

# The Living Soil

Volume 1, Issue 1, Summer 2002

An Advanced Microbial Solutions Production



Left: A salt-affected cotton field. Right: An adjacent plot after treatment with SuperBio®, a biological soil amendment.

## Salt - A Growing Problem

The agricultural industry has a long history of innovations. Few of those innovations, however, can rival the impact of mass-produced chemical fertilizers. Since first appearing on the agricultural scene in the early 1920's, the global fertilizer market has seen explosive growth. Global consumption of chemical fertilizers has grown from roughly 10 million tons in 1945 to nearly 150 million tons in 2000 – and could reach 180 million tons in the next few years. Asia, alone, has witnessed a 600% increase in the use of chemical fertilizers in the past 30 years. The

numbers are staggering – a massive global industry valued at over \$80 billion per year.

The use of these mass-produced and mass-distributed fertilizers has been at the core of a revolution in agricultural practices. And there is little doubt that these innovations, collectively, have proven to be an invaluable boon to the industry. Yields have increased dramatically. For example, advances in genetics and plant selection have more than doubled row-crop and cereal grain

yields on a national basis. As modern agricultural practices have touched every corner of the globe, marginal producing areas have been turned into productive ones. As a central part of modern farming protocols, the effect of chemical fertilizers has been profound – an unmatched contribution to helping feed the world!

But now, the global agricultural community faces an ironic new challenge. One impact of applying chemical fertilizers has been the

(Continued on page 2)

### IN THIS ISSUE

Ask Dr. Bob.....2

How a Texas Peanut Grower Increased Yields and Profits.....3

Soil Types.....3

How Salt Affects Soil .....4

## Welcome to The Living Soil

Rich, healthy soil is teeming with microbial life. A single ounce of healthy soil can contain *billions* of microorganisms that process nutrients essential for plant growth. Whether a plant is a citrus tree, tomato stalk, stand of cotton, or a patch of turf grass, its health is dependent upon the activity and diversity of biological life living within the soil.

This newsletter will share information and communicate practical “Lessons Learned” about soil microbial life to those whose livelihoods are dependent

upon it. Whether you are a farmer, grower, golf course superintendent, soil scientist or just an interested party, we hope you will find genuine value within these pages.

Each issue will focus on common problems within our soil community. Our first newsletter focuses upon the dilemma that high levels of salt contamination in the soil represent to growers worldwide. We will also highlight a few cases where innovative practices are being applied to address this problem.

We hope the information in this newsletter will be useful as well as thought provoking. We need your input. So, please bring forward your ideas for new feature articles as well as any questions about issues you are currently facing.

Regards,  
David Lanciault  
President and CEO,  
Advanced Microbial Solutions

Advanced Microbial Solutions  
801 Hwy. 377 South  
Pilot Point, TX 76258  
Tel: 940.686.5545

Volume 1, Issue 1

# Salt - A Growing Problem



SuperBio® being distributed via broadcast sprayer.

(Continued from page 1)

accumulation, over the past 60 years, of a high concentration of salt in our soils. Where has the salt come from? In part, the answer lies in the fertilizer itself.

The inert ingredients in commercial fertilizer are salt compounds used by fertilizer companies to bind plant nutrients into a stable form. These chemical salt compounds, when applied to the soil, are attracted to soil particles where the salt, nutrients and water are bound (locked up) to the soil particle. As a result, plants have difficulty extracting the water and nutrients they need.

Fertilizers are not the sole culprit of saline and sodic soil; there are many other sources of salt accumulation.

## Ask Dr. Bob



What are salts and why do they harm the soil?

**Dr. Bob:** Salts are water-soluble compounds consisting of two or more elements. When salts (fertilizers, minerals or sea salt) are dissolved in water, they separate into their component parts called ions. High concentrations of salt ions, especially sodium, cause soils to become compacted because the soil particles break into much smaller particles. Compacted soil reduces the emergence of germinating seeds, penetration by plant roots, and the infiltration of air and water. Water is held tightly by dissolved salts in soils with high salt concentrations, thus making it difficult for roots to extract the water for plant growth.

