alberta, Canada, T2E 3B3, (403) 230-9158.



Shot 6/30/87 before Biosol application



Shot 8/20/87 after Biosol application



Shot 9/24/87 after Biosol application



This slope at Beaver Creek, CO is at 9,600 feet. It was originally cut, seeded and fertilized (mineral) in 1982. Soil is very poor and rocky. Sixty pounds of Biosol was applied to a 25-foot square test plot and extra seed applied on the land around the plot. Photos show the slope before Biosol application, seven weeks after and twelve weeks after. Quality of the cover is evident in the close-ups.