**Q:** Do organisms die in salt-affected soils?

**Dr. Bob:** Although many organisms do not grow well in salt affected soils, it will not necessarily kill them. Due to their small size, soil microorganisms have access to water locked into small pores of the soil that may not be accessible by plant roots. Some microorganisms can form protective coatings around themselves and hibernate until conditions once again become favorable for growth. Certain soil bacteria can regulate the

Irrigation water may already be highly saline if the water is reclaimed. Salt intrusion can also occur from natural sources – for example, hurricane activity in coastal areas often leaves a deposit from both coastal flooding and seawater siphoned up by the storm activity and deposited on land. Whatever the source, one thing is clear – the agricultural boon of the past 60 years has created a legacy today's farmers must deal with – a growing problem with soil salinity that is choking yields and reducing agricultural productivity in virtually every region of the world.

The USDA suggests that millions of acres of US farmland may be suffering serious problems with salt contamination. In some areas, such as the Northeast Blacklands of North Carolina, the problem is so severe that the area is incapable of supporting vegetative life. In other areas, severe compaction caused by salt accumulation is placing additional pressures on crop production. In order to reclaim such damaged areas, and return them to a productive state for agriculture, the industry must enter a new cycle of innovation – a revolution in *soil science* every bit as important as the giant steps forward of the past 60 years.

In this issue of *The Living Soil*, we examine the problems with salt, its causes, and a few intriguing examples of the actions being taken to address them.

Source: "Fertilizer Indicators",  
IFA, April 2002 Edition

concentration of salts inside their cells, allowing them to thrive even in very salty soils.

**Q:** What happens to the SuperBio® microorganisms in soils with high salt concentrations?

**Dr. Bob:** SuperBio® microorganisms are very diverse and flexible. Some microorganisms grow very well in salty soils and begin making immediate improvements to the soil. As conditions improve, other SuperBio® organisms which could not grow before begin to contribute to the soil rebuilding process.



Dr. Bob received his Bachelor and Master degrees in Plant Pathology from Oregon State University and his PhD. from Colorado State University. His work has included studies of soil microbial interactions, plant nutrient uptake, and biological disease control.

If you have a question about plants or soils, please email them to Dr. Bob at [bames@mailcart.net](mailto:bames@mailcart.net).

# How a Texas Peanut Grower Increased Yields and Profits



*Peanuts harvested from a West Texas field.*

Peanut growers have long recognized the value of calcium in improving yields and producing superior grade crops. Many have observed the effect that calcium can have on inhibiting soil-borne diseases. The common practice in West Texas is to apply fungicides and fertilizers to combat disease and improve yields. Unfortunately, high fertility rates enhance fungal disease, reduce nitrogen fixation in peanuts, and add to the salinity of soils. High salts, especially sodium, can displace the important calcium in the soil. Thus the destructive cycle continues. One peanut grower in Quail, Texas, together with the US Department of Agriculture, decided to try another approach – one of enriching the naturally occurring microbes in the soil to increase crop yields.

The grower compared four treatments: a standard production program control, two fungicide products, and an application of SuperBio®, a diverse microbial product broadly used as a soil amendment. The results were astounding. The plots treated with SuperBio® produced an average of *over 600 pounds per acre* yield increase over the fungicide-treated plots – and nearly 1,000 pounds per acre over the control. Increased revenues of over \$115 per acre – an improvement of over 15%, on average – were realized from the SuperBio® plots (based on peanut prices of 17.5 cents per pound) – a return on investment of almost four to one. What could be the cause of this striking result?

**Benefits:**  
*10-15% Higher Peanut Yields*  
*\$91-126/acre Revenue Increase*  
*4 to 1 Return on Investment*

Crop evaluations revealed an interesting insight. The peanut vines from the SuperBio® plot showed significantly higher concentrations of calcium compared to the other treatments. The implications seem clear: the application of the diverse microbial product contributed to the crop’s ability to “mine” calcium from the soil. This enhanced calcium utilization led to yield increases and higher peanut grades.

Similar results have been realized in other West Texas peanut trials. In Comanche County, fields treated with SuperBio® generated a cash value of \$680 per acre – double the value of the control fields (at just over \$300 per acre). Other tests showed returns on investment as high as nine to one, especially in those areas with salt affected soils.

By no means are these tests limited only to peanuts. Other crops grown in salt-affected soils, including cotton, tomatoes, citrus and potatoes, have responded favorably to SuperBio® applications. In addition to salt and fertility problems, these treatments have been shown to help reduce compaction, improve water retention, and reduce leaching of nutrients.

The evidence is clear and consistent that consideration of soil microbiology is essential to proper soil management and crop productivity when dealing with disease and salinity problems.

	<i>Yield Per Acre</i>	<i>Revenue Per Acre</i>
<b>Terrachlor</b>	<b>4080 lbs.</b>	<b>\$714</b>
<b>Vitavax</b>	<b>4280 lbs.</b>	<b>\$749</b>
<b>SuperBio®</b>	<b>4800 lbs.</b>	<b>\$840</b>

*At \$0.175 per lb., SuperBio® increased revenues by \$126 and \$91 per acre, respectively.*

## Soil Types

### Sodic Soil

Sodic soils contain high amounts of sodium that can interfere with the growth of crops. Excess sodium leads to crusting and inadequate penetration of water and oxygen into the soil. Leaching the sodium out of the root zone using irrigation water can help *if* the irrigation water is not too salty. Gypsum (calcium sulfate) is also commonly used in sodic soils.

### Saline Soil

Saline soils contain high levels of soluble salts that ‘tie up’ nutrients and water, making them less available to plants. The salts can be from fertilizers, poor quality irrigation water, or coastal salt spray. Again, irrigating the root zone may help if low-salt water is used. This is often a costly and impractical solution.

### Sodic-Saline Soil

Sodic-saline soils exhibit the characteristics of both sodic and saline soils, requiring similar methods for correcting the problems.

In all of these conditions, irrigation water is often (and increasingly) a part of the problem. Salty water can cause leaf burn and is much more difficult for the root system to absorb than low-salt water. Oddly enough, crops in salt-afflicted soils can become water stressed even though the soil is moist.



## How Salt Affects Your Soil

Salt can spell trouble for soil structure, plant health and productivity, and can decrease grower profitability. But do we really understand the nature of the problem?

The term “salt” is not restricted to what we know as table salt (sodium chloride). Salts are combinations of chemicals that, when dissolved in water, break down into component parts called *ions*. Ions act like the opposing poles of a magnet – one with a positive charge and another with a negative charge, causing them to “stick” together. Water *dissolves* the salts, pulling the ions apart like separating one magnet from another. Table salt, for instance, dissolves into its component ions of sodium and chloride.

Fertilizers consist of many kinds of salts including ion components of sodium, potassium, calcium, magnesium, nitrate, phosphate and others. Soil moisture dissolves the fertilizers, making the components available for plant uptake and growth. But some soil types already have large amounts of certain ions. For example, a *sodic* soil is one that is high in sodium. Adding sodium-rich fertilizers or using salty irrigation water can compound the condition, saturating the soil with more ions than can be productively used. Voila - a salt problem!

### The Microbiological Solution:

While traditional treatments focus on leaching salts out of the soil, growers and agronomists look to soil microbiology to treat this ever-growing problem.

The biological approach strives to:

**Restore Soil Porosity** - Microorganisms can improve the soil aggregate, forming *pore spaces* capable of holding water and oxygen. The improved soil structure enhances the complex bio-chemical reactions needed to nurture plants.

**Protect Root Systems** - Beneficial bacteria feed on plant sugars and other nutrients that are released into the soil by roots. The activity of soil microbes colonizing the root system efficiently degrades organic matter and reduces plant toxicity.

**Disassociate Salt** - Beneficial soil microorganisms help break up salt compounds. As these salt compounds are *disassociated*, nutrients that were unavailable for plant use are released.

Today’s producers understand the challenges of salt intrusion on their land; yet, they have few attractive options. Compounded by concerns about water quality and availability, many seek new solutions. The tremendous irony is that many of the *new* solutions may lie in the *oldest* source of all – the rich world of soil microbiology. ■

*Salt problems can strike growers of all types. Faced with few attractive options to solving this challenge, many growers are now taking a biological approach to solving this 'growing' problem.*

Advanced Microbial  
Solutions  
801 Hwy. 377 South  
Pilot Point, TX 76258  
Tel: 940.686.5545